ASSESSING UNDERGRADUATE DENTAL STUDENTS' EXODONTIA COMPETENCIES BY EMPLOYING A NOVEL CONTINUOUS ASSESSMENT INSTRUMENT

by

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Submitted in partial fulfilment of the requirements for the degree MSc in the Department of Dental Management Sciences, School of Dentistry, Faculty of Health Sciences, University of Pretoria.

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Dedicated

To

Those with Imagination

ACKNOWLEDGEMENTS

- My parents, the ultimate teachers, who exemplified respect, dedication, honesty and integrity.
- My wife Andriette, without whom this would not have happened.
- My daughters, Anri and Lené, because it was never about me.
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- My "personal" animator André du Plessis, who brought the project to life.
- My creator for talent, wisdom, insight and time to make a difference.

Nihil Sine Deo. EldlƆ nlvnl MA I

DECLARATION

I declare, that the topic "Assessing undergraduate dental students' exodontia competencies by employing a novel continuous assessment instrument", which I hereby submit for the MSc degree program at the University of Pretoria, is my own work and that all sources I have used or quoted have been indicated and acknowledged by means of complete references in accordance with University requirements.

I declare that this work has never been submitted before for any other degree at any other institution.

AUGUST 2018

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ABSTRACT

Key words

Workplace-based assessment; programmatic assessment; clinical competence; novel assessment instrument; undergraduate dental students; achievable objectives / targets; progressive independence; clinical supervisor / assessor; task-level feedback.

Background

Universities are obliged to ensure that health professions graduates are competent to render safe and effective treatment. Unfortunately, empirical evidence of competence development is lacking, especially at undergraduate level. Hence, this study aimed to provide empirical evidence of dental students' development of independence in exodontia (tooth extractions) following task-level feedback in relation to achievable targets.

Summary of work

This entails the implementation of a novel workplace-based assessment instrument in the Module: Oro-facial Surgery, School of Dentistry, University of Pretoria. Thirteen trained clinical supervisors guided by the primary researcher assessed 28280 tooth extractions performed by fourth and fifth year dental students (2014-2016). Quarterly task-level feedback was provided to students on their ability to independently perform tooth extractions using "Independence ratios" (IR=extractions performed without assistance/total number of extractions) as key performance indicator. A customised Level of Difficulty Index (LDI) (<2=easier than standard; 2=standard; >2=more difficult than standard) was used to control for difficulty level attained. Based on 2014 data, minimum targets of 80% and 90% independence were, respectively set for fourth and fifth year students. Feedback aimed to increase the number of students who achieved targets. Only very low performing students were subjected to targeted intervention. Remaining students were left on their own to progress. Dijksterhuis' model of progressive independence and Zimmerman's model of self-regulated learning, served as conceptual models for analysis of structured student narrations (BChD IV 2015-2017) to evaluate the instrument.

Summary of results

Respective mean IRs (SD), (Ranges: IR; LDI; EC) for the 2014 (n=42), 2015 (n=51) and 2016 (n=62) BChD IV cohorts were 85% (SD: 6%) (Ranges: IR=73-95%; LDI=1.9-3.3; EC=57-232), 85% (SD: 5%) (Ranges: IR=71- 97%; LDI=1.8-3.1; EC=65-261) and 88% (SD: 4%) (Ranges: IR=74-94%; LDI=1.6-3.9; EC=55-140). The 2014 BChD V cohort (n=58) eventually achieved a mean IR of 90% (SD: 5%) (Ranges: IR=79-100%; LDI=2.2 - 4.4; EC=27-168). For the respective 2015 (n=37) and 2016 (n=51) BChD V cohorts these performance indicators increased to mean IRs of 92% (SD: 4%) (Ranges: IR=78-98%; LDI=1.8-4.7; EC=65- 219) and 94% (SD: 3%) (Ranges: IR=86-100%; LDI=1.6-4.3; EC=65-150). Students (BChD IV 2014) who achieved 80% independence increased from 60% after mid-year feedback to 81% at the end of the year. The 2015 and 2016 cohorts respectively improved from 67% to 86% and 56% to 97%. BChD V 2014 students who achieved 90% independence, increased from 40% after mid-year feedback to 48% at the end of the year. The 2015 and 2016 cohorts' improvements were 57% to 65% and 82% to 88%, respectively. Assessment differences were generally small among assessors and could be explained by operational circumstances. The qualitative analysis using the Dijksterhuis model revealed that trainee factors, supervisor factors, the professional activity and the working environment impacted significantly on assessment results. Another analysis using the Zimmerman model revealed that most students were self-regulated learners who set independence targets for themselves. Only a few students showed limited progression.

Discussion & Conclusions

IR appears to be a useful indicator of clinical competence as gradients of increased independence were illustrated over time. IR measurement was sensitive enough to distinguish between low and high performing students. Target introduction in 2015/16 coincided with increased independent practice compared to 2014 baseline data, suggesting a catalytic effect of assessment. Achievable objectives should accompany task-level feedback to facilitate competence development. Methods employed may be transferable to other disciplines.

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GLOSSARY

Term*	Explanation
Alveolalgia	An infective condition in bone sometimes occurring after extraction of a tooth (Dry socket/Focal osteomyelitis)
Alveolar	Part of the jaw bone relating to the tooth sockets
Anterior	Situated or directed to the front
Anteriors	Front teeth, including incisors and canines
Apical	Situated or directed towards the apex
Assessor	Clinical supervisor also functioning as assessor
Buccally	Situated or directed towards the cheek
ClickUP	Computerized learning platform used by the University of Pretoria
Dentectomy	Removal of all remaining teeth/multiple teeth
Endodontic	Concerning treatment of the dental pulp
Exact (Software)	Exact software computer program
Exodontia	Branch of dentistry that deals with tooth extractions
Extraction	Removal of a tooth
GoodX	GoodX Dental Studio software computer program
Odontology/Odont	Science dealing with teeth normally referring to restorative work
Palatally	Situated or directed towards the palate of the mouth
Periapical	Situated or directed around the apex of a tooth or Referring to a small radiograph taken of a tooth
Posterior	Situated or directed to the back
Posteriors	Back teeth, including premolar and molar teeth
Supervisor	Assessor also functioning as clinical supervisor

* Most of the terms listed above are terminology used by participants in the qualitative section of the study.

LIST OF ABBREVIATIONS

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Abbreviation	Description
AF	Achievement Factor
Apr	April
Aug	August
BChD	Baccalaureus Chirurgiae Dentium equivalent to Bachelor of Dental Surgery (BDS)
CI	Confidence Interval
CPC	Comprehensive Patient Care
Ctrl	Control/ Assessor statistics of investigator used as reference
DC	Difference from Control/Reference
EC	Extraction Count
Feb	February
Indep	Extractions done independently
IR	Independence Ratio
Jan	January
Jul	July
KGM	Afrikaans acronym for Maxillofacial and Oral Surgery
Mar	March
Max	Maximum
Min	Minimum
MOFS	Module: Orofacial Surgery
Not Indep	Extractions done with help
Nov	November
ns	Not significant
Oct	October
P	Probability
PF	Proficiency Factor
SD	Standard Deviation
SDUP	School of Dentistry, University of Pretoria
SE	Standard Error
Sep	September
X	Mean

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Chapter 1. Introduction

1.1 Overview

Competency-based approaches in medical education are designed and implemented with the intention to ensure safe and effective clinical services to the community after graduation.[1-5] According to the sustainability goals of the United Nations, the improvement and preparation of health care personnel in emerging economies is a priority to ensure healthy lives and to promote well-being for all ages.[6] Sustainability of competence seems to be key in reaching and maintaining these objectives.[5]

Competence can be defined as the ability to perform a skill independently and correctly.[7-12] It is desirable that increasing responsibility be given to students to develop competence over time.[13-19] This progression of independence should take place in an environment that promotes interaction, to advance appropriate development and professional growth.[12,20-22] In order to measure the development of competence over time it would be important to take independent performance and the assistance received from the teacher/supervisor into account, without jeopardising the necessity to seek advice when required.[21] Empirical evidence in this regard only exists in the domain of post-graduate surgery training.[23-26] No such evidence exists in Dentistry. Development and testing of instruments that provide evidence to support a model of progressive independence under supervision would therefore lay the foundation for further expansion and research in Dental Education.

Although a wide array of workplace-based assessment instruments exists,[27-28] that could be used to assess student performance on a continuous basis, few of them[26,29] have the ability to quantify independent performance as such. The majority of existing workplace-based assessment instruments attempt to quantify the level of competence using criterion-based methods.[30-31] Criteria are often focussed on detailed aspects of a procedure or a skill to provide applicable feedback but rarely focus on the skill as a whole.

It is well known that assessment practices influence the learning behaviour of students.[32-40] Assessment is often the source of feedback.[14] Feedback in turn is one of the most powerful catalysts to stimulate learning.[41-42] It has been shown that the learning of students can be enhanced by systematically exposing them to the methods of assessment.[43-44] It is therefore important that

students be assessed by means of specified criteria.[45-46] It can however be argued that it is equally important that students receive feedback on their level of competence to safely perform a procedure or skill on their own.[47-48] Formative assessment, including feedback, is the key to get students to reflect on their performance.[14,29] This self-reflection and self-regulation improves the behaviour of the student on a higher cognitive level, whereby analysis and evaluation of the data presented produces the opportunity to create, explore and expand on current experiences.[49-50] Formative feedback should therefore be an integral component of assessment.[14]

1.2 Local context

The competencies required to pass the Module: Orofacial Surgery (MOFS), School of Dentistry, University of Pretoria (SDUP) are communicated annually to students using a study guide.[51] One of these include the safe removal of compromised teeth. For many years, the MOFS at the SDUP relied on logbooks and minimum clinical quotas (quantitative assessment) to assess exodontia (tooth extraction) skills. In addition, students were subjected to a single clinical examination towards the end of their final year to determine competence. These measures can hardly be considered valid measures of competence and are nothing more than quantifications of what students are exposed to during their studies.[52] The single clinical assessment at the end of the course is particularly problematic because of the risk of inter-rater discrepancies, unstandardized patient selection, as well as unjust failure based on a single case without taking into consideration performance over time. Moreover, single high stakes clinical assessments also often lead to anxiety and stress amongst students and invigilators.[53] The system also did not allow for early identification of struggling students.[54]

These shortcomings, identified in the MOFS, are not unique to this department but also exist in other clinical disciplines.[55]

1.3 Problem statement

The problems identified in the local context were defined above. Literature also indicates a lack of empirical evidence that demonstrates development of competence. The main hindrance in finding a solution seems to be that existing workplace-based clinical assessment instruments are too complicated. They need to be simplified to establish their true value in a busy clinical setting.[27]

1.4 Aims of the study

The aims of this study were to design, pilot a novel continuous assessment instrument that monitored the progress of students to independently (without the assistance of a clinical supervisor or a fellow student) extract teeth at an appropriate degree of complexity over time. It furthermore aimed to provide formative feedback to aid competence development. The aims also included an evaluation of factors that affected the novel assessment instrument.

1.5 Objectives of the study

The objectives of this study are as follows:

1. To design and pilot a novel continuous assessment instrument that measures the development of exodontia competence over time.
2. To gauge and plot the progression in terms of extraction counts over time.
3. To gauge the progression in terms of the percentage of tooth extractions performed independently (independence ratio) as an indicator of level competence over time.
4. To monitor students' achieved level of difficulty, pertaining to tooth extractions to ensure appropriate standards.
5. To set minimum targets for extraction counts, independence ratios, and level of difficulty using mathematical methods similar to the Cohen method of standard setting.
6. To implement a task level feedback system to inform students on a quarterly basis of their:
   - Independence Ratios
   - Level of difficulty achieved
   - Extraction counts
7. To monitor student progress and to identify struggling students to give self-regulation feedback
8. To evaluate written student feedback of the continuous assessment system using the Dijksterhuis model of factors impacting on clinical assessment[25] and Zimmerman's model of self-regulated learning[47] as conceptual models of inquiry.

1.6 The Intervention

1.6.1 Design and piloting of the instrument

With this in mind, a new clinical assessment instrument was designed in the MOFS at the SDUP to develop exodontia skills in dental students. The idea was to include virtually all the tooth extractions completed by students in the MOFS into the assessment and to provide regular feedback on the level of independence achieved.

The premise was that students who have the ability to self-regulate their own learning would benefit from the feedback by adjusting their behaviour with the aim of improving their abilities over time.

The continuous assessment instrument (taught to the students in the fourth and fifth years of study) was officially implemented in 2014. It measured students' ability to extract teeth on their own. The ability for students to extract teeth independently without assistance was expressed by means of an "Independence Ratio (Under Supervision)". "Independence Ratio" was defined as the number of teeth extracted independently divided by the total number of teeth extracted, with or without physical assistance from the supervisor. Limited verbal interaction between student and supervisor was however allowed to ensure patient safety. A level of difficulty, achieved by the student, was factored into the equation to limit independence levels being manipulated or skewed by a low accomplishment of challenging extractions.

Data acquired from the instrument and feedback given to students served as constant reminders to students about their level of competence (level of independence under supervision), their achievement of quantitative procedural targets, and average level of difficulty of procedures completed. Continuous feedback communicated to students using anonymized lists, published on a notice board, included levels of achievement in relation to their peers.

It was envisaged that multiple assessments done over a long period would provide a more valid reflection of competence as opposed to the previously mentioned single clinical test. Data obtained from the instrument in addition allow for the early identification of struggling students enabling timeous intervention.

Continuous chair side assessment of fourth and fifth year dental students was carried out in the clinical area by an array of supervisors (2014-2016). Predetermined criteria were used to measure and record clinical procedures of students on a chair side computer. These computer-generated recordings were then exported and utilized to calculate indicators of independent practice. The quarterly outcomes were anonymously communicated to students to indicate their progress and relative performance in relation to their fellow students. Assessor performance was also monitored during the study, in an attempt to monitor and minimize inconsistencies in assessment, by performing Analysis of Variance, in combination with Least Square Difference *post hoc* contrast analyses.

1.6.2 Evaluation of factors influencing the instrument

Students were also afforded an opportunity to provide input in terms of their experiences with the assessment instrument as well as their thoughts and behaviour changes during the assessment process.[56] This was done by means of a structured reflection paper, written by each student, after the first six months of clinical training and exposure to the continuous assessment instrument. This enabled the researchers to gain valuable insight into the students' reasoning, performance and expectations to improve and also expand, develop and alter the assessment instrument if needed.

1.7 Premises

The main premise in this study is that limited verbal advice provided during clinical supervision of a tooth extraction does not significantly influence a student's ability to perform the procedure independently. This approach was necessary to ensure patient safety, given the fact that the learners are inexperienced undergraduate students treating real life patients.

1.8 Limitations

The assessment performed in this study can be defined as workplace-based assessment. By default, the assessment takes place in a hectic clinical environment, which creates many challenges. Severe time constraints is a definite limitation. Patient allocation in terms of numbers, time of day, age of the patient, as well as variability and complexity of procedures required by these patients, place an enormous strain on accurate and objective evaluation. Supervisor dissimilarities in terms of experience, availability and skills pose a threat to the validity and reliability of the assessment

procedure.[57] Moreover, traditional intra and inter-rater agreement assessments, to measure reliability of level of difficulty ratings, were not feasible in the busy environment. Fortunately, level of difficulty ratings served as a secondary control measure only. Due to its construct, this measure could not affect the reliability of the main measure (Independence Ratio). As mentioned before, Analysis of Variance, in combination with Least Square Difference *post hoc* contrast analyses, were used as alternatives to measure variances in ratings in relation to that of the primary researcher, who served as the Control (Ctrl) for statistical comparison.

1.9 Delimitations

This pilot study was limited to a single psychomotor skill, namely tooth extractions. It is recognised that clinical competence extends way beyond a single psychomotor skill into cognitive and affective domains. The idea was however to pilot the continuous assessment instrument on a single skill, where after it could possibly be applied to other skills, where applicable.

1.10 Summary and outline of the study

Chapter 1 specified the essence and foundation for the research and development of a new continuous assessment instrument. The chapter also highlighted the premises, limitations, and delimitations of the study. In the following chapter, a literature review underlines the current trends in continuous clinical assessment and feedback with the aim of developing competence. Chapter 3 explains detailed methods used in the study. The results of the study that provides empirical, qualitative and quantitative evidence of the new clinical assessment instrument follow in Chapter 4. Finally, after discussion, conclusions are reached and recommendations regarding the way forward are made.

Chapter 2. Literature Review and Motivation

2.1 Overview

Quality assurance guidelines propagate that a dental graduate should be competent to provide safe, independent clinical treatment to their patients.[10-11,58-61] Even students stipulate that independent practice should be propagated, as was highlighted by a national survey completed in 2009 in the United States.[62] These results published by the Yale School of Medicine indicated that 27.5% of residents in surgery are concerned that they will not feel confident in executing tasks by themselves.[62-63] Tertiary education institutions are therefore obliged to implement teaching, learning and assessment strategies that would develop clinical skills over time, to eventually ensure independent practice that is beneficial to the patient. The first part of this literature review therefore focusses on three inter-related concepts that stand central to the development of clinical competence namely, (1) assessment, (2) the provision of feedback and (3) the training environment. The second part of the literature review explores existing workplace-based assessment methods that could potentially be employed to assess the development of clinical competence over time.

2.2 The role of assessment and feedback in developing clinical competence

Assessment is key in evaluating the effectiveness of teaching and learning,[43,64-65] and serves as a communication tool used to inform students of their abilities and level of achievement during the learning process.[43-44] Systematic exposure to effective assessment methods is likely to enhance student learning,[27,65-67] especially when combined with appropriate feedback that informs the student of their inabilities and corrective measures needed to improve.[41,68] Formative feedback is the key to get students to reflect on performance.[41,69-70]

Self-reflection is a phase in Zimmermann's model of self-regulated learning (Figure 2.1).[47,69,71-73] Zimmermann's model of self-regulated learning has been validated in various contexts, ranging from novice to expert, mechanic to lawyer and from chess to athletics.[47,69,73] The aforementioned cyclic model suggests that students, who are capable of regulating their own learning, continuously evaluate their own performance (self-judgement). It has been shown that self-regulated learners have a tendency to attribute failure to their own inabilities instead of blaming external factors.[73] Hence they continuously adapt in order to improve performance (self-reaction).

Performance Phase

Self Control
Self-instruction
Imagery
Attention focusing
Task strategies

Self-Observation
Self-recording
Self-experimentation

Forethought Phase

Task Analysis
Goal setting
Strategic Planning

Self-Motivation Beliefs
Self-efficacy
Outcome expectations
Intrinsic interest/value
Goal orientation

Self-Reflection Phase

Self-Judgment
Self-evaluation
Causal attribution

Self-Reaction
Self-satisfaction/affect
Adaptive/Defensive

Figure 2.1 Phases and sub processes of self-regulation.[47]

Source: The Psychology of problem solving: J.E. Davidson, Chapter 8, page 239, Figure 8.1. Motivating Self-Regulated Problem Solvers: B.J Zimmerman and M Campillo (2003) © Cambridge University Press. Reprinted with permission of Cambridge University Press.

Students who engage in self-regulated learning often have high outcome expectations and are usually motivated (self-motivation).[74] They tend to display interest in a task and set goals through a process of strategic planning (task analysis). They usually have a focus on the task at hand (self-control) and tend to monitor their own performance (self-observation) over time.

It can be argued that Zimmermann's model is highly appropriate to be utilized as conceptual model for the development of competence over time. In addition, the model can be employed to gain an understanding of psychological factors that may affect student learning.[75] Zimmermann's model[47] can however only function if teachers provide students with continuous feedback.[76] By designing a continuous assessment instrument, that gives regular feedback, the premise will be that the student's self-regulated learning ability will be positively influenced on a continuous basis.

One of the main aims of feedback is to reduce the gap between the high and the low performing students.[41,77] It should be noted that self-regulated learning is often a trait of high performing students, while low performing students rely more on external motivation to drive their learning.[47,69,72-73] Supervisors must therefore put systems in place to identify struggling students to enable timeous corrective interventions,[9,28,76] which should lead to improvements of competence over time.

2.3 The impact of the training environment on allowing independent practice

The development of clinical competence is however not only reliant on assessment and feedback. It is also dependent on the amount of independence a clinical supervisor allows a student to have during the clinical training process. The inter-relationship between competence and independence and the factors that impact on them are clearly illustrated in the diagram devised by Dijksterhuis *et al.* in a study on assessment of competence and progressive independence (Figure 2.2).[25]

Patient safety and care is paramount during clinical training.[20,25,61,78-80] Clinical supervisors assess students over time through direct observation. They also interact with students and their co-supervisors to quickly gain a sense of the student's ability and knowledge to make decisions to consent to autonomous practice or not. Allowing inexperienced students to perform tasks independently on live patients often takes courage (audacity) on the part of the supervisor, as patient safety may be compromised.[25,81]
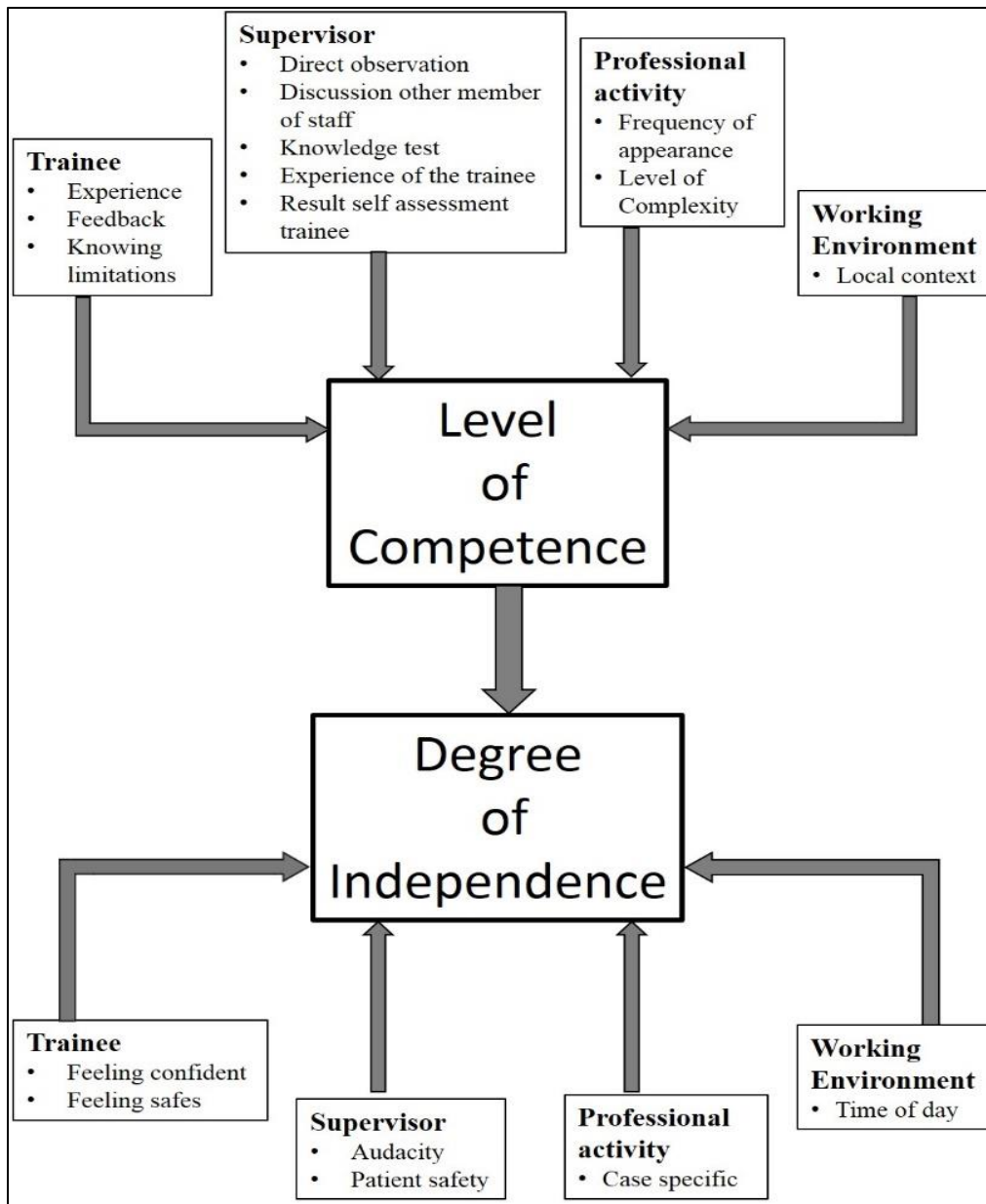
Figure 2.2 The inter-relationship between Competence and Independence.[25]

Source: Assessment of competence and progressive independence in postgraduate clinical training. Figure 1. Visualisation of the underlying construct of inter-relationships based on the emergence of two high-order themes: factors that determine the level of competence of a trainee for a certain professional activity, and factors that determine the level of independence granted to or acceptable to a trainee. M.G.K Dijksterhuis *et al.* (2009) © John Wiley & Sons, Inc. Reprinted with permission from John Wiley & Sons, Inc. © Blackwell Publishing Ltd 2009. MEDICAL EDUCATION 2009; 43: 1156–1165.

Clearly, the type of procedure and the level of difficulty of a task also come into play in deciding whether to sanction independent work by a student. Clinical supervisors are unlikely going to permit a student to perform a procedure the student has not encountered before. It therefore goes without saying that experienced clinical supervisors will more likely approve of autonomy to the more competent student, while assistance and feedback will be directed towards the unskilled student. Inexperienced students who know their limitations also tend to ask for help instead of completing procedures themselves. Students who are more confident are often afforded the opportunity to perform procedures independently.

The working environment may also play a role in the clinical supervisor's decision-making.[23,25] In an under-resourced environment, a clinical supervisor may have to supervise many students.[82] During such circumstances, the supervisor will by default allow students to work autonomously, just to cope with the workload. The time of day may also affect decisions in this regard.[25,83] If a student takes long or when it is getting late, it is also likely that the supervisor may take over the case to ensure patient comfort and satisfaction. Sometimes students are the ones who would ask for assistance because they have pending sessions or tests and know the supervisor will consistently be able to finish the task quicker.

It can therefore be concluded that the training environment as well as the participants (students and clinical supervisors) play a role in the amount of independence that is allowed, to gradually develop clinical competence.

The section on key elements required to develop clinical competence is hereby concluded. The next section explores existing workplace-based assessment methods that could be employed to develop clinical competence over time.

2.4 Workplace-based assessment instruments

Numerous methods pertaining to clinical skills assessment exist.[84-85] These range from the traditional clinical evaluation examinations (CEX),[9,53,86] where students are examined on single/supplementary patient presentations and treatment, to Objective Structured Clinical Examinations (OSCEs),[40,87-92] where some clinical abilities are split into smaller measurable components, with students alternating among stations during examination. Then there is also an

adaptation of this model by Winckel *et al.* (1994), the Objective Structured Assessment of Technical Skills (OSATS), where clinical specimens are used to standardise procedures and feedback.[28,93-94]

All of the aforementioned assessment methods have been tested and validated to certain degrees. In order to develop clinical competence over time a suitable workplace-based assessment instrument will have to be devised.[28] Several workplace based assessments exist.[27] Clinical Encounter Cards (CEC),[95-96] Clinical Work Sampling (CWS),[97] Blinded Patient Encounters (BPE)[98-99] and the Global Rating Index for Technical Skills (GRITS)[100] adapted from the OSATS for use in the operating room are among those used in different countries.[28] Another famous example is the mini-Clinical Evaluation Exercise (mini-CEX).[27,53] This assessment instrument fulfils three basic prerequisites for assessment:[27]

1. A structure that groups content, proficiency and evaluation.
2. Feedback is given throughout the assessment process.
3. Assessment is used intentionally to guide learners towards required objectives.

In the mini-CEX, developed in the United States, supervisor observation of the task takes place while the student executes it. Afterwards assessment of the performance occurs, and immediate feedback is given in a much shorter time than the CEX.[27] Similarly the Direct Observation of Procedural Skills (DOPS) method of assessment developed in the UK, concentrates on assessing the practical capabilities of students by monitoring them in a clinical setting.[27,52]

As was mentioned in Chapter 1, existing workplace-based assessment instruments focus on detailed criteria to provide feedback to the learner. The access to these assessment principles is paramount to objective assessment ("We should know the rules for how our work will be judged").[65,101] Even more significant is the prospect of actually realising the ideals being benchmarked, thus functioning on a higher level of fairness and quality to put exceptional standards within reach.[102] The difficult part however is to make these criteria and the shortcomings of the student visible. This can more often than not be done through feedback. Most of the instruments do not consistently provide feedback on task-level.[41] Hattie, in a meta-analysis study that involved more than 20 million students, concluded that the highest effect sizes in feedback, implicated students that obtained feedback at task level.[41] With the mini-CEX,[27,53] feedback is

essentially focussed on providing feedback at process level (Figure 2. 3),[41] whereas the DOPS system[27,52] also concentrates on providing feedback at task level (Figure 2. 4).[41] The ideal therefore would be to construct an instrument that provides feedback on different levels and makes a distinction between appropriate unsupervised practice and supervision with intervention.

Figure 2.3. Mini-clinical evaluation exercise form.[27]

Source: Workplace-based assessment as an educational tool: AMEE Guide No. 31 2007; 29: 855–871.
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Primary Source: The Foundation Programme. www.foundationprogramme.nhs.uk

Direct Observation of Procedural Skills (DOPS) - F1 Version

Please complete the questions using a cross: ☒ Please use black ink and CAPITAL LETTERS

Doctor's Surname

Forename

GMC Number: **GMC NUMBER MUST BE COMPLETED**

Clinical setting: A&E ☐ OPD ☐ In-patient ☐ Acute Admission ☐ GP Surgery ☐

Procedure Number: ☐☐ Other

Assessor's position: Consultant ☐ GP ☐ SpR ☐ SASG ☐ AHP ☐ Nurse ☐ Specialist Nurse ☐
☐ Other (please specify)

Number of previous DOPS observed by assessor with any trainee: 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5-9 ☐ >9 ☐

Number of times procedure performed by trainee: 0 ☐ 1-4 ☐ 5-9 ☐ >10 ☐   Difficulty of procedure: Low ☐ Average ☐ High ☐

Please grade the following areas using the scale below:	Below expectations for F1 completion		Borderline for F1 completion	Meets expectations for F1 completion	Above expectations for F1 completion		U/C*
1. Demonstrates understanding of indications, relevant anatomy, technique of procedure	☐	☐	☐	☐	☐	☐	☐
2. Obtains informed consent	☐	☐	☐	☐	☐	☐	☐
3. Demonstrates appropriate preparation pre-procedure	☐	☐	☐	☐	☐	☐	☐
4. Appropriate analgesia or safe sedation	☐	☐	☐	☐	☐	☐	☐
5. Technical ability	☐	☐	☐	☐	☐	☐	☐
6. Aseptic technique	☐	☐	☐	☐	☐	☐	☐
7. Seeks help where appropriate	☐	☐	☐	☐	☐	☐	☐
8. Post procedure management	☐	☐	☐	☐	☐	☐	☐
9. Communication skills	☐	☐	☐	☐	☐	☐	☐
10. Consideration of patient/professionalism	☐	☐	☐	☐	☐	☐	☐
11. Overall ability to perform procedure	☐	☐	☐	☐	☐	☐	☐

*U/C Please mark this if you have not observed the behaviour and therefore feel unable to comment.

Please use this space to record areas of strength or any suggestions for development.

Have you had training in the use of this assessment tool?: ☐ Face-to-Face ☐ Have Read Guidelines ☐ Web/CD rom

Assessor's Signature:

Date (mm/yy): M M / Y Y

Time taken for observation: (in minutes) ☐☐

Time taken for feedback: (in minutes) ☐☐

Assessor's Surname

Assessor's registration number:

Please note: Failure of return of all completed forms to your administrator is a probity issue

Figure 2.4. Directly observed procedural skills form.[27]
Source: Workplace-based assessment as an educational tool: AMEE Guide No. 31 2007; 29: 855–871
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Only two assessment instruments could be found in the literature that may serve the purpose to distinguish between having received assistance and independent practice. The first instrument devised by Bookhan *et al.*[29] is an assessment instrument described in the undergraduate dental context. This assessment instrument uses a worksheet with well-defined and precise criteria that are related to certain points of capability and are used by the assessor to mark the student. The instrument furthermore includes a similar worksheet for self-assessment used by the students. Six markers for capability, which ranged from Unqualified (0) to Exceptional (5), were used to define levels of competency. Levels 0 to 2 could principally be classified as "Not competent" (Unqualified = 0, Not Becoming Qualified = 1 and Becoming Qualified as a Beginner = 2). Levels 3-5 could be classified as "Competent" (Becoming qualified as a learner = 3, Qualified = 4 and Exceptional = 5). Level 3 falls within the description of "competent" because no clinical assistance takes place and only advice is given.

The second instrument is a continuous assessment system, which was employed in post-graduate education to train general surgery students.[103-104] The "Zwisch model", as it became known, was designed over time by Dr. J Zwischenberger to alert surgery students as to their growth in independence. The model was first published in 2013 by DaRosa *et al.*[103] and later validated and extensively used.[104-105] It consisted of a four-point scale that attempted to rate the degree of assistance given to a student and indicators for progression of the student (Figure 2.5). The first/lowest level ("Show & Tell") consisted of the procedural essentials, where the supervisor/surgeon would demonstrate, describe and explain actions taken. The second level ("Active Help") contained areas of decision-making directives by the supervisor during significant technical activities performed by the student. Important and substantial degrees of the procedures were however fulfilled autonomously by the student throughout the third level ("Passive help"), with the supervisor only acting to ensure patient safety or to enhance teaching. The highest level, number four ("Supervision only"), indicated full autonomy, with the well-being of the patient the only area of attention for the supervisor.

Both these systems[29,103] have the ability to describe the difference between receiving assistance and practicing independently. They equally also support the notion of progressive independence.[23-26,106] Although both the models showed validity, reliability and feasibility,[46] the "Bookhan model"[29] relied heavily on specific criteria that may confound supervisors and students.
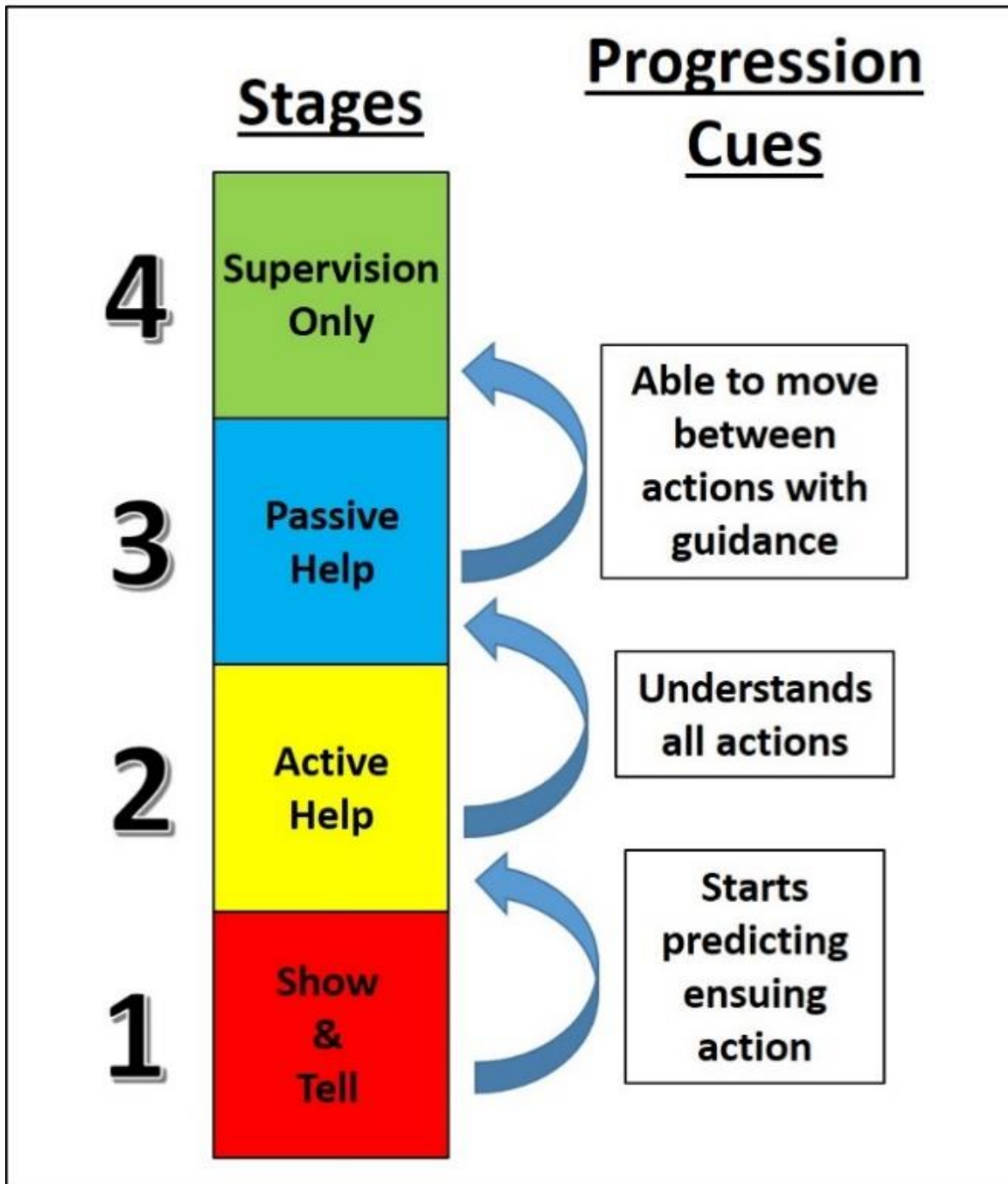
Figure 2.5 Schematic representation of the Zwisch scale.[103]
Adapted from descriptions: in DaRosa DA, Zwischenberger JB, Meyerson SL, George BC, Teitelbaum EN, Soper NJ, *et al.* A theory-based model for teaching and assessing residents in the operating room. Journal of surgical education. 2013;70(1):24-30 and George BC, Teitelbaum EN, Meyerson SL, Schuller MC, DaRosa DA, Petrusa ER, *et al.* Reliability, validity, and feasibility of the Zwisch scale for the assessment of intraoperative performance. Journal of surgical education. 2014;71(6):e90-e6.

The "Zwisch model"[103] conversely when used in isolation does not contain measures to provide for differences in complexity of the procedures and differing aptitude of students. The "Complexity score" added in a later study by George *et al.*,[104] and the use of smart-phones to sensibly rate students swiftly,[104] improved on these shortcomings. Further improvements regarding the use of such devices to provide formative feedback are eagerly awaited. In an undergraduate environment however, with large numbers of students and high student: supervisor ratios, both these systems lack simplicity and ease of use.

2.5 Summary

In Chapter 2 the status quo, as far as the manner in which assessment and feedback in the clinical environment are performed, was identified and confirmation for the development of a novel clinical instrument was acquired. Chapter 3 will now continue with describing the study methods employed as well as providing information regarding the statistical analyses used.

Chapter 3. Study Methods and Analysis

3.1 Introduction

This chapter describes the methods employed during this project. The chapter describes the study design, target population, sample size and the setting of the study. The chapter also explains the rationale and design of the novel continuous assessment instrument, including the methods employed for the statistical analysis. The chapter concludes with a qualitative evaluation, of the newly implemented continuous assessment instrument, from a student perspective.

3.2 Broad outline of the study

This mixed methods project comprised a quantitative and qualitative part.

3.3 Quantitative Assessment and Analysis

The quantitative part of the study involved the design and implementation of a novel continuous assessment instrument to develop clinical competence in exodontia.

3.3.1 Study design, target population, sample size and setting.

The quantitative part of the study was conducted in the form of a cohort study (2014-2016). The sample sizes of the respective cohorts can be viewed in Figure 3.1.

Year	2014	2015	2016
Cohorts	BChD 4 (n=42)	BChD 4 (n=51)	BChD 4 (n=62)
	BChD 5 (n=58)	BChD 5 (n=37)	BChD 5 (n=51)
Data collection	Retrospective	Prospective	Prospective

Figure 3.1 Student cohorts followed over time

Data of the 2014 BChD 4 and 5 cohorts were retrospectively collected followed by a prospective data collection of the 2015 and 2016 cohorts. It should be noted that the 2014 BChD 4 cohort were in effect followed over a two-year period, as they became the 2015 BChD 5 cohort. The same applied to the 2015 BChD 4 cohort who became the 2016 BChD 5 cohort. The 2014 cohorts served as baseline reference[*].

This study was conducted in MOFS at the SDUP in the exodontia clinic, comprising 13 dental chairs organized in cubicles in an open plan configuration (Figures 3.2 and 3.3) allowing for the supervision of multiple students during a set clinical routine. At the time of the study fourth and fifth year students were systematically rotated through the exodontia clinic on a three-session basis. One student was allocated per dental chair, per two-hour clinical session. Both fourth and fifth year students were simultaneously present in most clinical sessions. Each workday of the week comprised three sessions that started at 7:15, 9:30 and 14:00, with a supervision ratio of one lecturer per four students.

Each dental chair was equipped with a chair side computer linked to a local area network. Students captured their outputs on the GoodX Dental Studio Software application (Figure 3.4), by means of standard procedure codes used in the dental industry after secure login. Subsequent to completion of the clinical procedure, the clinical supervisor signed the electronic record off by means of a password-protected function built into the software, which allowed the data to be safely stored on a central server in the SDUP (Figure 3.5).

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[*] Part of a previous pilot study "Measuring the development of exodontia skills with a new continuous assessment instrument implemented for undergraduate dental students: A pilot study". Approved by the Faculty of Health Sciences Research Ethics committee, University of Pretoria on 28 May 2015, Ethics reference No.: 189/2015

Figure 3.2 Photo of clinical ward where assessments took place
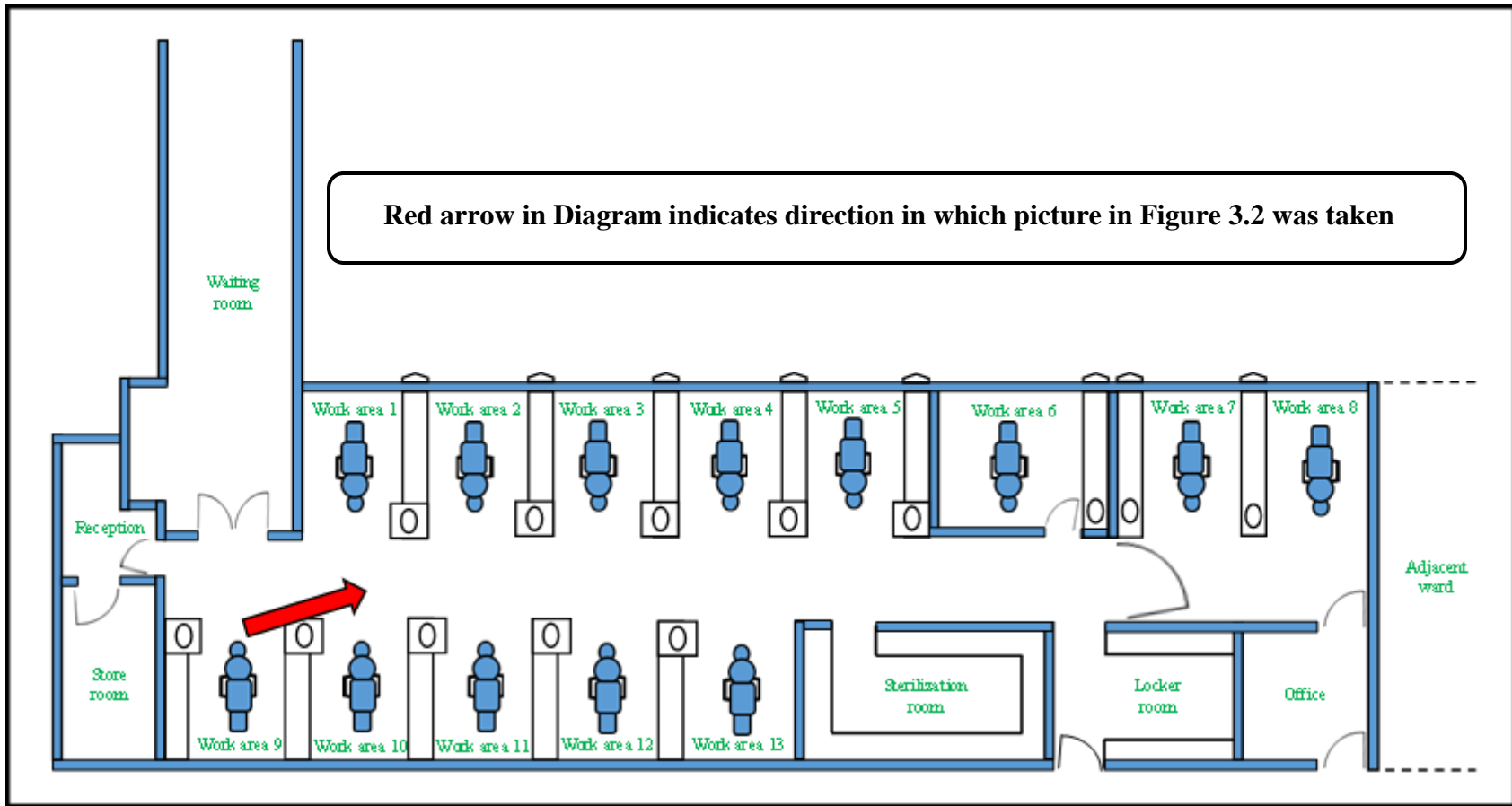
Figure 3.3 Diagram of clinical ward where assessments took place
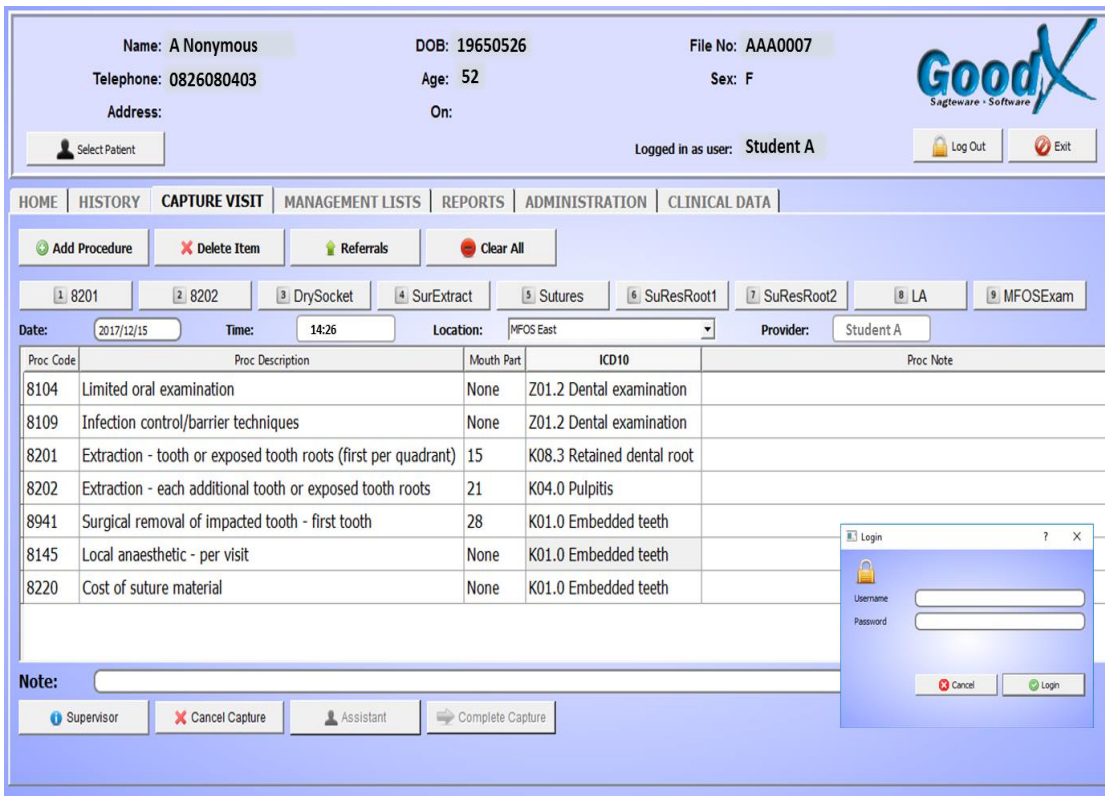
Figure 3.4 Screenshot of GoodX application after student input.
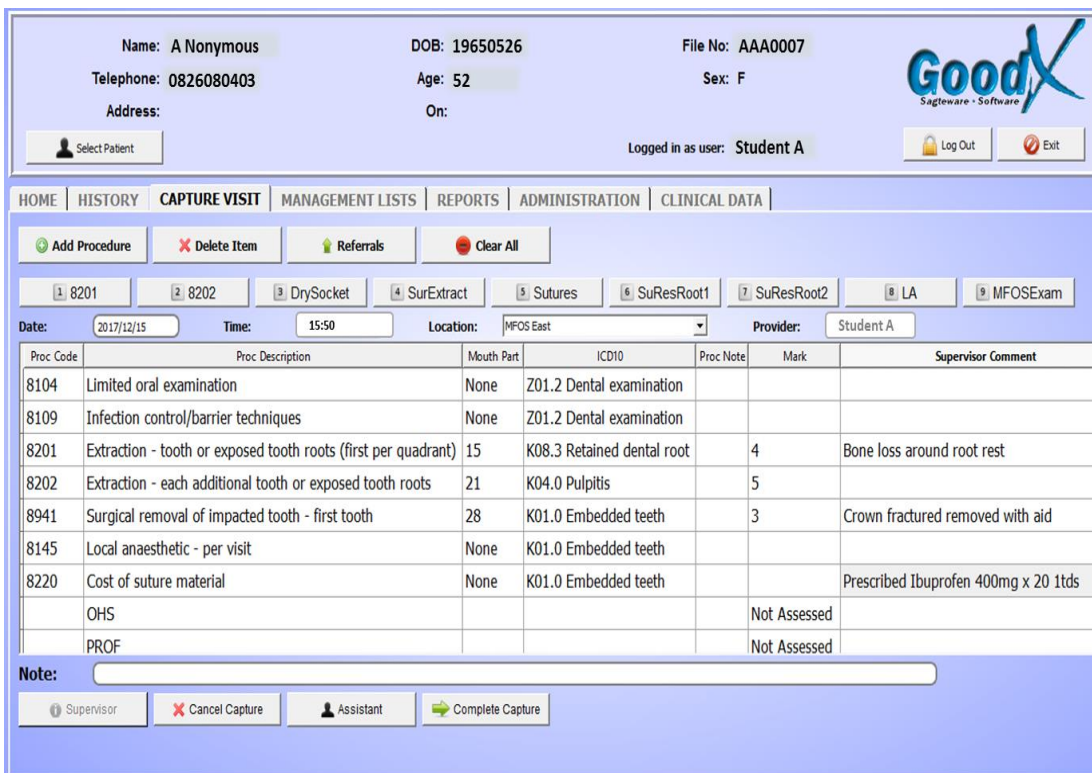
Figure 3.5 Screenshot of GoodX application after assessor input.

3.3.2 Rationale and design of the novel continuous assessment instrument

The rationale of the system was to create an instrument that could provide students with timeous task level feedback[41] about their ability to perform tooth extractions independently over time. The degree of difficulty of tooth extractions was also taken into account to ensure that students do not manipulate the instrument by only targeting easy extractions to increase their independence. It was decided to pilot the new continuous assessment on tooth extractions because of the frequent occurrence thereof in the SDUP.

The tooth extraction procedure codes (as published by the South African Dental Association),[†] applicable to this study, are contained in Table 3.1.

Table 3.1 Procedure codes for exodontia used in the assessment instrument.

Code	Description
8202	Extraction - each additional tooth or exposed tooth roots
8213	Surgical removal of residual roots, first tooth - per tooth
8214	Surgical removal of residual roots, second and subsequent teeth's roots
8937	Surgical removal of tooth
8941	Surgical removal of impacted tooth - first tooth
8943	Surgical removal of impacted tooth - second tooth
8945	Surgical removal of impacted tooth - third and subsequent teeth

Students' performance was scored on the GoodX Dental Studio Software application for each extraction using the scale illustrated in Table 3.2.

Table 3.2 Continuous assessment scale for exodontia

Score	Level of Difficulty	Competence Criteria
0	Easy / standard / difficult extraction	Completed by supervising dentist (usually as a clinical demonstration).
1	Easy extraction	Completed by the student, with physical intervention of the supervising dentist or a fellow student.
2	Standard extraction	
3	Difficult extraction	
4	Easy extraction	Completed by the student, without physical intervention of the supervising dentist. Oral advice may however be provided.
5	Standard extraction	
6	Difficult extraction	

[†] Information obtained from https://www.sada.co.za, using a personalised password. Information available from the researcher.

Detailed explanations for the LDI rating scale criteria shown in Table 3.2 are provided in Table 3.3.

Table 3.3 Definitions of the criteria used in the LDI scale for exodontia

Criteria	Definition
Easy	Periodontally compromised/Mobile Tooth
	Primary tooth with root resorption
	Bone loss around the roots *e.g.*, Peri-apical abscess on X-ray
Standard	Normal extraction of a primary or permanent tooth
	Primary tooth must have roots
	Permanent tooth or root has normal bone and roots
Difficult	Dilacerated or long or divergent roots
	Root canal treated tooth without bone loss
	Root rest with difficult approach
	Impactions

The implemented protocol dictated that the supervising dentist (assessor) had to decide on the LDI criteria before treatment commenced by making use of radiographic and clinical evaluations. The assessor however, had autonomy to upgrade the scale to the next level (easy to standard and standard to difficult) after the procedure had been completed. Such upgrades were warranted when complicating factors related to tooth or bone anatomy or patient behaviour became apparent. Factors such as abnormal root formations, not seen on 2D radiographic imaging, limited or small mouth opening with resultant difficult tooth access and the age of the patient (children under the age of 12 years) were noted as possible indicators for an upgrade to the next level.

3.3.3 Experience of clinical supervisors (Assessors)

An indication of assessor variation in the clinical ward is provided in Table 3.4. It shows five of the possible fourteen assessors were permanent staff members, while nine assessors only rotated through certain sessions. Four staff members had no private practice experience. Three staff members that had less than five years' experience, two that had less than 10 years' experience, another two had between ten and 15 years' experience and seven that had more than 20 years' experience. Four assessors out of the group of fourteen were female.

Table 3.4 Contextual information of Assessor variation

Assessor No.	Permanent staff	Session worker	Experience	Private practice experience	Gender
Investigator	x		>20 years	Yes	M
1	x		>20 years	No	F
2	x		>20 years	Yes	M
3		x	>20 years	Yes	F
4		x	>10 years	Yes	M
5		x	>20 years	Yes	M
6		x	<5 years	Yes	M
7	x		>20 years	Yes	M
8		x	< 5 years	No	F
9		x	< 10 years	Yes	M
10		x	< 10 years	No	F
11	x		>20 years	Yes	M
12		x	>10 years	Yes	M
13		x	< 5 years	No	M

3.3.4 Data Reliability and Calibration of Assessors

Assessor decisions pertaining to independent completion of tooth extractions did not require calibration due to the simplicity of the concept. It was recognized in advance that factors such as individual supervisor's views on patient safety as well workload issues related to student-supervisor ratios might result in variances in the way supervisors allowed students to work alone. It was decided to account for these variances in a *post hoc* contrast analysis (part of an Analysis of Variance Analysis).

Conversely, the LDI assessment required calibration in advance. Annual LDI training and calibration of supervising dentists at the beginning of the academic year took place as follows. The primary researcher gave a formal lecture on how to apply the LDI criteria after which all the supervising dentists had to apply the scoring principles. For calibration purposes, assessors were requested to evaluate previously assessed cases, according to the criteria in Table 3.3. Each assessor had to rate the LDI of previously extracted teeth using original orthopantomograms and clinical photos[‡] [§].

[‡] Examples of Orthopantomogram and clinical photos provided in Figures 3.6, 3.7 and 3.8 on page 26
[§] Relevant written consent forms for use of these images, obtained from the patients, are available from the author.
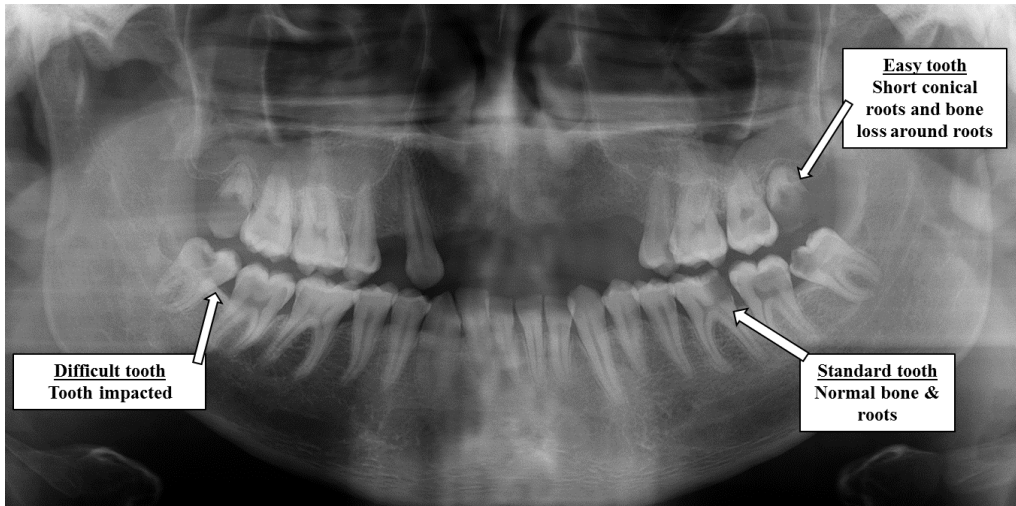
Figure 3.6. Orthopantomogram of clinical patient

Figure 3.7 Photo of patient's mouth

Figure 3.8 Photo of patient's teeth

When differences in opinion became apparent during training and calibration, the primary researcher discussed the requirements and standards with the supervising dentists until agreement was reached.

It is pertinent to note that because the study was conducted in a real-life environment, under time constraints, traditional inter- and intra-rater agreements were not feasible for LDI measurement. Fortunately, LDI only served as a secondary control. The measure also had no bearing on decisions pertaining to dependent/independent completion of tooth extractions. It was hence decided to also account for variances in this regard using *post hoc* contrast analysis. Given the expectation that some supervisors would be exposed to different types of cases due to their allocated slots within a workweek, a difference of up to 10% between the mean LDI score of an assessor and that of the reference (the primary researcher's mean LDI score) was considered acceptable. Deviating statistics were discussed with clinical supervisors when it became available to remediate methods of assessment or to gain clarity on reasons for deviations.

3.3.5 Calculation of the main performance indicators

The students' results were exported from the GoodX Dental Studio Software © database into Microsoft ® Office Excel. The primary researcher manipulated the data in Microsoft ® Office Excel to calculate the main performance indicators namely, the number of extracted teeth, independence ratio (IR), and the Level of Difficulty Index (LDI) score for a defined period.

3.3.5.1 Extraction count (number of extracted teeth) (EC)

The number of teeth extracted per student was calculated by counting the number of codes (refer to Table 3.1) entered into the software program for a defined period. This performance indicator is important because it is a reminder to students about their engagement in the clinical task. It therefore served the purpose of encouraging students to perform more tooth extractions as part of their training.

3.3.5.2 Level of Difficulty Index (LDI)

When independent practice serves as a performance indicator, there might be a risk that students will more frequently attempt easier tasks to obtain higher independence scores. A control measure is therefore needed to ensure that students also engage in procedures that are more difficult, to develop their skills. For this purpose, the LDI was devised.

The scores allocated to students for teeth removed without assistance, (a score of "4" (easy), "5" (standard) and "6" (difficult), (Tables 3.2 and 3.3) were used to calculate the LDI as follows:

A: Number of teeth for which a score of "4" was obtained.

B: Number of teeth for which a score of "5" was obtained.

C: Number of teeth for which a score of "6" was obtained.

Since A, B and C differed in degree of difficulty, each of these variables had to be loaded with a utility weight. Utility weightings of "1", "2.5" and "9" were respectively assigned to the "easy" extraction (A), "standard" extraction (B) and the "difficult" extraction (C). These numerical values in the formula were calculated according to the 2014 rates for dental treatment, as published by Discovery Health Medical Scheme (The largest open medical scheme in South Africa).[**]

[**] Information obtained from https://www.discovery.co.za/portal/individual/login, using a personalised password. Information available from the researcher.

Procedure code "8202", an additional tooth per quadrant (Easy tooth) was taken as the reference value of "1". Code "8201", first tooth per quadrant (Standard tooth) has a monetary value ± 2.5 times more than the reference value and code "8937", surgical extraction (Difficult tooth) has a monetary value ± 9 times the reference value. It should be noted that the aim of this measure was not to get an exact measurement of level of difficulty. The aim of this index was merely to obtain some kind of an estimate of the degree of difficulty.

The formula for the index was:

$$\text{LDI} = \frac{(1 \text{ x } A) + (2.5 \text{ x } B) + (9 \text{ x } C)}{(A + B + C)}$$

A minimum total count of 65 extractions (minimum quota per year) had to be achieved by students in order to calculate the final index. This minimum number of 65 equated more or less to 1.5 times the expected number of sessions per year that would be available for each student.

3.3.5.3 Independence ratio (IR)

Students who achieved a score higher than three (Table 3.2) were categorized as students who performed the work independently. Those with a score lower than four (Table 3.2) were categorized as students who performed the work with assistance. The independence ratio is then calculated as the number of extractions that were completed independently, divided by the total number of extractions that were completed, expressed as a percentage.

3.3.6 Feedback to students

The results attained through the assessment instrument were used to alert the students on a quarterly basis as to the number of teeth extracted, individual independence ratios and the level of difficulty achieved. This happened before the ensuing student holiday periods (Refer to Tables 3.5 and 3.6), which allowed them to voluntarily work in during the holiday time to improve their skills. Quarterly reports did not always cover the same number of weeks, as holiday recesses differed (Tables 3.5 and 3.6). The deadline for additional work was fourteen days after the fourth quarter assessment results were made available (Tables 3.5 and 3.6).

Table 3.5 Feedback schedule 4th year cohort

2014		
Dates	**Duration**	**Action**
27 January-11 April 2014	11 weeks	1st Quarter Assessment Results available
14 April-20 June 2014	10 weeks	2nd Quarter Assessment Results available
23 June-22 August 2014	9 weeks	3rd Quarter Assessment Results available
25 August-31 October 2014	10 weeks	4th Quarter Assessment Results available
3 November-14 November 2014	2 weeks	Final Assessment Results available
	42 weeks	
2015		
Dates	**Duration**	**Action**
26 January-20 March 2015	8 weeks	1st Quarter Assessment Results available
23 March-19 June 2015	13 weeks	2nd Quarter Assessment Results available
4 June 2015		Reflection Paper
22 June-21 August 2015	9 weeks	3rd Quarter Assessment Results available
24 August-6 November 2015	11 weeks	4th Quarter Assessment Results available
9 November-23 November 2015	2 weeks	Final Assessment Results available
	43 weeks	
2016		
Dates	**Duration**	**Action**
8 February-11 March 2016	5 weeks	1st Quarter Assessment Results available
14 March-17 June 2016	14 weeks	2nd Quarter Assessment Results available
9 June 2016		Reflection Paper
20 June-2 September 2016	11 weeks	3rd Quarter Assessment Results available
5 September-4 November 2016	9 weeks	4th Quarter Assessment Results available
7 November-18 November2016	2 weeks	Final Assessment Results available
	41 weeks	
2017		
Dates	**Duration**	**Action**
28 July 2017		Reflection Paper

Table 3.6 Feedback schedule 5th year cohort.

2014		
Dates	**Duration**	**Action**
13 January-11 April 2014	13 weeks	1st Quarter Assessment Results available
14 April-20 June 2014	10 weeks	2nd Quarter Assessment Results available
23 June-22 August 2014	9 weeks	3rd Quarter Assessment Results available
25 August-19 September 2014	4 weeks	4th Quarter Assessment Results available
22 September-3 October 2014	2 weeks	Final Assessment Results available
	38 weeks	
2015		
Dates	**Duration**	**Action**
12 January-20 March 2015	10 weeks	1st Quarter Assessment Results available
23 March-19 June 2015	13 weeks	2nd Quarter Assessment Results available
20 May 2015		Reflection paper Pilot
22 June-21 August 2015	9 weeks	3rd Quarter Assessment Results available
24 August-25 September 2015	5 weeks	4th Quarter Assessment Results available
28 September-9 October 2015	2 weeks	Final Assessment Results available
	39 weeks	
2016		
Dates	**Duration**	**Action**
11 January-11 March 2016	9 weeks	1st Quarter Assessment Results available
14 March-17 June 2016	14 weeks	2nd Quarter Assessment Results available
20 June-2 September 2016	11 weeks	3rd Quarter Assessment Results available
5 September-23 September 2016	3 weeks	4th Quarter Assessment Results available
26 September-7 October 2016	2 weeks	Final Assessment Results available
	39 weeks	

Ranking	Student Anonymized ID No	Extraction Count	Level of Difficulty Index	Independence Ratio
1	1279	40	2.24	98%
2	1091	38	2.34	77%
3	1097	38	2.72	89%
4	1109	37	2.83	81%
5	1021	36	2.26	92%
6	1123	33	2.71	73%
7	1163	31	3.31	86%
8	1061	31	4.09	88%
9	1213	30	2.52	81%
10	1039	29	3.63	67%
11	1049	29	3.80	83%
12	1153	27	2.42	79%
13	1291	26	3.90	91%
14	1181	25	2.42	90%
15	1277	24	2.04	68%
16	1009	22	1.96	74%
17	1063	21	1.47	89%
18	1151	20	2.43	88%
19	1223	20	2.27	76%
20	1018	29	2.89	82%
21	1171	19	3.15	81%
22	1231	16	2.65	81%
23	1019	16	1.80	94%
24	1187	16	2.64	88%
25	1201	15	2.35	67%
26	1283	15	1.54	93%
27	1117	15	2.11	93%
28	1217	15	2.07	93%
29	1237	14	2.56	57%
30	1289	13	2.94	62%
31	1031	12	3.21	100%
32	1051	11	3.50	91%
33	1193	9	2.50	82%
34	1229	7	2.29	100%
Minimum performance level		19.64	2.35	80%

Figure 3.9 Example of a typical feedback sheet

Figure 3.9 contains an example of feedback (anonymized) given to students, sorted in terms of EC. Students were able to gauge their own performance in relation to their peers using this feedback sheet (Figure 3.9). "Less than adequate performance" was highlighted on the feedback sheet for students to realize their inefficiencies. It should be noted that for the purpose of this pilot project "cut-off points" only served as an indicator to students that they are substantially lagging behind their peers. A description of the manner in which benchmarking is determined follows in the next section.

3.3.7 Benchmarking

"Less than adequate performance" for extraction count and LDI was defined by adopting mathematical methods normally employed during conventional standard setting. This was done after it became apparent that the data and graphs showed near perfect normal curves with a minority of students achieving performances way above expectation (outliers). Based on these observations and the sample size of about 50 it was decided to calibrate the standards on the ninetieth percentile student, similar to the Cohen Method of standard setting that uses the ninety-fifth percentile.[107-110] These methods were considered appropriate because different cohorts were exposed to different circumstances (scheduling, different supervisors and operational differences) on an annual basis, which makes the use of absolute cut-off points unfair for certain groups.

"Less than adequate performance" for extraction count was set at 55% of the ninetieth percentile while 65% of the ninetieth percentile was adopted for LDI. As noted before this was merely done for feedback purposes to encourage low achieving students to engage with the activity more often and to attempt more difficult tooth extractions to develop their skills.

The benchmarks for IR were arbitrarily chosen based on the data obtained from the 2014 cohorts. It quickly became apparent from the data that the majority of fourth year students are able to do eight out of ten extractions on their own throughout the year while fifth year students could achieve nine out of ten independent extractions.

Students with "less than adequate performances" were approached with an offer of support and discussions to improve performance.

3.3.8 Statistical analysis

Descriptive statistics, including graphs, were used to describe changes in number of teeth extracted, level of difficulty attained and level of independence achieved by students over time.

Differences in progression in terms of the number of tooth extractions completed were measured with the Wilcoxon signed-rank test because of the slightly abnormal distribution of EC (z-score for fourth year cohorts varied between 1.31 and 2.25, with the fifth year cohorts' z-scores ranging between 0.74 and 3.50). Normally distributed level of difficulty scores attained and independence achieved were measured by means of a paired t-test between feedback episodes (Tables 3.5 and 3.6).

Assessors LDI scores at year-end, were compared using one-way linear Analysis of Variance, in combination with Least Square Difference *post hoc* contrast analysis, to identify variances in interpretation and application. The primary investigator of this study served as the reference or Ctrl to compare all assessor statistics. It should be noted that the skill level of the clinical supervisors differed in terms of surgical extractions. Some supervisors by default supervised fewer of these procedures. Other part-time supervisors worked at times when surgical extractions were rare. Since surgical extractions are loaded considerably in the LDI, it would skew the LDI data for those who do not regularly supervise surgical extractions (and *vice versa*). For this purpose, the data had to be adjusted to ensure that LDI is assessed on equal terms for assessors (Adjusted LDI). All surgical codes, as described in Table 3.1, were subsequently omitted when these results were compared. Only procedure codes "8201" and "8202" were included when students performed tooth extractions independently. All "zero" ratings, as defined in Table 3.2, were also removed as these constituted clinical demonstrations only.

Chi-square analysis (using two-by two tables) were used to assess the differences in IR between the Ctrl and the other assessors. The IR scores of each assessor were systematically compared to that of the Ctrl. Again "zero" ratings were excluded.

It is pertinent to note that the primary researcher was absent due to a medical problem for a portion of the first and second quarters of 2016. These unforeseen circumstances may have affected the 2016 IR and adjusted LDI results. In the results section an adjustment to the statistics, by taking into consideration the absent time, will be made to ensure comparable rater agreement statistics.

The 2016 results may further have been affected by a sudden increase in the number of students that had to share the twelve dental chairs.

Student exposure to different clinical supervisors (assessors) were also calculated as a control measure.

Significance was set at $P<0.05$. It should be noted that this statistical cut-off point should be viewed with caution given the large sample size and the repeated testing. Consideration was rather given to the clinical significance of the size of the recorded differences.

3.4 Qualitative Assessment and Analysis.

The qualitative part of the study was done in order to gain an understanding of the students' self-regulated learning in relation to their learning exodontia skills, as well as their opinion of the new assessment instrument.[111-112]

3.4.1 Study design and target population

The qualitative part of the study involved an evaluation of student feedback that included students of the 2015, 2016 and 2017 fourth year cohorts. Fourth year students were asked to write a structured reflection[70,113] about the feedback they received as well as their perceptions and behaviours in relation to tooth extractions and the evaluation instrument as a whole.[114]

The initial part of the reflection was structured with questions (Appendix A) enquiring about the reasons certain students outperform others:

- Question 1: Why do you think some students extract more teeth than others?
- Question 2: Why do you think some students' Independence ratios are higher or lower than others?
- Question 3: Why do you think some students' level of difficulty achieved is higher or lower than others?

Questions 4 to 6 (Appendix A) were subsequently based on Zimmermann's model of self-regulated learning (Fig. 2.1).[47,69,72-73] This was done in order to acquire insight into students' self-regulation ability, as well as psychological factors that may influence students' learning in exodontia skills.

- Question 4: Do you have certain targets for the Independence ratio, level of difficulty and extraction quota levels?
  If "Yes", please specify separately. (Goal setting / strategic planning)
- Question 5: What do you focus on and what goes on in your mind when doing an extraction? (Task strategy and focus)
- Question 6: What do you think you can do to improve your ability to extract teeth? (Self-judgement)

An additional open-ended question (Question 7) was posed to students to elicit suggestions or any other comments. This question did not form part of the research, but was only added to obtain information that might help in future management of the instrument. Results of this

question will consequently not be reported.

- Question 7: Are there any other reactions, perceptions or suggestions that you would like to add in connection with the GoodX system?

The reflection format was piloted in a 2015 fifth year cohort of seven students. These students also participated in the clinical activities in the same clinic during 2015 and were therefore familiar with the assessment instrument. A small adjustment to the structured reflection paper was necessary to clarify the last question (Question 7).

The actual reflections took place at the end of the second quarter of 2015, 2016 and 2017 (refer to Table 3.5). The scheduling of the reflection in the middle of the year allowed students to settle in the new learning environment and gave them enough time to have completed a substantial number of tooth extractions. The anonymous written reflections took place during a formal lecture period supervised by the primary researcher.

3.4.2 Qualitative analysis

An independent individual retyped the hand-written reflection papers for all three cohorts (2015-2017) (Appendix B). This was done to negate any issues participants might have about anonymity and recognition of handwriting, as the researcher is also involved in marking of test and examination papers of the participants.[115] The retyped reflections were then read by the researcher and were thematically coded[75] using an open-ended coding strategy. Interpretation of categories, themes and subthemes through discussion and explanation of coding data was a team effort between the primary investigator and the research supervisor. Perspectives on and different observations of certain comments could be deliberated and clarified. Liaison negates preference and assumptions during coding of data to enhance the coding conclusions.[116] The coded themes were systematically grouped into common categories after the coding process had been completed. A protocol recommended by Taylor and Bogdan[117-118] was followed to do thematic coding of data. This protocol essentially has three components:

- Words/phrases that describe the essence of what is meant are noted
- Topics that are recognized are compared with other themes to look for unifying aspects
- Similarities among different themes are recognized and merged, to provide structure for higher order themes, which are then used for coding.

The final coding was devised by formulating abbreviations for the above protocol.

The leading part of the code firstly consisted of the year the reflection took place *e.g.*, "2015". Characters were then allocated to the questions posed in the structured reflection papers. Question one in the reflection paper was for example condensed to "Q1". Thirdly, reflection papers for each cohort were numbered chronologically, starting with "1". It therefore makes sense that the eighth participant's answers of Question 2 in 2016 translated to "2016.Q1.P8. This part of the coding would then indicate the "Source" of the data. The second part of the code consisted of alphabetical characters and numerical numbers being allocated to identified categories, themes and subthemes that emerged from these questions. This next element of the coding signified the "Analysis code".

Questions 1 to 3 were analysed using Dijksterhuis' model[25] of "the inter-relationship between competence and independence" (Fig. 2.2). The following broad categories obtained from the model served as higher-level themes:

1. Category 1 (C1) - Trainee
2. Category 2 (C2) - Supervisor
3. Category 3 (C3) - Professional Activity
4. Category 4 (C4) - Working environment

Reflections were then scrutinised to identify possible themes and subthemes for each category.

Questions 4 to 6 were subsequently analysed according to the three phases of Zimmermann's model of self-regulated learning (Fig. 2.1).[47,69,72-73]

The data obtained were imported into Microsoft ® Office Excel to do calculations of percentage distributions of emerging themes. Examples of the coding can be viewed in Appendix A

3.5 Ethical considerations

A proposal for the project was submitted and approved by the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, on 21 April 2016 (Appendix C). The primary researcher explained the study in full to the student participants. All Student participants (2015-2017) gave written informed consent for the qualitative part of the study (Appendix D).

Permission to do research and conduct an analysis of the BChD 4 and 5 cohorts' (2014-2017) written reflections and assessment data as done in the exodontia clinic of the MOFS at the SDUP, was obtained from the dean/manager of the SDUP (Appendix E).

Anonymity and confidentiality of all data supplied were respected and research data will be stored according to protocol.

3.6 Summary of the Chapter

Chapter 3 described the study design, including the rationale, construct and evaluation of a novel continuous assessment instrument. Chapter 4 provides a detailed representation of the results of the study.

Chapter 4. Results

Chapter 4 describes the results of the study. The first part of the chapter concentrates on the quantitative results and the second part on the qualitative results.

4.1 Quantitative Results

Data obtained from the BChD 4 and BChD 5 cohorts (2014 to 2016) served as the basis of the analysis. In total, 28 574 individual assessments of tooth extractions were performed by 14 clinical supervisors in the MOFS, of which 294 (1.03%) were excluded because of either, obvious incorrect mark allocation (5) or non-assessment (289). A grand total of 28 280 assessments were therefore included in the study.

4.1.1 Descriptive statistics

This section reports the descriptive statistics for "Tooth extraction count" (EC), "Level of Difficulty Index" (LDI), "Independence Ratio" (IR) and assessor rating comparisons.

4.1.1.1 Tooth Extraction Count Results

The EC results of the 2014 to 2016 fourth year cohorts are reported first, followed by the results of the 2014 to 2016 fifth year cohorts.

4.1.1.1.1 BChD 4 2014 Cohort

Table 4.1 provides a broad outline of the EC statistics for the BChD 4 cohort of 2014. At first feedback in April 2014, the BChD 4 students (n=42) achieved a median EC of 17, ranging from a minimum of seven to a maximum of 40 extractions per student. The EC gradually increased to a median of 97 at final feedback in November 2014, with a range of 57 - 232 extractions.

Table 4.1 Extraction Counts for BChD 4 2014 (n=42)

Feedback schedule	Mean Extraction count	Median	Range (Min-Max)
1st (11 April 2014)	19.81	17	7-40
2nd (20 June 2014)	42.74	37	22-104
3rd (22 August 2014)	61.00	57	32-149
4th (31 October 2014)	92.69	87	53-225
Final (14 November 2014)	102.60	97	57-232

Table 4.2 shows the incremental increase in EC between feedback episodes for the BChD 4 cohort of 2014. The median difference between the first two feedback episodes was 20. The subsequent three sequential incremental increases were 20, 30 and ten, respectively. All these incremental increases were statistically significant (Wilcoxon signed-rank test, P<0.001).

Table 4.2 Incremental Extraction Count increases between feedback episodes for BChD 4 2014 (n=42)

Increment boundaries	Incremental increase: Mean Difference	Incremental increase: Mean Difference	Wilcoxon signed-rank test (P-value)
1st feedback to 2nd feedback	22.93	20	<0.001
2nd feedback to 3rd feedback	18.26	20	<0.001
3rd feedback to 4th feedback	31.69	30	<0.001
4th feedback to final feedback	9.90	10	<0.001

Figure 4.1 displays the comparative EC scores for the BChD 4 2014 cohort at first and final feedback. At first feedback EC scores were low and very little variation was visible. Variation in EC increased at final feedback. Students with substantially more extractions compared to their peers (outliers) became evident at final feedback at the higher EC end of the graph.

A full account of EC increases is provided in Appendix F with Figures F.1 to F.5 displaying the incremental increases for each feedback episode and Figure F.6 showing a combination of all the episodes (five feedback episodes during the year).
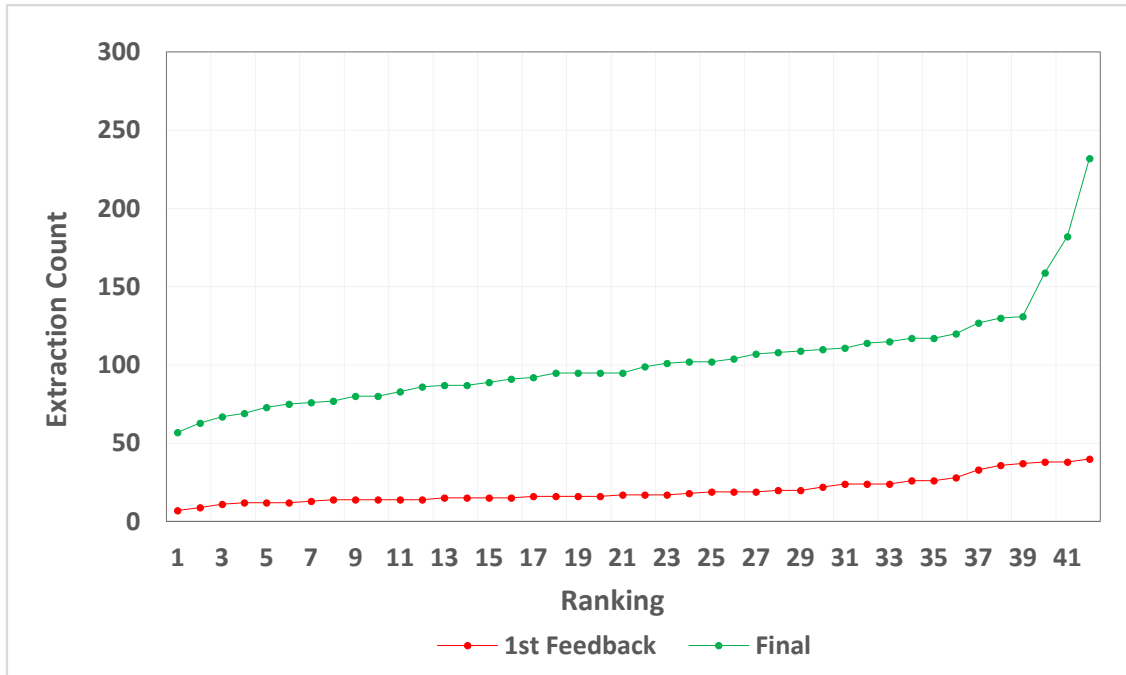
Figure 4.1 BChD 4 2014 (n=42) Extraction Counts at first and final feedback episodes

The increase in EC per individual student for the 2014 BChD 4 cohort is displayed in Table F.1 in Appendix F (Page 218). All students showed a gradual increase in EC over time. The highlighted areas in the table, display a significant decrease in the gap between the students with the highest EC scores and the students with the lowest EC scores over time.

4.1.1.1.2 BChD 4 2015 Cohort

Table 4.3 represents EC results for the 2015 BChD 4 cohort (n=51). At first feedback in March 2015, this cohort achieved a median EC of 15, ranging from eight to 62 extractions. This increased to a median of 105 extractions at final feedback in November 2015, ranging between 65 and 261.

Table 4.3 Extraction Counts for BChD 4 2015 (n=51)

Feedback Schedule	Mean Extraction count	Median	Range (Min-Max)
1st (20 March 2015)	17.18	15	8-62
2nd (19 June 2015)	55.22	53	29-178
3rd (21 August 2015)	76.16	70	39-202
4th (6 November 2015)	107.73	100	60-256
Final (23 November 2015)	110.43	105	65-261

Table 4.4 displays the incremental increase in EC between feedback episodes for the BChD 4 cohort of 2015. The median difference between the first and the second feedback episodes was 38. The subsequent three sequential incremental increases were 17, 30 and 5 respectively. Again, all these incremental increases were statistically significant (Wilcoxon signed-rank test, P<0.001).

Table 4.4 Incremental Extraction Count increases between feedback episodes for BChD 4 2015 (n=51)

Increment boundaries	Incremental increase: Mean Difference	Incremental increase: Median Difference	Wilcoxon signed-rank test (P-value)
1st feedback to 2nd feedback	38.04	38	<0.001
2nd feedback to 3rd feedback	20.94	17	<0.001
3rd feedback to 4th feedback	31.57	30	<0.001
4th feedback to final feedback	2.71	5	<0.001

The matching EC scores for the BChD 4 2015 cohort at first and final feedback are shown in Figure 4.2. At first feedback EC scores demonstrated small variation and were low in comparison with the final feedback, which showed increased variation. "Outliers", on both the lower and higher ends of the graph, became evident at final feedback.

A complete account of EC scores is provided in Appendix F, with Figures F.7 to F.11 demonstrating incremental increases between feedback episodes. Figure F.12 displays ECs for all the feedback episodes.

The improvement in the EC of individual students for the 2015 BChD 4 cohort is displayed in Table F.2 in Appendix F (Page 219). Again, all students showed a gradual increase in EC. The highlighted areas in the table of EC scores, once again display an important decrease in the gap between high and low scoring students.
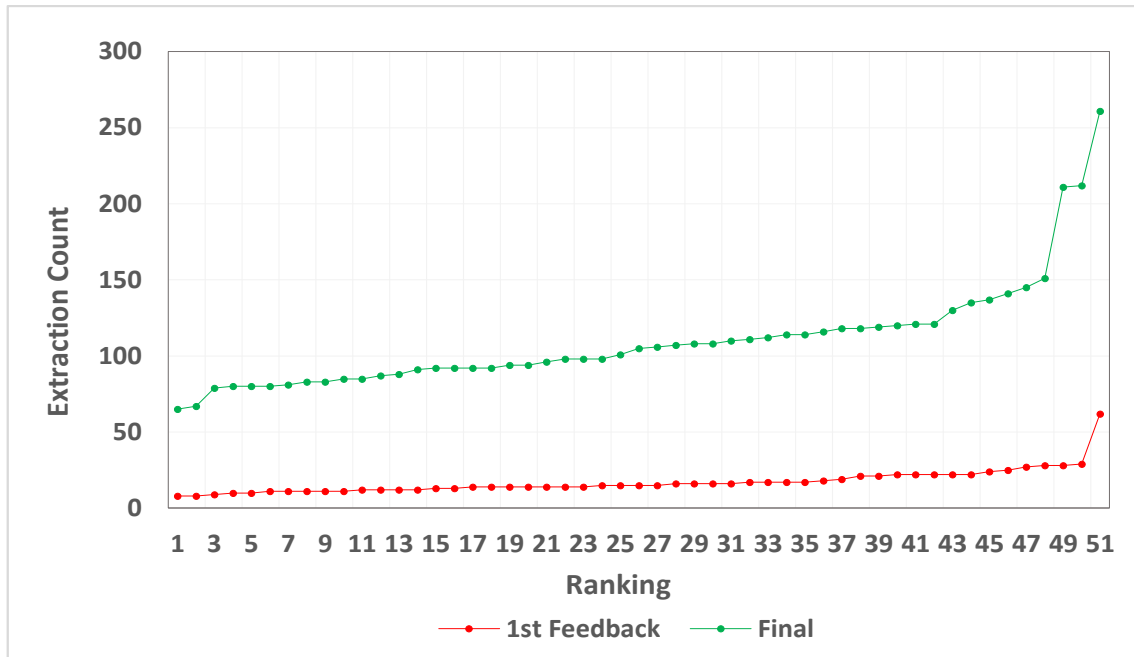
Figure 4.2 BChD 4 2015 (n=51) Extraction Counts at first and final feedback episodes

4.1.1.1.3 BChD 4 2016 Cohort

Table 4.5 demonstrates the EC outcome for the 2016 BChD 4 cohort (n=62). At first feedback (11 March 2016) this cohort achieved a median EC of five. Their EC ranged between one and 16 extractions per student for this period. This result eventually changed to a median of 81 at final feedback in November 2016. The range at final feedback was 55 to 140 extractions for individual students.

Table 4.5 Extraction Counts for BChD 4 2016 (n=62)

Feedback Schedule	Mean Extraction Count	Median	Range (Min-Max)
1st (11 March 2016)	5.26	5	1-16
2nd (17 June 2016)	24.16	23	11-45
3rd (2 September 2016)	47.37	44	15-89
4th (4 November 2016)	77.15	77	47-134
Final (18 November 2016)	81.87	81	55-140

Table 4.6 displays incremental increase in EC between feedback episodes for the BChD 4 cohort of 2016. The median difference between the first two feedback episodes constituted 18 tooth extractions. The following three consecutive incremental increases were 21, 33 and 4, respectively. Once more, all the incremental increases were statistically significant (Wilcoxon signed-rank test, P<0.001).

Table 4.6 Incremental Extraction Count increases between feedback episodes for BChD 4 2016 (n=62)

Increment boundaries	Incremental increase: Mean Difference	Incremental increase: Mean Difference	Wilcoxon signed-rank test (P-value)
1st feedback to 2nd feedback	18.90	18	<0.001
2nd feedback to 3rd feedback	23.21	21	<0.001
3rd feedback to 4th feedback	29.77	33	<0.001
4th feedback to final feedback	4.73	4	<0.001

Figure 4.3 displays ECs at first and final feedback for the 2016 BChD 4 cohort. The EC scores presented, showed little variance at first feedback, but differences at final feedback were more visible, with the "outliers" at the top end of the EC graph. A comprehensive version of ECs is provided in Appendix F. Figures F.13 to F.17 shows the incremental increases between feedback episodes. Figure F.18 in turn displays ECs for all the feedback episodes.
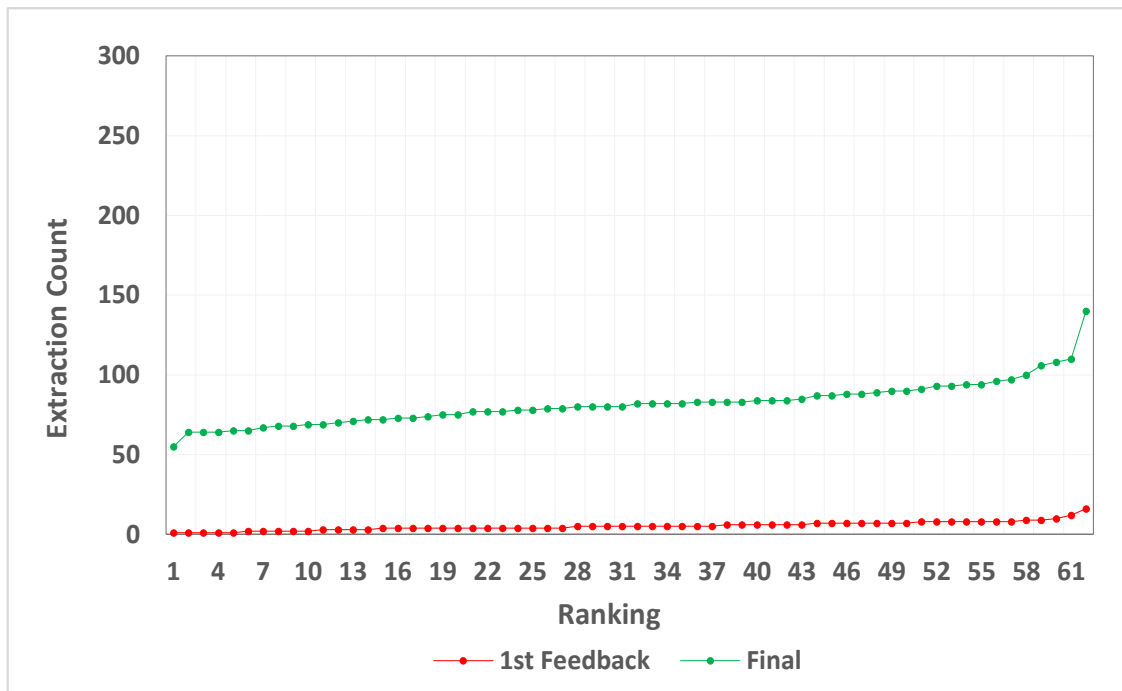
Figure 4.3 BChD 4 2016 (n=62) Extraction Counts at first and final feedback episodes

The increase in the EC for individual students of the 2016 BChD 4 cohort is displayed in Table F.3 in Appendix F (Page 220). All students, as with the previous two cohorts, showed a gradual increase in EC over time. The decrease in the gap between students with high EC scores and those with low EC scores are once more visible in the highlighted areas of the table.

4.1.1.1.4 BChD 5 2014 Cohort

Table 4.7 provides a summary of the EC statistics for the 2014 BChD 5 cohort (n=58). In April 2014, at first feedback, students achieved a median EC of 33, ranging from a minimum of 13 to a maximum of 75 extractions. This result continuously improved to a median of 87 with a range of 27-168 extractions at final feedback time in November 2014.

Table 4.7 Extraction Counts for BChD 5 2014 (n=58)

Feedback Schedule	Mean Extraction count	Median	Range (Min-Max)
1st (11 April 2014)	35.52	33	13-75
2nd (20 June 2014)	57.34	55	17-121
3rd (22 August 2014)	75.29	73	25-153
4th (19 September 2014)	85.60	84	26-162
Final (3 October 2014)	89.78	87	27-168

Table 4.8 shows the incremental increase in EC between feedback episodes for the BChD 5 cohort of 2014. The median difference between the first two feedback episodes was 22. The subsequent three consecutive increases were 18, 11 and three, respectively. All incremental increases were statistically significant (Wilcoxon signed-rank test, P<0.001).

Table 4.8 Incremental Extraction Count increases between feedback episodes for BChD 5 2014 (n=58)

Increment boundaries	Incremental increase: Mean Difference	Incremental increase: Mean Difference	Wilcoxon signed-rank test (P-value)
1st feedback to 2nd feedback	21.83	22	<0.001
2nd feedback to 3rd feedback	17.95	18	<0.001
3rd feedback to 4th feedback	10.31	11	<0.001
4th feedback to final feedback	4.17	3	<0.001

A graphical representation of the correlative EC scores at first and final feedback for the BChD 5 2014 cohort can be viewed in Figure 4.4. The EC scores at first feedback varied slightly but the disparities increased at final feedback. At the top and bottom ends of the EC graph, "outliers" were clearly visible and were more pronounced at final feedback.

A full version of EC score increases are shown in Appendix F. Figures F.19 to F.23 illustrate the results per feedback episode and Figure F.24 a combination of all the episodes.

The increase in EC per individual student for the 2014 BChD 5 cohort is displayed in Table F.4 in Appendix F (Page 221). The BChD 5 2014 cohort had all students showing a gradual increase in EC over time. As with the BChD 4 cohorts, a decrease in the gap between students with a high and those with a low EC was evident. This is displayed in the highlighted areas.
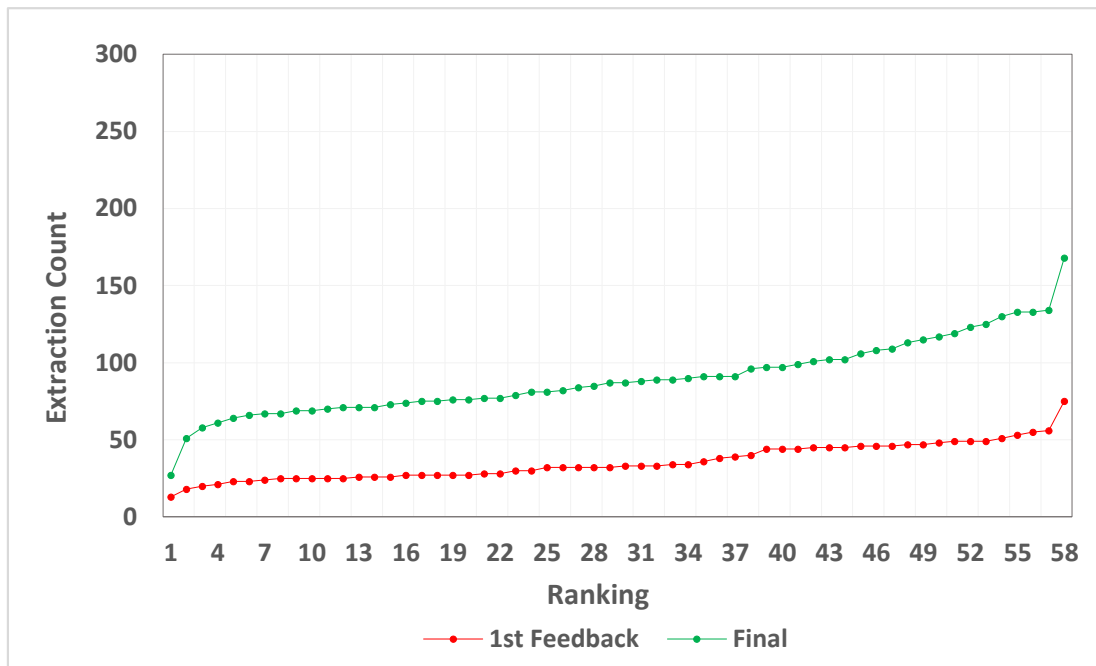
Figure 4.4 BChD 5 2014 (n=58) Extraction Counts at first and final feedback episodes

4.1.1.1.5 BChD 5 2015 Cohort

Table 4.9 indicates the EC results for the 2015 BChD 5 cohort (n=37). It should be noted that these results are in addition to the 2014 BChD 4 EC results (Tables 4.1 and 4.2 above). The 2015 BChD 5 cohort is largely the same group of students who progressed from BChD 4 at the end of 2014.

At first feedback in March 2015, this cohort had accomplished a median EC of 30 for the year, ranging from a minimum of 17 to a maximum of 66 extractions. This result improved to a median EC of 92 at final feedback in October 2015, ranging between 65 and 219 extractions for individual students.

Table 4.9 Extraction Counts for BChD 5 2015 (n=37)

Feedback Schedule	Mean Extraction count	Median	Range (Min-Max)
1st (20 March 2015)	30.89	30	17-66
2nd (19 June 2015)	60.27	57	39-147
3rd (21 August	80.97	78	54-190
4th (25 September	91.86	89	64-207
Final (9 October	93.97	92	65-219

Table 4.10 displays the incremental increase in EC between feedback episodes for the BChD 5 cohort of 2015. Also, refer to Table 4.2 above for the cohort's 2014 incremental increases in EC. The median difference between the first two feedback episodes of 2015 was 27. The subsequent three incremental increases were 21, 11 and three, respectively. Again, all incremental increases in EC were statistically significant (Wilcoxon signed-rank test, P<0.001).

Table 4.10 Incremental Extraction Count increases between feedback episodes for BChD 5 2015 (n=37)

Increment boundaries	Incremental increase: Mean Difference	Incremental increase: Median Difference	Wilcoxon signed-rank test (P-value)
1st feedback to 2nd feedback	29.38	27	<0.001
2nd feedback to 3rd feedback	20.70	21	<0.001
3rd feedback to 4th feedback	10.89	11	<0.001
4th feedback to final feedback	2.11	3	<0.001

Figure 4.5 graphically displays the BChD 5 2015 cohort's EC scores at first and final feedback. The EC scores at first and final feedback demonstrated small variations but the "outliers" at the top end of the graph were very notable. Appendix F provides a more comprehensive account of these EC scores. Figures F.25 to F.29 display ECs per feedback episode and Figure F.30 shows a combined graph for all the episodes.

Increases in EC per individual student for the 2015 BChD 5 cohort are displayed in Table F.5 in Appendix F (Page 222). Again, all students showed a gradual increase in EC over time. Highlighted parts in the table indicate a marked decrease in the gap between students with low scores and those that have a high EC.
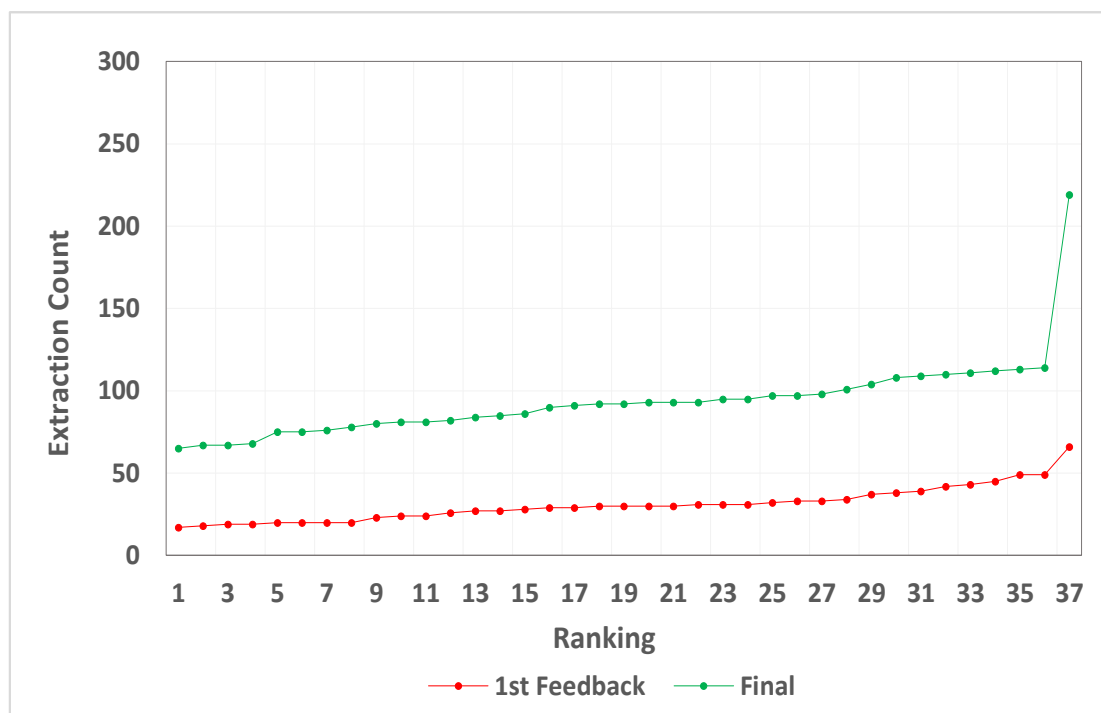
Figure 4.5 BChD 5 2015 (n=37) Extraction Counts at first and final feedback episodes

4.1.1.1.6 BChD 5 2016 Cohort

Table 4.11 reveals the EC outcome for the 2016 BChD 5 cohort (n=51). These results are again in addition to the 2015 BChD 4 EC results (Tables 4.3 and 4.4 above). The 2016 BChD 5 cohort is the same group of students who progressed from BChD 4 at the end of 2015.

At first feedback in March 2016, this cohort achieved a median EC of 23. Individual ECs ranged between nine and 62 extractions. This result changed to a median EC of 85 at final feedback in October 2016. ECs for individual students ranged from a minimum of 65 to a maximum of 150 extractions.

Table 4.11 Extraction Counts for BChD 5 2016 (n=51)

Feedback Schedule	Mean Extraction count	Median	Range (Min-Max)
1st (11 March 2016)	25.39	23	9-62
2nd (17 June 2016)	60.22	56	29-115
3rd (2 September 2016)	79.84	77	50-127
4th (23 September 2016)	87.06	83	58-148
Final (7 October 2016)	89.78	85	65-150

The incremental increase in EC between feedback episodes for the BChD 5 cohort of 2016 is indicated in Table 4.12. The median difference between the first two feedback episodes was 33 this time round. The following three consecutive incremental increases were 21, six and two, respectively. Once more all incremental increases were statistically significant (Wilcoxon signed-rank test, P<0.001).

Table 4.12 Incremental Extraction Count increases between feedback episodes for BChD 5 2016 (n=51)

Increment boundaries	Incremental increase: Mean Difference	Incremental increase: Mean Difference	Wilcoxon signed-rank test (P-value)
1st feedback to 2nd feedback	34.82	33	<0.001
2nd feedback to 3rd feedback	19.63	21	<0.001
3rd feedback to 4th feedback	7.22	6	<0.001
4th feedback to final feedback	2.73	2	<0.001

A graphical representation of associated EC scores, at first and final feedback, for the BChD 5 2016 cohort can be viewed in Figure 4.6. EC scores at first feedback were once again low, with slight variation between students compared to much higher scores and lower variation at final feedback. "Outliers" at the top end of the graph were once again visible. Table 4.4 shows the performance of this cohort for 2015 (Their preceding year).
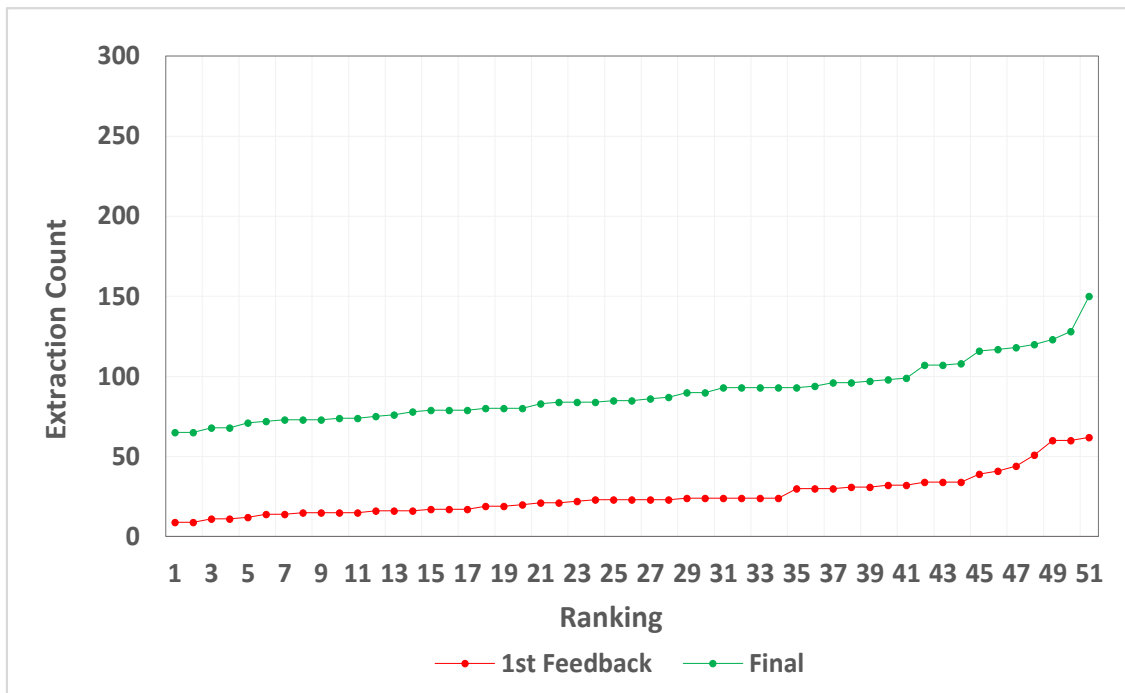
Figure 4.6 BChD 5 2016 (n=51) Extraction Counts at first and final feedback episodes

More comprehensive illustrations of EC scores for this cohort can be found in Appendix F, with Figures F.31 to F.35 showing the scores per feedback episode and Figure F.36 demonstrating a combined image of all the episodes.

Increases in EC for individual students for the 2016 BChD 5 cohort are displayed in Table F.6 in Appendix F (Page 223). All students, as with the previous two fifth year cohorts, showed a gradual increase in EC throughout. A significant decrease in the gap between scores of students at the top end of the graph and those at the lower end is once again visible in the highlighted sections of the table.

4.1.1.1.7 Extraction Count target achievement over time

Table 4.13 indicates the number of students who achieved mathematically determined EC minimum targets during feedback episodes per cohort. Distinct increases in the percentage of students who attained minimum targets could be observed across all the cohorts over time.

Table 4.13 Attainment of Extraction Count targets following feedback episodes

Episodes	Year	Number of BChD 4 students achieving target	%	Year	Number of BChD 5 students achieving target	%
1st Feedback	2014 (n=42)	15	35.71%	2014 (n=58)	43	74.14%
2nd Feedback		24	57.14%		51	87.93%
3rd Feedback		32	76.19%		46	79.31%
4th Feedback		37	88.10%		52	89.66%
Final Feedback		38	90.48%		50	86.21%
1st Feedback	2015 (n=51)	35	68.63%	2015 (n=37)	26	70.27%
2nd Feedback		42	82.35%		33	89.19%
3rd Feedback		42	82.35%		37	100.00%
4th Feedback		49	96.08%		37	100.00%
Final Feedback		49	96.08%		37	100.00%
1st Feedback	2016 (n=62)	35	56.45%	2016 (n=51)	28	54.90%
2nd Feedback		41	66.13%		34	66.67%
3rd Feedback		47	75.81%		45	88.24%
4th Feedback		61	98.39%		48	94.12%
Final Feedback		62	100.00%		51	100.00%

A total of 9.52% of fourth year students and 13.79% fifth year students did not achieve the minimum targets at final feedback in 2014. In 2015, only two fourth year students did not achieve the minimum targets. All students achieved minimum targets in 2016 at final feedback.

4.1.1.1.8 Extraction Count per session worked

The number of two-hour sessions worked by students is displayed in Appendix G. It should be noted that not all sessions culminate in an assessable procedure being performed. Sometimes patients have to be referred for specialist/medical treatment or procedures other than tooth extractions are performed. EC per session is shown in Table 4.14. These results indicate that EC per session remained consistent for all cohorts, except for the BChD 5 2106 cohort, which displayed a slight increase of EC per session. Students with excessive number of extractions ("outliers") compared to their peers can be viewed at the top end of the scale in Figures F.1 to F.36.)

Table 4.14 Time available to students in relation to procedures performed

Cohort	Weeks	Mean Number of Sessions	Mean Extraction Count per Week	Mean Extraction Count per Session
BChD 4 2014 (n=42)	42	49.29	2.44	2.08
BChD 4 2015 (n=51)	43	52.24	2.57	2.11
BChD 4 2016 (n=62)	41	38.98	2.00	2.10
BChD 5 2014 (n=58)	38	42.16	2.36	2.13
BChD 5 2015 (n=37)	39	44.70	2.41	2.10
BChD 5 2016 (n=51)	39	38.86	2.30	2.31

4.1.1.1.9 Summary of Tooth Extraction Count Results

All students, in all cohorts, showed a gradual increase in EC over time as displayed in Tables F.1-F.6 in Appendix F (pages 218-223). All the cohorts also displayed a significant increase in EC throughout. The percentage of students below the mathematically determined "less than adequate cut-off point" declined as feedback was given (Table 4.13). "Outliers", especially at the top end, were easily identifiable (Figures 4.1-4.6).

This concludes the tooth EC results. Level of Difficulty Index results will follow.

4.1.1.2 Level of Difficulty Index Scores

The next part of the analysis includes statistics pertaining to the LDI achieved by the various cohorts. The results of the three fourth year cohorts will be reported first, followed by the results of the three fifth year cohorts.

4.1.1.2.1 BCHD 4 Level of Difficulty Index Scores

The mean LDI for the 2014 fourth year cohort (n=42) varied from 2.68 (SD: 0.67) to 2.57 (SD: 0.38) from first to final feedback (Table 4.15).

Table 4.15 Level of Difficulty Index scores for BChD 4 2014 (n=42)

Feedback Schedule	Number of assessments (n)	Mean Level of Difficulty Index	SD	SE	Range (Min-Max)
1st (11 April 2014)	832	2.68	0.67	0.10	1.47-4.30
2nd (20 June 2014)	1795	2.67	0.59	0.09	1.63-3.94
3rd (22 August 2014)	2562	2.66	0.49	0.08	1.65-3.73
4th (31 October 2014)	3893	2.58	0.38	0.06	1.85-3.40
Final (14 November 2014)	4309	2.57	0.38	0.06	1.88-3.33

Incremental changes between feedback episodes were small and statistically insignificant (Paired samples t-test, P>0.05) (Table 4.16). Results became less variable (smaller standard deviations and errors, as well as a smaller minimum maximum range) over time.

Table 4.16 Incremental Level of Difficulty Index changes between feedback episodes for BChD 4 2014 (n=42)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	-0.01	-0.14	0.12	0.877
2nd feedback to 3rd feedback	-0.01	-0.09	0.06	0.701
3rd feedback to 4th feedback	-0.08	-0.16	0.01	0.070
4th feedback to final feedback	-0.01	-0.04	0.02	0.492

Figure 4.7 graphically shows the variability of LDI scores at first and final feedback. At first feedback, LDI scores varied considerably but became more precise at the end of the year showing an almost perfect normal probability distribution.

The mean LDI, as well as incremental changes between feedback episodes, for the fourth-year cohort in 2015 (n=51), also remained similar at each of the feedback episodes (Tables 4.17 and 4.18). Again, results became less variable (smaller standard deviations and errors, as well as a smaller minimum maximum range) over time. Figure 4.8 shows the variability of LDI scores at first and final feedback. At first feedback, LDI scores once more varied considerably changing to a near flawless Bell curve at final feedback.
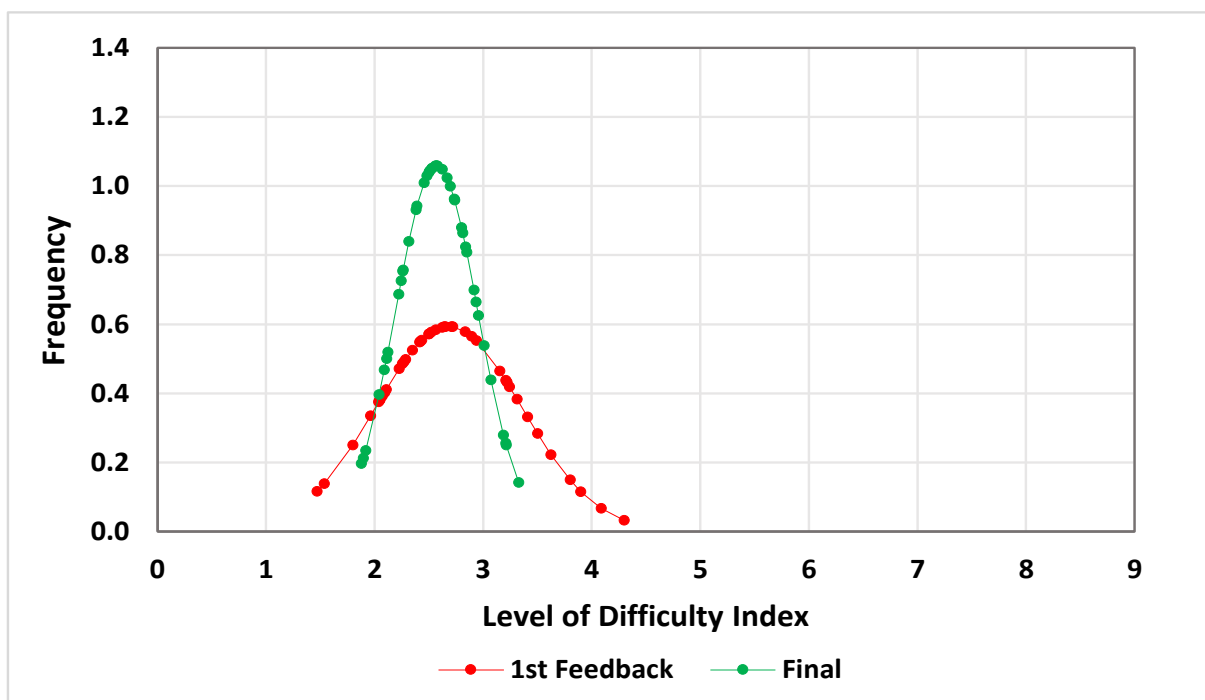
Figure 4.7 BChD 4 2014 (n=42) Level of Difficulty Index comparison between first and final feedback scores

Table 4.17 Level of Difficulty Index scores for BChD 4 2015 (n=51)

Feedback Schedule	Number of assessments (n)	Mean Level of Difficulty Index	SD	SE	Range (Min-Max)
1st (20 March 2015)	876	2.28	0.59	0.08	1.43-4.15
2nd (19 June 2015)	2816	2.43	0.44	0.06	1.37-3.60
3rd (21 August 2015)	3884	2.45	0.39	0.05	1.58-3.38
4th (6 November 2015)	5494	2.48	0.34	0.05	1.74-3.23
Final (23 November 2015)	5632	2.47	0.32	0.05	1.78-3.14

Table 4.18 Incremental Level of Difficulty Index changes between feedback episodes for BChD 4 2015 (n=51)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	**Upper**	
1ˢᵗ feedback to 2ⁿᵈ feedback	0.14*	-0.04	0.33	0.132
2ⁿᵈ feedback to 3ʳᵈ feedback	0.02	-0.04	0.09	0.468
3ʳᵈ feedback to 4ᵗʰ feedback	0.03	-0.04	0.10	0.425
4ᵗʰ feedback to final feedback	-0.01	-0.02	0.01	0.298

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.17
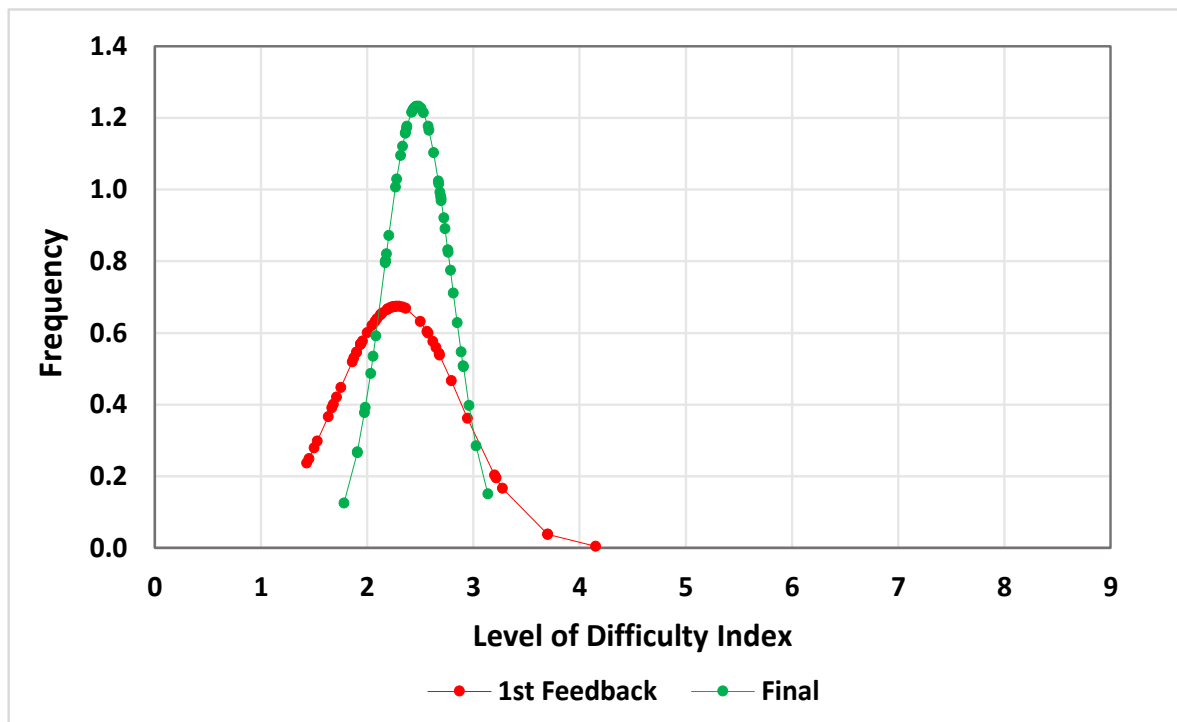
Figure 4.8 BChD 4 2015 (n=51) Level of Difficulty Index comparison between first and final feedback scores

For the 2016 fourth year cohort (n=62) the mean LDI continued to remain comparable among feedback episodes, except for the first feedback episode where the mean LDI was 2.47 (SD: 1.69) (Table 4.19). During the March 2016 feedback episode (Table 4.19) the number of assessments (n=326) was also considerably lower than during corresponding episodes of the previous two cohorts (2014: n = 832 and 2015: n = 876)(Tables 4.15 and 4.17).

Results once again became less variable (smaller standard deviations and errors, as well as a smaller minimum maximum range) over time. Incremental changes between feedback episodes were also again minor and proved to be statistically insignificant (Paired samples t- test, P>0.05).

Table 4.19 Level of Difficulty Index scores for BChD 4 2016 (n=62)

Feedback Schedule	Number of assessments (n)	Mean Level of Difficulty Index	SD	SE	Range (Min-Max)
1st (11 March 2016)	326	2.47	1.69	0.21	0.00-9.00
2nd (17 June 2016)	1498	2.86	0.84	0.11	1.52-5.66
3rd (2 September 2016)	2937	2.89	0.73	0.09	1.56-5.90
4th (4 November 2016)	4783	2.73	0.56	0.07	1.59-4.83
Final (18 November 2016)	5076	2.73	0.52	0.07	1.60-3.94

Table 4.20 Incremental Level of Difficulty Index changes between feedback episodes for BChD 4 2016 (n=62)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	0.39	-0.05	0.83	0.078
2nd feedback to 3rd feedback	0.03	-0.12	0.18	0.669
3rd feedback to 4th feedback	-0.16	-0.26	-0.06	0.002
4th feedback to final feedback	-0.01*	-0.05	0.03	0.759

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.19

Figure 4.9 illustratively displays the variability of LDI scores at first and final feedback. This time LDI scores varied extensively at first feedback, but as with the previous final feedback, results changed the curve to a practically unblemished normal parametric distribution.
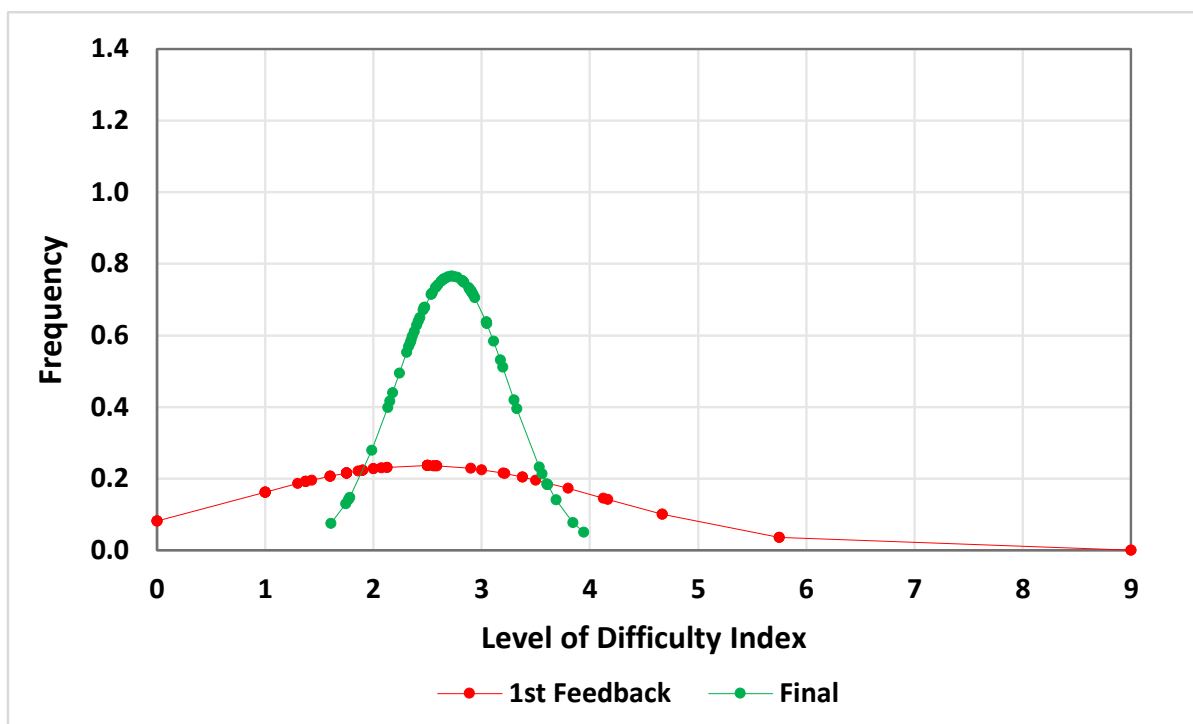
Figure 4.9 BChD 4 2016 (n=62) Level of Difficulty Index comparison between first and final feedback scores

A graphic representation of mean LDI results for the fourth-year cohorts (2014-2016) can be found in Appendix H (Figures H.37-H.39) (pages 238-240). Mean LDI results for these cohorts varied but became more predictable and evened out over time. Moreover, Tables H.1 to H.3 in Appendix H (pages 238-240) display individual LDI results for all the fourth-year students. The reduction in the gap between high and low performing students, as far as their level of difficulty attained, is evidently visible in the highlighted areas in the mentioned tables.

4.1.1.2.2 BCHD 5 Level of Difficulty Index Scores

Similar LDI results to those of the fourth-year cohorts are reported for the fifth-year cohorts. The 2014 cohort fifth-year cohort (n=58) had a mean LDI of 3.06 (SD: 0.71) at the end of the first feedback episode, that declined slightly to 2.93 (SD: 0.49) at final feedback (Table 4.21). For the fifth-year cohort of 2015 (n=37) a mean LDI of 2.75 (SD: 0.74) was reported at first feedback, and this changed to a mean LDI of 2.70 (SD: 0.58) at final feedback in October (Table 4.22). The LDI calculations for the 2016 fifth-year cohort (n=51), followed a similar trend (Table 4.23). As with the fourth-year cohorts, index scores became less variable (smaller standard deviations and errors, as well as a smaller minimum maximum range) over time.

Table 4.21 Level of Difficulty Index scores for BChD 5 2014 (n=58)

Feedback Schedule	Number of assessments (n)	Mean Level of Difficulty Index	SD	SE	Range (Min-Max)
1st (11 April 2014)	2060	3.06	0.71	0.09	2.03-4.55
2nd (20 June 2014)	3326	3.02	0.59	0.08	2.11-4.41
3rd (22 August 2014)	4367	2.97	0.55	0.07	2.05-4.58
4th (19 September 2014)	4965	2.94	0.50	0.07	2.11-4.50
Final (3 October 2014)	5207	2.93	0.49	0.06	2.20-4.43

Table 4.22 Level of Difficulty Index scores for BChD 5 2015 (n=37)

Feedback Schedule	Number of assessments (n)	Mean Level of Difficulty Index	SD	SE	Range (Min-Max)
1st (20 March 2015)	1143	2.75	0.74	0.12	1.47-4.62
2nd (19 June 2015)	2230	2.74	0.59	0.10	1.80-4.50
3rd (21 August 2015)	2996	2.68	0.60	0.10	1.84-4.50
4th (25 September 2015)	3399	2.69	0.59	0.10	1.76-4.67
Final (9 October 2015)	3477	2.70	0.58	0.10	1.77-4.73

Table 4.23 Level of Difficulty Index scores for BChD 5 2016 (n=51)

Feedback Schedule	Number of assessments (n)	Mean Level of Difficulty Index	SD	SE	Range (Min-Max)
1st (11 March 2016)	1295	2.66	0.86	0.12	1.30-4.67
2nd (17 June 2016)	3071	2.74	0.69	0.10	1.49-4.61
3rd (2 September 2016)	4072	2.74	0.58	0.08	1.61-4.45
4th (23 September 2016)	4440	2.73	0.57	0.08	1.61-4.31
Final (7 October 2016)	4579	2.71	0.56	0.08	1.61-4.43

Fluctuations amid feedback episodes for all three the fifth-year cohorts proved to be minor and statistically insignificant (Paired samples t-tests, $P > 0.05$) (Table 4.24, 4.25 and 4.26).

Table 4.24 Incremental Level of Difficulty Index changes between feedback episodes for BChD 5 2014 (n=58)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	-0.04	-0.12	0.05	0.405
2nd feedback to 3rd feedback	-0.05	-0.11	0.00	0.072
3rd feedback to 4th feedback	-0.04*	-0.07	0.00	0.059
4th feedback to final feedback	-0.01	-0.03	0.01	0.286

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.21

Table 4.25 Incremental Level of Difficulty Index changes between feedback episodes for BChD 5 2015 (n=37)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	-0.01	-0.17	0.14	0.886
2nd feedback to 3rd feedback	-0.06	-0.13	0.00	0.066
3rd feedback to 4th feedback	0.02*	-0.02	0.06	0.327
4th feedback to final feedback	0.01	-0.01	0.03	0.328

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.22

Table 4.26 Incremental Level of Difficulty Index changes between feedback episodes for BChD 5 2016 (n=51)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	0.09*	-0.14	0.32	0.442
2nd feedback to 3rd feedback	0.00	-0.09	0.08	0.917
3rd feedback to 4th feedback	-0.01	-0.05	0.02	0.427
4th feedback to final feedback	-0.02	-0.04	0.01	0.151

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.23

Figures 4.10, 4.11 and 4.12 compare first feedback LDI scores with final feedback scores.
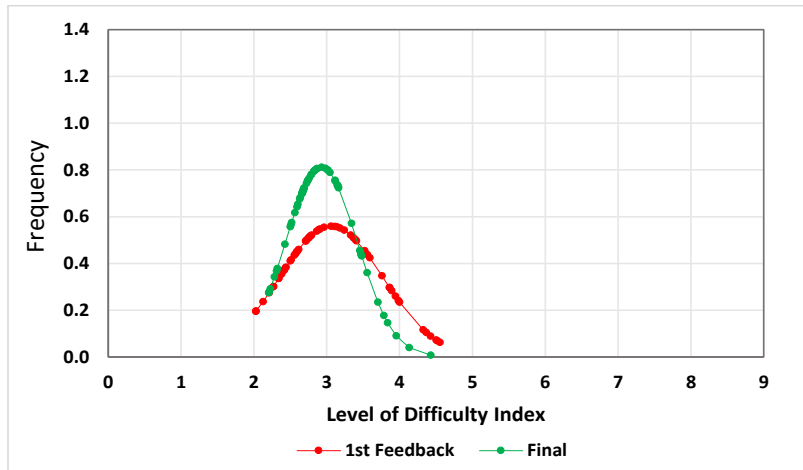
Figure 4.10 BChD 5 2014 (n=58) Level of Difficulty Index comparison between first and final feedback scores
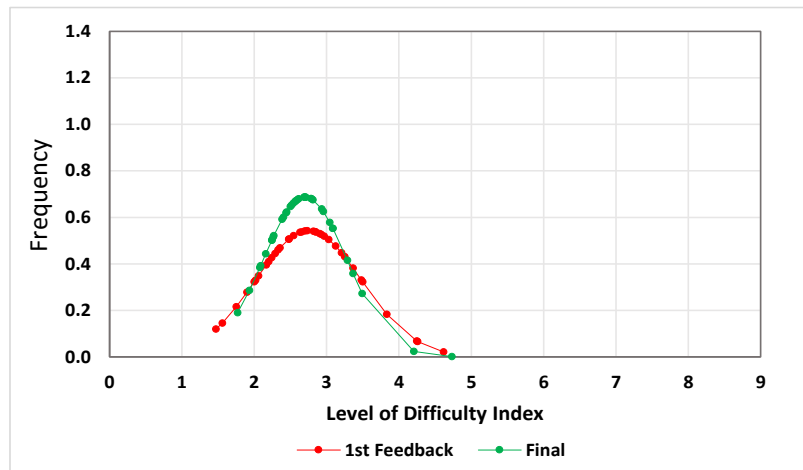
Figure 4.11 BChD 5 2015 (n=37) Level of Difficulty Index comparison between first and final feedback scores
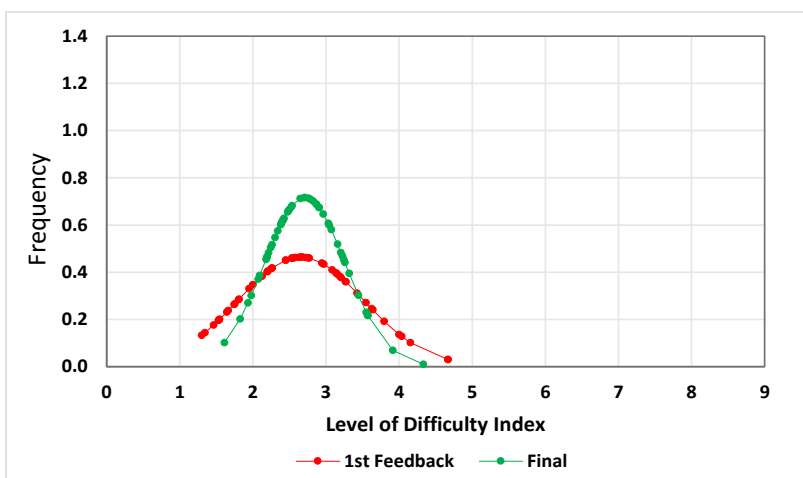
Figure 4.12 BChD 5 2016 (n=51) Level of Difficulty Index comparison between first and final feedback scores

The LDI scores were already less variable compared to fourth-year scores at first feedback and became even more precise over time. Data were however slightly skewed towards the right-hand side of the graphs (Figure 4.10, 4.11 and 4.12), indicating that some students were assessed on more difficult tooth extractions.

As in the case of the fourth-year cohorts, depictions of mean LDI results for the fifth-year cohorts (2014-2016) can be viewed in Appendix H (Figures H.40-H42) (pages 241-243). Mean LDI results for the fifth-year cohorts also showed variation between feedback episodes but became more predictable and uniform. Individual LDI results for all the fifth-year students are shown in Tables H.4 to H.6 (Appendix H) (pages 241-243). The decrease in the gap between high and low performing students is obvious in the highlighted areas in the mentioned tables.

4.1.1.2.3 Summary of Level of Difficulty Scores

LDI remained fairly consistent and the standard deviation in all cohorts became smaller, with pronounced predictability of LDI results in the course of time.

This concludes the LDI results. Independence Ratio results will follow in the next section.

4.1.1.3 Independence Ratio Results

The first part of the report on the IR calculations concentrates on the results of the three fourth year cohorts, followed in the second section by the results of the three fifth year cohorts.

4.1.1.3.1 4th Year Independence Ratios

Table 4.27 provides a broad outline of the IR statistics for the BChD 4 cohort of 2014 (n=42). At first feedback in April 2014, this cohort achieved a mean IR of 82.22% (SD: 10.83%), ranging from a minimum of 57.14% to a maximum of 100.00% of the extractions done independently. This result changed to a mean of 85.43% (SD: 5 57%), with a range of 73.02% - 94.97% at final feedback in November 2014.

Table 4.27 Independence Ratio – BChD 4 2014 (n=42)

Feedback Schedule	Mean Independence Ratio	SD	SE	Range (Min-Max)
1st (11 April 2014)	82.22%	10.83%	1.67%	57.14-100.00%
2nd (20 June 2014)	82.52%	8.05%	1.24%	65.63-96.77%
3rd (22 August 2014)	83.75%	6.17%	0.95%	74.36-96.67%
4th (31 October 2014)	85.09%	5.88%	0.91%	73.44-97.03%
Final (14 November 2014)	85.43%	5.57%	0.86%	73.02-94.97%

In Table 4.28 the incremental increases in the IR percentages between feedback episodes, for the BChD 4 cohort of 2014 are shown.

Table 4.28 Independence Ratio incremental increases between feedback episodes: BChD 4 2014 (n=42)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	0.30%	-2.00%	2.61%	0.792
2nd feedback to 3rd feedback	1.24%*	-0.17%	2.64%	0.084
3rd feedback to 4th feedback	1.33%*	0.42%	2.25%	0.005
4th feedback to final feedback	0.34%*	-0.12%	0.80%	0.145

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.27

None of these incremental increases were statistically significant (Paired sample t- test, P<0.05), except the third episode which showed a statistically significant incremental increase (P=0.005).

Figure 4.13 displays a comparison of first feedback and final feedback results. An initial wide distribution of IR results is seen with a long tail to the left. At final feedback, the results are less variable and the left tail almost diminished. The peak of the curve moved upwards and advanced to the right. A full account of the graphical representations of IR results per feedback episode are given in Appendix I (Figures I.1 to I.5). A comparison among all the feedback episodes can be viewed in Figure I.6. To view an animation of the progression of independence for the whole year, scan the QR-code available in Appendix K.1.
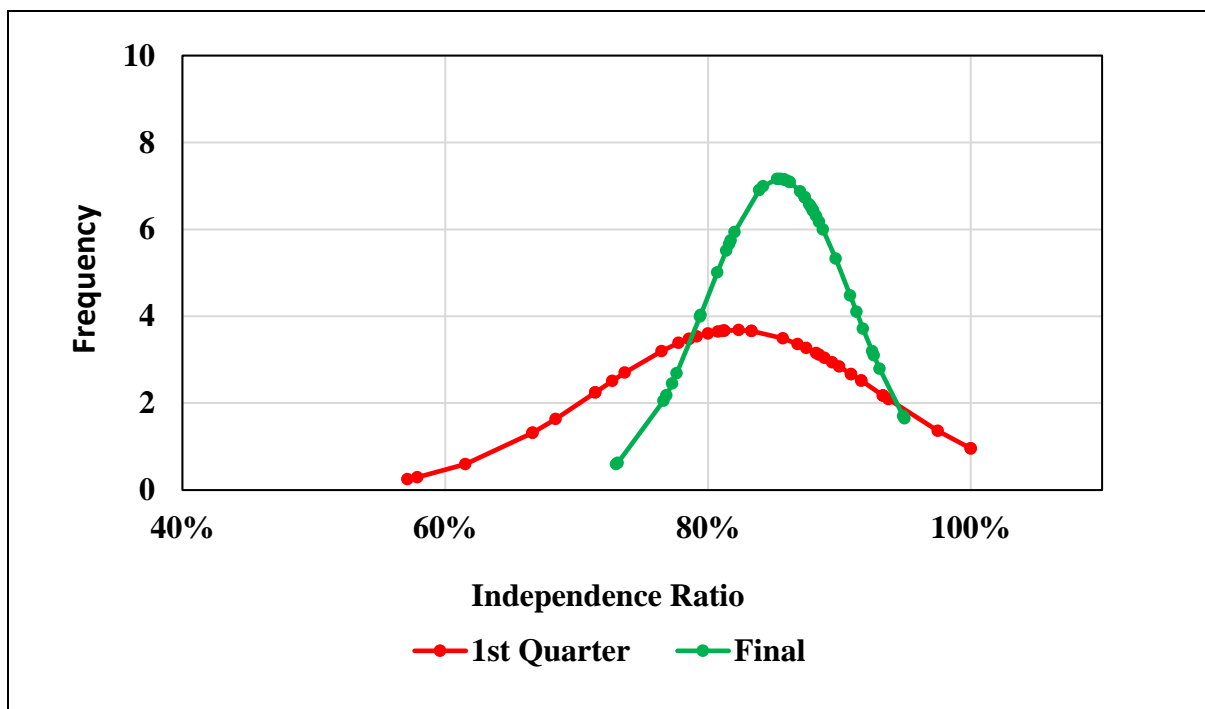
Figure 4.13 BChD 4 2014 Independence Ratio comparison between first and final feedback (n=42)

The IR outcomes for individual students of the 2014 BChD 4 cohort are displayed in Table I.1 in Appendix I (Page 256).

The 2015 BChD 4 cohort (n=51) IR results are depicted in Table 4.29. Following first feedback in March 2015 this cohort achieved a mean IR of 76.13% (SD: 13.69%), ranging from a minimum of 40.91% to a maximum of 100% procedures done on their own. This result changed to 85.38% (SD: 5.43%), ranging between 70.89% and 96.64% independence at the final feedback in November 2014.

Table 4.29 Independence Ratio – BChD 4 2015 (n=51)

Feedback Schedule	Mean Independence Ratio	SD	SE	Range (Min-Max)
1st (20 March 2015)	76.13%	13.69%	1.92%	40.91-100.00%
2nd (19 June 2015)	82.77%	7.57%	1.06%	62.5-100.00%
3rd (21 August 2015)	84.23%	6.38%	0.89%	66.10-98.15%
4th (6 November 2015)	85.35%	5.46%	0.76%	70.89-96.58%
Final (23 November 2015)	85.38%	5.43%	0.76%	70.89-96.64%

Incremental increases in IR between feedback episodes for the BChD 4 cohort of 2015 are displayed in Table 4.30.

Table 4.30 Independence Ratio incremental increases between feedback episodes: BChD 4 2015 (n=51)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	6.65%*	3.80%	9.49%	0.000
2nd feedback to 3rd feedback	1.46%	0.55%	2.36%	0.002
3rd feedback to 4th feedback	1.12%	0.29%	1.95%	0.009
4th feedback to final feedback	0.03%	-0.16%	0.21%	0.783

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.29

The mean difference between the first two feedback episodes this time was 6.65% (95% CI: 3.80%-9.49%). The subsequent three succeeding incremental increases surmounted to 1.46% (95%CI: 0.55% - 2.36%), 1.12% (95%CI: 0.26% - 1.95%) and 0.03% (95%CI:-0.16% - 0.21%), respectively. All these incremental increases were statistically significant (Paired sample t-test, $P<0.05$) except for the final episode that had a P- value of 0.783.

Figure 4.14 depicts a graphical comparison of first and final feedback results. A very wide distribution of IR results is noticeable at first feedback with a long tail on the left. At final feedback the results were less variable and the left tail almost diminished. The modus of the curve is a lot higher and markedly advanced to the right.
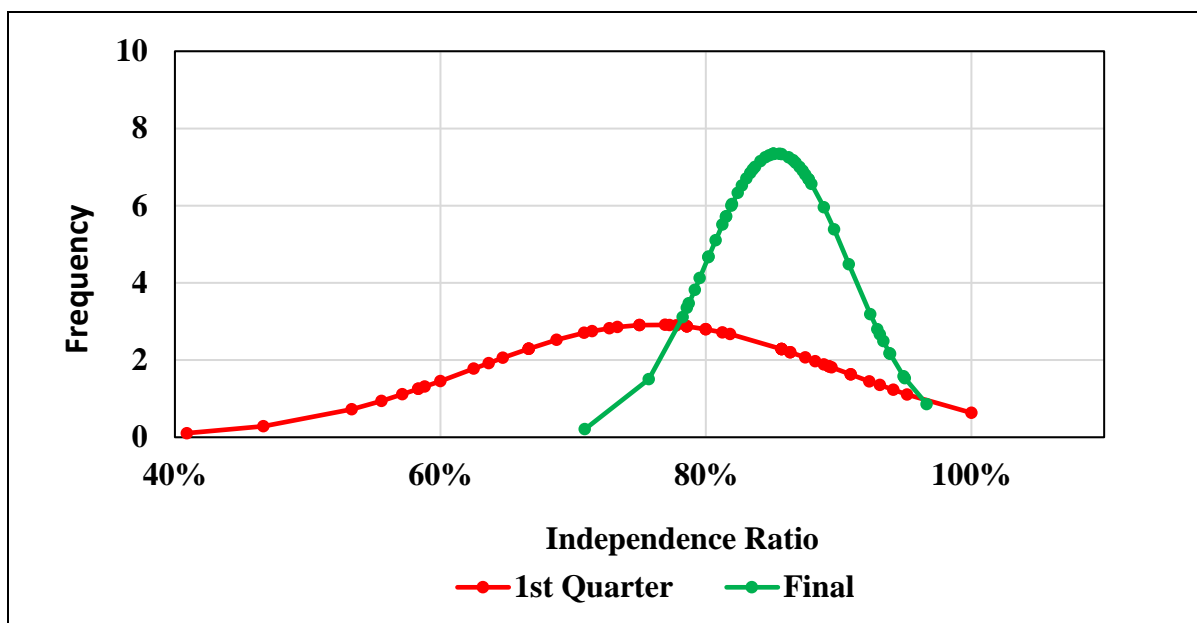
Figure 4.14 BChD 4 2015 Independence Ratio comparison between first and final feedback (n=51)

Detailed graphical representations of IR results per feedback episode are provided in Appendix I (Figures I.7 to I.11), with a combined graph in Figure I.12. Additionally, an animated video of the progression of independence for the year is accessible by scanning the QR-code in Animated Video K.2.

Individual students' development in their independence for the 2015 BChD 4 cohort is offered in Table I.2 in Appendix I (Page 257).

The IR outcomes in mean IR increases for the 2016 BChD 4 cohort (n=62) are demonstrated in Table 4.31. The first feedback was given in March 2016 where this cohort attained a mean IR of 73.96% (SD: 25.88%), and their IR varied between 0.00% and 100%. This result changed to 87.54% (SD: 4.37%), and a range with a minimum of 73.85% and a maximum of 94.38% extractions done unaided at the final feedback in November 2016.

Table 4.31 Independence Ratio – BChD 4 2016 (n=62)

Feedback Schedule	Mean Independence Ratio	SD	SE	Range (Min-Max)
1st (11 March 2016)	73.96%	25.88%	3.29%	0.00-100.00%
2nd (17 June 2016)	81.47%	11.19%	1.42%	42.86-100.00%
3rd (2 September 2016)	85.21%	6.39%	0.81%	68.57-100.00%
4th (4 November 2016)	87.24%	4.79%	0.61%	72.13-95.16%
Final (18 November 2016)	87.54%	4.37%	0.55%	73.85-94.38%

Table 4.32 specifies the incremental increase in IR between feedback episodes for the BChD 4 cohort of 2016. The mean difference between the first two feedback episodes at this point stood at 7.51% (95%CI: 1.38%-13.63%). The following three consecutive incremental increases were 3.74% (95%CI: 1.77%-5.71%), 2.03% (95%CI: 1.04%-3.02%) and 0.30% (95%CI: 0.00%-0.61%), respectively. This time all the incremental increases were statistically significant (Paired sample t-test, P<0.05). Figure 4.15 gives an illustrative account of first feedback results compared to final feedback results. The extremely varied first feedback results are almost linear in distribution. At final feedback, the results are more predictable with a small left tail. The modus once again moved significantly upward and to the right. A more detailed graphical representation of IR results per feedback episode is provided in Appendix I (Figures I.13 to I.17) and the combined feedback graph in Figure I.18.

Table 4.32 Independence Ratio incremental increases between feedback episodes: BChD 4 2016 (n=62)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	**Upper**	
1st feedback to 2nd feedback	7.51%	1.38%	13.63%	0.017
2nd feedback to 3rd feedback	3.74%	1.77%	5.71%	0.000
3rd feedback to 4th feedback	2.03%	1.04%	3.02%	0.000
4th feedback to final feedback	0.30%	0.00%	0.61%	0.050
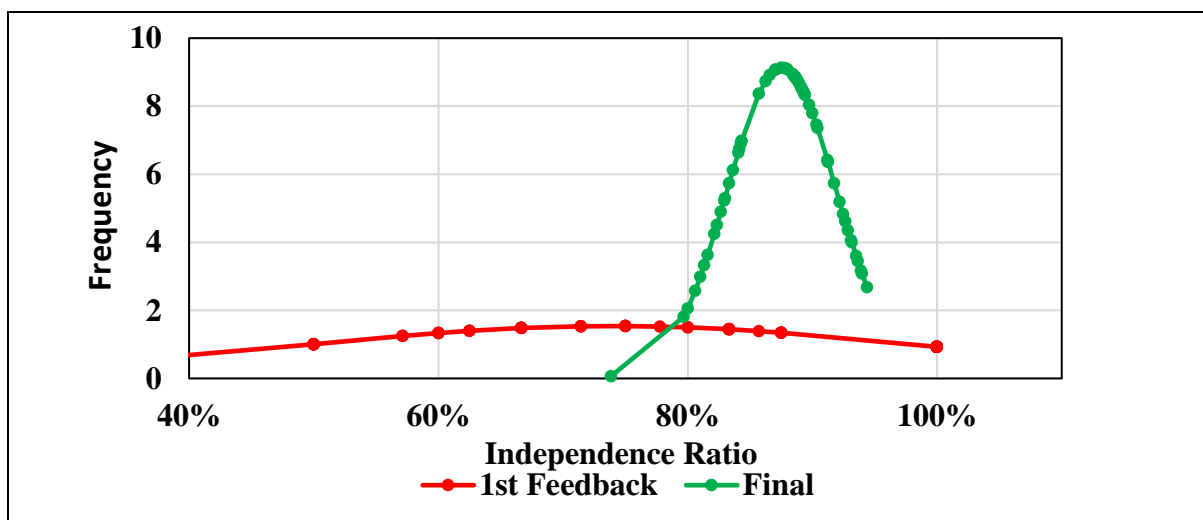
Figure 4.15 BChD 4 2016 Independence Ratio comparison between first and final feedback (n=62)

Individual students' progress in their independence for the 2016 BChD 4 cohort is presented in Table I.3 in Appendix I (Page 258). Once again, an animated video of the independence progression of the entire cohort is available in Animated Video K.3 (Appendix K, page 272). The simulation that can be found in Animated Video with Audio K.4 (Appendix K, page 272), shows a comparison of all three the BChD 4 cohorts' progression for their respective years.

4.1.1.3.2 5th Year Independence Ratios

Table 4.33 provides a summary of the IR statistics for the BChD 5 cohort of 2014 (n=58). In April 2014, at first feedback, these students achieved a mean IR of 86.16% (SD: 9.38%), ranging from a minimum of 56.00% to a maximum of 100%. This result improved to 90.08% (SD: 4.91%), with a range of 78.79%-100.00% at the time of final feedback in November 2014.

Table 4.33 Independence Ratio – BChD 5 2014 (n=58)

Feedback Schedule	Mean Independence Ratio	SD	SE	Range (Min-Max)
1st (11 April 2014)	86.16%	9.38%	1.23%	56.00-100.00%
2nd (20 June 2014)	87.66%	6.91%	0.91%	74.19-100.00%
3rd (22 August 2014)	89.03%	5.88%	0.77%	75.44-100.00%
4th (19 September 2014)	89.86%	5.11%	0.67%	78.46-100.00%
Final (3 October 2014)	90.08%	4.91%	0.64%	78.79-100.00%

Table 4.34 shows the incremental increase in IR between feedback episodes for the BChD 5 cohort of 2014.

Table 4.34 Independence Ratio incremental increases between feedback episodes: BChD 5 2014 (n=58)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	1.50%	0.19%	2.81%	0.026
2nd feedback to 3rd feedback	1.37%	0.84%	1.91%	0.000
3rd feedback to 4th feedback	0.83%	0.44%	1.21%	0.000
4th feedback to final feedback	0.22%	0.01%	0.44%	0.042

The mean difference between the first two feedback episodes was 1.50% (95% CI: 0.19% - 2.81%). The subsequent three increases were 1.37% (95%CI: 0.84% - 1.91%), 0.83% (95%CI: 0.44%-1.21%) and 0.22% (95%CI: 0.01% - 0.44%), respectively. All these incremental increases were statistically significant (Paired sample t-test, P<0.05).

Figure 4.16 graphically represents first feedback results compared to final feedback results. First feedback results are mostly grouped with a slight left tail present. At final feedback, the results depicted an almost perfect Bell curve with a higher peak, which advanced to the right of the graph.
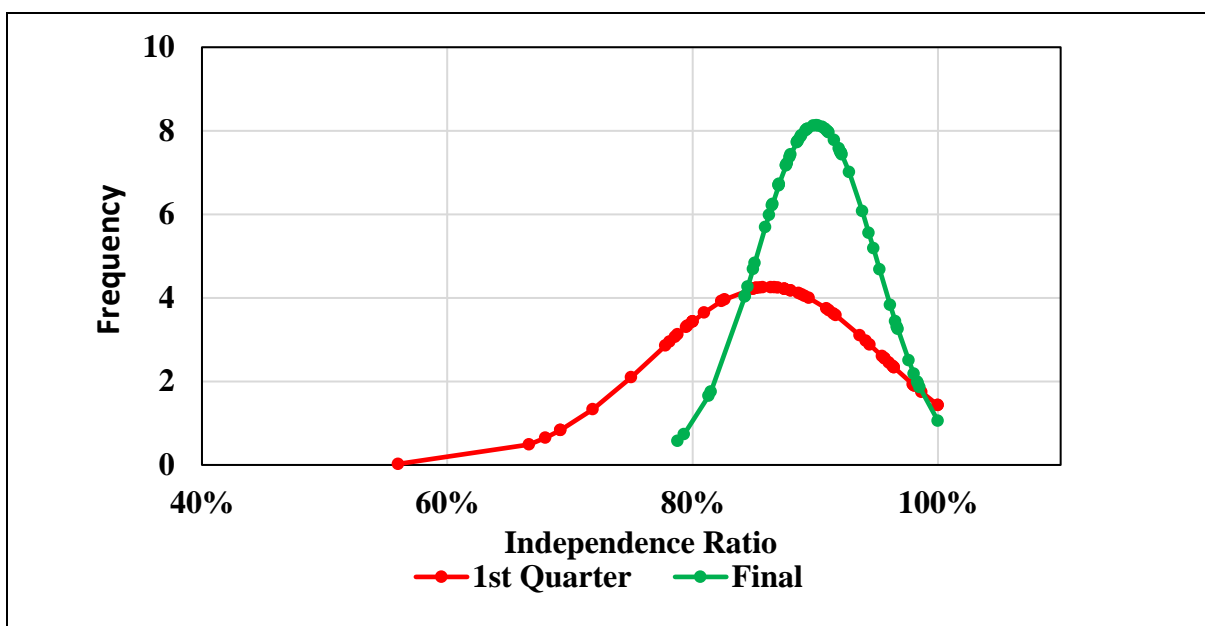
Figure 4.16 BChD 5 2014 Independence Ratio comparison between first and final feedback (n=58)

A more detailed graphical representation of IR results per feedback episode can be found in Appendix I (Figures I.19 to I.23) with a combined graph of feedback episodes in Figure I.24. The reproduction of this cohorts' progression of independence can be viewed in Appendix K (Animated video K.5)

The IR changes for individual students of the 2014 BChD 5 cohort are displayed in Table I.4 in Appendix I (Page 259).

Mean IR results for the 2015 BChD 5 cohort (n=58) are represented in Table 4.35. When they received their first feedback in March 2015 this cohort had accomplished a mean IR of 88.65% (SD: 9.82%), with the range of a minimum of 52.63% to a maximum of 100.00% of tooth extractions completed unaccompanied. This result changed to 91.51% (SD: 4.42%), ranging between an IR of 77.63% and 98.17% at the final feedback in October 2015.

Table 4.35 Independence Ratio – BChD 5 2015 (n=37)

Feedback Schedule	Mean Independence Ratio	SD	SE	Range (Min-Max)
1st (20 March 2015)	88.65%	9.82%	1.62%	52.63-100.00%
2nd (19 June 2015)	90.25%	5.76%	0.95%	71.79-98.04%
3rd (21 August 2015)	91.18%	4.62%	0.76%	73.77-97.89%
4th (25 September 2015)	91.44%	4.41%	0.72%	77.33-98.07%
Final (9 October 2015)	91.51%	4.42%	0.73%	77.63-98.17%

Table 4.36 displays the incremental increase in the IR between feedback episodes for the BChD 5 cohort of 2015 (n=37).

Table 4.36 Independence Ratio incremental increases between feedback episodes: BChD 5 2015 (n=37)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	1.61%*	-0.21%	3.42%	0.081
2nd feedback to 3rd feedback	0.93%	0.21%	1.64%	0.013
3rd feedback to 4th feedback	0.26%	-0.07%	0.59%	0.123
4th feedback to final feedback	0.07%	-0.06%	0.20%	0.283

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.35

The mean difference between the first two feedback episodes this time was 1.61% (95% CI: -0.21%-3.42%). The following three succeeding incremental increases surmounted to 0.93% (95%CI: 0.21%-1.64%), 0.26% (95%CI: -0.07%-0.59%) and 0.07% (95%CI: -0.06%-0.20%), respectively. The incremental increases were statistically significant (Paired sample t- test P<0.05) only for the second episode, but for the other three episodes the results for the paired sample t-tests were (P=0.081), (P=0.123) and (P=0.283), respectively for episodes one, three and four.

Figure 4.17 demonstrates first feedback results and final feedback results. First feedback results are slightly varied with a long initial tail on the left. At final feedback, the results however portray a more clustered curve with a small left tail still evident. The peak, as with the previous fifth year cohort, is much higher and has also progressively moved to the right. Illustrative graphs of IR results per feedback episode are provided in Appendix I (Figures I.25 to I.29).
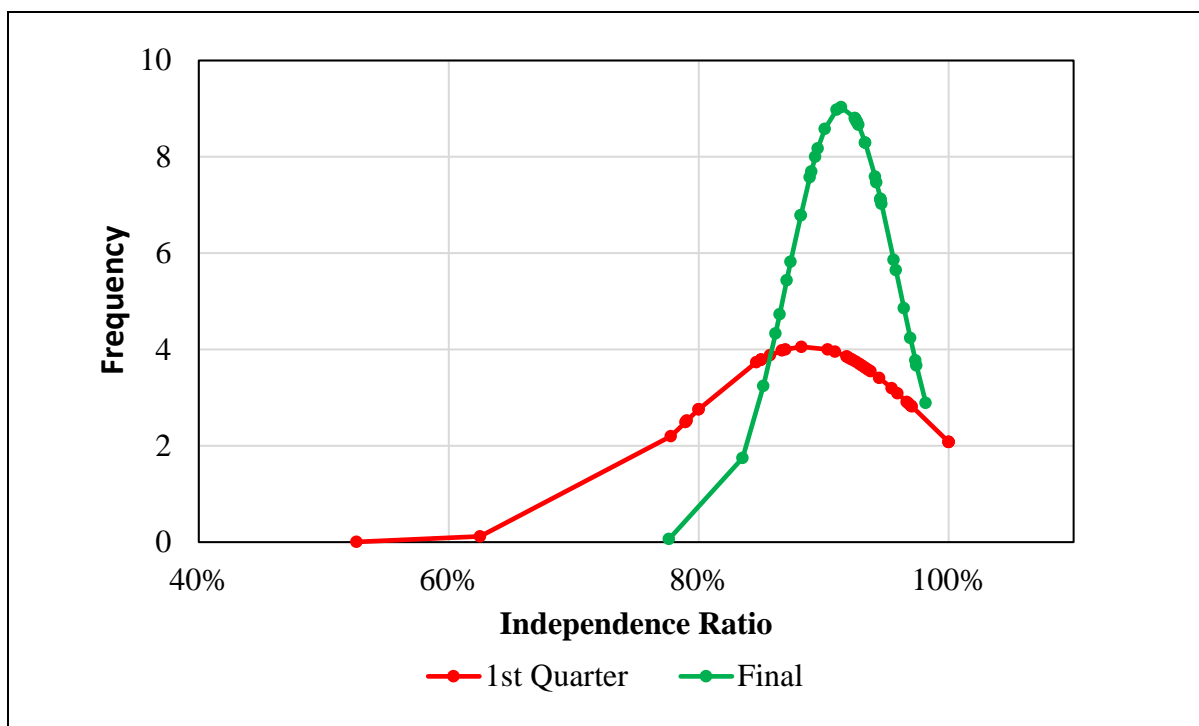
Figure 4.17 BChD 5 2015 Independence Ratio comparison between first and final feedback (n=37)

A combined graph of all five the feedback episodes is visible in Figure I.30 and a recreation, showing advancement of the entire cohort's independence progression over the 39-week period is presented in Animated video K.6. The movement in IR per individual student for the 2015 BChD 5 cohort is displayed in Table I.5 in Appendix I (Page 260).

IR outcomes for the 2016 BChD 5 cohort (n=51) are demonstrated in Table 4.37. First feedback was given in March 2016, when this cohort achieved a mean IR of 91.59% (SD: 6.47%), ranging between 78.57% and 100.00%. This result improved to 93.98% (SD: 3.04%), at final feedback in October 2016, ranging between a minimum of 86.3% and a maximum of 100%.

Table 4.37 Independence Ratio – BChD 5 2016 (n=51)

Feedback Schedule	Mean Independence Ratio	SD	SE	Range (Min-Max)
1st (11 March 2016)	91.59%	6.47%	0.91%	78.57-100.00%
2nd (17 June 2016)	93.27%	3.73%	0.52%	83.33-100.00%
3rd (2 September 2016)	93.71%	3.60%	0.50%	81.82-100.00%
4th (23 September 2016)	93.85%	3.21%	0.45%	86.11-100.00%
Final (7 October 2016)	93.98%	3.04%	0.43%	86.30-100.00%

Table 4.38 illustrates the incremental increases in IR between feedback episodes for the BChD 5 cohort of 2016 (n=51). The mean difference between the first two feedback episodes was 1.68% (95% CI: 0.34%-3.01%). The ensuing three incremental increases were 0.44% (95%CI: -0.09%- 0.97%), 0.14% (95%CI: -0.20%-0.48%) and 0.14% (95%CI: 0.00%- 0.27%), respectively. The incremental increases were statistically significant for the first and last feedback episodes (Paired sample t- test, P<0.05) but not so for the second and third episodes where the paired sample t-tests resulted in P-values of 0.104 and 0.406 respectively.

Table 4.38 Independence Ratio incremental increases between feedback episodes BChD 5 2016 (n=51)

Increment boundaries	Incremental increase: Mean Difference	95% Confidence Interval of the Difference		Paired samples t-test (P-value)
		Lower	Upper	
1st feedback to 2nd feedback	1.68%	0.34%	3.01%	0.015
2nd feedback to 3rd feedback	0.44%	-0.09%	0.97%	0.104
3rd feedback to 4th feedback	0.14%	-0.20%	0.48%	0.406
4th feedback to final feedback	0.14%*	0.00%	0.27%	0.053

* = Apparent conflicting values are reflected in calculations because of rounding in Table 4.37

Figure 4.18 provides an indication of first feedback results matched to final feedback results.
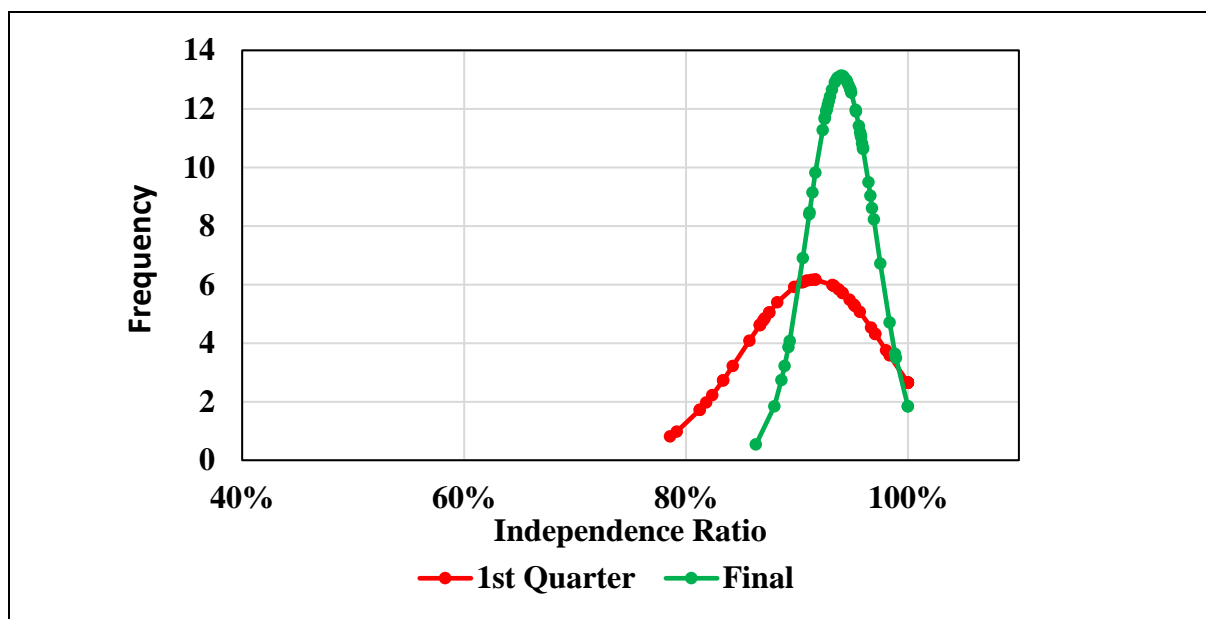
Figure 4.18 BChD 5 2016 Independence Ratio comparison between first and final feedback (n=51)

First feedback results show a slight tail to the left, but results are mostly collected symmetrically around a wide base. At final feedback, the results once more reveal a mode that has moved upward and progressed to the right with a decreased width of the base of the graph. Appendix I (Figures I.31 to I.35) displays a more comprehensive account of the IR results per feedback episode for this cohort, with a combined graph shown in Figure I.36. A video demonstrating the progression of independence, for the total cohort, is accessible by scanning the QR-code in Animated Video K.7. Also, in Appendix K (Animated video with Audio K.8), is a simulation of all three the fifth-year cohorts' progression of independence, presented simultaneously. Individual students' achievement in IR for the 2016 BChD 5 cohort are displayed in Table I.6 in Appendix I (Page 261). Almost all students, in all cohorts, demonstrated an increase in IR over time (Table I.1 to Table I.6).

Table 4.39, on the following page, confirms the number of students who achieved IR targets (as defined in the methods under "less than adequate performance") for all the cohorts. A reduction of sub-optimal performers is seen across all the cohorts over time. When the first feedback results of the fourth-year cohorts are compared with their final results, an increase in the proportion of students who achieved targets was noticed. In the 2014 cohort the proportion increased from 27 to 34 (62.96%). The 2015 cohort also exhibited an increase from 23 to 44 (91.31%) while the 2016 cohort showed an improvement from 31 students to 60 students (93.55%) achieving targets.

The fifth-year cohorts follow a similar pattern with an escalation in the number of students achieving targets. Comparisons between first and final feedback for the 2014 fifth-year cohort saw numbers increasing from 20 to 28 (40.00%). For the 2015 cohort the figure increased from 22 to 24 (9.01%) and in the 2016 cohort an improvement of 31 to 45 (45.16%) was observed. A total of 80.95%, 86.27% and 96.77% of fourth-year students achieved the 80% target in 2014, 2015 and 2016, respectively. In the 2014-2016 fifth-year cohorts, 48.28%, 64.82% and 88.24% of students achieved the set target of 90%.

This completes the Independence Ratio results for all the cohorts. In the following subdivision, after Table 4.39, the results of the variance in assessor ratings will be reported.

Table 4.39 Attainment of Independence Ratio targets following feedback episodes

Episodes	Year	Number of BChD 4 students achieving 80% target	%	Year	Number of BChD 5 students achieving 90% target	%
1st Feedback	2014 (n=42)	27	64.29%	2014 (n=58)	20	34.48%
2nd Feedback		25	59.52%		23	39.66%
3rd Feedback		28	66.67%		28	48.28%
4th Feedback		33	78.57%		28	48.28%
Final Feedback		34	80.95%		28	48.28%
1st Feedback	2015 (n=51)	23	45.10%	2015 (n=37)	22	59.46%
2nd Feedback		34	66.67%		21	56.76%
3rd Feedback		42	82.35%		23	62.16%
4th Feedback		43	84.31%		24	64.86%
Final Feedback		44	86.27%		24	64.86%
1st Feedback	2016 (n=62)	31	50.00%	2016 (n=51)	31	60.78%
2nd Feedback		35	56.45%		42	82.35%
3rd Feedback		50	80.65%		44	86.27%
4th Feedback		59	95.16%		44	86.27%
Final Feedback		60	96.77%		45	88.24%

4.1.1.4 Variance in Assessor Ratings

This section compares the assessments of clinical supervisors against the ratings of the primary researcher who served as the Ctrl. The results of the assessor statistics for the fourth-year cohorts are described first, followed by the assessor statistics for the fifth-year cohorts. Students' exposure to different clinical supervisors/assessors is also addressed.

4.1.1.4.1 4th Year of Study Assessor Rating Summaries

Table 4.40 contains the assessor statistics for the 2014 BChD 4 cohort (n=4056). Only one notable IR difference of 4.89% was recorded between the Ctrl and Assessor 2. The remaining differences of the eight other assessors were small and insignificant for IR. The Ctrl's mean IR score differed only 1.01% from the entire group's score. The Ctrl's LDI score differed significantly from the scores of seven of the nine assessors. The percentage difference was however small. Only in three cases, a rating difference between five and 10% were detected. The average LDI score of the Ctrl was only 1% lower than that of the entire group of assessors.

Table 4.40 Rater variances between Assessors and Control for BChD 4 2014 cohort (n=42)

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
															95% Confidence Interval for Mean			
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	Lower Bound	Upper Bound	SD	SE
Primary Investigator	**2**	**24**	**33**	**194**	**280**	**26**	**559**	**59**	**500**	**89.45%**	**Control**	**4.66**			**4.61**	**4.71**	**0.57**	**0.03**
Assessor 1	1	1	8	50	71	14	145	10	135	93.10%	0.187	4.73	1.49%	0.171	4.62	4.84	0.64	0.05
Assessor 2	1	14	29	257	448	29	778	44	734	94.34%	0.001	4.69	0.54%	0.402	4.65	4.73	0.54	0.02
Assessor 3	4	18	23	140	242	57	484	45	439	90.70%	0.499	4.81	3.15%	<0.001	4.75	4.87	0.64	0.03
Assessor 4		11	57	78	597	24	767	68	699	91.13%	0.302	4.92	5.55%	<0.001	4.89	4.95	0.37	0.01
Assessor 5		2	59	4	470	20	555	61	494	89.01%	0.814	5.03	7.90%	<0.001	5.01	5.05	0.22	0.01
Assessor 6		3	25	47	89	20	184	28	156	84.78%	0.088	4.83	3.49%	0.001	4.73	4.93	0.63	0.05
Assessor 7		1	6	8	21	4	40	7	33	82.50%	0.175	4.88	4.61%	0.022	4.67	5.09	0.60	0.10
Assessor 8	6	21	11	161	107	23	329	38	291	88.45%	0.646	4.53	-2.96%	<0.001	4.45	4.60	0.64	0.04
Assessor 9		4	23	44	117	27	215	27	188	87.44%	0.427	4.91	5.27%	<0.001	4.82	5.00	0.61	0.04
Assessor 10	Did not take part in any assessment activities during 2014																	
Assessor 11	Did not take part in any assessment activities during 2014																	
Assessor 12	Did not take part in any assessment activities during 2014																	
Assessor 13	Did not take part in any assessment activities during 2014																	
Total	14	99	274	983	2442	244	4056	387	3669	90.46%		4.80	2.89%		0.54	0.01	0.54	0.01

Control = Assessor statistics of investigator
% DC = % Difference from Control
SD = Standard Deviation
SE = Standard Error
X = Mean
Indep. = Extractions done independently
Not Indep. = Extractions done with help

The assessor statistics for the 2015 BChD 4 cohort are contained in Table 4.41 (n=5284). Four prominent IR differences were noted between the Ctrl and the group of assessors. Three of the statistically significant differences were below 5%. The remaining difference was close to 7% (difference with Assessor 7). The other differences were small and insignificant. The Ctrl's mean IR score differed slightly less than 2% from the entire group's score. The Ctrl's LDI score differed significantly from the scores of eleven of the twelve assessors. In five cases, a rating difference between five and 10% were detected. In one instance a 12.37% difference was detected with Assessor 6. It is pertinent to note that Assessor 6 only performed 13 of the total number of assessments. The average LDI score of the Ctrl was once again only 1% lower than that of the entire group of assessors.

Table 4.41 Rater variances between Assessors and Control for BChD 4 2015 cohort (n=51)

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	95% Confidence Interval for Mean		SD	SE
															Lower Bound	Upper Bound		
Primary Investigator	2	37	36	237	312	17	641	75	566	88.30%	Control	4.61			4.57	4.66	0.55	0.02
Assessor 1		2	21	74	120	39	256	23	233	91.02%	0.239s	4.85	5.17%	<0.001	4.76	4.94	0.68	0.04
Assessor 2	1	28	35	277	421	54	816	64	752	92.16%	0.013	4.70	2.00%	0.004	4.66	4.75	0.59	0.02
Assessor 3	6	34	29	287	511	38	905	69	836	92.38%	0.007	4.70	1.97%	0.003	4.66	4.74	0.55	0.02
Assessor 4		7	40	72	291	24	434	47	387	89.17%	0.659	4.88	5.74%	<0.001	4.83	4.92	0.48	0.02
Assessor 5		1	30	21	286	22	360	31	329	91.39%	0.127	5.00	8.50%	<0.001	4.96	5.04	0.36	0.02
Assessor 6			2		9	2	13	2	11	84.62%	0.684	5.18	12.37%	0.001	4.91	5.45	0.40	0.12
Assessor 7		5	5	54	134	12	210	10	200	95.24%	0.004	4.79	3.88%	<0.001	4.72	4.86	0.54	0.04
Assessor 8	8	18	13	294	146	55	534	39	495	92.70%	0.011	4.52	-2.04%	0.007	4.46	4.58	0.69	0.03
Assessor 9		2	45	78	194	40	359	47	312	86.91%	0.519	4.88	5.79%	<0.001	4.81	4.95	0.60	0.03
Assessor 10		1	2	10	16	8	37	3	34	91.89%	0.506	4.94	7.15%	0.001	4.68	5.20	0.74	0.13
Assessor 11	2	43	37	342	254	22	700	82	618	88.29%	0.994	4.48	-2.80%	<0.001	4.44	4.53	0.57	0.02
Assessor 12				11	4	4	19	0	19	100.00%	0.113	4.63	0.44%	0.879	4.23	5.03	0.83	0.19
Assessor 13	Did not take part in any assessment activities during 2015																	
Total	19	178	295	1757	2698	337	5284	492	4792	90.69%		4.70	2.00%		4.69	4.72	0.59	0.01

Control = Assessor statistics of investigator

% DC = % Difference from Control

SD = Standard Deviation

SE = Standard Error

X = Mean

Indep. = Extractions done independently

Not Indep. = Extractions done with help

Table 4.42 contains the assessor statistics for the 2016 BChD 4 cohort (n=4735). These statistics appear the most erratic of all as was expected (refer to the remarks in method section (paragraph 3, page 33) made about the primary researcher who was absent for a long period during the first half of 2016). Four prominent IR differences were noted between the Ctrl and the group of assessors. Of these statistically significant differences, two results (Assessor 3 and Assessor 7) differed by about 5% with the Ctrl and the other two results differed more than 10% with the Ctrl. The Ctrl differed substantially from Assessors 8 and 9 who recorded lower IR scores. Again, the remaining differences were small and insignificant. The Ctrl's mean IR score differed 2.4% from the entire group's score. The Ctrl's LDI score differed significantly from the scores of five of the ten assessors. In three cases, a rating difference between five and 10% were detected. In two instances, rating differences of above 10% were detected. It should further be noted that, when compared to the number of assessments performed by the Ctrl, four of these assessors did less than (or close to) 50% of the number of assessments performed by the Ctrl.

Table 4.42 Rater variances between Assessors and Control for BChD 4 2016 cohort (n=62)

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	95% Confidence Interval for Mean Lower Bound	Upper Bound	SD	SE
Primary Investigator	1	7	16	170	190	23	407	24	383	94.10%	Control	4.62			4.56	4.68	0.60	0.03
Assessor 1			20	45	107	38	210	20	190	90.48%	0.097	4.96	7.52%	<0.001	4.87	5.06	0.66	0.05
Assessor 2	1	30	25	287	495	58	896	56	840	93.75%	0.805	4.73	2.41%	0.002	4.69	4.77	0.58	0.02
Assessor 3		31	44	219	352	38	684	75	609	89.04%	0.005	4.70	1.88%	0.025	4.66	4.75	0.58	0.02
Assessor 4	Did not take part in any assessment activities during 2016																	
Assessor 5	Did not take part in any assessment activities during 2016																	
Assessor 6	Did not take part in any assessment activities during 2016																	
Assessor 7				1	2		3	0	3	100.00%	0.665	4.67	1.09%	0.883	3.23	6.10	0.58	0.33
Assessor 8	6	8	5	45	15	4	83	19	64	77.11%	<0.001	4.36	-5.56%	0.001	4.21	4.51	0.60	0.08
Assessor 9		3	69	67	262	23	424	72	352	83.02%	<0.001	4.88	5.61%	<0.001	4.82	4.93	0.49	0.03
Assessor 10		2	5	4	89	55	155	7	148	95.48%	0.521	5.34	15.78%	<0.001	5.26	5.43	0.53	0.04
Assessor 11		21	34	261	244	25	585	55	530	90.60%	0.045	4.55	-1.33%	0.121	4.50	4.60	0.58	0.03
Assessor 12		2	6	18	120	72	218	8	210	96.33%	0.229	5.26	13.88%	<0.001	5.18	5.34	0.60	0.04
Assessor 13		5	52	417	507	89	1070	57	1013	94.67%	0.667	4.68	1.30%	0.090	4.64	4.71	0.63	0.02
Total	8	109	276	1534	2383	425	4735	393	4342	91.70%		4.74	2.78%		4.73	4.76	0.62	0.01

Control = Assessor statistics of investigator
% DC = % Difference from Control
SD = Standard Deviation
SE = Standard Error
X = Mean
Indep. = Extractions done independently
Not Indep. = Extractions done with help

Table 4.43 contains the assessor statistics for the 2016 BChD 4 cohort (n=4165) with data for all assessors deleted during the period 27 March 2016 to 15 May 2016 (refer to the remarks in method section (paragraph 3, page 33) made about the primary researcher who was absent for this period). Here three prominent IR differences were noted between the Ctrl and the group of assessors. One statistically significant result with a difference of 5.64% was present, whereas the other two (Assessors 8 and 9) were respectively 22.67% and 9.03% below the Ctrl. Again, the remaining P-values (P<0.05) were insignificant. The Ctrl's mean IR score differed 1.64% from the entire group's score.

Table 4.43 Rater variances between Assessors and Control for BChD 4 2016 cohort (n=62) (Table created specifically due to unforeseen circumstances described above)*

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	95% CI Lower Bound	Upper Bound	SD	SE
Primary Investigator	1	7	16	170	190	23	407	24	383	94.10%	Control	4.62			4.56	4.68	0.60	0.03
Assessor 1			16	39	90	25	170	16	154	90.59%	0.130	4.91	6.35%	<0.001	4.81	5.01	0.64	0.05
Assessor 2		22	16	266	434	51	789	38	751	95.18%	0.424	4.71	2.11%	0.009	4.67	4.76	0.58	0.02
Assessor 3		28	41	188	306	35	598	69	529	88.46%	0.002	4.71	2.05%	0.017	4.66	4.76	0.58	0.03
Assessor 4	Did not take part in any assessment activities during 2016																	
Assessor 5	Did not take part in any assessment activities during 2016																	
Assessor 6	Did not take part in any assessment activities during 2016																	
Assessor 7				1	2		3	0	3	100.00%	0.665	4.67	1.09%	0.883	3.23	6.10	0.58	0.33
Assessor 8	6	7	5	30	11	4	63	18	45	71.43%	<0.001	4.42	-4.20%	0.038	4.22	4.62	0.66	0.10
Assessor 9			53	65	216	21	355	53	302	85.07%	<0.001	4.85	5.16%	<0.001	4.82	4.91	0.51	0.03
Assessor 10		1	4	2	57	36	100	5	95	95.96%	0.729	4.56	-1.13%	0.202	4.51	4.62	0.59	1.03
Assessor 11		13	28	227	218	23	509	41	468	91.94%	0.206	4.66	0.98%	0.206	4.62	4.70	0.62	0.02
Assessor 12		2	6	13	108	69	198	8	190	95.96%	0.339	5.36	13.74%	<0.001	5.25	5.46	0.52	0.05
Assessor 13		2	40	392	462	77	973	42	931	95.68%	0.210	5.29	14.70%	<0.001	5.21	5.38	0.59	0.04
Total	7	82	225	1393	2094	364	4165	314	3851	92.46%		4.73	2.53%		4.71	4.75	0.62	0.01

Control = Assessor statistics of investigator

% DC = % Difference from Control

SD = Standard Deviation

SE = Standard Error

X = Mean

Indep. = Extractions done independently

Not Indep. = Extractions done with help

* Adjustments made to this table omitted assessments of all assessors corresponding to the period, which coincided with the Control's injury period.

4.1.1.4.2 5th Year of Study Assessor Rating Summaries

The comparison of assessor statistics for the 2014 BChD 5 cohort are contained in Table 4.44 (n=4854).

Table 4.44 Rater variances between Assessors and Control for BChD 5 2014 cohort (n=58)

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	Lower Bound	Upper Bound	SD	SE
Primary Investigator		16	29	180	439	65	729	45	684	93.83%	Control	4.83			4.79	4.88	0.57	0.02
Assessor 1		3	6	78	149	61	297	9	288	96.97%	0.041	4.94	2.26%	0.004	4.86	5.02	0.69	0.04
Assessor 2		11	25	269	518	43	866	36	830	95.84%	0.068	4.73	-2.16%	<0.001	4.69	4.77	0.55	0.02
Assessor 3		5	23	147	400	58	633	28	605	95.58%	0.153	4.85	0.47%	0.450	4.81	4.90	0.56	0.02
Assessor 4		5	32	67	538	43	685	37	648	94.60%	0.535	4.96	2.71%	<0.001	4.93	4.99	0.41	0.02
Assessor 5			51	1	599	37	688	51	637	92.59%	0.353	5.06	4.65%	<0.001	5.04	5.08	0.24	0.01
Assessor 6		2	19	58	118	42	239	21	218	91.21%	0.164	4.93	1.96%	0.024	4.84	5.02	0.67	0.05
Assessor 7		1	3	4	28	13	49	4	45	91.84%	0.579	5.20	7.62%	<0.001	5.02	5.38	0.59	0.09
Assessor 8	1	4	3	155	216	54	433	8	425	98.15%	<0.001	4.76	-1.44%	0.037	4.70	4.83	0.66	0.03
Assessor 9		2	13	54	129	37	235	15	220	93.62%	0.909	4.92	1.88%	0.030	4.84	5.01	0.64	0.04
Assessor 10	Did not take part in any assessment activities during 2014																	
Assessor 11	Did not take part in any assessment activities during 2014																	
Assessor 12	Did not take part in any assessment activities during 2014																	
Assessor 13	Did not take part in any assessment activities during 2014																	
Total	1	49	204	1013	3134	453	4854	254	4600	94.77%		4.88	0.96%		4.86	4.89	0.55	0.01

Control = Assessor statistics of investigator
% DC = % Difference from Control
SD = Standard Deviation
SE = Standard Error
X = Mean
Indep. = Extractions done independently
Not Indep. = Extractions done with help

Two notable IR differences were observed between the Ctrl and individual assessors. Both Assessors 1 and 8 showed significantly higher IRs compared to the Ctrl. Differences were however below 5%. The Ctrl's mean IR score differed less than 1% from the entire group's score. The Control's LDI score differed significantly from eight of the nine assessors. The percentage difference was small in most cases with only one assessor registering a difference between five and 10%. The average LDI score of the Ctrl was very similar to that of the entire group of assessors.

Table 4.45 contains the assessor statistics for the 2015 BChD 5 cohort (n=3189). Two noteworthy IR differences of less than 5% were seen between the Ctrl and Assessors 2 and 3. The Ctrl's mean IR score differed 2.5% from the entire group's score. The Ctrl's LDI score differed significantly from seven of the ten assessors. The percentage difference was small in most cases with only two assessors registering differences between five and 10%. The average LDI score of the Ctrl was very similar to that of the entire group of assessors.

Table 4.45 Rater variances between Assessors and Control for BChD 5 2015 cohort (n=37)

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	95% Confidence Interval for Mean		SD	SE
															Lower Bound	Upper Bound		
Primary Investigator		6	13	81	141	19	260	19	241	92.69%	Control	4.74			4.67	4.82	0.59	0.04
Assessor 1			7	69	81	42	199	7	192	96.48%	0.082	4.86	2.46%	0.039	4.75	4.97	0.75	0.05
Assessor 2		8	5	195	285	40	533	13	520	97.56%	0.001	4.70	-0.86%	0.371	4.65	4.75	0.60	0.03
Assessor 3		7	6	173	213	15	414	13	401	96.86%	0.013	4.61	-2.88%	0.004	4.55	4.66	0.56	0.03
Assessor 4		2	12	67	226	24	331	14	317	95.77%	0.106	4.86	2.56%	0.015	4.81	4.92	0.52	0.03
Assessor 5		1	21	22	261	27	332	22	310	93.37%	0.746	5.02	5.76%	<0.001	4.97	5.06	0.40	0.02
Assessor 6			2	2	8	1	13	2	11	84.62%	0.286	4.91	3.51%	0.356	4.55	5.27	0.54	0.16
Assessor 7		2	5	41	129	10	187	7	180	96.26%	0.112	4.83	1.79%	0.140	4.75	4.90	0.51	0.04
Assessor 8	6	5	4	135	67	43	260	15	245	94.23%	0.478	4.62	-2.49%	0.026	4.53	4.72	0.77	0.05
Assessor 9		1	10	34	93	21	159	11	148	93.08%	0.879	4.91	3.57%	0.006	4.81	5.01	0.61	0.05
Assessor 10	Did not take part in any assessments activities during 2015																	
Assessor 11		17	12	265	191	16	501	29	472	94.21%	0.413	4.47	-5.70%	<0.001	4.42	4.52	0.56	0.03
Assessor 12	Did not take part in any assessments activities during 2015																	
Assessor 13	Did not take part in any assessments activities during 2015																	
Total	6	49	97	1084	1695	258	3189	152	3037	95.23%		4.73	-0.31%		4.71	4.75	0.61	0.01

Control = Assessor statistics of investigator
% DC = % Difference from Control
SD = Standard Deviation
SE = Standard Error
X = Mean
Indep. = Extractions done independently
Not Indep. = Extractions done with help

The assessor statistics for the 2016 BChD 5 cohort are presented in Table 4.46 (n=4291). Only one important IR difference was detected between the Ctrl and Assessor 9. This difference was again less than 5%. The Ctrl's mean IR score was very similar to the entire group's score. The Ctrl's LDI score differed significantly from six of the eight assessors. The percentage difference was small in most cases with only one assessor registering a difference between five and 10% and another a difference above 10%. The average LDI score of the Ctrl was exactly the same as that of the entire group of assessors.

Table 4.46 Rater variances between Assessors and Control for BChD 5 2016 cohort (n=51)

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
															95% Confidence Interval for Mean			
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	Lower Bound	Upper Bound	SD	SE
Primary Investigator		3	5	99	117	21	245	8	237	96.73%	Control	4.67			4.59	4.75	0.63	0.04
Assessor 1		2	5	79	156	51	293	7	286	97.61%	0.539	4.90	4.95%	<0.001	4.82	4.98	0.67	0.04
Assessor 2	1	7	10	453	342	53	866	18	848	97.92%	0.278	4.53	-3.05%	0.001	4.49	4.57	0.61	0.02
Assessor 3	1	15	19	240	321	37	633	35	598	94.47%	0.163	4.66	-0.22%	0.825	4.61	4.71	0.59	0.02
Assessor 4	Did not take part in any assessments activities during 2016																	
Assessor 5	Did not take part in any assessments activities during 2016																	
Assessor 6	Did not take part in any assessments activities during 2016																	
Assessor 7	Did not take part in any assessments activities during 2016																	
Assessor 8	1	10	1	144	93	31	280	12	268	95.71%	0.542	4.58	-1.98%	0.089	4.50	4.66	0.69	0.04
Assessor 9	1	4	27	85	232	41	390	32	358	91.79%	0.013	4.88	4.41%	<0.001	4.82	4.94	0.58	0.03
Assessor 10		3	3	2	114	70	192	6	186	96.88%	0.933	5.37	14.87%	<0.001	5.29	5.44	0.50	0.04
Assessor 11		7	7	388	232	28	662	14	648	97.89%	0.317	4.44	-4.85%	<0.001	4.40	4.49	0.58	0.02
Assessor 12	1	1	5	31	96	31	165	7	158	95.76%	0.605	5.00	7.05%	<0.001	4.90	5.10	0.63	0.05
Assessor 13		2	7	248	262	46	565	9	556	98.41%	0.127	4.64	-0.73%	0.470	4.58	4.69	0.63	0.03
Total	5	54	89	1769	1965	409	4291	148	4143	96.55%		4.67	0.02%		4.65	4.69	0.65	0.01

Control = Assessor statistics of investigator
% DC = % Difference from Control
SD = Standard Deviation
SE = Standard Error
X = Mean
Indep. = Extractions done independently
Not Indep. = Extractions done with help

The adjusted assessor statistics (due to his injury early in 2016) for the 2016 BChD 5 cohort (refer to previous remarks made about the absence of the primary researcher on pages 76 and 77) are presented in Table 4.47 (n=3541). Two statistically important IR differences were detected between the Ctrl and Assessors 9 and 13. Assessor 9 differed with 5.59% with the Ctrl and Assessor 13 with 2.27%. The Ctrl's mean IR score was very similar to the entire group's score. The Ctrl's LDI score differed significantly from two of the nine assessors. The percentage difference was small in most cases with the two statistically significant recordings having one assessor registering a difference between five and 10% and another a difference above 10%. The average LDI score of the Ctrl was exactly the same as that of the entire group of assessors.

Table 4.47 Rater variances between Assessors and Control for BChD 5 2016 cohort (n=51) (Table created specifically due to unforeseen circumstances described above)*

Assessor	Number of ratings for each assessment score							Independence Ratio Statistics				Adjusted Level of Difficulty Index Statistics						
															95% Confidence Interval for Mean			
	1	2	3	4	5	6	Total	Not Indep.	Indep.	IR	P-value	X	% DC	P-value	Lower Bound	Upper Bound	SD	SE
Primary Investigator		**3**	**5**	**99**	**117**	**21**	**245**	**8**	**237**	**96.73%**	**Control**	**4.67**			**4.59**	**4.75**	**0.63**	**0.04**
Assessor 1		1	4	58	120	33	215	5	211	97.69%	0.539	4.88	4.51%	<0.001	4.79	4.97	0.65	0.04
Assessor 2	1	4	10	386	269	46	716	15	701	97.91%	0.301	4.51	-3.34%	0.001	4.47	4.56	0.62	0.02
Assessor 3	1	15	18	208	255	31	525	31	494	94.10%	0.120	4.64	-0.62%	0.545	4.59	4.69	0.60	0.03
Assessor 4	Did not take part in any assessments activities during 2016																	
Assessor 5	Did not take part in any assessments activities during 2016																	
Assessor 6	Did not take part in any assessments activities during 2016																	
Assessor 7	Did not take part in any assessments activities during 2016																	
Assessor 8	1	10	1	143	88	30	273	12	261	95.60%	0.505	4.57	-2.22%	0.058	4.48	4.65	0.69	0.04
Assessor 9	1	3	24	72	182	34	316	28	288	91.14%	0.007	4.87	4.22%	<0.001	4.80	4.94	0.59	0.03
Assessor 10		3	3	2	104	58	170	6	164	96.47%	0.885	5.34	15.08%	<0.001	5.26	5.42	0.50	0.04
Assessor 11		5	6	301	195	25	532	11	521	97.93%	0.315	4.47	-4.30%	<0.001	4.42	4.52	0.59	0.03
Assessor 12	0	1	4	29	89	26	149	5	144	96.64%	0.964	4.98	6.60%	<0.001	4.88	5.08	0.62	0.05
Assessor 13		1	3	165	202	28	399	4	395	99.00%	0.039	4.65	-4.68%	0.724	4.59	4.71	0.61	0.03
Total	4	43	78	1463	1621	332	3541	125	3416	96.47		4.67	-0.04%		4.65	4.69	0.64	0.01

Control = Assessor statistics of investigator
% DC = % Difference from Control
SD = Standard Deviation
SE = Standard Error
X = Mean
Indep. = Extractions done independently
Not Indep. = Extractions done with help

* Adjustments made to this table omitted assessments of all assessors corresponding to the period, which coincided with the Control's injury period.

4.1.1.4.3. Student exposure to different clinical supervisors/assessors

The availability of assessors (except for normal holiday and short sick leave times) for the research period is presented in Table 4.48. Four assessors (Assessors 1, 2, 3 and 9) supervised throughout. The Ctrl and assessor number 8 were available to both the fourth and fifth year cohorts during 2014 and 2015. Assessor numbers 4, 5 and 6 were available for the whole of 2014. During 2016 Assessor 10, 11 and 12 were on duty for the entire year with Assessor 11 also in attendance during the whole of 2015. All other periods were only partially covered by some of the assessors.

Table 4.48 Availability of Supervisors during assessment periods

	BChD 4 2014	BChD 5 2014	BChD 4 2015	BChD 5 2015	BChD 4 2016	BChD 5 2016
Assessor						
Control	X	Y	X	Y	Feb-Mar May-Nov	Jan-Mar May-Nov
1	X	Y	X	Y	X	Y
2	X	Y	X	Y	X	Y
3	X	Y	X	Y	X	Y
4	X	Y	Feb-Jul	Jan-Jul	-	-
5	X	Y	Feb-Aug	Jan-Aug	-	-
6	X	Y	Feb-Mar	Jan-Mar	-	-
7	Mar-Aug	Jan-Sep	Feb-Sep	Y	Oct	-
8	X	Y	X	Y	Feb-Mar	Jan-Mar
9	X	Y	X	Y	X	Y
10	-	-	Oct-Nov	-	X	Y
11	-	-	X	Y	X	Y
12	-	-	Oct-Nov	-	X	Y
13	-	-	-	-	Apr-Nov	Apr-Nov
X = Assessor performed assessments for entire year. See Table 3.5 (page 29)						
Y = Assessor performed assessments for entire year. See Table 3.6 (page 30)						
"-" = No assessments were performed.						
Other listings indicate assessors that did not perform assessments for entire year. These listings indicate months during which assessments were performed						

Table header spans: Cohorts 2014 to 2016

The exposure students experienced to the different assessors are summarised in Table J1 - J6. A condensed summary of these results appears in Table 4.49.

Table 4.49 Mean exposure to assessors for individual cohorts

Cohort	% of clinical supervisors/assessors students were exposed to per year		
	2014	2015	2016
BChD 4 (n=42)	87%		
BChD 4 (n=51)		78%	
BChD 4 (n=62)			80%
BChD 5 (n=58)	88%		
BChD 5 (n=37)		87%	
BChD 5 (n=51)			90%

The mean exposure of the BChD 4 2014 cohort was 87% (Table 4.49), ranging between 60% and 100% (Table J.1). It is noticeable that one assessor performed only 40 assessments (1% of all assessments) (Table J.1).

Fourth year students, in the 2015 cohort, were on average exposed to 78% of the clinical supervisors (Table 4.49), ranging from 62% to 100% (Table J.2). It should however be noted that three of the assessors (Assessors 6, 10 and 12) were, respectively, active in only 13, 37 and 19 (a total of 1.31%) of the assessments and did therefore not come into contact with most students (Table J.2).

The assessor exposure of the 2016 fourth year cohort was 80% (Table 4.49) and ranged between 55% and 100% (Table J.3). As with the previous cohort, there were three assessors who individually performed only three, 83 and 155 assessments, respectively, totalling 5.09% of all the assessments (Table J.3).

The exposure results of the fifth-year cohorts had a markedly higher and more consistent pattern compared to the fourth-year cohorts, with the BChD 5 2014 cohort being exposed to 88% of the assessors (Table 4.49), ranging between 60% and 100% (Table J.4). Assessor 7 again performed only 49 assessments (1.01% of the assessments) (Table J.4).

The BChD 5 2015 cohort had a similar exposure. They were exposed to 87% of the supervisors (Table 4.49), ranging from 73% to 100% with Assessor 6 completing merely 13 assessments (0.41% of the assessments) (Table J.5).

For the 2016 BChD 5 cohort the results were marginally higher at 90% (Table 4.49), fluctuating between 70% and 100% (Table J.6).

4.2 Qualitative Results

Structured reflection papers (Appendix B) guided by six questions, were completed by 47 (92%) of the 2015 BChD 4 cohort, 51 (82%) of the BChD 4 2016 cohort while the 2017 BChD 4 cohort had 46 (72%) participants. Answers to these questions can be viewed in Appendix B. It should be noted that the original answers were hand written by participants. As English is not the first language for most participants, answers were retyped, with minor spelling and grammar mistakes corrected to ease reading. No alteration to substance nor meaning was made.

4.2.1 Factors that impact on independence (Questions 1 to 3)

The four broad categories of the Dijksterhuis model (Fig 2.2),[25] namely the "trainee" (C1[††]), "supervisor" (C2[‡‡]), "professional activity" (C3[§§]) and the "working environment" (C4[***]) consistently emerged during the qualitative analysis.

The "trainee" as an entity was identified by 44 (94%), 40 (78%) and 36 (78%) of the respective participants from 2015 – 2017 (Table 4.50). In the corresponding cohorts, 20 (43%), 23 (45%) and 20 (43%) participants (Table 4.50) suggested that the "supervisor" behaviour had an effect on their independence while the "professional activity" under scrutiny was mentioned by 22 (47%), 23 (45%) and 20 (43%) of the participants (Table 4.50), respectively. Lastly, the "working environment" was mentioned by 45 (96%), 50 (98%) and 42 (91%) of the respective participants (Table 4.50).

Table 4.50 Summary of responses by BChD 4 Cohorts (2015-2017): percentage distribution of emerging categories according to the Dijksterhuis model.[25]

Dijksterhuis Category[25]	2015 Cohort Participants (n=47) n (%)	2016 Cohort Participants (n=51) n (%)	2017 Cohort Participants (n=46) n (%)
-Trainee (C1)	44 (94%)	40 (78%)	36 (78%)
-Supervisor (C2)	20 (43%)	23 (45%)	20 (43%)
-Professional Activity (C3)	22 (47%)	20 (39%)	36 (78%)
-Working Environment (C4)	45 (96%)	50 (98%)	42 (91%)

[††] Dijksterhuis Category – "Trainee"
[‡‡] Dijksterhuis Category – "Supervisor"
[§§] Dijksterhuis Category – "Professional Activity"
[***] Dijksterhuis Category – "Working Environment"

Within the above-mentioned broad outline categories of the model, an additional 16 higher order themes (T[†††]) emerged that could be linked to the development of independence (Table 4.51). These included "Students' ability or experience" (T1), students' audacity or confidence (T2), self-regulation or diligence" (T3), "gender-bias" (T4), "unethical practice" (T5), "knowledge" (T6), "undue supervisor interference" (T7), "supervisor audacity" (T8), supervisor inconsistency (T9), "lack of guidance" (T10) from the supervisor, "poor supervisor: student ratio" (T11), "favouritism" (T12), "difficulty of the procedure"(T13), "inconsistent patient allocation" (T14), "time of day" (T15), and "time constraints" (T16).

Table 4.51 Summary of emerging higher order themes from responses by BChD 4 Cohorts (2015-2017) according to the Dijksterhuis model[25].

Higher order theme number (T)	Higher order theme	2015 Cohort (n=47) Number of Responses (%)	2016 Cohort (n=51) Number of Responses (%)	2017 Cohort (n=46) Number of Responses (%)
C1 Trainee				
T1	Ability or Experience	26 (55%)	28 (55%)	19 (41%)
T2	Audacity or Confidence	14 (30%)	20 (39%)	26 (57%)
T3	Self-regulation or Diligence	34 (72%)	14 (27%)	16 (35%)
T4	Gender bias	4 (9%)	7 (14%)	3 (7%)
T5	Unethical practice	23 (49%)	10 (20%)	8 (17%)
T6	Knowledge	3 (6%)	2 (4%)	-
C2 Supervisor				
T7	Undue supervisor interference	16 (34%)	14 (27%)	11 (24%)
T8	Audacity	6 (13%)	10 (20%)	11 (24%)
T9	Inconsistency	15 (32%)	16 (31%)	12 (26%)
T10	Lack of guidance	2 (4%)	-	-
T11	Poor supervisor : student ratio	-	1 (2%)	1 (2%)
T12	Favouritism	-	2 (4%)	1 (2%)
C3 Activity				
T13	Difficulty of procedure	22 (47%)	20 (39%)	36 (78%)
C4 Environment				
T14	Inconsistent patient allocation	45 (96%)	50 (98%)	41 (89%)
T15	Time of day	-	3 (6%)	7 (15%)
T16	Time constraints	-	-	1 (2%)

The percentage distributions of the emerging higher order themes are displayed in Table 4.51 in relation to the four main categories.

The following sections provide a detailed account of the results displayed in Table 4.51.

[†††] Higher order theme

4.2.1.1 Trainee

T1-T6 emerged under "Trainee" (C1) (Table 4.51). A detailed breakdown of the analyses is contained in Tables A.10 – A.12 of Appendix A.

T1 Ability / Experience

Participants suggested that "ability/experience" (T1) affected the trainee's independence in 26 (55%), 28 (55%) and 19 (41%) cases for the 2015, 2016 and 2017 cohorts, respectively.

The words "ability" and "experience" were specifically mentioned by the participants. Three additional sub-themes, however, emerged under T1, namely "skills", "technique" and the "ability to work faster". The detailed breakdown of the percentage distributions of the emerging sub-themes can be viewed in Tables A.10 – A.12, Appendix A.

T2 Audacity / Confidence

Audacity/confidence of the trainee was mentioned in 14 (30%), 20 (39%) and 26 (57%) of the reflection papers for the corresponding cohorts.

Terms and expressions such as "confidence", "unsure", "incompetent" and "playing it safe" were grouped under T2. Again, the detailed breakdown of the percentage distributions of the emerging sub-themes for this category can be viewed in Tables A.10 – A.12, Appendix A.

T3 Self-regulation / Diligence

The corresponding cohorts furthermore referred to "self-regulation/diligence" in 34 (72%), 14 (27%) and 16 (35%) instances.

Four sub-themes consistently emerged under T3 in all the participating cohorts. These included: "working in extra sessions", "perseverance", "arriving early for sessions", and "working harder". Two of the participating cohorts indicated, "Taking long to adapt to the environment", while three other non-generalised sub-themes emerged from individual students. These sub-themes included "preference for the type of work", "missed sessions" and "planning". Detail breakdowns of the percentage distributions of these emerging sub-themes are available in Tables A.10-A.12, Appendix A

T4 Gender Bias

"Gender bias" featured on four (9%), seven (14%) and three (7%) occasions, respectively for the 2015, 2016 and 2017 cohorts.

T5 Unethical Practice

"Unethical practice" occurred 23 (49%), 10 (20%) and eight (17%) times, respectively for the above-mentioned three participating cohorts.

T6 Knowledge

Participants from the 2015 and 2016 cohorts, respectively alluded to "knowledge" in three (6%) and two (4%) cases.

4.2.1.2 Supervisor

T7-T12 emerged under "Supervisor" (C2) (Table 4.51). A detailed breakdown of the analyses is again provided in Tables A.10-A.12 of Appendix A.

T7 Undue supervisor interference

"Undue interference" by a supervisor came to the fore respectively in 16 (34%), 14 (27%) and 11 (24%) narrations for 2015 – 2017 participants.

T8 Audacity

A lack of "supervisor audacity" was another factor that received attention from six (13%), 10 (20%) and 11 (24%) of the respective 2015-2017 participants.

T9 Inconsistency

Respectively, 15 (32%), 16 (31%) and 12 (26%) of the 2015-2017 participants mentioned "supervisor inconsistency" as a factor that influenced the development of independence.

T10 Lack of guidance

Only two (4%) of the 2015 cohort's participants suggested that "lack of guidance" by supervisors was problematic.

T11 Poor supervisor to student ratios

Only one (2%) participant each from the 2016 and 2017 cohorts mentioned "poor supervisor to student ratios" as a factor that influenced independence ratios.

T12 Favouritism

Two (4%) participants in the 2016 and one (2%) from the 2017 cohort believed that preferential treatment by the supervisor was influential on their independence.

It should be noted that "gender bias" was also detected from a supervisor's perspective in very limited number of cases. Because it was listed as theme under "Trainee" (C1) it will not be repeated under "Supervisor" (C2) again.

4.2.1.3 Professional Activity

The only higher order theme that was apparent in this category (C3) was the "level of difficulty" of the procedure (T13) that the trainee had to engage with (Table 4.51)

T13 Level of difficulty

Participants in all three cohorts recognised this factor as paramount to their ability to practice independently. In the 2015 cohort, 22 (47%) contributors to the reflection papers mentioned this. The 2016 cohort had 20 (39%) referring to the difficulty of the procedure and in the 2017 cohort the number of participants, indicating it as a factor, went as high as 36 (78%).

4.2.1.4 Working environment

T14-T16 emerged under "Working Environment" (C4) (Table 4.51). A detailed breakdown of the analyses can be viewed in Tables A.10-A.12 of Appendix A.

T14 Inconsistent Patient Allocation

An emerging theme in all three cohorts was "inconsistent patient allocation". The 2015 cohort had 45 (96%), the 2016 cohort 50 (98%) and the 2017 cohort 41 (89%) participants who were of the opinion that, inconsistent patient allocation was hampering their ability to practice independently.

T15 Time of day

In the 2016 cohort three (6%) and in the 2017 cohort seven (15%) of the respondents also indicated that the time of day may be a factor.

T16 Time constraints

The 2017 cohort furthermore had one (2%) of the participants who indicated that time constraints might have an influence on their independence.

4.2.1.5 Quotations from reflection papers (Questions one to three)

This section reports a selection of emerging quotations specifically related to Questions 1 to 3, related to the achievement of minimum targets. Refer to Tables A.1, A.2, A.4, A.5, A.7 and A.8 in Appendix A for detail narrations and coding (refer to Section 3.4.1 and 3.4.2 on pages 34 to 36 in the methods section).

4.2.1.5.1 Trainee

Emerging quotations related to each of the "Trainee" factors that influence independence are as follows.

T1 Ability / Experience

"This is dependent on the level of experience and skill of the student and their ability to handle difficult cases and the patients they receive."
(Source: 2016[‡‡‡].Q3[§§§].P20[****]; Analysis code: C1.T1.ST[††††]1).

"…… I also believe that some students' clinical technique in removing teeth are of a higher standard."
(Source: 2015.Q1.P8; Analysis code: C1.T1.ST3).

"…… Some students have better skill ……., thus being able to do the job independently."
(Source: 2015.Q2.P11; Analysis code: C1.T1.ST2).

T2 Audacity / Confidence

"…… Some are more fearless than others."
(Source: 2016.Q1.P7; Analysis Code: C1.T2.ST5).

"Uncertain or student depends on supervisor for guidance most of the time."
(Source: 2015.Q3.P44; Analysis code: C1.T2.ST7).

T3 Self-regulation / Diligence

"Some students have …… and perseverance, thus being able to do the job independently."
(Source: 2015.Q2.P11; Analysis code: C1.T3.ST12).

"I think it is a combination of luck and skill but also particularly students arriving earlier at wards are guaranteed patients."
(Source: 2017.Q1.P10; Analysis code: C1.T3.ST9).

[‡‡‡] The year that reflection took place (2015-2017)
[§§§] Question number in reflection paper answers
[****] Participant number for a specific year
[††††] Sub-Theme

T4 Gender Bias

"Some doctor's doubt student's ability, come assist. (especially small females)."
(Source: 2015.Q2.P25: Analysis code: C1.T4.ST17).

T5 Unethical Practice

"There are some students that skip a thorough examination process and proceed to do the extraction! (witnessed)."
(Source: 2016.Q1.P7; Analysis code: C1.T5.ST18).

T6 Knowledge

"… this too for me is the reflection of one's theory…"
(Source: 2015.Q3.P1; Analysis code: C1.T6.ST19).

4.2.1.5.2 Supervisor

Emerging quotations related to each of the "Supervisor" factors are as follows.

T7 Undue supervisor interference

"Some doctors   just take over the whole procedure, costing us our independence."
(Source: 2015.Q2.P11; Analysis code (C2[‡‡‡‡].T7.ST21.).

"It also depends on the supervisors, some supervisors like being too involved and this would take the opportunity to take the tooth out of the students' struggles, even when the student has requested of and stills feels like he/she can extract the tooth."
(Source: 2016.Q2.P3; Analysis code: C2.T7.ST21).

T8 Audacity

"Also dependent on the type of supervisor that you have. Some supervisors want to challenge you to try it on your own, other supervisors just take over."
(Source: 2017.Q3.P16; Analysis code: C2.T8.ST22).

T9 Inconsistency

"Also some doctors are stricter than others…"
(Source: 2017.Q3.P8; Analysis code: C2.T9.ST23).

[‡‡‡‡] Dijksterhuis Category - Supervisor

T10 Lack of guidance

"Some doctors do not guide students … and just take over …"
(Source: 2015.Q2.P11; Analysis code: C2.T10.ST24.)

T11 Poor supervisor to student ratios

"Not enough doctors in the ward to always monitor what students are doing"
(Source: 2016.Q2.P40; Analysis code: C2.T11.ST26).

T12 Favouritism

"Some students are favoured more than other and are given first priority…)
(Source: 2017.Q1.P7; Analysis code: C2.T12.ST27).

4.2.1.5.3 Professional Activity

Emerging quotations related to the "Professional Activity" factors are as follows.

T13 Level of difficulty

"Difficulty in cases. Some extractions are more difficult, must get help"
(Source: 2016.Q2.P22; Analysis code: C3.T13.ST28).

4.2.1.5.4 Working environment

Emerging quotations related to the "Working Environment" factors are as follows.

T14 Inconsistent Patient Allocation

"Some students are often given dentectomies… some of us get wisdoms only…)
(Source: 2016.Q1.P4; Analysis code: C4[§§§§].T14.ST29).

"They get patients that require multiple extractions … other students get difficult molars … only 1 tooth per patient"
(Source: 2017.Q1.P1; Analysis code: C4.T14.ST29).

T15 Time of day

"It depends on what session you work in, morning sessions are not so busy"
(Source: 2017.Q1.P29; Analysis code: C4.T15.ST30).

T16 Time constraints

"… time constraints may cause a doctor to take over"
(Source: 2017.Q2.46; Analysis code: C4.T16.ST31).

[§§§§] Dijksterhuis Category – "Working Environment"

4.2.2 Targets and factors that influence learning (Questions four to six)

This section provides an account of the qualitative analysis of Questions 4 to 6 according to Zimmermann's model of self-regulated learning (Fig. 2.1).[47,69,72-73] Analysis of the detailed written responses to questions four to six can be observed in Appendix A

4.2.2.1 Students' goal setting in relation to performance targets

The analysis of Question 4 focused on whether the students had certain targets in mind for the different levels of extraction assessment.

Respectively, 40 (85%), 43 (84%) and 39 (85%) of the 2015. 2016 and 2017 participants indicated that they had targets in mind to achieve the various targets. There were conversely six (13%) participants each in the 2015 and 2017 cohorts and four (8%) in the 2016 cohort who did not have targets. The number of participants who did not answer this question were one (2%) in the 2015 cohort, four (8%) in the 2016 cohort and also one (2%) in the 2017 cohort.

In the 2015 cohort, 22 (47%) participants set their goals for EC higher than required. In the 2016 and 2017 cohorts the number of students who aimed higher than the expected quota was 17 (33%) and 20 (43%).

In terms of IR objectives, the respective participants from the 2015 to 2017 cohorts indicated that 27 (57%), 29 (57%) and 28 (61%) of them aspired to achieve higher than their obligatory independence. For LDI the results were 12 (26%), 20 (39%) and 23 (50%), respectively.

4.2.2.2 Students' thoughts, focus and strategy during exodontia

Question 5 aimed at determining which elements students focused on and also influenced their achievement during the execution of the procedure. Analysis of the results identified four factors indicated by all three cohorts (2015 – 2017). The recognised achievement factors (AF) were:

- Focus on patient safety/comfort (AF1)
- Focus on trainee safety/comfort (AF2)
- Focus on technique improvement (AF3)
- Thoughts of possible task failure (AF4)

Condensed results for the above factors influencing achievement follow in Table 4.52.

Table 4.52 Factors considered to influence students, achievement of exodontia

Achievement Factor (AF)	Number of responses (%)		
	2015 Cohort (n=47)	2016 Cohort (n=51)	2017 Cohort (n=46)
Patient safety or comfort (AF1)	37 (79%)	31 (61%)	31 (67%)
Trainee safety or comfort (AF2)	9 (19%)	11 (22%)	11 (24%)
Technique or gaining experience (AF3)	23 (49%)	32 (63%)	32 (70%)
Possible failure of task (AF4)	19 (40%)	20 (39%)	20 (43%)

Responses related to a focus on patient safety/comfort was accounted for by 37 (79%) participants in the 2015 cohort, 31 (61%) participants in the 2016 cohort and also 31 (67%) participants in the 2017 cohorts. A focus on their own competence and comfort/discomfort were respectively mentioned by nine (19%), 11 (22%) and 11 (24%) of the respondents from the 2015 to 2017 cohorts. The third factor mentioned by 23 (49%), 32 (63%) and 32 (70%) of the respective participants in the corresponding 2015 to 2017 cohorts alluded to task strategy by focussing on using correct techniques during exodontia. The final factor notably on the minds of the participants, during the performance of the procedure, was negative outcome expectations. Possible failure of the task was referred to by 19 (40%), 20 (39%) and 20 (43%) of the corresponding students who took part in the structured reflections.

4.2.2.3 Students' self-judgement in terms of self-improvement needs

The analysis of the answers of Question 6 revealed three main themes (proficiency factors (PF)) the participants considered important for the improvement to improve their exodontia skills:

- Training or gaining experience (PF1)
- Skill expansion (PF2)
- Improved ability and confidence (PF3)

A summary of the responses regarding proficiency factors are provided in Table 4.53.

In the respective 2015 to 2017 cohorts 30 (64%), 40 (78%) and 32 (70%) participants indicated that repetition, gaining experience over time and more clinical demonstrations, put together under "Training or gaining experience" (PF1), were crucial for the improvement of their competence.

Development of skill or technique and acquisition of knowledge were grouped under "Skill expansion" (PF2). This second factor was regarded by 22 (47%), 17 (33%) and 14 (30%) of the reflection paper contributors as a principal indicator to advance their capabilities.

The third factor identified by students was collectively grouped as "Improved ability and confidence" (PF3). This factor encompassed progressive weaning of dependence on their supervisors, increased confidence and advancement in difficulty of procedures attempted. This was reported by 13 (28%). 19 (37%) and 23 (50%) of the participants.

Table 4.53 Factors considered important for improvement of proficiency in exodontia

Proficiency Factors	Number of responses (%)		
	2015 Cohort (n=47)	2016 Cohort (n=51)	2017 Cohort (n=46)
Training or gaining experience (PF1)	30 (64%)	40 (78%)	32 (70%)
Skill expansion (PF2)	22 (47%)	17 (33%)	14 (30%)
Improved ability and confidence (PF3)	13 (28%)	19 (37%)	23 (50%)

4.2.3 Quotations from reflection papers (Questions four to six)

Quotations, central to the key factors, are presented below to explain and provide clarity. Codes as described in Chapter 3 (Study Methods and Analysis) are once again used to label the quotations.

For ease of localisation of responses to question four, quotations are labelled to define the year that reflection took place, question number answered in the reflection paper and also the number of the participant.

Questions five and six had the same coding as above, which was then additionally followed by factors the participant identified as central to their growth and success in exodontia. For question five, this would be factors influencing achievement (AF) and for question six, factors influencing proficiency (PF). Comprehensive coding can be viewed in Tables A.3, A.6 and A.9 in Appendix A.

4.2.3.1 Students' goal setting in relation to performance targets

As indicated by the analyses, many students set targets and some additionally had high outcome expectations.

> *"I'd like to have a high difficulty and independence level …. so I know at the end that I was challenged ..."*
> (2015.Q4.P5).

> *"I want to challenge myself and learn how to do more difficult work. It's how I can get/learn the knowledge and skills from the doctors."*
> (2016.Q4.24).

> *"Do more and most of all do more difficult extractions without someone helping me! More important is to learn something … and strive to do better."*
> (2017.Q6.P2.PF1, 3).

Some students however were content to have an average target.

> *"My target is to pass 4th year…"*
> (2015.Q4.P28).

> *"Targets in line with what is required from us for the year…"*
> (2016.Q4.P12).

> *"To get the required quota. At this stage I am personally struggling…"*
> (2015.Q4.P39).

4.2.3.2 Students' thoughts, focus and strategy during exodontia

> *"I focus on the well-being of the patient … on my technique …on not breaking the crown…"*
> (2015.Q5.P13.AF1, 3, 4).

> *"To be safe and careful not to do any damage or inflict harm onto the patient and also to perform the extraction independently."*
> (2016.Q5.P39.AF1, 2).

> *"I'm trying my best to concentrate …. Anticipate what is going to happen. … you think of time and that puts unnecessary pressure on a person."*
> (2017.Q5.26.AF1, 3).

> *"I focus on not breaking the tooth…"*
> (2016.Q5.17.AF4).

> *"… I focus on breathing and not fainting."*
> (2016.Q5.P31.AF2, 4).

> *"… hoping and praying that it doesn't break."*
> (2017.Q5.P12.AF4).

4.2.3.3 Students' self-judgement in terms of self-improvement needs

> *"I need more experience and to learn more skills and improve my knowledge…"*
> (2015.Q6.P43.PF1, 2).

> *"… to learn something with each case and strive to do better."*
> (2017.Q6.P2.PF1 2, 3).

> *"Learn … from experienced doctors … practice…. Welcome difficult cases."*
> (2017.Q6.P10.PF1, 2, 3).

4.3 Summary of the Chapter

Chapter 4 presented quantitative and qualitative results of the study. Chapter 5 follows with a detailed discussion of these results.

Chapter 5. Discussion

5.1 Introduction

Both the qualitative and quantitative results of the study were presented in Chapter 4.

Chapter 5 discusses the findings regarding the main indicators of the assessment instrument in detail and provides insight into student perceptions and reactions concerning their learning through feedback received. Conclusions surrounding the implementation of the assessment instrument are drawn and recommendations made for future use and expansion of the project.

5.2 Overview

This research project involved the design and implementation of a novel continuous workplace-based assessment instrument, to evaluate and improve undergraduate dental students' clinical competencies. The focus of the research was to measure and encourage progression of independent practice among students. This pilot study specifically concentrated on the advancement of exodontia skills, which included normal tooth extractions and a variety of surgical extractions. The MOFS, at the SDUP, introduced this novel instrument in 2014. It functioned as an evaluation tool to provide students with regular task-level feedback[41] about their abilities to remove teeth independently. The performance indicators built into the assessment tool were:

IR: The number of procedures (tooth extractions) completed independently under the supervision of an experienced dentist.

LDI: The level of difficulty attained for these procedures

EC: The number of procedures performed

The aim of the task-level feedback given,[41] using these indicators, was to make students realise their abilities in relation to their peers. The hypothesis was that feedback would initialise self-regulated learning,[47,69,72-73] resulting in a situation where underperforming students attempted more tooth extractions at an increased level of difficulty on their own.

The researcher however also requested qualitative feedback from students via anonymous structured reflection papers. These narrations were used to gain an understanding of factors that may influence students' self-regulated learning in relation to their learning exodontia.

A graphic representation of the design and interaction of all the different elements of the assessment instrument within the clinical environment, as experienced during the study, is depicted in Figure 5.1. An animated video that describes the interaction among the different elements impacting on one another can furthermore be viewed in Animated Video with Audio K.11 (Appendix K).
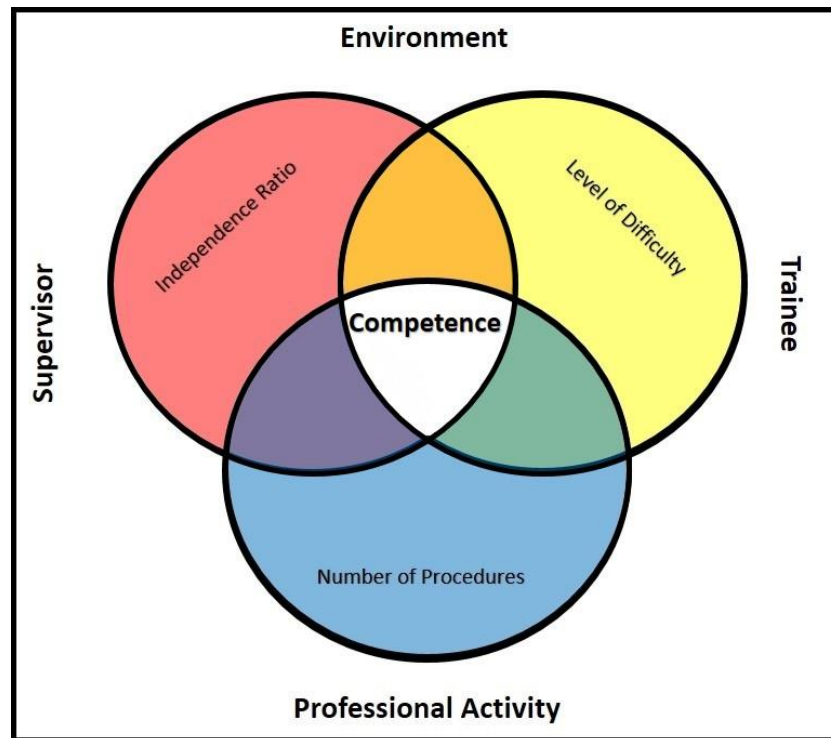
Figure 5.1 Design of Workplace-based Assessment instrument within Clinical setting. Adapted from Dijksterhuis model.[25]

The eventual achievement of competence in a psychomotor skill (professional activity) in an undergraduate environment is ultimately dependent on repeated practice (number of procedures) completed by students (the trainees). The achievement of independent practice (independence ratio) in turn is dependent on the gradual weaning of the support from the clinical supervisor, which in turn relates to the level of difficulty of the procedure. Ultimately, more practice will be required to master difficult procedures.

5.3 Main findings of the study

Two key findings emerged during the course of the study. This study firstly showed that progressive development of independence,[23-26,106] in a particular skill, could be measured over time using the concept of IR (under supervision). Secondly, there is some evidence that showed that the number of students who initially performed below par, in relation to their peers at feedback episodes, gradually decreased over time.

Qualitative results obtained as part of this study generally supported the quantitative findings[119-120] and provided valuable detailed information about the dynamics of the instrument as well as the educational effects. Management information acquired from this feedback is regarded as important supplementary information that enriched the study.

5.3.1 Developing independence over time

The notion of competence measured by means of progressive independence has been described on a few occasions.[23-26,106] Empirical evidence however, is limited. Evidence mostly exists in the domain of post-graduate surgical training,[23-26,106] with no evidence found in Dentistry or at an undergraduate level. Some articles in fact criticise competency-based approaches because of a distinct lack of empirical evidence.[121] The current study is an attempt to bridge this gap to show that the development of competence can be measured over time, even at an undergraduate level. The study also sets the example of how workplace-based assessment can become part of programmatic assessment,[122-127] with thousands of data points being collected over time. Finally, the research demonstrated how regular feedback could contribute to the catalytic effect of assessment.[46,128]

5.3.1.1 Measuring gradual increase in Independence Ratio over time

The results of this study clearly showed a gradual increase in independence over time, for all the cohorts. By the end of the fourth year of study, students achieved an average IR of between 85 and 87%, for the three cohorts, which improved to a value that ranged between 90 and 94% in the fifth year of study. A huge leap in IR is observed in the results between fourth and fifth year (Figures I.43 and I.44 in Appendix I). This can be accounted for by the lower level of independence achieved during the early stages of the fourth year of study. The fourth year of study is the starting point for dental students in the clinical environment. The new and distinctly unfamiliar clinical environment reduced the cumulative IR score at the end of the year, for most of the students. By implication, students would have finished with higher IRs if calculations were based on the second part of the fourth year of study only. Lower IR's would also be evident in the fifth year of study, if IRs were measured, as a combined result, over an extended period of two years. Comparison of the two years as separate entities however seemed to be more encouraging to students, as slow starters were not penalised in the succeeding year. The results therefore showed that students, even after a lengthy two-month holiday period at the end of their fourth year of study, continued to grow their level of independence when they resumed their clinical training in their fifth year of study.

IR therefore appears to be a useful indicator to measure the development of independent practice (under supervision) over time. This measure is however, dependent on the supervisor's behaviour as was shown in the qualitative student feedback and the slight discrepancies found between assessor ratings during the *post hoc* contrast analyses. Students suggested that inefficiencies in terms of patient allocation might impact on how IR is measured. In the structured reflection papers completed by fourth year students, 94% of the respondents indicated that inconsistent patient allocation might have had an effect on IR. They specifically suggested that some students are allocated easier extractions by chance, while other students pick and choose easier extractions for themselves.

Source: 2016.Q2.P3:

> *"They may be higher because some students get teeth that are easy to*
> *extract and some get teeth that are difficult and this requires help."*

By default, those with easier extractions have a higher likelihood of achieving higher IRs. A high percentage of students however also indicated that their inability, inexperience and lack of confidence or audacity were main contributors to their failure to perform independently at the outset. These issues are scrutinized in the sections below.

5.3.1.2 Students' perceptions about the development of independence

Having the ability to measure the development of independence over time creates a necessity to understand the dynamics of developing clinical independence in a real-life setting. The results of the study showed that IR is influenced by trainee factors, supervisor behaviour, the activity itself and the environment in which it takes place. These dynamics were brought to the fore during the qualitative analysis of structured student reflections, done according to the Dijksterhuis model,[25] which was previously performed at post-graduate level. On a higher level, (Categories) the results of the current study were conceptually similar to the Dijksterhuis model.[25] The identified factors however differed on a lower level (themes and sub-themes), since undergraduate clinical training environment differs completely form the post-graduate training context (Figure 5.2).
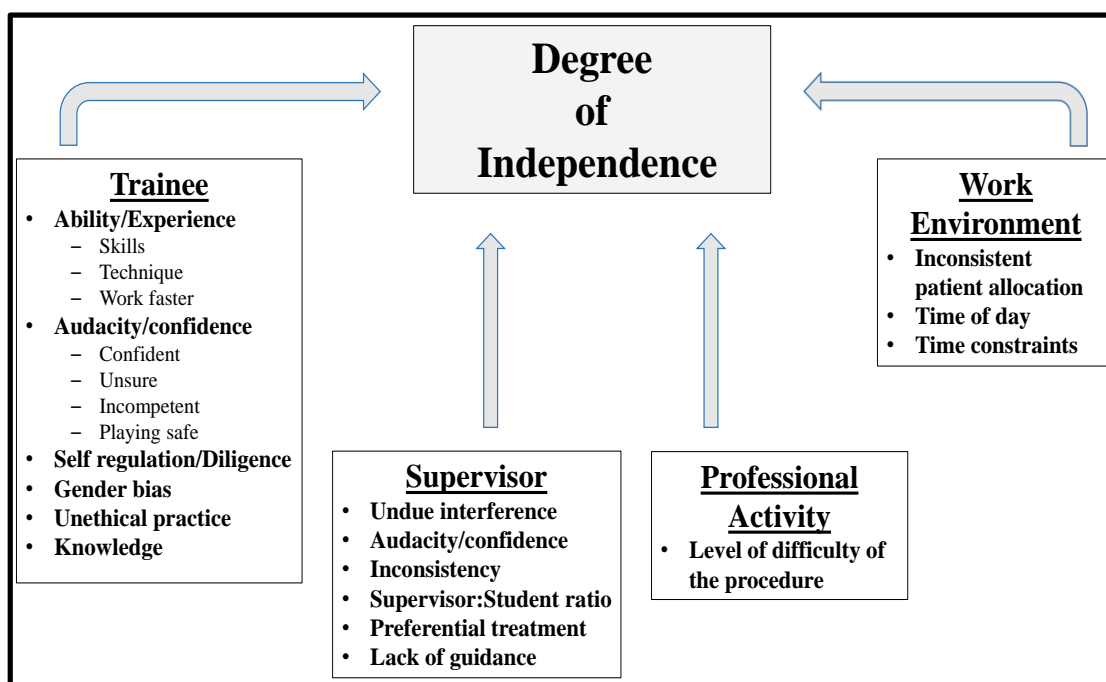
Figure 5.2 Factors impacting on independence in exodontia in an undergraduate context. Adapted from Dijksterhuis model.[25]

It is highly conceivable that "trainee" and "supervisor" factors would be completely different in an undergraduate workplace-based setting when compared to post-graduated training. The sections below therefore provide a more detailed discussion on this topic.

5.3.1.2.1 Influence of trainee factors on the development of independence

Results of the qualitative feedback suggest that students often feel insecure and doubtful about their ability to perform a task alone. This relates to negative outcome expectation in the mind of the learner during the forethought phase of Zimmermann' model of self-regulated learning (Fig 2.1, page 8).[47,69,71-73] This is not only true about undergraduates but has also been reported at post-graduate level where students expressed concerns about being able to work independently.[24] In this study almost 70% of participants expressed concern about "confidence", "ability" and "lack of experience and skill" that impact on their capacity to practice independently. At post-graduate level, these concerns are shared by practicing physicians.[24] Perceptions to the same effect might however also exist among the public and practicing dentists about our undergraduate students. A large percentage of students (almost 40%) indicated a fear of failure. This can prevent students to move forward and achieve goals.[129] These reflections took place early in their clinical years and can therefore also be linked to other concerns such as "confidence", "ability" and "lack of experience and

skill," mentioned above. This is to be expected because it is a fact of life that different people are often at different levels of development.[130] The feedback received through this assessment instrument can not only be deemed as an indicator of deficit in ability but also as an indicator of achievement, which in turn would enhance self-efficacy beliefs[47,131] when targets are achieved.

Students indeed recognised that self-regulating capabilities[47] influence their independence. More than 40% of respondents agreed that "working harder", "perseverance" and "planning" could have an impact on their autonomy. Passive conformity to the attainment of competence is no longer adequate. A proactive approach to developing independence is required. These constructs relate to "task analysis", which is another element of the forethought phase of Zimmermann's model of self-regulated learning (Fig 2.1 page 8).[47]

Taking control and ownership of their own actions by self-regulating and exhibiting diligence and commitment had a varied reaction (27% to 72% among cohorts). This is not surprising as self-regulation, although a trait of high performing students,[71-72] can sometimes be turned around to redirect responsibility and blame to someone else. Causal attribution with either an attenuating or a defensive mode can ensue.[47,132] An example of defensive causal attribution detected in this study was students blaming patient allocation and inequality in terms of the level of difficulty of cases for their substandard IRs.

It was furthermore alluded by 30% of the participants that unethical practice by students may influence IR. These practices related to students "selecting" patients that would suit their current needs. They would for instance reach an agreement with support staff to book a patient with multiple easy extractions in order to improve their EC and IR.

Source: 2015.Q1.P12:

> *"Some students have contacts who give them patients needing dentectomies."*

Although this could not be regarded as the norm, it is definitely something to be recognised and addressed to ensure patient-centred care[133-134] at all times. Students should not be able to select patients to their own advantage. This could have a negative impact not only on care given during their studies but also have ethical and moral implications later during their years as general dental practitioners.[135] Patients should be treated individually, whether it is a difficult case, which may need assistance, or only a referral to another department. Patient needs and

participation in decision-making should be taken into account[134]

Students also started to choose assessors, whom they perceived to be more lenient towards their obtaining a better mark, to present to. Factors such as a supervisor who interferes less during the procedure, someone who allows them to do more difficult procedures, or somebody who permits them to struggle longer with a procedure all came into play as they got to know the instrument.

Source: 2016Q1.P49:

> *"Not all doctors are keen to let 4ᵗʰ years do surgical extractions."*

Source: 2017.Q2.P32:

> *"Some doctors are more patient…help you...other doctors will just take over."*

Gender bias was a minor issue mentioned by only 10% of respondents. Most of the comments specifically related to female students not being strong enough to perform difficult extractions.

Source: 2015.Q2.P35:

"… also force/power are different, especially girls struggle in the beginning of extractions."

These inferences might specifically relate to the skill assessed (extraction) and the Department in which assessment takes place. Maxillofacial and Oral Surgery is generally viewed as a male dominated speciality[136-146] and there is a perception that a big strong man does extractions and surgery more easily.

There were however, other comments that implicated supervisors of being biased against female students because of a perception of a lack of ability.

Source: 2015.Q2.P25:

> *"Some doctors doubt student's ability, come assist. (especially small females)."*

Once again, these remarks should not be considered typical of the situation. Nevertheless, the workplace should be observed to ensure an environment that supports equal opportunity to all.[147]

Trainees and supervisors need feedback on performance to provide focussed direction.[47,148-149] The instrument developed in this study has the ability to visually demonstrate to students their improvement or regression over time for a single skill. Students may find it difficult to remember achievement or failure. Feedback will remind them of their development and allow them to understand variations in their independence over time. Quarterly feedback if done as in this study, can allow them to compare previous accomplishments. It also permits them to see if their own targets have been met or exceeded and finally contributes towards comparison with their fellow students.

The previous evaluation system relied heavily on quotas. Students however were not gauged on independence nor difficulty achieved (surgical extractions were treated as a different entity). They would therefore easily request help from a supervisor when they started to struggle and the supervisor would intervene and complete the procedure. This created problems in the sense that students would not engage or show further interest in the task, as they would not receive quota and merely move on to the next clinical assignment. No deeper learning took place to try to understand or solve the challenge. With the new instrument, students inevitably became more involved in the clinical ward. When it came to difficult procedures, they participated more, because a difficulty index (LDI) was connected to performance. Students were more reluctant to ask the supervisor to take over (Their IR would decline). They would rather ask for advice on how to solve the problem, or how they could approach the task differently to achieve success. They would stay engaged for longer to see if they cannot personally resolve the predicament. This in itself created some problems with supervisor interference. Some supervisors would be more concerned with patient safety and comfort and would not let the student continue, while others with more audacity and perhaps less compassion for patient-centred care[133] would leave the student to labour on the task. Students were however exposed to a variety of supervisors as was shown in the assessor results (Table 4.49 and Tables J.1-J.6) and could learn from all of them. The consensus among the students was that the instrument was fair with limited opportunity for bias because of the continuous nature of evaluation and involvement of several assessors.

5.3.1.2.2 Influence of supervisor factors on the development of independence

Student feedback suggested that clinical supervisors sometimes take over difficult cases and that some supervisors are more lenient than others to let students work on their own. In the qualitative analysis, 44% of the students who contributed to the structured reflection papers

mentioned that supervisors in one way or another influenced IR. These accusations, as mentioned previously, may be strongly related to individual supervisor's views on patient safety.[25] Because supervisors are dealing with inexperienced students, that have to administer complicated treatment to patients, trust comes into play.[150] Supervisors have to control these precarious situations without compromising the safety of the patient.[150] It sometimes takes a lot of courage for a clinical supervisor to allow inexperienced students to work alone on a patient. In a surgical ward, it becomes even more complex, because of the inherent dangers and possible injury to a patient, associated with treatment. Students, especially in the latter stages of the course, may put pressure on supervisors to leave them alone. They feel that they have the skill and the knowledge to perform the procedure independently if no interference takes place. This places additional strain on the supervisor to make a decision between patient safety, comfort and general efficiency on the one side and student agreement, student satisfaction and supervisor popularity on the other. Operational pressures in the clinical working environment,[25] as well as time management issues, further complicate this situation. The exodontia clinic is indeed run within a tight time schedule, with a high workload. Some part-time supervisors have private practice commitments to attend to after their sessions finish and can ill-afford to be postponed. Some of them furthermore do not know the students that intimately, because of the small number of sessions they supervise. Knowledge of the students' capabilities and trust in their abilities are therefore sometimes compromised. This may cause supervisors to take charge prematurely and thus seize an opportunity from the student to complete the task independently. Inter-rater variation in the assessors' results existed in all the cohorts. From these results it was evident that of the assessors whose results differed significantly from that of the Control, some assessors were more prepared to leave students to finish the procedure independently (Notably assessors number 1, 2, 3 and 7). All of these assessors, that seemingly had a wait and observe attitude, had more than 20 years' experience. It is postulated that this might be because they are more confident to provide assistance once a real problem arises, than assessors with less experience (Assessors number 7 and 8).

In other instances, when supervisor-student ratios are sub-optimal, supervisors might have no choice but to leave students to work on their own because they often have to attend to the more difficult and time-consuming surgical extractions themselves. The absence by a champion of the overall system, during a period in 2016, furthermore displayed that you need a person in charge to ensure continuity and accountability.[151] The dynamics change when the leader is not there.[152]

5.3.1.2.3 Influence of the environment on the development of independence

The environment, in which these assessments took place, is also not a measured one where selection of patients under normal circumstances takes place. All students whether fourth or fifth year are subjected to the same variety of patient. This was evident in the reflection papers, where a high number of students complained about patient allocation. It should be noted here that the reflection papers were done only one quarter of the way through the students' total performance. The upside of non-selection is that if one looks at the bigger picture, nothing changes for the student and yet their independence increases over time. The same students later treat patients independently for whom they initially needed assistance.

Time of day also featured in some of the students' statements. They felt that the number of patients seen by some students were more because of the timing of their allocated sessions. This is part of the busy environment in which the instrument functions. Patient numbers peak during the middle of the day. Initial numbers of treatable patients are low when administrative matters such as registration, screening and patient distribution to different departments takes place. Patient numbers at the end of the day also decline as the majority are already treated.

The environment therefore certainly has an impact on development of independence. If one however looks at the bigger scheme of events, it would seem that most students are exposed equally. If minor adjustments, as will be proposed later in the recommendations section, are made it should however lessen the influence.

5.3.1.2.4 Conclusion on students' perceptions

The qualitative results of the current study summarised in Fig 5.2 can now serve as a conceptual model for the development of competence (under supervision) in an undergraduate environment, especially in exodontia.

5.3.1.3 Accounting for Independence Ratio discrepancies amongst assessors

Given the deliberations above, it is not surprising that variances in IR were shown amongst clinical assessors. Ideally, the IR of assessors should be more or less the same when hundreds of assessments have been performed. Calibration in term of IR was not required, because assessors merely have to indicate whether they provided physical assistance to the students or not. Yet clear discrepancies were detected. A total of, fourteen of fifty-nine assessors' results measured against the Ctrl presented with significant differences ($P<0.05$) in average IR within an academic year. Fortunately, most of these differences could be explained by operational

circumstances. The first factor that came into play was the number of assessments performed, as low sample size has the potential to skew statistical results considerable. Further analysis showed for example showed that Assessor 8 assessed only 83 students in 2016, which is considerably lower than many of the other assessors. Assessors 1 and 7, in turn, performed 50% fewer assessments compared to the Ctrl for BCHD 5 (2014) and BChD 4 (2015), respectively.

A second complicating factor in this environment was that assessors did not necessarily assess over the full period. Assessing students in this context at the beginning of the year will ultimately result in low IRs because students are very uncertain at the beginning. Assessing students predominantly at the end of the year will result in higher IRs because students will be more competent due to repeated practice. Cessation of sessions, work contracts that expire, retirement and illness that interrupts service at different times of the year all have an impact on the final IRs that would be attributed to a specific assessor. A good example of this is provided, when in 2016 the primary investigator (Ctrl) was unable to perform assessments for an extended period of six weeks. This resulted in the primary investigator's IRs to appear considerably higher when compared to results from previous years. This period of absence (earlier part of the year, March-April) coincided with a stage when students were still low on experience and IRs not high. Because the primary investigator (Ctrl) missed assessing during this time, final IRs could potentially have reflected lower if assessment took place over the full period because students were already more competent by the time he returned. Another example occurred during the 2015 period. Assessors 10 and 11 only started assessing in October of that year (latter part of the year), with resultant higher IRs being attributed to them.

Discrepancies among different supervisors may therefore be accounted to a differing number of assessment interactions as well as dissimilar assessment periods with students.

Given the above circumstances, discrepancies in this study, mostly remained within 5% when compared to the Ctrl. For the fourth-year cohorts (2014-2016) only seven of the 32 IR values compared to the Ctrl differed with more than 5% with the Ctrl. Five of the seven assessors mentioned performed assessments (Table 4.48) for only a part of the year. Of the seven assessor values that appeared to be excessive, only Assessor 3 and 9 performed assessments for the entire period.

Assessor-Ctrl comparisons were also more consistent for fifth year cohorts compared to fourth year cohorts. Only two (out of 28) of the fifth-year values varied with more than 5% of that of

the Ctrl. In one of these instances, Assessor 6 performed assessments only until March 2015 accounting for a low IR (8.07% below the Ctrl). The other assessor, outside the 5% margin, was Assessor 9 who showed a difference of only 5.59% below the Ctrl in 2016. Fifth-year students' results among assessors indeed seem to be a lot more consistent when compared to the   fourth-year students' assessor results. This might be because assessors will trust them more to continue with the procedure, as they know them better. They might tend to also leave them longer without interference and rather spend time with a fourth-year student whom they might not want to leave alone.

Given the huge number of assessments performed, as well as the exposure of most students to most assessors, are taken into account, discrepancies shown can be interpreted as less significant.

Student reflections however alluded to the fact that supervisors differ as to what they will allow a student to do. Inconsistencies might be related to personality traits, partiality or personal preference. Fortunately, students are concurrently exposed to assessors who intervene too quickly as well as to those assessors who tend to have more audacity to wait or only give advice to a student (Tables J.1-J.6).

5.3.1.4 Accounting for Extraction Count and Level of Difficulty discrepancies

5.3.1.4.1 Overview

As mentioned before, students complained that some trainees were allocated easier extractions and that others choose easier extractions themselves to increase their IR.

Since the researcher anticipated these issues, the LDI was developed as a control measure to counter these problems. Without a certain parity in terms of level of difficulty (This stands in contrast to suggestions made by Durham *et al.*),[153] IR will not be valid. Students for instance who only perform easy extractions might have a much higher IR than students who are allocated or attempt more difficult and challenging procedures. Conversely, there needs to be a minimum number of procedures that are assessed to validate IR.[154]

These two elements were therefore added to the instrument to create a mechanism of control for the development of independence. For example, achieving either 50% or 100% independence with a very low sample size would be meaningless. A student performing four extractions without help might have an IR of 100% and another also performing four

extractions an IR of 50%. Neither mark could be regarded as an acceptable result or indication of independence given the low number of procedures performed. The same reasoning extends to the LDI, where a high IR could be distorted by a very low LDI if a student only performed a few easy procedures.

5.3.1.4.2 Accounting for discrepancies in Extraction Count

As was to be expected the EC results showed a gradual increase in the number of procedures performed over time. No significant difference was recorded between the 2014 and 2015 cohorts, but there was a significant difference when the 2016 cohort was compared to the other two cohorts. The mean extraction count for the 2016 cohort was markedly lower than the other two fourth year cohorts. The mean EC, although a lot lower for the BChD 4 2016 cohort, has to be seen in the light of the number of sessions that were available to students. A marked reduction in available sessions for the BChD 4 and 5 cohorts occurred, due to an increased number of students in the combined BChD 4 and BChD 5 2016 cohorts. Mean ECs per session, however still correlated well with the other cohorts. (Appendix F and Table 4.14) and the cohort nonetheless performed a significant number of extractions during the year. Despite initial results and graphs displaying meaningful differences in LDI and IR for the BChD 4 2016 cohort in comparison to the corresponding 2014 and 2015 fourth year cohorts, final results were not affected. Similar effects were not evident for the BChD 5 2016 cohort, notwithstanding the fact that they also initially experienced a marked reduction in EC. Although time spent on developing a clinical skill and the repetitive nature of it definitely influence the efficiency and proficiency of performance, there seems to be a minimum threshold that needs to be reached for this to stabilize.

When the EC graphs are inspected, the "outliers"[107-108,110] are unmistakably visible. The visual representations of EC in Figures 4.1-4.6 clearly display this occurrence, and seems to become more pronounced over time, especially at the top end of the graph. This observation might validate the use of the 90th or 95th percentile as a reference point to determine targets, instead of the absolute highest mark. In this study, the 90th percentile was used to set the minimum targets, because of student numbers being less than 100.

5.3.1.4.3 Accounting for discrepancies in Level of Difficulty

Despite initial fluctuations, the mean LDI were fairly constant at final feedback for both the fourth and fifth year cohorts. The combined fourth-year cohorts exhibited a mean LDI that ranged from 2.47 to 2.73 compared to 2.70-2.93 for the combined fifth year cohorts. As

expected, it evident that fifth year students' levels of achievement included more complicated procedures.

Over time, allocation of patients with different levels of difficulty, pertaining to the procedures, seemed to equalize because of a high procedure count. This is especially evident when the 2016 BChD 4 cohort is compared to all the other cohorts. This cohort at first feedback initially displayed a huge discrepancy concerning LDI variation, with a Min-Max of 0.00-9.00 and a low EC of 326 (See Table 4.19 and Figure 4.9). All the other cohorts had much higher ECs at similar feedback stages (See pages 53-60, Tables 4.15, 4.17, 4.21, 4.22, 4.23 and Figures 4.7, 4.8, 4.10, 4.11 and 4.12), with subsequent less significant variation in LDI. Min - Max LDI scores for the other two fourth year cohorts (2014 and 2015) respectively varied from 1.47-4.30 (EC=832) and 1.43-4.15 (EC=876). The fifth-year cohorts (2014-2016) demonstrated similar LDI variations to the latter two fourth-year cohorts, with individual LDI Min-Max ranges of, 2.03-4.55, 1.47-4.62 and 1.30-4.67. Correspondingly, EC counts were again high with 2060, 1143 and 1295 procedures being evaluated for the given feedback episodes.

The LDI results of two groups of cohorts followed through two years demonstrated a slight increase of the mean LDI from 2.47 to 2.70 if final assessment results for the 2014-2015 cohorts are examined. Similar results were experienced for the 2015-2016 cohorts that were also tracked over two years. An LDI increase of the final results from 2.47 to 2.71 was noted.

The LDI for individual students however fluctuated a lot. Respective ranges of 1.60 to 3.94 and 1.61- 4.73 were measured for the collective fourth and fifth year cohorts. As with the ECs, the "outliers" described by Cohen[107] are unmistakably visible for LDI scores in Figures 4.7 - 4.12. With the fourth-year cohorts, the evidence of these outliers is only evident during early feedback episodes, but when the fifth-year results are scrutinized, a significant show of "outliers" at the higher end of the graph is visible and appears to become more pronounced over time. This might be a clear indication of students showing a keen interest in, or preference for the particular clinical work and relishing the opportunity to attempt and succeed at procedures that are more complicated. The very high LDI values are indicative of a small number of distinct students who more often engage in surgical extractions on their own.

5.3.1.5 Concluding remarks on developing independence over time

The value and evidence if IR as an indicator of progressive independence seems to be conclusive. However, to define competence and per implication readiness to practice a specific skill independently it would be imperative to include an LDI score, combined with a minimum

procedure count, in the final analysis. This is to ensure that IRs alone do not skew the decision on whether a student can function unaided or not.

5.3.2 Improving the attainment of targets through periodic feedback

The second finding of the study implicates the ability of the feedback mechanism to help students attain pre-set minimum targets. There is an indication that information provided to students at feedback episodes, may be responsible for a phenomenon witnessed during the study. This occurrence that the number of students who performed below par, when compared to their peers, gradually diminished over time transpired in all the cohorts. As far as the existence of the initial gap with ECs between the high and the low performing students is concerned, the outcomes showed a dramatic reduction in all the cohorts (Table 4.13). A similar decrease in disparity was also evident in IR results (Table 4.39).

Initial scores had the students spread out with a wide variety of scores, but as time progressed, most students moved closer to one another. The interesting fact that emerged with this study is that, by employing a feedback system using a mathematical method similar to the Cohen method of standard setting[107-108,110] to set minimum targets, it could be showed how underperforming students gradually exceeded the targets without compromising the scores of the top achievers. A reduction in the gap, which existed between students at the top end of independence and those lagging behind in independence, could clearly be illustrated (Tables 4.13 and 4.39). A progression of independence was consequently shown, not only for individual students, but also for the cohort as a whole. This relates to the catalytic effect of assessment.[46]

The catalytic effect of assessment refers to a situation where assessment advances the accumulation of knowledge and skills in a positive way.[46] It is highly conceivable that the reductions in under-performing students witnessed after feedback episodes in this study (Tables 4.13 and 4.39) can be construed as a catalytic effect of the instrument. The fact that cohorts as a whole performed better as time progressed provides additional support to this inference. Mean IRs in the fifth-year cohorts consistently increased year on year. The mean IR results for the BChD 5 2014 cohort was 90.08%. This increased to 91.51% in 2015 and finally to 93.98% in 2016 (Tables 4.33, 4.35 and 4.37).

The aim of quarterly feedback was to provide students with statistics about their own performance and additionally supply indicators as to their performance in relation to their

fellow classmates. This information was supplementary to the advice they get at chair-side regarding their performance during a particular assessment. By plotting student performance in relation to minimum targets, students become aware of their abilities. Self-regulated learners are subsequently stimulated to perform on a different level. Trainees see their equals mature and in so doing start to believe in their own capabilities. Achievement becomes a reality as their confidence levels rise and so the catalytic effect continues.

The expectation was that self-regulated learners, as described by Zimmerman,[47] would react to this information and attempt to better their position. Such learners have the ability to monitor and evaluate achievement, set goals, motivate themselves by employing individual plans and adjust behaviour to reach certain objectives.[69,71-73] The qualitative part of the study confirmed that most students that participated in the structured reflection papers indeed set targets. In all the fourth-year cohorts, the percentage of students who set targets was consistently above 80%. Setting targets to achieve goals is one of the traits of a self-regulated learner. More than 50% of these students furthermore had their targets for IR set even higher than required. According to Zimmerman, students who engage in self-regulated learning frequently have high outcome expectations.[47] The formative feedback reports provided would enable these students to reflect on their performance. This would enable them to strategize, adapt and improve achievement to continue with the process of self-enhancement.

It should also be noted that the results obtained from the study alerted assessors to engage with "underperforming" students to understand the nature of the problem (if any) and to suggest mechanisms in implementing remedial action if necessary. These assessors are then furthermore able to engage with students in conversation on a deeper level by using previous results to explain the reasoning and the resultant effect of where and how previous students completed their training. This instils confidence and belief, in students who lag behind, that they can also become fully independent. Advice given to such learners should not only include task-level feedback, it should also be on a process and self-regulation-level,[41] to ensure improvement.

As students get to know the assessment instrument, they alter behaviour. It was found through the reflection papers that students, with an interest in the clinical field, would come in earlier for sessions, to be able to start earlier and see more patients than other students These same students would also work in extra sessions, thus enabling them to increase their EC. Students would observe other students and learn to adjust their work ethics, efforts and execution.

The premise would be that students, who self-regulate, would use this information to alter their behaviour to become more competent. Although feedback with this instrument is given at task level, it would seem that using targets and sub-par indicators further stimulated students to engage in higher order self-regulation feedback levels. They were able to reflect, strategically plan and adapt their behaviour to improve, succeed and reach a stage of self-realisation. For students to become self-reliant they need to be creative and productive.[149,155] If we expect them to be creative, we need to structure, develop and implement our assessment practices by employing resourceful and imaginative approaches.

Martinez and Lipson, already in 1989 described the importance of "assessment *for* learning, rather than assessment *of* learning".[123,156] This attitude towards assessment needs to become an intrinsic part of how we evaluate our students. Assessment should be so much more than a quantification of results. It should become an essential entity in the course of student enrichment during clinical training.[157]

The measurability of development of independence, using the concept of IR (under supervision) and the reduction of the gap between high and low performing students, stand central to the IR findings of the study. Animations depicting the results of two groups of students followed over two years (BChD 4 2014 evolving into BChD 5 2015, as well as BChD 4 2015 advancing to BChD 5 2016) can be viewed in Animated Videos K.9 and Animated Video with Audio K.10. The instrument demonstrated that improvement in independence over time is measurable. The catalytic effect witnessed, that succeeded assessment and feedback, might be attributed to self-regulated learning capabilities of students who reacted to results and feedback provided.

5.4 Limitations of the research

The study was performed in a hectic real-life environment. This made control over all situations difficult with especially supervisor and trainee behaviour challenging. Integrity and validity of data are dependent on how both of these entities conduct themselves. Results showed discrepancies, but most could be explained. Allocations of equal number of sessions to students were also complicated by multifaceted roster implications.

Moreover, qualitative data acquired, are student perceptions and cause and effect can therefore not summarily be inferred. Qualitative feedback made were only given by fourth year students in the middle of the year. It could be argued that qualitative data obtained from fifth year students may have provided a different picture. To obtain fifth year reflections would have

been more problematic during a tight and busy schedule of their concluding year. Their focus is on final examination and attaining clinical quotas.

The study did also not elicit any supervisor perceptions, which could have enhanced the understanding of the dynamics of the workplace-based assessment instrument. This could be regarded as a suggestion for a follow up study combined with other recommendations to follow after the conclusion.

5.5 Conclusion

"Assessment drives learning"[34,38,158-161] and "Feedback is one of the most powerful influences on learning and achievement":[41] Two of the most authoritative quotations in modern teaching. With this in mind, a novel clinical assessment instrument was designed in the MOFS at the SDUP.

This study showed that independent practice (under supervision) could be measured reliably in a workplace-based context involving thousands of dental extractions by means of IRs and can be deemed the first programmatic assessment pilot study in a developing country. The interpretation of IRs should however always be understood in the context of sample size (extraction count in this instance) and the level of difficulty of the procedures over time.

Similar to the post-graduate context, several factors such as the "trainee", "supervisor" and the "environment" and "professional activity", impacts on the outcome of assessment. These dynamics need to be clearly understood to minimize their influence and strengthen the assessment process. Corrective and educative measures should be taken to reduce controllable components. The undergraduate context is however completely different from the postgraduate context simply because undergraduate students are far less experienced and requires a different type of supervision to ensure patient safety and positive clinical outcomes.

An assessment instrument that works in tandem with a feedback system that provides minimum targets, with visual achievement indices, seems to have a catalytic effect on performance. Students with the ability to self-regulate will process the results, use self-observation and control, to adapt and react to achieve success. If their motivation to achieve is high and they value the effort and task, they will excel.

Results obtained from the instrument also allows for the identification and assistance of those who do not progress.

The conclusion showed that it is possible to assess *for* learning.[123,156] Chapter 6 completes the study with a few proposals on other potential applications of the instrument as well as suggestions on prospective strategic and guidance changes that should be implemented.

Chapter 6. The Way Forward

6.1 Introduction

The intervention that took place with this research had several interesting results and some conclusions have been reached. It would however be naïve to think that the work is done. A few recommendations regarding the instrument and its future use should be made. Four general recommendations will be put forward. These include

- Education of clinical teachers
- Expansion of the instrument within the module
- Transferability of the instrument to other disciplines
- Setting of targets that are more permanent.

6.2 Educating clinical teachers/supervisors

Several opinions became known during the implementation and evaluation of the assessment instrument. Supervisor inconsistency, interference, audacity and lack of guidance all came to the fore. A concerted attempt must be made to ensure that the training of supervisors facilitates consistency during clinical training.[19,162-163] This needs strategic planning and can only occur if current staff is engaged and provided support, to improve skill levels that are lacking. Newly appointed members in the department should be carefully selected with proper attributes for a surgical ward.[162] Retention of duly qualified and capable supervisors should be managed to ensure continuity and uniformity.

Competence and professionalism are two essential attributes clinical supervisors need for the provision of patient-centred care.[80,133] The team should therefore receive information on the importance of patient-centred care, not only to protect patient interests but to set an example to students on how to act professionally.[16-17] Although supervisors receive training regarding the implementation of the assessment instrument, they should receive enhanced feedback on the way they act as role models[157,162] and their education philosophy.[36] Everyone should furthermore be on the lookout for dishonesty and be aware of gender issues and the perception of a male dominated speciality.[136-137,139] The supplementation of female staff in the department could have a beneficial effect on the gender observation.

On the education front, supervisors should be educated on the different levels of feedback[41] they can provide. More emphasis should be placed on being able to provide task, process and self-reflection level feedback to enhance students' self-regulating capabilities.[28] Not all

students have self-regulating capabilities.[47] Some students have no goal setting elements, while others display negative outcome expectations and have failure in mind.[47] They have an external locus of control and blame outside factors for their failure. They do not take responsibility and use causal attribution to hide their inadequacies. Feedback should focus on explaining the self-regulating principles to supervisors and students alike. This will enable students to change their attitude.[28] If students' self-regulating abilities are taught and improved they will become learners for life.[77,164]

6.3 Expansion of the instrument within the Module: Orofacial Surgery

Introduction of the instrument in the MOFS had so much positive critique from both personnel and students that it will have to be expanded.

It can be immediately extended to the area of local anaesthesia application. This area attracts enough procedures to be measured. For local anaesthesia, the technique can be divided into two categories, namely (1) infiltrations and (2) block techniques, each with three criteria and correlating scores (Table 6.1). The competence (IR) in this case would then be measured by dividing the number of scores achieved on Level 3 by the total number of scores done to provide a percentage. Alternatively, percentage ratios can be applied to each competence criteria. A pilot study would have to be undergone to determine which competence level is effective.

Table 6.1 Continuous assessment scale for Local Anaesthesia

Technique	Competence Criteria	Level
Infiltration	Local anaesthetic not achieved / help needed	1
	Local anaesthetic achieved with difficulty	2
	Local anaesthetic achieved correctly	3
Block technique	Local anaesthetic not achieved	1
	Local anaesthetic achieved with difficulty	2
	Local anaesthetic achieved correctly	3

For the clinical examination, a multi-step procedure, independence can be measured per step in conjunction to testing the students' knowledge application based on clinical findings. Assessment can therefore be done on several levels. It should also be investigated if these concepts could be applied during diagnosis and treatment planning.

6.4 Transferability of the instrument to other disciplines

The instrument may be transferrable to other disciplines in Dentistry and Medicine that are frequently performed by students and allows for programmatic assessment.[122-127]

Radiography, where numerous radiographs are taken is one area of interest. Division of periapical radiography techniques into anterior and posterior procedures is advised. Scores of, 1 (not achieving objective), 2 (achieving objective with difficulty) and 3 (achieving objective), can be allocated to calculate competence or ratios, as with the local anaesthetic scale in Table 6.1 above.

Restorative Dentistry is another field where these assessment principles can be applied. Students often place hundreds of restorations annually. Basic Restorative Dentistry consists of a variety of multi-step procedures that can be classified according to type (*e.g.*, amalgam restorations or composite restorations) and location (anterior or posterior). Different steps such as cavity preparation, base-layers, etching and bonding, matrix placement, the packing of material and finishing, could all be assessed based on the student's ability to complete these independently. Each step could be divided into scores of 1 (not achieved) or 2 (achieved independently). The IR for each step is then calculated by dividing the number of 2 scores achieved through the total number of scores (1 + 2) for each step. Obviously, the final outcome must be that the student can perform all the steps independently. Students must therefore also be assessed whether they completed the entire procedure independently, or not. The advantage is that students could be alerted to the areas in which they struggle. Specific remediation could be done to achieve competence. Students might for instance be competent in removing caries and cavity preparation but not so in the actual placement of the restoration.

The same principles can be assigned to procedures in the medical profession, for example endotracheal intubations being performed or intravenous lines placed. Registrars in specialities who perform multiple procedures can also be assessed in this manner, either in single procedure techniques or in multi-step procedures.

6.5 Setting more permanent targets

As more data are collected for each skill, the method used by employing the 90th/95th percentile as described in Chapter 3, might be used to set targets that are achievable and more permanent. It should be investigated if extraction rate per session could be used to set targets for students.

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Examples of Coding

Appendix A: Examples of Coding

Table A.1 Initial coding of Questions 1 and 2 BChD 4 2015 (n=47)

	Allocated participant numbers with corresponding responses BChD 4 2015 (n=47)																																															Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Question 1: Why do you think some students extract more teeth than others?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47				
Allocation of patients	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	43	91%	43	91%
Technique	x						x																																									2	4%	7	15%
Skills												x				x	x							x																					x			5	11%		
Audacity of student																	x																															1	2%	2	4%
Take long to adapt to environment														x																																		1	2%		
Work faster/slower	x				x									x		x			x															x		x			x					x				9	19%	34	72%
Planning			x																																													1	2%		
Come early					x																																								x			2	4%		
Extra sessions			x		x	x	x		x	x	x	x		x	x	x	x	x	x		x			x	x		x				x			x	x	x	x	x		x		x		x		x		28	60%		
Miss sessions	x											x																																				2	4%		
Work harder										x																						x		x	x													4	9%		
Stronger (Gender)										x																																						1	2%	1	2%
Unethical practice by students							x	x			x	x	x		x	x	x	x	x			x	x	x	x									x	x	x	x	x							x	x		21	45%	22	47%
No regard for patient														x														x																x				3	6%		
Student preference for type of work				x				x																										x	x													4	9%	4	9%
Question 2: Why do you think some students' Independence ratios are higher than others?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Allocation of patients		x			x		x		x						x	x				x			x		x										x													10	21%	10	21%
Difficulty of procedure		x			x		x	x	x		x		x		x	x		x		x		x		x	x		x		x												x	x	x	x	x	x		22	47%	22	47%
Technique	x				x																			x	x																							4	9%	18	38%
Skills							x	x		x		x		x	x	x	x					x											x	x	x						x							13	28%		
Knowledge	x				x																									x																		3	6%		
Perseverance									x																													x		x			x		x			5	11%	19	40%
Incompetence/unsure	x																					x																		x			x					4	9%		
Ability/Experience				x										x								x						x	x		x												x					7	15%		
Confidence		x	x	x		x		x		x																					x																	7	15%		
Take long to adapt to environment															x																																	1	2%		
Stronger or perception (Gender)																						x												x														2	4%	2	4%
Patient Safety			x																															x		x												3	6%	3	6%
Dr Interference		x			x			x						x	x	x						x	x			x		x	x											x	x		x				x	15	32%	16	34%
Dr Inconsistency														x														x	x		x																	4	9%		

Appendix A

Examples of Coding

Table A.2 Initial coding of Questions 3 and 4 BChD 4 2015 (n=47)

Allocated participant numbers with corresponding responses BChD 4 2015 (n=47)				
Question 3: Why do you think some students' level of difficulty achieved is higher or lower than others?	Participants 1–47 (x = response)	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Allocation of patients	x at 4,6,7,8,9,11,12,13,14,15,17,20,21,23,24,26,27,28,30,32,33,34,36,38,39,42,43	27	57%	27	57%
Skills	x at 25	1	2%		
Technique	x at 40	1	2%		
Knowledge	x at 1	1	2%	6	13%
Come early	x at 13	1	2%		
Work harder	x at 44,45,47	3	6%		
Audacity	x at 18,35	2	4%		
Incompetence/unsure	x at 3,42	2	4%		
Perseverance	x at 15,44	2	4%	12	26%
Ability/Experience	x at 1,4,25,27,38,41,42	7	15%		
Confidence	x at 3,18	2	4%		
Stronger or perception (Gender)	x at 4	1	2%	1	2%
Dr Inconsistency	x at 3,4,6,10,13,14,15,19,20,26,27,30,35,47	14	30%	14	30%
Unethical practice	x at 10,30,36	3	6%	3	6%

Question 4: Do you have certain targets for the Independence ratio, level of difficulty and extraction quota levels?	Participants 1–47 (x = response)	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
No	x at 1,30,37,43,44,45	6	13%	6	13%
Yes	x at 2–29,31–42,45–47 (most participants)	40	85%	40	85%
No answer	x at 17	1	2%	1	2%
Quota 65/N	x at 6,13,14,26,29,30,40,41,47	9	19%	9	19%
Quota 65-75	x at 9,10,11,15,28	5	11%		
Quota 85-100	x at 8,18,26,34,35	5	11%		
Quota>100	x at 36,45	2	4%	22	47%
Quota as much as possible	x at 3,6,7,21,28,31,39,40,41,47	10	21%		
IR low	x at 13	1	2%	1	2%
IR 80%/N	x at 12,22,24,25,27,28,36,39,41	9	19%	9	19%
IR 80-85%	x at 14,15,25,34	4	9%		
IR 86-90%	x at 7,8,11,34,35	5	11%		
IR 91-95%	x at 40	1	2%	27	57%
IR>95%	x at 1	1	2%		
IR High	x at 5,6,8,9,17,18,20,21,22,28,32,36,40,45,46,47	16	34%		
LDI N	x at 11,14,26,29,34,35,39	7	15%	7	15%
LDI>N	x at 5,6,14,43	4	9%		
LDI High	x at 7,8,24,27,33,34,45,47	8	17%	12	26%

Examples of Coding

Table A.3 Coding of Questions 5 and 6 BChD 4 2015 (n=47)

Question 5: What do you focus on and what goes on in your mind when doing an extraction?	Achievement Factors (AF)	Allocated participant numbers with corresponding responses BChD 4 2015 (n=47) 1–47	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Patient comfort	Patient safety or comfort (AF1)	(1,2,5,7,9,10,11,23,24,27,30,41,42,43,44)	15	32%	37	79%
Patient safety		(1,3,6,7,8,10,12,13,14,15,16,18,20,23,24,25,26,27,28,30,31,32,34,35,36,37,39,41,45,46,47)	31	66%		
Stay calm	Trainee safety or comfort (AF2)	(2)	1	2%	9	19%
Own discomfort		(10,17)	2	4%		
Own competence		(3,9,13,35,39,40)	6	13%		
Right technique	Technique improvement (AF3)	(1,2,6,7,10,11,15,19,22,23,24,26,30,33,34,35,36,37,38,39,40,41)	22	47%	23	49%
Gaining experience		(18)	1	2%		
Failing in extracting	Possible task failure (AF4)	(38)	1	2%	19	40%
Breaking tooth		(3,8,9,11,14,17,20,22,24,26,27,29,31,35,41,43,44)	18	38%		

Question 6: What do you think you can do to improve your ability to extract teeth?	Proficiency Factors (PF)	Allocated participant numbers 1–47	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Practice	Training or gaining experience (PF1)	(2,3,7,8,9,13,14,15,17,19,20,21,22,25,28,33,37,38,39,41,43,46,47)	23	49%	30	64%
Gain Experience		(3,9,10,11,18,23,25,33,37,40,43)	11	23%		
Improve knowledge	Skill expansion (PF2)	(1,8,9,10,21,41)	6	13%	22	47%
Improve skill		(4,9,17,22,23,24,26,28,29,32,33,34,41,42,45)	15	32%		
Improve technique		(1,8,9,11,30,34,38)	7	15%		
Increase difficulty	Improved ability or confidence (PF3)	(4,34,35,44)	4	9%	13	28%
Increase independence		(3,4,13,28,32,33,43,46)	8	17%		
Increase confidence		(13,30,37,38,43)	5	11%		
Be more patient		(4,13)	2	4%		

Examples of Coding

Table A.4 Initial coding of Questions 1 and 2 BChD 4 2016 (n=51)

Question 1: Why do you think some students extract more teeth than others?	Allocated participant numbers with corresponding responses BChD 4 2016 (n=51)																																																			Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51				
Allocation of patients	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	45	88%	45	88%
Time of day																													x									x		x												3	6%		
Technique																																							x													1	2%	8	16%
Skills						x			x						x				x																x												x		x			7	14%		
Audacity									x																																								x			2	4%	2	4%
Work faster									x						x												x	x					x				x						x						x			7	14%	18	35%
Come early																															x																					1	2%		
Extra sessions											x			x					x					x							x	x	x			x										x						9	18%		
Work harder						x																						x																								2	4%		
Stronger or Perception (Gender)					x																												x																			2	4%	2	4%
Unethical practice									x						x						x					x					x	x	x			x											x		x			10	20%	10	20%
Preferential treatment by staff	x					x	x				x	x			x			x						x		x		x	x	x	x			x			x			x			x	x	x	x		x				21	41%	21	41%
Question 2: Why do you think some students' Independence ratios are higher than others?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Allocation of patients	x				x	x	x		x												x													x									x									8	16%	8	16%
Difficulty of procedure	x	x	x		x		x	x					x			x		x			x	x	x										x	x		x				x	x	x			x		x					20	39%	20	39%
Technique			x				x																																													2	4%	24	47%
Skills	x			x			x				x	x	x			x			x		x												x					x	x						x							13	25%		
Knowledge																																		x											x							2	4%		
Work faster							x																																						x							2	4%		
Audacity						x													x							x	x																									4	8%	4	8%
Perseverance																												x																					x			2	4%	24	47%
Ability/Experience			x	x				x					x		x			x					x							x				x	x		x												x			12	24%		
Confidence						x					x	x	x				x				x							x	x		x	x	x			x	x		x		x								x			16	31%		
Stronger or Perception (Gender)			x				x			x																								x			x															5	10%	5	10%
Dr interference		x	x				x			x		x	x		x						x			x			x	x		x							x												x	x		15	29%	19	37%
Dr inconsistency					x						x	x		x	x		x							x			x			x																		x				10	20%		
Supervisor to student ratio																																					x															1	2%		

Examples of Coding

Table A.5 Initial coding of Questions 3 and 4 BChD 4 2016 (n=51)

Question 3: Why do you think some students' level of difficulty achieved is higher or lower than others?	Allocated participant numbers with corresponding responses BChD 4 2016 (n=51) (participants 1–51)	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Allocation of patients	(see table)	38	75%	41	80%
Skills	(see table)	2	4%	3	6%
Work harder	(see table)	1	2%		
Audacity	(see table)	1	2%	6	12%
Ability/Experience	(see table)	6	12%		
Confidence	(see table)	1	2%		
Stronger or perception (Gender)	(see table)	3	6%	3	6%
Staff Inconsistency or system not clear	(see table)	16	31%	16	31%

Question 4: Do you have certain targets for the Independence ratio, level of difficulty and extraction quota levels?	Allocated participant numbers with corresponding responses (participants 1–51)	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
No	(see table)	4	8%	4	8%
Yes	(see table)	43	84%	43	84%
No answer	(see table)	4	8%	4	8%
Quota 65/N	(see table)	16	31%	16	31%
Quota 65-75	(see table)	2	4%	17	33%
Quota 75-85	(see table)	1	2%		
Quota 85-100	(see table)	3	6%		
Quota>100	(see table)	1	2%		
Quota as much as possible	(see table)	10	20%		
IR low	(see table)	2	4%	2	4%
IR 80%/N	(see table)	8	16%	8	16%
IR 80-85%	(see table)	3	6%	29	57%
IR 86-90%	(see table)	4	8%		
IR 91-95%	(see table)	1	2%		
IR High	(see table)	21	41%		
LDI N	(see table)	8	16%	8	16%
LDI>N	(see table)	19	37%	20	39%
LDI High	(see table)	1	2%		

Examples of Coding

Table A.6 Coding of Questions 5 and 6 BChD 4 2016 (n=51)

Question 5: What do you focus on and what goes on in your mind when doing an extraction?	Achievement Factors (AF)	Allocated participant numbers with corresponding responses BChD 4 2016 (n=51) (columns 1–51)	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Patient comfort	Patient safety or comfort (AF1)	x at 3,4,5,7,8,11,16,26,43,49 +	11	22%	31	61%
Patient safety		x at 1,2,3,5,8,13,15,17,20,21,23,26,27,28,33,36,37,40,41,45,46,50,51	23	45%		
Own Comfort	Trainee safety or comfort (AF2)	x at 3,7,25,27,31,37	6	12%	11	22%
Own competence		x at 3,38,40,43,44,45	6	12%		
Gaining experience		x at 27,43	2	4%		
Right technique	Technique improvement (AF3)	x at 1,2,3,5,7,9,10,11,12,13,14,17,18,19,20,26,27,30,31,32,33,34,35,36,37,39,43,46,47,48,49 +	32	63%	32	63%
Anatomy of tooth		x at 34	1	2%		
Failure	Possible task failure (AF4)	x at 4,6,7,10,13,16,17,18,21,23,24,25,29,33,36,37,39,41,48 +	20	39%	20	39%

Question 6: What do you think you can do to improve your ability to extract teeth?	Proficiency Factors (PF)	Allocated participant numbers with corresponding responses (columns 1–51)	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Practice	Training or gaining experience (PF1)	x at 1,2,3,6,7,9,11,14,16,18,19,20,23,26,27,30,31,32,33,36,37,40,43,45,46,48 +	28	55%	41	80%
Gain Experience		x at 4,5,6,7,11,12,14,15,16,17,20,22,24,27,29,33,36,38,43,48,49,50,51	23	45%		
Improve knowledge	Skill expansion (PF2)	x at 14,23,27,31,47	5	10%	20	39%
Improve skill		x at 1,4,6,8,9,14,18,34,40,41,43	11	22%		
Improve technique		x at 3,15,25,37,46,47	6	12%		
Increase difficulty	Improved ability or confidence (PF3)	x at 2,5,7,11,12,13,22,27,28,34,44	11	22%	19	37%
Increase independence		x at 30,34,44,48,51	5	10%		
Increase confidence		x at 14,25,26,31,32,36,39,46	8	16%		

Examples of Coding

Table A.7 Initial coding of Questions 1 and 2 BChD 4 2017 (n=46)

Allocated participant numbers with corresponding responses BChD 4 2017 (n=46)

Question 1: Why do you think some students extract more teeth than others?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Allocation of patients	x		x	x	x	x		x		x	x				x	x	x	x		x	x		x	x		x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	36	78%	37	80%
Time of day				x													x						x								x	x		x									x				7	15%		
Technique																			x																												1	2%	2	4%
Skills									x																																						1	2%		
Audacity																										x																					1	2%	2	4%
Take long to adapt to environment													x																																		1	2%		
Work faster										x		x					x		x			x							x																		6	13%	17	37%
Come early								x																	x															x	x						4	9%		
Extra sessions	x					x											x					x				x	x				x			x													8	17%		
Work harder	x	x																																													2	4%		
Stronger or Perception (Gender)																										x																					1	2%	1	2%
Unethical practice by student			x				x															x									x	x			x			x		x							8	17%	8	17%
Preferential treatment by staff					x																																										1	2%	1	2%
Difficulty of procedure	x						x	x	x																		x						x														6	13%	6	13%

Question 2: Why do you think some students' Independence ratios are higher than others?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Allocation of patients				x		x	x								x	x				x			x			x									x		x				x						11	24%	11	24%
Dificulty of procedure	x			x	x		x						x			x	x			x		x	x	x		x	x		x		x			x	x		x				x		x	x	x		22	48%	22	48%
Technique																																															0	0%	8	17%
Skills			x																	x			x								x				x	x					x	x					8	17%		
Knowledge																																															0	0%		
Work faster																																															0	0%		
Perseverence			x						x											x									x																		4	9%	25	54%
Ability/Experience																				x	x											x		x	x				x								6	13%		
Confidence		x					x				x	x	x			x						x	x	x			x						x		x	x	x			x		x	x		x		17	37%		
Student Audacity								x										x	x												x																4	9%		
Dr Interference			x				x							x	x					x		x				x	x	x			x									x	x						12	26%	17	37%
Dr inconsistency															x												x				x	x				x				x	x				x		8	17%		
Dr audacity	x						x																																								2	4%		
Time constraints makes doctor take over																																													x		1	2%		
Supervisor to student ratio							x																																								1	2%		

Examples of Coding

Table A.8 Initial coding of Questions 3 and 4 BChD 4 2017 (n=46)

	Allocated participant numbers with corresponding responses BChD 4 2017 (n=46)																																														Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Question 3: Why do you think some students' level of difficulty achieved is higher or lower than others?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46				
Allocation of patients	x		x	x	x					x					x	x			x						x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	31	67%	31	67%
Skills								x																																			x		x		3	7%	3	7%
Work harder																																															0	0%		
Audacity		x					x		x													x						x					x	x					x								8	17%	16	35%
Ability/Experience					x				x									x																													3	7%		
Confidence		x			x			x														x	x	x	x									x							x						9	20%		
Perseverence																								x																							1	2%		
Stronger or perception (Gender)																							x																								1	2%	2	4%
Females have an x-factor		x																																													1	2%		
Supervisor Inconsistency							x	x									x				x											x															5	11%	5	11%
Supervisor interference																	x				x																										2	4%		
Difficulty of procedure	x			x	x						x	x	x				x	x	x				x	x	x			x	x		x			x	x					x	x	x					20	43%	20	43%
Question 4: Do you have certain targets for the Independence ratio, level of difficulty and extraction quota levels?	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
No						x									x		x		x						x																		x				6	13%	6	13%
Yes	x	x	x	x	x		x	x	x	x		x	x	x	x	x		x		x		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	39	85%	39	85%
No answer												x																																			1	2%	1	2%
Quota 65/N																	x									x					x											x	x				5	11%	5	11%
Quota 65-75			x			x																														x											3	7%	20	43%
Quota 75-85	x																																														1	2%		
Quota 85-100																																												x			1	2%		
Quota>100																								x																				x			2	4%		
Quota as much as possible		x		x				x		x	x												x					x		x		x		x		x	x			x							13	28%		
IR 80%/N	x																									x						x											x				4	9%	4	9%
IR 80-85%														x																														x			2	4%	28	61%
IR 86-90%		x																																													1	2%		
IR 91-95%							x		x									x						x												x									x		6	13%		
IR High			x	x			x		x	x			x	x			x			x		x		x		x		x		x		x					x	x	x	x							19	41%		
LDI N																										x					x												x				3	7%	3	7%
LDI>N	x																																														1	2%	23	50%
LDI High			x	x	x		x	x		x				x		x		x				x		x				x		x		x	x	x	x	x	x	x	x	x					x		22	48%		

Examples of Coding

Table A.9 Coding of Questions 5 and 6 BChD 4 2017 (n=46)

		Allocated participant numbers with corresponding responses BChD 4 2017 (n=46)																																														Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Question 5: What do you focus on and what goes on in your mind when doing an extraction?	**Achievement Factors (AF)**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46				
Patient comfort	Patient safety or comfort (AF1)				x			x		x		x			x		x			x	x							x				x											x					11	24%	20	43%
Patient safety		x	x				x	x			x							x	x		x		x		x	x		x		x		x																x	14	30%		
Own Comfort	Trainee safety or comfort (AF2)					x																			x		x			x		x		x									x			x	x	9	20%	13	28%
Own competence			x			x						x					x			x														x												x		7	15%		
Gaining experience												x																			x			x														3	7%		
Right technique	Technique improvement (AF3)	x		x	x	x	x		x	x				x	x			x	x	x	x				x	x	x		x	x	x		x	x			x	x	x		x	x	x	x	x		x	30	65%	30	65%
Anatomy of tooth																																														x		1	2%		
Failure	Possible task failure (AF4)			x		x				x			x			x						x				x	x					x			x		x	x	x	x		x		x				16	35%	16	35%
Question 6: What do you think you can do to improve your ability to extract teeth?	**Proficiency Factors (PF)**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	Individual Number of responses	Individual Percentage of responses	Combined Number of responses	Combined Percentage of responses
Practice	Training or gaining experience (PF1)		x	x			x	x		x		x		x	x		x	x	x	x	x	x	x	x	x			x	x				x				x		x		x						x	26	57%	32	70%
Gain Experience			x		x	x		x	x											x					x			x					x											x				9	20%		
Get more clinical demonstrations		x			x		x	x																							x																	5	11%		
Improve knowledge	Skill expansion (PF2)		x																												x																	2	4%	14	30%
Improve skill			x											x				x	x										x	x		x							x			x					x	10	22%		
Improve technique																x									x									x	x				x									5	11%		
Increase difficulty	Improved ability or confidence (PF3)			x			x			x	x	x	x					x											x	x												x		x		x	x	13	28%	23	50%
Increase independence				x	x																						x										x											4	9%		
Increase confidence												x																			x						x		x	x			x	x	x			8	17%		

Examples of Coding

Table A.10 Final Coding according to Dijksterhuis model[25] BChD 4 2015 (n=47)

Dijksterhuis Category	Question number of Reflection paper	Higher order theme	Higher order theme number	Total Number of Responses for Higher order themes	Percentage Distribution for Higher order themes	Sub theme	Sub theme number	Number of Responses for Sub themes	Percentage Distribution for Sub themes
C1	Q2 / Q3 / Q1	Ability or Experience	1	26	55%	Ability/Experience	1	12	26%
	Q2 / Q3 / Q1					Skills	2	15	32%
	Q2 / Q3 / Q1					Technique	3	6	13%
						Work faster/slower	4	9	19%
	Q1 / Q3	Audacity or Confidence	2	14	30%	Audacity of student	5	2	4%
	Q2 / Q3					Confidence	6	8	17%
	Q3 / Q2					Incompetence/unsure	7	5	11%
	Q3 / Q2					Patient Safety	8	3	6%
	Q1	Self-regulation or Diligence	3	34	72%	Come early	9	3	6%
	Q3 / Q1					Extra sessions	10	28	60%
	Q1					Miss sessions	11	2	4%
	Q2 / Q3					Perseverance	12	6	13%
	Q1					Planning	13	1	2%
	Q1					Student preference for type of work	14	4	9%
	Q1 / Q2					Take long to adapt to environment	15	2	4%
	Q1 / Q3					Work harder	16	7	15%
	Q1 / Q2 / Q3	Gender bias	4	4	9%	Stronger or perception	17	4	9%
	Q1 / Q3 / Q1	Unethical practice	5	23	49%	Unethical practice	18	23	49%
	Q2 / Q3	Knowledge	6	3	6%	Knowledge	19	3	6%
Trainee (C1) Total				**44**	**94%**				
C2	Q2 / Q3	Undue supervisor interference	7	16	34%	Undue Interference	21	16	34%
	Q2 / Q3	Supervisor audacity related to skill	8	6	13%	Audacity of Supervisor	22	6	13%
	Q2 / Q3	Supervisor Inconsistency	9	15	32%	Dr. Inconsistency	23	15	32%
	Q2	Lack of guidance	10	2	4%	Lack of guidance	24	2	4%
	Q2	Gender bias	4	1	2%	Gender bias	25	1	2%
Supervisor (C2) Total				**20**	**43%**				
C3	Q2	Difficulty of procedure	13	22	47%	Difficulty of procedure	28	22	47%
Professional Activity (C3) Total				**22**	**47%**				
C4	Q1 / Q2 / Q3	Inconsistent patient allocation	14	45	96%	Allotment/allocation of patients	29	45	96%
Working Environment (C4) Total				**45**	**96%**				

The right-hand section of the table (columns headed "Allocated Participant Number with corresponding responses", numbered 1–47) records individual participant responses marked with "x" for each sub-theme.

Examples of Coding

Table A.11 Final Coding according to Dijksterhuis model[25] BChD 4 2016 (n=51)

Dijksterhuis Category	Question number of Reflection paper	Higher order theme	Higher order theme number	Total Number of Responses for Higher order themes	Percentage Distribution for Higher order themes	Sub theme	Sub theme number	Number of Response for Sub themes	Percentage Distribution for Sub themes
C1	Q2	Ability or experience	1	28	55%	Ability/Experience	1	17	33%
	Q3								
	Q1					Skills	2	20	39%
	Q2								
	Q3								
	Q1					Technique	3	3	6%
	Q2								
	Q1					Work faster/slower	4	9	18%
	Q2								
	Q1	Audacity or Confidence	2	20	39%	Audacity of student	5	6	12%
	Q2								
	Q3								
	Q2					Confidence	6	16	31%
	Q3								
	Q1	Self-regulation or Diligence	3	14	27%	Come early	9	1	2%
	Q1					Extra sessions	10	9	18%
	Q2					Perseverance	12	2	4%
	Q1					Work harder	16	2	4%
	Q3								
	Q1	Gender bias	4	7	14%	Stronger or Perception	17	7	14%
	Q2								
	Q3								
	Q1	Unethical practice	5	10	20%	Unethical practice	18	10	20%
	Q2	Knowledge	6	2	4%	Knowledge	19	2	4%
Trainee (C1) Total				**40**	**78%**				
C2	Q2	Undue supervisor interference	7	14	27%	Undue interference	21	14	27%
	Q2	Supervisor audacity related to skill	8	10	20%	Audacity of Supervisor	22	10	20%
	Q1								
	Q3								
	Q2	Supervisor Inconsistency	9	16	31%	Dr. Inconsistency	23	16	31%
	Q3								
	Q3	Gender bias	4	1	2%	Gender bias	25	1	2%
	Q2	Poor supervisor:student ratio	11	1	2%	Poor supervisor:student ratio	26	1	2%
	Q1	Favouritism	12	2	4%	Preferential treatment by staff	27	2	4%
Supervisor (C2) Total				**23**	**45%**				
C3	Q2	Difficulty of procedure	13	20	39%	Difficulty of procedure	28	20	39%
Professional Activity (C3) Total				**20**	**39%**				
C4	Q1	Inconsistent patient allocation	14	50	98%	Allotment/allocation of patients	29	50	98%
	Q2								
	Q3								
	Q1	Time of day	15	3	6%	Time of day	30	3	6%
Working Environment (C4) Total				**50**	**98%**				

Allocated Participant Numbers with corresponding responses (columns 1–51) shown with "x" marks.

Examples of Coding

Table A.12 Final Coding according to Dijksterhuis model[25] BChD 4 2017 (n=46)

Dijksterhuis Category	Question number of Reflection paper	Higher order theme	Higher order theme number	Total Number of Responses for Higher order themes	Percentage Distribution for Higher order themes	Sub theme	Sub theme number	Number of Responses for Sub themes	Percentage Distribution for Sub themes
C1	Q2 / Q3	Ability or Experience	1	19	41%	Ability/Experience	1	9	20%
	Q1 / Q2 / Q3					Skills	2	10	22%
	Q1 / Q2					Technique	3	1	2%
	Q1 / Q2					Work faster	4	6	13%
	Q1 / Q3	Audacity or Confidence	2	26	57%	Audacity of student	5	10	22%
	Q2 / Q3					Confidence	6	21	46%
						Patient Safety	8	2	4%
	Q1	Self-regulation or Diligence	3	16	35%	Come early	9	4	9%
	Q1					Extra sessions	10	8	17%
	Q2					Perseverance	12	5	11%
	Q1					Take long to adapt to environment	15	1	2%
	Q1 / Q3					Work harder	16	2	4%
	Q3	Gender bias	4	3	7%	X-factor of Females	20	1	2%
	Q1 / Q3					Stronger or Perception	17	2	4%
	Q1	Unethical practice	5	8	17%	Unethical practice	18	8	17%
Trainee (C1) Total				**36**	**78%**				
C2	Q2 / Q3	Undue supervisor interference	7	11	24%	Undue Interference	21	11	24%
	Q2 / Q3	Supervisor Audacity	8	11	24%	Audacity of Supervisor	22	11	24%
	Q2 / Q3	Supervisor Inconsistency	9	12	26%	Dr. Inconsistency	23	12	26%
	Q2	Poor supervisor:student ratio	11	1	2%	Poor supervisor:student ratio	26	1	2%
	Q1 / Q3	Favouritism	12	1	2%	Preferential treatment by staff	27	1	2%
	Q3	Gender-bias	4	1	2%	Gender-bias	25	1	2%
Supervisor (C2) Total				**20**	**43%**				
C3	Q1 / Q2 / Q3	Difficulty of procedure	13	36	78%	Difficulty of procedure	28	36	78%
Professional Activity (C3) Total				**36**	**78%**				
C4	Q1 / Q2 / Q3	Inconsistant patient allocation	14	41	89%	Allotment/allocation of patients	29	41	89%
	Q1	Time of day	15	7	15%	Time of day	30	7	15%
	Q2	Time constraints	16	1	2%	Time constraints makes doctor take over	31	1	2%
Working Environment (C4) Total				**42**	**91%**				

The right-hand portion of the table is headed "Allocated Participant Numbers with corrponding responses" with columns numbered 1 through 46, each sub-theme row marked with x's indicating the participants who gave corresponding responses.

Retyped Reflection Paper Answers

Appendix B: Retyped Reflection Paper Answers

Answers to reflection paper questions of BChD 4 2015 students

Question 1

Why do you think some students extract more teeth than others?

Participant 1
Some students are fast workers so they are able to see more than one patient per session. Technique of extraction: Those students who know the technique tend to extract more teeth. They don't spend lots of time to struggle with one tooth. At certain times one or a couple of students find themselves doing referrals instead of doing extractions

Participant 2
- Some students have to refer, others get dentectomies.
- Other students do not get patients at all.
- Some miss sessions.

Participant 3
Because of the type of case one gets. Some even make arrangements to get patients with more teeth to extract and even work in on sessions where they are not allocated a chair.

Participant 4
Some students extract more teeth as they get more patients in one session and do not have to refer patients and extract no teeth.

Participant 5
Sometimes it's a matter of luck, a dentectomy. Other students take greater interest in the subject and clinical work and therefor put in extra hours/sessions.

Participant 6
- Some people book extra sessions and other students booked in the sessions end up not having patients.
- Some sessions are overbooked for the amount of chairs available.
- Sometimes people are taken to surgery and don't get to do anything (based on a week's observation)
- People will come early.

Participant 7
- Some students work faster, so they can see more than one patient a session.
- Some students are luckier to get more extractions, where others only get referrals.
- Some students attend extra sessions.

Participant 8
I think it is a combination of reasons. Either the patient you are allocated has more teeth to extract than other students' patients do. I also believe that some students' clinical technique in removing teeth are of a higher standard.

Participant 9
They extract in their off-sessions. Also just the luck of the draw, some patients have one tooth that needs to be extracted, others have dentectomies.

Retyped Reflection Paper Answers

Participant 10
- Some students prefer to work in extra KGM sessions while others of us go and finish our prosthetic lab work in our off sessions.
- Some students get a lot of referrals in the KGM-session and do not manage to extract any teeth in some sessions.
- Some patients need to be sent home due to medical conditions such as high BP or sugar levels so that students also don't manage to extract any teeth.
- Full dentectomy cases do not get distributed throughout the class. Some students already had two dentectomies while others not even one.

Participant 11
- Some students attend KGM in their off sessions and 'steal' patients from the students who needs to be at KGM for that session and then only do referrals.
- Some students have contacts who give them patients needing dentectomies.

Participant 12
- Stronger (males)
- Some get the dentectomies CONSTANTLY (do they have contacts sending the patients to them?)
- Some students work in sessions (extra) and then take the students' patients who are actually supposed to be in the session. Then their quotas are sky high and those whose patients are taken, have insufficient quotas. If you want to specialize in KGM, you can come in the holiday.

Participant 13
- Some students are more skilled than others when extracting.
- Some students don't attend sessions.
- Dedicated students attend more sessions and are able to extract more teeth.

Participant 14
This is quite controversial as some students by chance receive patients with a need for multiple extractions, whereas others might get one extraction over a period of a single/many sessions due to referrals. CPC should filter patients better and sent KGM-West patients straight to them. MOST NB. Students who are not allocated to sessions who take over scheduled sessions student's patients just to increase their quota, not bothering to care for patients, e.g. *Student A*. Some students should stop boosting about how great they are at extractions.

Participant 15
- Some people just have the capability to work faster than others.
- Some people takes a bit longer to adapt to a new environment than others and new work.
- Just lucky getting patients that needs a lot of teeth extracted.
- BUT MOST IMPORTANTLY, students working extra sessions, sessions where they are not supposed to be and many times taking other students' patients or patients with many extractions. Unfair towards students that need quota!
- Students who have extracted their minimum requirements and still come in holidays to extract, taking other students chance to make up quota that they need- *Student A*!

Retyped Reflection Paper Answers

Participant 16
- Some students some out of their session time.
- Sometimes you are lucky and get dentectomies, whereas others get referrals every time and one tooth the other times.
- Some people have better skills.
- Some people take more patients than they are allowed to while others have only done referrals the whole session.
- Some people with many teeth should not be allowed to work in on holidays.

Participant 17
Some students are better and some students are less cautious. A lot of the students take considerable longer to do an examination than others. A lot of students come in when they do not have sessions. Some patients have received dentectomy cases which is unfair because some others have not.

Participant 18
- Not all patient that's in KGM is there for extraction.
- Also for referrals.
- Patient that I see may have medical complications.
- Student that are free from other sessions and they some to KGM and see the patient, while the student that that are supposed to see the patients then does not because patients are limited per session. Personally I think this is unfair for those that have their sessions then. The student that are free should wait before and see that other students have patients and after that if there are patients left they can see them.

Participant 19
Some students are in our sessions, that they are not allocated to the session and the students in the session get patients who are mostly referrals because these students take patients before we get a chance.

Participant 20
Everyone has different activities and takes a different amount of time to do the work. Also, it depends on the patients one receives and the availability of extractions to do, as appose to patients who only come specifically for referrals. It is also unfair if students who are not scheduled for a KGM-session, come in in their free time and take away patients which we (who are scheduled for KGM) should have had.

Participant 21
Some students that are not allocated (this) session come and take patients that we could have extracted instead of them, then we get less teeth to extract.

Participant 22
Because often some students get only referral cases in their session, or more difficult cases, then it takes the whole session to extract one tooth. Some students also get more dentectomies than others, luck of draw. Also some students have been going to other students' KGM sessions and have been seeing patients and the student whose actual KGM session it is does not get a patient.

Participant 23
It depends on the patients we get allocated. Some students are lucky to always get dentectomy patients.

Participant 24
There is a few variables. It could be some students, have the lack of clinical skill at first. Draw of luck, sometimes you get one tooth and other times multiple. Usually I get one tooth per session but try to get two patients in one session.

Retyped Reflection Paper Answers

Participant 25

Because some overly eager students work in additional sessions, come in early, then there are no patients by the time one pitches for their scheduled session (or if there is a referral, there are no longer cases left). Also depends on luck of draw. Sometimes you get a dentectomy, sometimes you refer, refer, refer…

Participant 26

At KGM, the type of patient and consult can be extremely variable. Sometimes some students are lucky to attend to patients who need many extractions in a session. Working in extra sessions also contributes to more extractions and I feel this is acceptable to an extent. Two students in the class are excessively working in sessions which has led to them having exponentially greater no. of extractions. It's not understandable why this is done because it is very inconsiderate to us working our actual sessions and they are taking up patients that we could've seen and extracted teeth.

Participant 27

The main reasons why I think this happens is: During a session there is usually more people than there should be students who shouldn't be there (often don't need to be there) take patients of students who are meant to be in the session. There are students who when they see a fellow student struggling they take over and end up extracting it. Some students pick and choose patients (they get to choose patients).

Participant 28

I feel very strongly about this issue. Some students work in so many sessions, they come VERY early, read through all the files and choose the patient with the most extractions, even though it is not even their session. Then the people who come at a normal time and who are still on time get left with referrals. If students want to work in sessions to extract, they shouldn't be allowed to especially if their quota is already reached. Some students (1) have already almost double their quota by working in other people's sessions. NOT fair, if they want to work in sessions, students in that actual session should all first get patients, because sometimes there aren't enough patients.

Participant 29

Some students do not take patients into consideration and only want to push their quota number higher for example if 37 and 38 is carious but only 37 is bothering the patient. I will only extract the 37 but some students will convince the patient the 38 needs extraction even though it is against the patient's wishes. NB, other students come into the ward, look at the patients file then move onto another patient if they won't get quota from the first patient. Only there for quota, not helping patients even though it is just a referral.

Participant 30

It is because that some students get more dentectomies and some don't get them at all, like in my instance, there was a time where I extracted one tooth in 4 weeks because I had to do referrals all the time. If I look in the file and leave the patient because I know it will be a referral, then I look bad and the sisters ask me why I left the patient and so on.

Participant 31

Students, some of them get referrals, so that day they don't get a chance to extract teeth. I think referrals should be taken into account, for example, if a student get referrals he or she must have to come for extra session to extract in his or her free time. Some students are lucky and get a dentectomy.

Participant 32

- Others work harder.
- Others get a lot of dentectomies due to perio or whatever.

Appendix B
Retyped Reflection Paper Answers

Participant 33

Some are fortunate to get many dentectomies and extraction of several teeth nearly every session while others keep getting one or two teeth a session. Some students also get many referrals and thus do not extract. Others attend several extra sessions taking the quota of others.

Participant 34

Hard working students vs. students that just want to get the session over. Students that excel find interest in this department and wants experience for further possible specialization so work faster than others.

Participant 35

Patient's present with different problems or need for extractions, this influence the amount as well as the level of difficulty. Some students work harder and put in more time if they have a REAL interest in the specific field of dentistry.

Participant 36

- Works faster.
- Luck of the draw (patients with more extractions per session)
- Own effort to do extra sessions.
- Had dentectomies earlier or more frequently.
- Patients for dentectomies pitch up.
- See more patients per session.

Participant 37

Some students browse through patient files before each session. PICKS the patient with the most extractions, I do believe karma will intervene somewhere in the future. Some students also show up in other student's sessions, doing the above or just takes a patient before making sure that the students who actually need to be there takes a patient first.

Participant 38

- Because they work in extra sessions, using other students time and taking patients that they should have had.
- Some students search for a dentectomies. I think it would be fair to give each student a dentectomy case, except of some students getting three and more dentectomy cases.

Participant 39

Some students look at files and choose which patient to see. Some students work in many sessions and this often leads to them seeing the patients that the students scheduled for the sessions would have seen.

Participant 40

- Some have good luck.
- Some work quickly and see two patients per session.
- Some looks at all the patients in the ward and picks the ones with the most teeth.

Participant 41

- Some students look at the file before going to the patient and therefore avoid doing referrals.
- Some students work in other sessions which may seem fair but by doing so they take away from the students in the session.

Participant 42

With difficult extraction in a session, one can in most cases manage one extraction per session.

Retyped Reflection Paper Answers

Participant 43
Because of perio and dentectomy teeth which are often mobile or generally not complicated.

Participant 44
- They work extra sessions.
- Perio teeth extracted easily.
- Have done dentectomy.

Participant 45
Some students get "easier to extract" teeth than others. Some get more dentectomies than others. Some students choose to extract, even when it is not in the best interest of the patient. (Tooth could still be saved but student convinces patient to extract). Some students also have certain sessions where they only refer patients to the other KGM-ward and therefor do not get a chance to extract during that particular session.

Participant 46
Better skills allows the students to be faster and more efficient of extracting teeth. Therefor some students one able to treat two or three patients in one two hour session. Some students are fortunate enough to get a patient that requires a dentectomy.

Participant 47
- There are some students who come to other sessions that they are not a part of. Come early and take the patients meant for other students.
- There are also students who regularly have dentectomies.

Question 2

Why do you think some students' Independence ratios are higher than others?

Participant 1
I think it's based again on the knowledge/Technique of extraction.

Participant 2
- Other students get perio cases (which are fairly easy). Some get very difficult cases.
- Other students are incompetent.
- Some doctors take over unnecessarily without the student asking for help.

Participant 3
Levels of confidence play a role in one's independence ratio, because one might not be confident enough to perform certain extractions.

Participant 4
Some students are more independent and have more confidence than others.

Participant 5
Initially most students are trepidatious in the beginning and feel/fear they might injure the patient. Perhaps for some students this feeling continues throughout the year.

Participant 6
This is a luck of draw thing with the difficulty of the teeth you get. I am sure if you compare the difficulty of the teeth vs. independence ratio there will be a correlation. People that book many dentectomies have a higher independence ratio. I would suggest that when appropriate lecturers can help with difficult situations but still let students do it in order to be able to do it on their own the next time.

Retyped Reflection Paper Answers

Participant 7
- Students that don't know the theory on how to inject and which movements to use when extracting teeth have to ask for attendance after making a mistake.
- Some students are more confident in their ability than others.

Participant 8

Some students do receive more difficult cases that they are not yet able to do alone. Also some students are more skilful at this stage than others.

Participant 9

Obviously skill plays a roll but I think it depends mostly on the specific cases that the student gets, some students get perio teeth to extract and others get wisdoms.

Participant 10

Some students have more confidence than others while some students make sure everything they do is correct before just extracting even if it means they have to ask for some assistance.

Participant 11

Some students strike it lucky and get dentectomies with perio teeth making it easier to do the extractions independently. Some students get difficult cases end on end. Some students have better skill and perseverance thus being able to do the job independently. Some doctors do not guide students into how to do a difficult extraction and just take over the whole procedure, costing us our independence.

Participant 12

Some students are more cautious/unsure of their abilities, thus ask more help.

Participant 13
- Some students may have had more difficult extractions.
- Some students are more skilled.

Participant 14

This is due to different lecturers giving different marks for evaluation. Some doctors just want to take over from the students and don't allow students to try to their best ability. It's fine if they want to demonstrate at first BUT by just taking over for no reason is unacceptable e.g. *Drs. A, B and C*. Independence ratio is not determined objectively.

Participant 15
- Some people are just more capable of extracting without help.
- Just lucky with easy teeth like perio teeth.
- Some people just take longer to get used to extracting and managing.
- It depends on the doctors, sometimes they just take over.

Participant 16
- There are more and less difficult cases some people get perio teeth and they are easy.
- Some have better skills.
- Depends on the doctor you get, some doctors take over from you early on.

Participant 17

Some students are perhaps better than others.

Participant 18
- Not all students have the same skills.
- Others take time before they get comfortable.
- Not all cases are the same, some may get difficult while others get easy cases.

Participant 19

Some students have worse luck.

Retyped Reflection Paper Answers

Participant 20

It often depends on the patient and the tooth to be extracted, not necessarily the student's ability. It is a matter of luck what patient you get and the circumstances surrounding the tooth vary.

Participant 21

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Participant 22

Due to ability.

Participant 23

Some teeth are easier to extract than others.

Participant 24

Depends on the case and clinical experience. Some students get easy cases and others more difficult. Doctors should also not interfere with cases where guidance is asked. Rather stand by and explain the student what to do. If he is incompetent take over.

Participant 25

- Better technique.
- Some doctors doubt student's ability, come assist. (especially small females)

Participant 26

Some students employ good techniques and work on their own, but it can be just the case of a difficult extraction and the doctor needs to assist. Some students get easier cases often and others are just stuck with difficult cases often.

Participant 27

Sometimes clinicians don't allow the student to try harder/struggle a little more, but overall it's something that varies from individual to individual.

Participant 28

It all depends on the luck of the draw. Sometimes you have referrals and get no quota so then you have less sessions or extractions to influence the ratio and then if a crown breaks off or if a surgical drill is used. I also think different supervisors consider the situations differently. One will give advice and feel that they helped you and another will still feel that you did it alone. I think this makes a huge difference.

Participant 29

Depends on the difficulty of teeth. Some lecturers take over without asking for their help then you get 'with assistance'.

Participant 30

It's because when you ask for help from the doctors, some just come and extract the tooth without even telling you/guiding you. Some doctors are good because they ask how you are going to approach it and if you are wrong they tell you and if you struggle, they verbally help you, not extract the tooth right away.

Participant 31

The level of difficulty of the teeth is not the same. Some students get perio teeth, some get enclosed teeth. Sometimes it depends on the experience of different cases. Also the use of drillers must be taught to the student because it is where they get low independence ratio.

Participant 32

Because they apply what they learned in theory and they use the tips they are getting from the session doctors.

Retyped Reflection Paper Answers

Participant 33

Some of us generally get difficult extractions while others it may be simple. Things occur during tooth extractions that compels us to request assistance of which is not really avoidable.

Participant 34

Some students learn faster than others and can do certain procedures better and alone. Confidence play a role and skills.

Participant 35

The student's skill but also force/power are different, especially girls struggle in the beginning of extractions. Some students are more 'playing safe' when starting with extractions.

Participant 36

- Some students learn quicker than others.
- Once again luck of the draw.

Participant 37

Some students might be scared of making a big mistake that could put a patient's life in danger, thus keep asking doctors what to do.

Participant 38

- Some students really try hard to take out the tooth by themselves, while others give up to soon.
- Some doctors don't always give a student a chance to try.

Participant 39

Sometimes doctors take over when a student has a query, without the student asking for direct help.

Participant 40

Some are still not comfortable in doing the extractions. Others learn by doing and figuring it out by themselves.

Participant 41

Some patients have periodontal disease and require many extractions which are generally easy teeth to extract and gives many teeth with an average of four where other patients have a more complicated situation and the student has been working on the tooth but then a doctor takes over and instead of a five or a six it is now a three.

Participant 42

Difficult vs. simple extractions ratios encountered.

Participant 43

They adapt well to the skills of extractions than others. It also depends on the teeth that their extracting, some are difficult especially the last lower molars with dilacerated roots.

Participant 44

Depends on level of ability of the student with extractions. The difficulty of teeth extracted and sometimes emotional/physical status of the student at the time of extraction. More time commitment for extractions.

Participant 45

Easier to extract teeth make it easy to have a high independence ratio. When the tooth is difficult to extract, one has to call the doctor so you learn in the process, while also decreasing your independence ratio.

Participant 46

Student's willingness to learn and work efficiently without requesting the help of a supervisor.

Retyped Reflection Paper Answers

Participant 47

Some lecturers, such as *Dr. C* take over unduly for students. The students get zero.

Question 3

Why do you think some students' level of difficulty achieved is higher or lower than others?

Participant 1

The students who achieve the level of difficulty I think they know how to deal with difficult problems and this too for me is the reflection of one's theory, if one sure about their theories they will always know what to do.

Participant 2

Staff members must familiarize themselves with the assessment level scales.

Participant 3

Some choose to be assisted most of the time and some are just not competent because some Dr's usually take over and render those students not acquiring the necessary skill.

Participant 4

Some students are stronger than others and have more experience.

Participant 5

From my experience and that of my colleagues, most patients whose teeth we extract have perio. There's not much effort required to extract the teeth.

Participant 6

- Sometimes if you get a difficult tooth out without any hassles you won't get marks for difficult teeth.
- According to the list of what classifies as a difficult tooth, not all lecturers award the relevant difficulty.

Participant 7

- Some students are simply handed files of patients that have more difficult extractions. There is no control over which file you will be handed and thus which extraction you will have to do.

Participant 8

Because of the patients they are randomly allocated. Some students receive very difficult cases where other simply do not.

Participant 9

It depends on whether they get difficult teeth or not. Someone with great skill who just gets easy teeth to extract, won't achieve a high level of difficulty.

Participant 10

A full dentectomy due to severe perio will decrease the level of difficulty extremely, while other students don't ever get a dentectomy case.

Participant 11

Doctors have different opinions on level of difficulty. Some students attend the session very early and snatch easy patients for themselves.

Participant 12

This depends on the patient you get.

Participant 13

It has a lot to do with luck. If you receive a patient with 10 extractions that are easy you will reach your quota very easily but will have a lower difficulty.

Retyped Reflection Paper Answers

Participant 14
This is not delivered objectively as some doctors give different levels of difficulty than others. Some students are just lucky to get easy extractions.

Participant 15
I have seen that some doctors give easier marks for difficulty than other doctors, so it can be because of them. Just lucky to get a lot of patients with difficult teeth. Personality, some people give up easily and others keep trying themselves.

Participant 16
- It depends on the doctor you get.
- And also you have NO control over the patients you get, SO LUCK.

Participant 17
Some students are afraid of difficult cases and choose to work on easy teeth to ensure no mishaps.

Participant 18
Depending on patient and cases. There are difficult and easy cases.

Participant 19
--

Participant 20
This is very subjective as a tooth may be perceived as easy initially, but it may appear more complicated than perceived. Also may depend on many things, like doctor's mood, feelings towards you and your opinion.

Participant 21
Some doctors take over before we've tried to extract, even if we haven't asked for assistance.

Participant 22
Luck of the draw, sometimes you get a difficult case, sometimes you don't.

Participant 23
It depends on the teeth you get given.

Participant 24
This is only about clinical skill as you develop harder cases will be done by students more independently.

Participant 25
Luck of the draw.

Participant 26
- Students with higher difficulty level achieved is due to being able to apply themselves to the case that is difficult.
- Other students have easier cases.
- It depends on the patient you get.

Participant 27
--

Participant 28
Again, it is all luck of the draw, it just depends on the patient. If you happen to get perio teeth all the time, your difficulty level will be low, but it is out of your control.

Participant 29
Depends on the patients and how the supervisor scores the level of difficulty.

Retyped Reflection Paper Answers

Participant 30

We get different patients so some people get perio teeth most of the time, maybe that's why some students say they extracted perio teeth but they get 5's and 6's so it depends on the mood of the doctor actually.

Participant 31

--

Participant 32

That is luck, sometimes you get a very difficult case to extract. Sometimes you just get a very easy 1st molar. It's a matter of the patient's anatomy.

Participant 33

This is partly due to doctor's perception as well as others simply scouting relatively simple extractions.

Participant 34

Some only wants to do easy extractions and not learn difficult stuff (luck of draw). Some students go out to do difficult cases to get their level of difficulty higher and their experience better.

Participant 35

Patients all have different teeth/problems that needs to be addressed.

Participant 36

Depends on patients you receive. Depends on the student's amount of patients and the types of extraction that he or she has successfully completed on their own.

Participant 37

--

Participant 38

- It totally depends on the patient that arrive.
- It can maybe just be made clear under the doctors which grade should be given to which case.

Participant 39

As above mentioned, some students read files before commencing.

Participant 40

Some are more capable than others, it depends on the level of difficulty of the extractions.

Participant 41

Luck of the draw.

Participant 42

--

Participant 43

Some need more experience with extractions, which can only be achieved if they go to KGM, in the sessions they are free or during holidays.

Participant 44

- Less practise or extractions done.
- Uncertain or student depends on supervisor for guidance most of the time.
- Improper technique for tooth removal.
- Coincidence, to get difficult teeth on most of their sessions.

Participant 45

Same reason as question two.

Participant 46

Perseverance and willingness to learn and take advice. Never giving up even if the treatment is difficult.

Retyped Reflection Paper Answers

Participant 47

Lecturer/evaluator defined, based on opinion.

Question 4.

(a) **Do you have certain targets for the Independence ratio, level of difficulty and extraction quota levels?**

Of the 47 participants 40 participants answered "Yes"
Participant numbers:
  2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 38, 39 40, 41, 45, 46, 47.

Of the 47 participants six participants answered "No"
Participant numbers:
  1, 31, 37, 42, 43, 44.

Of the 47 participants one participant had no answer indicated.
Participant number:
  19.

(b) **If "Yes" Please specify separately**

Participant 1
  --
Participant 2
  - Independence ratio 100%
  - As many extractions as possible.
  - Level 6 difficulties.
Participant 3
  100% independence ratio because I want to gain enough experience and confidence to work on my own as not long from now I will be having to work on my own.
Participant 4
  Independence ratio should be high.
Participant 5
  I'd like to have a high difficulty and independence level (higher than average) so I know at the end that I was challenged and will hopefully have learnt a lot from the challenging cases.
Participant 6
  - I would like to improve my independence ratio by learning how to remove difficult broken off roots etc. on my own.
  - I prefer removing difficult teeth to be able to improve my skills therefore I am aiming for a higher level of difficulty.
  - Quota is fine just as long as I get enough.
Participant 7
  I would like to extract as many teeth as possible, with the least amount of help from doctors and with highest level of difficulty.

Retyped Reflection Paper Answers

Participant 8

I wish to achieve a high number from all 3.

Participant 9

I would like to extract 100 teeth with an independence ratio of 90%

Participant 10

- Independence ratio: 90%
- Level of difficulty: >1.8
- Extraction quota: >70

Participant 11

Independence: 75%-70% for 4th year.

Extractions: 70 teeth.

Participant 12

Independence ratio 86% for 4th year.

Quota at least 70 teeth.

Participant 13

I had a bad start in MFO's. I had very difficult cases and needed guidance and help from lecturers. I now have to do 50 extractions without any assistance to reach my required independence ratio, which will be difficult.

Participant 14

Aiming for 65 extractions and whatever is achieved thereafter is just to a great advantage.

Participant 15

Just aiming for above minimum requirements.

Participant 16

Independence: 85%

Difficulty: not up to me

Extraction quota: 80-100

Participant 17

Want to do everything without help eventually.

Participant 18

Want to achieve high independence ratio because in the 'real/outside' world no one is there to supervise you.

Participant 19

--

Participant 20

I try and keep up to a similar standard to what the rest of the students in the class are achieving. The more teeth I can extract alone the better.

Participant 21

To be mostly independent.

Participant 22

Completely independent.

Participant 23

I would like an independence ratio of 80%

Participant 24

Independence: 85%

Difficulty: 90%

Extraction quota: 100

Participant 25

My target: pass

Retyped Reflection Paper Answers

Participant 26

  Extractions 70

  Independence ratio 80%

Participant 27

  I want to try and get as much experience as possible to be able to carry out extractions efficiently and with ease.

Participant 28

  My target is to pass 4th year with all the requirements.

  IR: 80%

  Extractions: between 65 and 80/100

  Difficulty: standard difficulty.

  And I want to do this in my sessions, without working in sessions ALL the time and stealing other people's patients.

Participant 29

  Extraction quota: more than 30 by June, more than 65 by end of the year.

  Independence ratio: as independent as possible while still taking the patient into consideration.

Participant 30

  I wanted at least 45 teeth before the end of the semester and 90% but more than 80% is fine.

Participant 31

  --

Participant 32

  85%

Participant 33

  100 teeth is a nice quota to reach.

  90% independence ratio.

  I like level 5 difficulty teeth.

Participant 34

  Independence ratio 90%

  Extractions more than 200

  Level of difficulty (5-6)

Participant 35

  Independence: >80%

  Level of difficulty: any… done alone.

  Quota level: 100 teeth.

Participant 36

  To achieve as many and as much as possible within the allocated sessions and to at least achieve minimum requirements.

Participant 37

  --

Participant 38

  I would like to extract as many teeth as possible on my own without help.

Participant 39

  To get the required quota. At this stage I am personally struggling with quota.

Retyped Reflection Paper Answers

Participant 40
- I want to have an independence ratio of above 90, I want to be able to do an extraction comfortably and not worry.
- I'm not racing to win the most extractions 'prize'. I just want to do a good job, learn everything I can and achieve the best quota I can manage.

Participant 41
Independence: 80%
Extractions: 65
Difficulty: 5

Participant 42
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Participant 43
--

Participant 44
--

Participant 45
Independence ratio: as close as possible to the maximum.
Level of difficulty: 6
Extraction quota by the end of the year: 150 extractions.

Participant 46
I would like to achieve above 65 teeth during this one year and I will continue to try to achieve a higher independence ratio. I would like my clinical work to be excellent. I also want to be able to develop the necessary skills required to treat patients without the help of a supervisor.

Participant 47
I would like to do well with regard to all the above mentioned aspects.

Question 5

What do you focus on and what goes on in your mind when doing an extraction.

Participant 1
Patient's comfort. Amount of force to use in order not to hurt the patient. What goes on in my mind is the question am I doing the extraction/treatment the right way.

Participant 2
Keeping calm, using the right technique and patient comfort.

Participant 3
Getting the tooth out without implementing pain on the patient. Making sure that less damage is done to the patient's tissue and that they gain enough confidence in me.

Participant 4
Do not break the crown off.

Participant 5
--

Participant 6
Patients comfort and trying to preserve the surrounding tissues.

Retyped Reflection Paper Answers

Participant 7
- Minimal trauma for the patient.
- Correct method and location of anaesthetizing.
- Correct movements to use when extracting a specific tooth.
- Using the instrument correctly.

Participant 8

I focus on getting the tooth out as quick and painlessly as possible.

Participant 9

Keeping the patient as calm as possible, while doing as little trauma as possible.

Participant 10

Not to break off a root apex even if it takes me the full session to extract one tooth.

Participant 11
- Do not fracture the root.
- It is a traumatic experience for the patient.
- Patients think it is a dentist's fault for the conditions of their teeth.
- Comfort the patient.

Participant 12

I focus on my technique and the patient's comfort especially when patients are scared. I try to shift their focus away from the extraction. Sometimes I just think how hot it gets behind the mask.

Participant 13
- I focus on the well-being of the patient.
- I focus on calming the patient.
- I then focus on my technique and the patients positioning.
- I also focus on NOT BREAKING THE CROWN.
- 'The whole tooth and nothing but the tooth' that is my philosophy in MFO's.

Participant 14

To first take the patients emotional status into consideration. To undergo an extraction is such an emotional experience. TREAT YOUR PATIENT HOLISTICALY! Not just to jump in and extract the teeth. To my mind that is unacceptable, in ethical and unprofessional.

Participant 15

Want to try to cause less pain possible for the patient and discomfort. Even if it take a little longer. I care more about the patient than quota.

Participant 16

To get the tooth out as a whole and I note when patients feel pain so I take long with waiting and giving local anaesthetic.

Participant 17

To do extraction with minimum amount of damage to patient.

Participant 18

Want to get as much experience as possible.

Participant 19

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Participant 20

To get the tooth out as fast as possible, causing minimal/no pain to the patient and to not fracture the tooth in any way.

Participant 21

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Appendix B
Retyped Reflection Paper Answers

Participant 22
How bad the patient's breath is.

Participant 23
- Not harming patients.
- Getting the tooth out in one piece.
- Using methods taught to us.

Participant 24
I go through the steps of what I'm supposed to do. Focus mainly on my grip, apical pressure and the tooth movements specified to the specific tooth.

Participant 25
Apical pressure. Don't break crown. More apical pressure.

Participant 26
- Technique.
- Patient's reaction.

Participant 27
I pray that the tooth comes out without breaking and without hurting/causing unnecessary discomfort to the patient.

Participant 28
What the lecturers have taught me, especially the tips and advice given by the lecturers about hand movement etc. and I also try to distract my patient and make them comfortable.

Participant 29
- DO NOT BREAK THE TOOTH!
- Try your best not to hurt the patient's cheek/gums or try to cause as little as possible trauma.
- Try to cause as little as possible discomfort to the patient.

Participant 30
Patient is pain free and not reacting negatively. Also that I don't break the root.

Participant 31
I don't want to break the teeth, want to do a painless extraction.

Participant 32
Focus on trauma for the patient, hence I try to ensure the tissue as far as I can.

Participant 33
Patient comfort and imagining the root movement. I literary try imagining what is happening underneath the bone. Plus suctioning where necessary.

Participant 34
- To extract tooth as a traumatic as possible to preserve bone.
- To prevent apex of root to stay behind and unnecessary drilling.
- To ensure the gingiva is not damaged to reduce post-operative sensitivity and pain and prolong heeling.

Participant 35
- The shape of the root.
- The movement necessary to achieve mobility.
- APICAL PRESSURE!
- Is the patient still ok?

Retyped Reflection Paper Answers

Participant 36
- Figure out how to remove this tooth successfully.
- Do not fracture the root.
- Is the patient okay to?
- Am I hurting the patient?
- What type of tooth is it and what method must I use to remove it.

Participant 37

I always try to stabilize the head of the patient as much as I can. I also try and focus on the movements while extracting a teeth to evaluate if I should do it different or the same the next time.

Participant 38

I always focus on not hurting the patient too much and keep in mind that I should place enough apical pressure.

Participant 39

I focus on my patient, speaking to them properly to get a proper history and put them at ease. During the extraction one focus on what I should theoretically be doing and the tactile feeling.

Participant 40

I focus on applying apical pressure and a little voice in my head praying the root does not break off. I also try not to hurt the patient too much.

Participant 41

Trying to be efficient and not hurt the patient too much. I am trying to perfect my technique.

Participant 42

To follow procedures and when the extraction starts to be difficult it is not easy for me to give over to the supervisor due to the 'Independence ratio' because this makes me feel like I 'fail' to extract.

Participant 43

On the patient 1st, I try to make the patient as comfortable as possible and I also keep in mind their medical history. Then I worry about how I am going to extract. If it's necessary to use the elevator or not, with adjacent teeth present within the arch it compromises other teeth, so I have to compromise and use only the forceps only which I find a little bit challenging.

Participant 44
- Will the tooth come out completely within its roots?
- Am I trained enough to take out the tooth?
- The patients level of anxiety.

Participant 45

I focus on making sure that the patient is somewhat at ease and trusts me to have a good 'extraction experience'.

Participant 46
- Concentrate, take time and don't be too hasty as there is a higher chance of the tooth or other structures fracturing or getting damaged.
- Ensure patient is comfortable and properly anaesthetised.

Participant 47
- Not to fracture the tooth
- Not to cause pain.

Appendix B
Retyped Reflection Paper Answers

Question 6

What do you think you can do to improve your ability to extract teeth?

Participant 1
Understanding more about the theoretical aspects of extractions and techniques

Participant 2
Practise and more practise.

Participant 3
Get more extractions and work more independently for the most time.

Participant 4
Experience.

Participant 5
--

Participant 6
Learn how to do more difficult procedures on my own.

Participant 7
- Use a wider range of instruments e.g. more elevators than forceps.
- Be more patient.

Participant 8
Increase my experience.

Participant 9
Experience, the more you extract the better you will get.

Participant 10
To do more extractions. Practise makes perfect.

Participant 11
Practise more.

Participant 12
Practise, practise and some more practise.

Participant 13
Improve my technique and knowledge of instruments and how to use them effectively to do an extraction.

Participant 14
Just to improve my knowledge in anatomy. W.r.t. technique. I am very fortunate that I've had several difficult teeth to extract to improve my knowledge.

Participant 15
- Better knowledge of anatomy.
- Try harder and not ask for help after a while of struggling.

Participant 16
- Practise more.
- Get more doctors opinions on what's the best way to extract different types of teeth.

Participant 17
Do more extractions, no more difficult cases.

Participant 18
See as much patients as possible. Getting experience would be priority.

Participant 19
--

Participant 20
Practise and try/learn different methods and to learn how to handle situations.

Retyped Reflection Paper Answers

Participant 21

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Participant 22

Get more practise, more teeth to extract, and more dentectomies.

Participant 23

More practise.

Participant 24

Get more exposure and experience. Need to extract more and more teeth to improve skill.

Participant 25

- More upper body strength.
- Or become an overly eager student and work in additional sessions.

Participant 26

- Read up more on my theory.
- Upper body strengthening.
- Absorb everything the doctor says and always use that knowledge.

Participant 27

Increase the number of extractions I do, less stress.

Participant 28

Pay more attention to fine detail, rather how to pull out the tooth properly and easily instead of trying to pull out a lot of teeth.

Participant 29

- Apical pressure.
- Confidence.

Participant 30

I think if I come during the holidays, I would improve my skills because you are a lot so one on one is sometimes not possible.

Participant 31

Have the ability and confidence of using an elevator. Want to know how to use surgical drill.

Participant 32

Go to the gym. Work more on my technique.

Participant 33

More practise, more extractions and being assisted without paying for it through independence ratios or doctors helping halve way, e.g. drilling one halve out and guiding on the other root.

Participant 34

Assist Drs while doing impactions and do more impactions alone. Experience more difficult and complex cases. Learn new methods of a traumatic extractions and carry them out.

Participant 35

- Improve the amount of force and skill to be able to extract more difficult teeth.
- To not be scared to get mobility or to remove a tooth (Get self-confidence)

Participant 36

- Use of elevators, technique and then to use which one.
- Positioning of patient in chair.

Participant 37

Have more confidence and just do it! Work in more sessions (and in doing so, doing it the ethical way)

Retyped Reflection Paper Answers

Participant 38
- Do more hand and arm exercises because my hand really gets tired.
- Practise on technique.

Participant 39
Work faster.

Participant 40
Go back to the lecturers, also to see how someone with a lot of experience extract teeth.

Participant 41
Extract more teeth.

Participant 42
I think my skill improvement is time depended.

Participant 43
I need more experience and to learn more skills and improve my knowledge concerning anatomy, because sometimes it is hard to numb the area I am extracting especially with inferior alveolar nerve.

Participant 44
- Practise more extractions.
- Have confidence and be able to work independently of supervisor's assistance.

Participant 45
I need to get better at giving long buccal nerve and inferior alveolar nerve injections.

Participant 46
Have more sessions and be exposed to more cases. Extract more cases with a variety of difficulties.

Participant 47
Practise.
Patience by Doctors.

Appendix B
Retyped Reflection Paper Answers

Answers to reflection paper questions of BChD 4 2016 students.

Question 1

Why do you think some students extract more teeth than others?

Participant 1
Some students are lucky enough to get cases for full dentectomies while others sometimes don't. The sisters in the ward also allocate referrals to the 4th years, preventing them from extracting teeth in a session. We only have 1 session in a week, so while some students can extract others go 2 weeks maybe in a row doing referrals.

Participant 2
It's the luck of the draw. Some people have had multiple dentectomies while others always get wisdom teeth.

Participant 3
I think that some students extract more based on two things: chance and skill levels. When I say chance I mean that some students are 'unlucky' to always get single extractions at every session they attend, while others get multiple extractions. There is no system in place that allows for 'fairly' distributing amongst students. Some students may also be more skilled at extractions so they will extract more teeth for instance see more than 1 patient every session.

Participant 4
Some students are often given dentectomies more than 1 in a few weeks) and some of us get wisdoms only, thus 1 tooth per session. The more rugged and built people tend to get more teeth to extract per session, our strength abilities are judged on before a patient is given to us.

Participant 5
Some students get more referrals than others regardless of getting to the ward early. Preferential treatment from certain sisters in the ward. *Sister A* often refuse to give students more patients even when there is still more time left for the session.

Participant 6
Sister A intentionally gives us referral patients. She usually comes to you with the patient's file and the referral file together, meaning that she reads the file before. Sometimes she takes the patients away from you if you accidentally got one to extract and tells you it's for fifth years but the patient always ends up with the student in the same class as you. Regardless of time you arrived at, I have referred more patients than I have extracted.

Participant 7
Luck with some patients that require dentectomy. Some are more fearless than others. There are some students that skips a thorough examination process and proceed to extraction! Did not do EO thoroughly (witnessed). Soma are more skilled (works fast)

Participant 8
Depends on the patient put on that day and number of extracted teeth per patient.

Retyped Reflection Paper Answers

Participant 9

Luck also plays a big role in how some students extract more teeth, for example some students are incredibly fortunate enough to get dentectomies while some of us are unlucky to get a bunch of referrals in comparison to the extractions we get. I for example, in this term have received more than 6 referrals, dry socket case and when I get an extraction it can be a difficult case for me (because we are all different) or I get to the ward and there is no patient for me so I end up assisting while some students get lucky enough to get more than one dentectomy.

Participant 10

Some have dentectomies which increase the number of teeth extracted. Some attend KGM multiple times. Some get given patients with multiple teeth to be extracted.

Participant 11

Because they get preferential treatment from *Sr. A* she books patients for them and only gives some of us referrals. As such we can never extract even if we are in the ward early. Even when she finds us extracting she will call us and tell us that that patient was not meant for us.

Participant 12

Lucky enough to get patients needing multiple extractions. Arrange with sisters for patients. You're forced into doing referrals because no one else wants to do it. (Consumes your session time)

Participant 13

I think it depends on the file a student is given by a sister. Some patient file would only require one tooth extraction other more tooth extraction other referrals so depending on which file a student gets for a particular patient then the student can extract one or more teeth or non.

Participant 14

Luck. Sometimes people get dentectomies of 15 teeth and you only get one tooth to extract. (Not fair). Some may not see a dentectomy ever because just unlucky.

Participant 15

They work in sessions in which they are not allocated to, especially 5th years. Some specific 5th year students go in for extra sessions, take 2/3 patient's files at a time and see 2/3 patients a session while others get nothing in that session. *Sister A* most of the time if we go in a bit early to get patients, she only gives us referrals. She's reluctant to give multiple extractions to 4th years. Luck, most of us get one tooth per session if we get a patient, 2 teeth if we are lucky.

Participant 16

It all depends on the patient that you get on a certain day. One student might get one extraction of a 17 and another might get a dentectomy, it also depends on how fast (and accurate) you work in the KGM ward.

Participant 17

Some students are lucky enough to get patients that require dentectomies and others get 1 tooth at a time. The sister in the ward allocates patients to students often and may be biased in who she gives the dentectomy patients to.

Participant 18

It's all a matter of luck. I believe all students have the same skills more or less to extract a certain number of teeth. It depends on whether you see a patient with no/ many extractions to be done and how easy or difficult it is to extract the teeth.

Appendix B
Retyped Reflection Paper Answers

Participant 19

Some students get many referrals for theatre resulting in less extractions. Some students get dentectomies while most only extract 1 or 2 teeth in a session. We only have 1 KGM session per week so extraction quota cannot compared to 5th years.

Participant 20

Occasionally, some students might just be lucky in continuously receiving patients that need extractions whilst others keep getting cases of referrals. It has also been seen that some students work in sessions they are not supposed to/ sessions not allocated to them in order to gain more quota and even when quota has been achieved they don't allow other students the opportunity of extracting more teeth. Some students also receive many cases of dentectomies or their skill levels are just higher than others.

Participant 21

It depends on how lucky you are (sometimes you only get dry sockets or referrals or when you get a patient with extractions to be done, it's only one tooth to be extracted.

Participant 22

Some students is unlucky. Get referrals.

Participant 23

By luck. It depends on the patients you are given which is out of your control. In CPC they give the students with the lowest quota the patients first to ensure they don't fall behind. Perhaps a similar system can be implemented.

Participant 24

The sister thinks they can do it because they have extracted more teeth.

Participant 25

They are lucky to get dentectomies. Some students do not go in their own sessions or they do and in other sessions which are not their sessions. Then taking the patients of the students actually scheduled for the session. Some 5th years do this a lot.

Participant 26

Sister A gives some students (like the fifth years) all the multiple tooth extractions and others all the referrals.

Participant 27

Some students get referrals and others get a dentectomy. It all depends on the patients you get.

Participant 28

Patient selection given from sisters. Luck. You get practised and work faster so you extract more and don't waste time.

Participant 29

I think it depends on the case you have. Some students have e.g. dentectomy while others has only a referral or a dry socket to treat/do. Sometimes there are extra patients if you finish early with the extractions, but sometimes the sisters don't allow you to. The sisters (*Sr. A*) give the file to you as a fourth year of teeth or referrals and give extractions of more teeth/molar teeth to 5th years. I feel in the 1st semester this can be done, but I feel after the April holidays we should be allowed to extract all teeth. It depends on what session you work in morning session are not so busy and sometimes there is not enough for patient. The 2nd session there is usually more patients.

Retyped Reflection Paper Answers

Participant 30

Luck of the draw. Sometimes you only get referrals where you waste a session you could have potentially extracted a tooth. However, the sr. handing out the patients also pick out sometimes who she wants to give a referral. The 5th years with already sufficient quota, they are given dentectomies.

Participant 31

Some students refuse to do referrals and insist on seeing a patient first. Some students 'crash' KGM sessions and come when they are not assigned a session.

Participant 32

Some students work in extra sessions when they aren't meant to be in the session. The sisters in the ward also usually give the boys the patients with multiple extractions and so they end up getting more quota. Some students demand extractions and then others have to settle with referrals.

Participant 33

Some students work in extra sessions. Some students book patients to extract teeth from. There isn't always enough patients, some students are very lucky and get patients every session. If a student work in an extra session without booking a patients I think that student should be the last to receive a patient. (There isn't always enough patients in the session).

Participant 34

Some students have had more clinic sessions where as others have had less (due to cancelled sessions and too many 4th year students in amount of clinic sessions). Some students get more referrals than others, less extractions. Some students get more dry sockets than others, less extractions. Some students are faster than others at extractions. Some students have had patients that need dentectomies, remove a lot more teeth.

Participant 35

Some students get more dentectomies, others get lots of perio teeth. Also the number of referrals that some of us get sets us back quite a bit.

Participant 36

4th years are generally given referrals. Some students work out of their session time. This affects the students who are supposed to be there during that session because it is usually those students who are not supposed to be there who are given extraction cases. Students also swop sessions with 5th years. Again this affects students who are in session.

Participant 37

Some students just get lucky with the patients they see in the session e.g. patient requires multiple number of teeth extracted. Some students get patients every session that require extractions and not referrals.

Participant 38

They get to the ward much earlier and select the patients they want. In afternoon appointments there tends to be a lot of referral rather than patients who need extractions. *Sister A* sometimes allocate who gets what. KGM401 sessions did affect our quota this semester. We don't get signed off for the teeth we extract in KGM west.

Participant 39

I think that for the most part the problem is the fact that we cannot select our own patients, we are given a file and then have to go through all the steps that someone who would extract has to do. Even if the purpose of the consult is for a referral our suture removal or dry socket Rx. The allocation of patients to students isn't really controlled e.g. a student may be lucky enough to already have done two dentectomies where other student has had 3 or 4 referrals.

Retyped Reflection Paper Answers

Participant 40

Because the sister gives certain patients to certain students. Because lots of patients get sent away from waiting room at 14h30. Too little KGM sessions, KGM401, referrals. Dr's teach them good techniques to extract. Work faster, can get another patient in sessions.

Participant 41

Some people are just better with their hands and practical skills. Also it's the 'luck of the draw' as to what patients each and every person gets. Solution! Give students with low quota a dentectomy if possible.

Participant 42

It all depends on the patient's file you get in the ward session. Some people get dentectomies and some get referrals every time.

Participant 43

It is because they don't get referrals every week as teeth that needs surgical removals.

Participant 44

Because *sister A* she always have her students like they tell give her their names that they are in short of patients then she gives the dentectomy. Where also she gives some of us referrals for 3 weeks. When the patients come in she choose the files and give her people patients with no sticker on the file or a patient who have dentectomy. Again she make sure that the 3rd molars she give them to some of us as they might be referrals. Practise to do

Participant 45

Sister A has a habit of choosing who she gives extractions to and who she gives referrals to. For instance in the 2nd term since school re-opened I got referrals 95% of the time. So far I've only extracted 3 teeth.

Participant 46

Some students extract more than others because there are those who are given files with more teeth to be extracted. Cases such as dentectomies are given specifically given to other students over others. The *sister (A)* once told me that 4 extractions was for a 5th year. There was no fifth year. She gave that file to my fellow classmate. If all students were treated equal by sister Buys then there wouldn't be big margin with regards to difference of extracted teeth.

Participant 47

There is one *sister A* that check files and read them before distributing and she always give us referrals and lie that those cases are for final year. After that she will give it to our classmate. She gives you a file and while your preparing and she realise she gave you many extraction she come and take it and she says this one is complicated.

Participant 48

Some students gain a clinical understanding of anatomical structures and clinical knowledge quickly, but lack the immediate ability to clinically incorporate such knowledge into the practical setting. Students who master this at an earlier stage tend to be able to work faster at an earlier stage and therefore extract more teeth then their colleagues.

Participant 49

Mostly because it depends on the patient you get, some students get easier and more teeth to extract. Some students come to non-allocated sessions and take patients. Not all doctors are keen to let 4th years do surgical extractions.

Retyped Reflection Paper Answers

Participant 50

Some are more clinically proficient and unafraid of extracting and so end up being able to extract more teeth. It also depends on how many teeth a patient needs taken out. This is not a controllable factor.

Participant 51

Based on luck mostly. Some students work in 'more than the necessary' amount of session. Referrals! Referrals! Referrals! Some students just stand around in the ward even if it is not their session to get as much quota as they can. This should be addressed as it does not make sense to practically 'steal' quota from the students who actually NEED quota.

Question 2

Why do you think some students' independence ratios are higher or lower than others?

Participant 1

The cases get allocated randomly, so some people only get perio teeth while others get difficult extractions week after week (if they get it extracted at all) and then need assistance.

Participant 2

Depends on the difficulty of the cases. The student's skill and whether the supervisor takes over.

Participant 3

They may be higher because some students get teeth that are easy to extract and some get teeth that are difficult and this requires help. It also depends on the supervisors, some supervisors like being too involved and this would take the opportunity to take the tooth out of the students' struggles, even when the student has requested of and still feels like he/she can extract the tooth.

Participant 4

Their strength and their experience of taking out many more teeth than others. This may be an assumption, but I feel that those students that extract more teeth have higher independence ratio due to the fact of their technique being stable.

Participant 5

Difficulty of cases vary and others skill get good marks even after getting assisted.

Participant 6

They get more patients, more experience/learning time for them.

Participant 7

Patient luck, since not all patients are considered easy and do require some assistance by the doctors. Some students are more independent, fearless and confident to proceed difficult cases without asking for any help.

Participant 8

Depends on the difficulty of that tooth. Some students can get most easy extractions or moderate extractions.

Participant 9

This obviously depends on strength of a student as much as skill and technique is also involved. Some people are just much stronger than others therefore they can easily extract any standard tooth. For smaller people, it is harder and we're trying (we put in all our energy) but sometimes your energy just runs out and you just have to give up and let someone stronger do it (and of course, they pull it out with ease). But even as we persist, we will take longer and some supervisors get fed up and take it out for you without asking.

Retyped Reflection Paper Answers

Participant 10

Some days are good, others are bad, random.

Participant 11

Some students get assistance but the Dr. still marks them favourably. Some students grasp things quicker hence they may adapt to different manner by which extractions are done quicker. Our levels of confidence are not the same, some of us require more assistance than others hence our independent ration is lower.

Participant 12

Higher: prefer doing it themselves, present to dentists known not to interfere as much. Lower: scared/timid to do extraction themselves, need reassurance and help from dentists. Dentists interfere prematurely and end up doing extraction for you.

Participant 13

Think higher independence ratios is due to skill and confidence and also some cases are easy other can be difficult. Difficulty will require assistance.

Participant 14

Some doctors have 'issues'! Also skill. If you can take it out you can if you can't you ask for help. 'Simple ask'!

Participant 15

It might be due to skills, but it also depends on the doctor that is with you. Some doctors are very eager to help you with advice e.g. regarding surgical extractions, but let you do it yourself. Other doctors e.g. *Dr. B*, do not want us to touch a bur. I for example have seen (assisted) ¾ times how to split the roots of a molar of which the crown broke off, but not once have I gotten the chance to try and do so myself.

Participant 16

Some students are able to do more independent extractions, but I think one student might need more help with a wisdom teeth than a patient with perio who wants to extract the 21.

Participant 17

The doctors in the ward don't all give students the freedom to work at their own pace and take over prematurely. Most supervisors don't let students use the drill in a surgical case.

Participant 18

The chances of a student that will need assistance is without a doubt higher if he/she needs to extract a difficult tooth. I guess it also depends on how competent and confident the student is.

Participant 19

Some students work more independently.

Participant 20

This also depends on the patients the students happen to receive. Some have teeth that may be easier to extract thereby allowing those students to have a higher independence ratio as compared to a student who constantly receives difficult cases such as impactions/cases that result in surgical intervention. Some students also learn faster and are able to adapt their skills quickly allowing them to be more confident and able to handle difficult cases.

Participant 21

Sometimes you get patients with severely carious teeth and it doesn't matter how hard you try, you will sometimes need help.

Participant 22

Difficulty in cases. Some extractions are more difficult, must get help.

Retyped Reflection Paper Answers

Participant 23

The more skilled a student is the less assistance they will need. If have a student has many difficult cases it will be difficult to have a high independence ratio.

Participant 24

Those students with high independence ratios pick certain doctors which lets them work/try new things alone or with GUIDANCE. Other doctors don't guide you, they just take over.

Participant 25

Skills and practice of people are not the same cause maybe extracting a lot of teeth or not.

Participant 26

Some doctors allow students to struggle longer or allow them to use the drill etc. while other doctors take over earlier and the doctors in the sessions with students don't swap enough. Some students are also more scared than others.

Participant 27

Some students are scared to try to do an extraction by themselves and impatient with extractions.

Participant 28

Try doing it yourself, it is the only way you learn. See one, do one, teach one. Doctors must not help you every time, because then something is wrong.

Participant 29

Some has more confidence. Some have done a 'likewise' case. Some doctors take over. (Dr. Sirrals) while other doctors spend time to explain and try to show you better techniques and instruments. Some doctors won't let you touch or bur and feel you are incompetent even if you have seen it 3x and did it with another doctor, depends on your supervisor.

Participant 30

Some Doctors, when you ask them one question they show you 'for the next time'. You ask one piece of advice and they take over and then you are marked as a 'done with assistance'.

Participant 31

Confidence.

Participant 32

Some students are more confident in themselves and the doctors trust them more too, so they don't interfere as much.

Participant 33

I think it has to do with confidence of the student, the more confident the student the easier it will be for the student to try it alone.

Participant 34

Some students get 'easier' teeth to extract. Higher independence levels, because they get to remove them by themselves with no help. Some students are just better at extractions than others. Smaller students (smaller formed females) struggle a lot more regarding application of force and removal of teeth. Need more assistance as compared to i.e. larger male students, have a lower independence ratio.

Participant 35

It depends on the level of difficulty. I may get a tooth that has a higher level of difficulty than another student.

Retyped Reflection Paper Answers

Participant 36

Students with higher independence ratios have more experience and higher confidence levels. Sister in the ward decides who is capable of doing what.

Participant 37

Patient factor e.g. some students get patients with thick dense bone while others might get teeth with periodontitis (easy vs. difficult teeth). Some students may have difficulty due to a lack of strength in applying apical pressure/movement. Lacking in confidence to do extractions e.g. sure of breaking the tooth, have patients complaining of pain even though anaesthetised.

Participant 38

Some doctors, for example *Dr. A* takes over the procedure and not giving us a chance to extract.

Participant 39

Some students may feel more confident to perform extractions on their own. Possibly because they have had the opportunity to extract more teeth and in doing so, have gained more experience to equip them with skills to perform procedures independently.

Participant 40

More skilled at extractions. Don't do enough extractions. Not enough Dr's in the ward to always monitor what students are doing.

Participant 41

It's all about how positive a student's confidence is combined with the difficulty of patient's co-operation. Easy and willing patient definitely improve independence ratios.

Participant 42

Obviously some teeth are easier to extract than others.

Participant 43

Its' because they extract tooth every week, they don't go for three weeks without extracting teeth. The more you extract, is the more you gain experience. If you get some type of teeth more always to extract you won't know how to extract others.

Participant 44

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Participant 45

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Participant 46

Again it still goes back to the fact that allocation of patients is not fair. If you are always (mostly) given back teeth you end up getting help and your independence ratio is low. For instance, there was a point where I asked not to be given 8's/referrals because my independence ratio was low. We can't go into the ward to do only referrals and be given posterior teeth to extract which are more difficult. (Please consider system of patient allocations).

Participant 47

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Participant 48

Please see above mentioned comment which holds similar value.

Participant 49

Depends on difficulty of teeth (some students get easier teeth). Depends on doctor. Some supervisors allow students to do surgical extractions and some do not.

Retyped Reflection Paper Answers

Participant 50

Proficiency is higher with some students especially those with more experience. Can also depend on the supervisor as some supervisors assist without being asked.

Participant 51

Some lecturers just want to extract the tooth/teeth by themselves. Confidence! Students just need more confidence. Patients is 'key'.

Question 3

Why do you think some students' level of difficulty indexes are higher or lower than others?

Participant 1

Teeth get allocated randomly, so you either get a difficult/easy tooth. Some students are not lucky enough to get easy teeth.

Participant 2

Some students may have a better aptitude for extracting teeth.

Participant 3

Well, because they come across extractions that are difficult more frequently than other students so their indexes are higher.

Participant 4

Some students only get perio-affected teeth thus their level of difficulty indexes are lower.

Participant 5

Depends on the case.

Participant 6

Level of difficult lies with the supervisor, what is difficult/easy for one supervisor, it might be easy to the next. Sometimes difficult indexes are sometimes unfair. It really depends on the supervisor on what she/he thinks, because are no things protocol to follow on what difficult or easy tooth should be.

Participant 7

Patient selection factors. Students more skilled.

Participant 8

Patient depended and tooth difficulty.

Participant 9

Again, this depends on the strength of the student. It's not fair to keep the same standard for someone who can't lift a 20kg bag for too long as compared to a student who can bench 100kg. That is not fair. But I guess, we will have to just work on our muscles because I can't think of any way to make it fair. But if I don't get my strength up I'm never going to come close to a good mark in clinical session.

Participant 10

Don't know. All depends on the patient you get.

Participant 11

Students with higher indexes for level of difficulty are lucky as we don't choose the teeth we want to extract. Others have a relationship with *Sr. A* whereby she keeps a patient for that student based on the type of extraction that is required.

Participant 12

Depends on patients and how they present.

Participant 13

Depend on the specific case a student gets.

Appendix B
Retyped Reflection Paper Answers

Participant 14

Could be due to subjectivity (important measure).

Participant 15

You mostly can't control the type of teeth (patient) you get. Some students got impacted teeth and ended up extracting them while sister Buys initially allocated that patient to them because she thought and said it's probably a referral.

Participant 16

It all depends on the patient you get.

Participant 17

Dependent on patient situation/co-operation as well as how hard the supervisor thinks you tried.

Participant 18

Once again it depends on what you get and how many of the difficult/easy teeth.

Participant 19

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Participant 20

This is dependent on the level of experience and skill of the student and their ability to handle difficult cases and the patients they receive.

Participant 21

Depends on the type of teeth- anteriors are easier to extract than a severely carious tooth for example.

Participant 22

Rating system. Some cases of extraction is on more difficult level.

Participant 23

It depends on the patient given.

Participant 24

Also depends on the doctor what they let you do.

Participant 25

Patient selection, just luck.

Participant 26

Depends on the patients they get and the multiple tooth extractions that *sister A* hands out to the students are usually easier to extract.

Participant 27

This is subjective to your supervisor as well as the pt. that you get (perio teeth).

Participant 28

If you work faster and gain more experience you take on more difficult cases. I got from easy to difficult cases.

Participant 29

It depends on the type of case you get. I feel marks are totally dependent on cases what you get and not what you want to do.

Participant 30

Once again, luck of the draw.

Participant 31

To me that depends on the luck of the draw- which patients you are assigned. I haven't yet drilled or done very difficult extractions.

Participant 32

It depends on what patients the sisters give you. The 5th years and boys generally get the more difficult extractions.

Retyped Reflection Paper Answers

Participant 33

It depends on luck, if you get a difficult or easy extraction.

Participant 34

All depends on the teeth that need to be extracted, some are easy and some a lot more challenging.

Participant 35

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Participant 36

Have had a wide range of teeth- ranged from a low to high. I think amount of experience in the field plays an important role. Also, the level of confidence of the students can influence on what level they are comfortable working on. Some students hate a challenge and therefor prefer easy extractions. Student capability level determined by the sister in ward.

Participant 37

Dependent on the type of patient students see e.g. whether it is teeth with periodontitis or impacted wisdoms.

Participant 38

Depends on the patient you get. Depends on the perception of the supervisors.

Participant 39

Different students are given different patients (I am not aware of students being able to decline or opt to allow another student to see the patient). On this basis students are obliged to see the patient they are allocated and if the case happens to be difficult, it may just be luck of the draw.

Participant 40

Because they do more difficult teeth.

Participant 41

It's just the luck that you get. Also different doctors equal difficulty according to their own decision which is a 'grey area'. Personally I get a bit of both.

Participant 42

If you only get easy teeth, that's what you get. You can't choose what teeth you want to extract.

Participant 43

It's because they stay for long time without extracting. They get referrals and surgical removal teeth.

Participant 44

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Participant 45

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Participant 46

The same reason in 2 still applies in this case, however the doctors do try and assist and not down mark us as easy teeth.

Participant 47

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Retyped Reflection Paper Answers

Participant 48

When students master certain basic skills they can progress to try and do more difficult and challenging procedures and when considering the comments as given in question 1 above those students who learn faster tend to progress quicker than their colleagues to more difficult procedures, although it is mostly luck of the draw and certain students must learn to cope with difficult situations first- and may therefore have lower initial marks, although this should even out by end of 5th year.

Participant 49

Depends on patient and depends on supervisor. Same as question 2. I ONLY GET DIFFICULT TEETH AND THEN I AM NOT ALLOWED TO DO THE EXTRACTION. EVEN GOT 0 QUOTA ONCE.

Participant 50

Again this is a random uncontrollable factor and is also a very subjective assessment. I believe the lack of true standardisation attributes to this.

Participant 51

Luck! Some students are favoured more with some lecturers, mainly due to their gender i.e. males. The number of males that have done surgical extractions of teeth compared to female is unacceptable.

Question 4

(a) Do you have certain targets for the independence ratio, level of difficulty and extraction quota levels?

Of the 51 participants 43 participants answered "Yes"
Participant numbers:
  1, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 46, 47, 48, 49, 50, 51.

Of the 51 participants four participants answered "No"
Participant numbers:
  2, 20, 25, 26

Of the 51 participants four participants had no answer indicated
Participant numbers:
  5, 11, 43, 45

(b) If "Yes" Please specify separately

Participant 1

I would like to have at least 90% independence ratio, with a good balance between easy/difficult teeth. I would either like the quota levels to be reduced or given more time in the clinical ward. Once a week is not enough.

Participant 2

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Participant 3

Independence 80%

Extraction: 65 teeth

   Not sure of the level of difficulty, but I know that you get assessed based on the tooth's mobility, whether it is treated (Endodontically)

Retyped Reflection Paper Answers

Participant 4

I would like to improve my independence ratio and extraction quota, as this is how I will gain my experience and I will get confidence to do it by myself with a technique which I find useful.

Participant 5

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Participant 6

Extract as much as the class average. 90% independence ratio.

Participant 7

I think most students have similar targets: to get more independence ration. To do difficult cases themselves and have enough extraction quota to pass the year.

Participant 8

100% independency and at least 70 teeth.

Participant 9

Higher independence ratio. Doing difficult extractions successfully.

Participant 10

More impactions, more surgical procedures/opening by myself and a greater amount of teeth per session, especially if I finish within 30 minutes.

Participant 11

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Participant 12

Targets in line with what is required from us for the year (no target for level of difficulty though)

Participant 13

To be more or same as the targets of the class average gets or attain.

Participant 14

Independence: would like to be independent.

Level of difficulty: would like to experience everything. Harder is better for me in the future but not quota wise.

Quota levels: would like to be over 100

Participant 15

At this moment, although I would hope and try for more, I think I will be lucky to get at least the minimum quota. I would however love to get more experience than just that. I wanted to aim for 90% independence ration at least.

Participant 16

Independence ratio: I want to keep is as low as possible. In the ward I try to do as much procedures on my own as possible.

Level of difficulty: it would be ideal to extract more teeth with a higher level of difficulty, but I feel that I cannot really control this.

Extraction quota levels: my aim is to achieve my quota at the end of the year. I have already worked in sessions in order for me to increase my quota.

Participant 17

I aim for an independence ratio of 1 and to reach the quota level for the course. The range of difficulty of cases is acceptable and I have experienced easy and difficult cases and been marked accordingly.

Appendix B
Retyped Reflection Paper Answers

Participant 18

Independence ratio: as low as reasonably achievable.

Level of difficulty: not always in my own hands.

Extraction quota: I'm aiming to reach the quota expected of us by the end of the year.

Participant 19

I would like an independence ratio for >80% and the required quota.

Participant 20

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Participant 21

Want to extract about 100. I've extracted about 20 now.

Participant 22

Correct quota. Being average not less than average. Keeping up to date with rest of class.

Participant 23

I don't want to fall behind the class. I want to reach the prescribed quota and independence ratio.

Participant 24

I want to challenge myself and learn how to do more difficult work. It's how I can get/learn the knowledge and skills from the doctors.

Participant 25

I am not sure if the difficulty count for anything will a difficult without assistance count the same towards quota as a standard tooth?

Participant 26

I would just like to be competent in extracting difficult teeth.

Participant 27

--

Participant 28

Reach quota as soon as possible and start learning for private practise out there. Out there you are alone. Do impactions and more difficult cases

Participant 29

I would say yes because you want to learn, get experience and give your best. But I feel it is too much 'out of your hands' to really set targets. It depends on the cases you get. Depends on your number of sessions.

Participant 30

If you are going to refer all pts. with impactions for example because you are scared to drill, you will lose money one day and this is the place and time to learn from difficult cases.

Participant 31

Extraction quota levels: initially I thought I would surpass the required quota…now I'm just hoping to reach 65 because I've hardly extracted!

Independence 80%

Level of difficulty: I haven't done hardly any difficult simply because of lack of exposure so I would like to improve that!

Participant 32

I want at least 80-90% independence ratio.

Level of difficulty: 5's are usually good.

I want to try achieve my quota as quickly as possible, +- 2 extractions per session.

Participant 33

I want to get to my quota at the end of the year.

Retyped Reflection Paper Answers

Participant 34

Independence ratio: I need to improve mine.

Level of difficulty: I would like to remove more 'difficult' teeth with no assistance.

Quota levels: I need to increase my number of extractions per session and extractions in general (I have had a lot of referrals etc. low on quota)

Participant 35

To extract teeth at a level where I feel confident and competent enough that I would be fine doing it without supervision.

Participant 36

Independence ratio: 85%

Number of teeth: 100

Level of difficulty: aim to achieve more 5's and 6's

Participant 37

Independence ratio: I would like to learn how to be as independent as possible.

Level of difficulty: depends a lot on patient factor.

Extraction quota level: no set amount, as long as I learn something with every extraction.

Participant 38

Extraction quota: 80

Level of difficulty: 5 and up (not always attainable)

Independence ration: 65% (hard to reach at the moment)

Participant 39

The end goal here is to become competent and have enough experience with different procedures. So ideally a 90-100% independence ratio, high level of difficulty and exceed the quota levels is what I would ultimately aim to achieve.

Participant 40

I prefer to achieve higher independence: be more capable of extracting on my own in future.

Progressively move to more difficult teeth.

Be able to extract teeth with ease and have enough experience to be a good clinician after varsity.

Participant 41

100 teeth, 75% independence ratio.

Participant 42

I would like to have a very high independence ratio.

Participant 43

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Participant 44

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Participant 45

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Participant 46

Independence ratio: I would want to extract without assistance by the end of the year. This also boosts my confidence level.

Extraction quota: my extraction quota is low, however I has planned in remaining during holidays to pick up my quota levels.

Participant 47

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Retyped Reflection Paper Answers

Participant 48

I aim to have a high independence ratio when looking at my overall- and especially latest extractions. As well as a progressively more difficult level by the end of 2017. I aim to have sufficient (and hopefully extra) extractions by the end of 2017.

Participant 49

Would like to be allowed to do a surgical extraction as I have seen it done numerous time. Need to start to learn to do it by myself. Would like to get patients with more teeth to be extracted.

Participant 50

80% independence ration.

5 difficulty level.

65 extractions in 4th year.

Participant 51

I would like most of my extractions to be done alone. I may ask for help but I only want 'verbal' help.

Level of difficulty can vary.

Extraction quota level, the necessary quota needed for that time period.

Question 5

What do you focus on (what goes on in your mind) when doing an extraction?

Participant 1

How to get the tooth out as soon and painless as possible. What movements should I make? Can I see enough?

Participant 2

Doing correct movements. Applying apical pressure and not doing damage to the patient.

Participant 3

Remove the tooth correctly without destroying any structures. Also tooth keep the patient calm and comfortable.

Participant 4

I need to get this tooth out on my own. The patient is getting tired and I'm struggling to get some movement.

Participant 5

Completing the extraction without breaking the roots and learning new ways for adjusting to each case. Managing my time and patients comfort.

Participant 6

Be as conservative as I can. Try not to cause any harm to bone and unnecessary tissue around the tooth.

Participant 7

Apical pressure. Don't break the roots/bone. Patient comfort. Time.

Participant 8

Patient comfort and time. Not to break the tooth or bone.

Participant 9

Hope for an extraction and not a referral (because you don't get quota). Hope it isn't going to be difficult. Hope to not have a sore arm for 3 days.

Participant 10

Patients' anxiety. Blocking correctly. Doing the extraction and as quickly as humanly possible.

Appendix B
Retyped Reflection Paper Answers

Participant 11
Getting the tooth out without fracturing the crown. Not injuring the patient. Hoping the anaesthesia is working. Time. Not breaking bone.

Participant 12
The application of apical pressure. Getting a good grip.

Participant 13
The patient's response and comfort. If my skills are correct, movements are correct. Not to fracture tooth.

Participant 14
Thinking of the techniques I can use or the tricks to aid in order to extract it cleanly.

Participant 15
Apical pressure. Being patient and not to rush. Try to get this tooth out in one piece if possible.

Participant 16
Applying a lot of apical pressure to make sure that the crown does not break off. I make sure the patient is not feeling in pain when I extract.

Participant 17
I focus on not breaking the tooth/roots.

Participant 18
I often find myself worrying about whether the patient is completely numb. I concentrate on having patience because this increases chances of extracting without breaking roots.

Participant 19
The technique, movements and that the patient is comfortable.

Participant 20
Trying to help the patient experience as less pain as possible, hoping not to break roots during extraction/ fracturing the crown which can result in a surgical intervention. Applying the correct technique and trying to remember to apply apical pressure ALWAYS.

Participant 21
Being patient and thinking about the movements and apical pressure.

Participant 22
Pressure! Not breaking the tooth.

Participant 23
To loosen the roots in the most a traumatic way without damaging the surrounding tissue too much to not break roots. The less traumatic it is the less post-op pain the patient will have.

Participant 24
Am I helping the patient or not? I don't want to break the roots.

Participant 25
Patients are lying they don't feel the pain but are very "kleinserig" (Afrikaans for touchy).

Participant 26
Patients comfort and extracting as a traumatically as possible.

Participant 27
Doing/using the right movements and apical pressure. Positioning the patient so that I am comfortable.

Participant 28
Apical pressure! Correct technique and getting the tooth out. Not hurting the patient.

Participant 29
Not harming your patient.

Retyped Reflection Paper Answers

Participant 30

Reactions from the patient e.g. closing their eyes tight, holding on for life on those arm rests or bending their ankles which will show signs of pain.

Participant 31

I still have to focus a lot to get proper grip so I'd say that takes up most of my mind space. Sometimes I get very hot and dizzy so I have to focus on breathing and not fainting.

Participant 32

Apical pressure, my grip on the tooth and anchoring myself well so I don't slip.

Participant 33

The apical pressure and the correct movement of that tooth.

Participant 34

To cause as little pain as possible to the patient. To visualise where the roots are and their anatomy to prevent them from breaking. Focus on applying enough apical pressure which I feel like I don't always have enough of!

Participant 35

I focus on the techniques/movements that were demonstrated to us during the course of the year as well as remembering to apply apical pressure.

Participant 36

Correct instrument, whether the periosteum is stripped well, getting a good grip on the root, movements necessary, having a good support, making certain not to injure the patient/damage adj. teeth.

Participant 37

Whether I am doing the movements correctly. If the patient is in pain or not. Fearful that the tooth might break, always checking to see if forceps are positioned correctly.

Participant 38

Apical pressure all the time, scared of crown fracturing. Breathe in and breath out.

Participant 39

To be safe and careful not to do any damage or inflict harm onto the patient and also to perform the extraction independently.

Participant 40

Apical pressure. Correct angulation of the forceps. Don't hurt the patient. Correct movements. Not breaking the root. Not tearing the gingiva.

Participant 41

How good I really can be without impending on patients comfort.

Participant 42

Not breaking the tooth.

Participant 43

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Participant 44

Focus on how the patient feels first, then after try focus on taking out the tooth.

Participant 45

First that my block worked, I need my patient as calm as possible, then I focus on visualizing the tooth in the socket and how it's responding to my movements. The more teeth I pull out the more my technique improves.

Participant 46

Focus on getting the tooth out, that's my primary focus.

Participant 47

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Retyped Reflection Paper Answers

Participant 48
  Systematically I go through each step, being careful not to depend too heavily on routine, although this plays an important role in the process and must be intergraded accordingly.
Participant 49
  Movement, apical pressure-need to do. Scared to break off crown (has happened a few times)
Participant 50
  Doing the correct movements, giving painless injections. Making patient as comfortable as possible.
Participant 51
  Apical pressure. I hope I am not inflicting too much discomfort.

Question 6

What do you think you can do to improve your ability to extract teeth?

Participant 1
  I think if we are allocated more time in the clinical ward and teeth are allocated fairly, everyone gets equal opportunity to exercise their skills.
Participant 2
  Practising is probably the best way to improve.
Participant 3
  Extract more teeth. Extract difficult teeth.
Participant 4
  Improve upper body strength and get experience.
Participant 5
  Get more perfect to gain more experience.
Participant 6
  Get more experience on extracting posteriors.
Participant 7
  Work in sessions, more experience. Exercise hand and arm muscles using a stress ball, since extracting requires lots of force.
Participant 8
  Do more extractions, at least one difficult extraction/week.
Participant 9
  Gym more for more strength.
Participant 10
  Nothing except get a chance to do more teeth that require the use of instruments except forceps (e.g. Warwick). Haven't been exposed to that much.
Participant 11
  Extracting a variety of teeth.
Participant 12
  Extract more teeth. Extract more difficult and compromised teeth.
Participant 13
  To extract teeth that I have not extracted before such as upper posterior molars. To learn how to use surgical drill for fracture crowns and root rest.
Participant 14
  Have a mentor like *Dr. D* teach me. He explains steps and makes you think. Doesn't tell you what to do but rather listens to your suggestions and then advices you.

Retyped Reflection Paper Answers

Participant 15

Extract more teeth. I think I have adequate theoretical knowledge (although one can always learn more), but I need clinical knowledge, hands-on experience and guidance from someone who is willing to teach me clinically. I am more than eager to learn.

Participant 16

I think one will only improve on something if you get more experience.

Participant 17

Gain experience/extract more teeth.

Participant 18

I need to apply more force. I often get tired while extracting.

Participant 19

Get more sessions to do extractions and less referrals. Maybe do referrals before pt. gets sent to ward.

Participant 20

More experience with a variety of different cases by working in more sessions.

Participant 21

Not much. It's not about my abilities to me, because I know what to do, but rather about getting a patient with less difficult teeth or at least the opportunity to extract more than one tooth per session.

Participant 22

More experience.

Participant 23

Practise more and get more experience. Get input from different lecturers at different sessions. Study my anatomy.

Participant 24

Learn more and different techniques.

Participant 25

Do more difficult teeth and extract more.

Participant 26

More sessions and more practice on difficult teeth.

Participant 27

Trying to be more independent. Not to be AFRAID to use different instruments.

Participant 28

Work in sessions, concentrate, see one, do one, teach one.

Participant 29

Come in holiday where there is less students and patients and time.

Participant 30

I want more time to drill as I have never even touched the drill.

Participant 31

More practise! To build confidence so I can work more independently without doubting myself.

Participant 32

Practise extracting more difficult teeth. Be confident of the method of extracting.

Participant 33

See more patients, extract more teeth per session. I'm not lucky because I never get more than 1 tooth per patient to extract.

Retyped Reflection Paper Answers

Participant 34

More practise. I am getting a lot better at it. (The more we do, the better and quicker we get. Try and improve my strength.

Participant 35

I think I need to stop being afraid to apply more pressure and be more confident in my abilities to extract teeth.

Participant 36

Work during the holidays and gain experience.

Participant 37

To have more teeth to extract.

Participant 38

Be more confident.

Participant 39

Practise. The more teeth I extract, the more competent I will become.

Participant 40

Apply more force. Shadow experienced dentists in the holiday.

Participant 41

Definitely need to improve on my skills and techniques. Also more tolerance of the doctor to patient. 'a bit of muscle power)

Participant 42

I think I do okay in KGM, I just need to learn how to use the drill.

Participant 43

If I can extract every week and get different types of teeth to extract, I think that will improve my skills.

Participant 44

Sometimes when I extract by looking on the tooth I judge it that it might be difficult.

Participant 45

Extract more teeth! And get helpful tips from the supervisors.

Participant 46

More practise i.e. to see as many patients as possible and I believe that will improve with time.

Participant 47

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Participant 48

Keep learning with every procedure done. To reflect on my experiences by the end of the day and to study as much as possible about new procedures, as well as general techniques and tips other professionals recommend. To time myself and to, at the end of the day be able to do everything I need to do in the allocated time, and as thoroughly as possible.

Participant 49

Get better assistance in whether I am doing movement and apical pressure or not. Get a better idea of what not to do to avoid breaking crown,

Participant 50

Experience is key.

Participant 51

Do extractions alone. Get no referrals. The more experience I will have, the better I will get at extracting teeth.

Retyped Reflection Paper Answers

Answers to reflection paper questions of BChD 4 2017 students

Question 1

 Why do you think some students extract more teeth than others?

 Participant 1
  They get patients that require multiple extractions or dentectomies where as other students get difficult molars to extract and only 1 tooth per patient

 Participant 2
  They either go other sessions or they work diligently. They don't sit on their asses

 Participant 3
  They are lucky to get a dentectomy. Sisters want us to take files in the order of patient arrival

 Participant 4
  Some look at the files beforehand to look for multiple teeth. Some are lucky. Some just work hard and are keen to learn and do the procedure

 Participant 5
  Their sessions have more patients e.g. 07:00-09:00. I barely ever get patients at 07:00. The luckier you are the more you extract

 Participant 6
  Some students get dentectomies more than others

 Participant 7
  Some students are favoured more than other and are given first priority in terms of getting patients. They are even given allowance to work in some sessions even though they have no session allocated for that time

 Participant 8
  Luck, sometimes you arrive and no patients in the session, other times referrals, other times dentectomies…

 Participant 9
  I think some students are more concerned about taking out a lot of teeth even if they are easy extractions than focusing on gaining experience with much more difficult teeth

 Participant 10
  I think it is a combination of luck and skill but also particularity students arriving earlier at wards are guaranteed patients. Students who develop better skills earlier extract more teeth. Students who receive patients needing dentectomies are lucky compared to students who only receive surgical referrals…

 Participant 11
  I think it's because files are distributed randomly. So some students are just fortunate to get dentectomies while some get one tooth or 2 and some referrals

 Participant 12
  Sometimes I think its luck because we might get to KGM at the same time but I can end up with a referral and other may get extraction of a teeth on that same day

 Participant 13
  Some students work faster than others. Some students take time to get used to the working environment of KGM

Appendix B
Retyped Reflection Paper Answers

Participant 14
  Students work faster than others
Participant 15
  Luck – depending on the patient they receive
Participant 16
  Files that are randomly given to students irrespective of the amount of teeth that needs to be extracted thus luck
Participant 17
  Due to the random assignment of patient, thus luck mostly. Some have more morning (early) sessions which are sometimes very quiet, thus not enough patients
Participant 18
  Getting a patient depends on how many people are there in a session and also it is a first come first serve situation. Also some students are lucky and get multiple extractions when others get 1 per session
Participant 19
  They are fast and some attend when they are free. They have a good technique
Participant 20
  Because other students are lucky enough to get multiple dentectomies in the ward
Participant 21
  Because they get patients who have many teeth that need to be extracted and some get patients with 1 tooth
Participant 22
  The pace we work with is different for everyone and sometimes it takes too long to type and do the clinical exam
Participant 23
  Because it depends on what kind of patients you have, some have patients that need referrals which wastes a session and sometimes you just extract 1 tooth. Some may be fortunate enough to get dentectomies. Luck plays a role. Some eager beavers though like booking extra sessions ALL THE TIME and leave students that are supposed to be there with no patients
Participant 24
  Some students get dentectomies whilst others don't but also patients sometimes don't show up at the clinic particularly the 1st session so it becomes a wasted session
Participant 25
  Pace that we work with is not the same. Also the strength plus heart to continue especially with difficult patients
Participant 26
  Because some students just get all the time the patients with more than 1 teeth that need to be extracted. And as fate is, some students just get all the time difficult extractions that end up in surgical removal
Participant 27
  Luck, the patients they're given need more than others (extractions)
Participant 28
  They receive files from the sisters which requires extractions verses the students who has referrals, dry sockets and might not even get a patient because there are too many students in the ward

Retyped Reflection Paper Answers

Participant 29

Some students work in extra sessions when they have off. Some come in ½ an hour early to get a patient with more extractions needed and they don't refer. Sometimes they are just lucky for they get a patient with multiple extractions where us with less extractions get referrals, children or dry socket

Participant 30

Patients are at random. You don't get to choose which patient you want to help

Participant 31

They have more clinical sessions and they are always in sessions where there are patients. They may also have more patients with dentectomies than others

Participant 32

It depends on the patients you get. Some extractions are too difficult or need to be referred and that effects how many teeth are extracted. Some sessions also are more busy than others and if for example you only have 7:00 sessions there aren't enough patients so then your extraction numbers are less

Participant 33

It depends on a range of factors, sometimes some students do work faster and can see more than 1 patient in a session, a lot of the time they just get patients with multiple extractions and dentectomies whereas others don't

Participant 34

Certain students ask for patients with easy/perio teeth to be able to extract a larger number of teeth in a shorter period of time. Sessions in early mornings and late afternoons are much quieter thus sessions are 'lost' due to the lack of patients

Participant 35

Students work in extra sessions or ask for dentectomies or just get lucky with patients

Participant 36

Get lucky with patients

Participant 37

Some students are more lucky. There isn't really a fair system on how students get patients

Participant 38

It's just luck of the draw. And some students like to hang around when it's not their session to try do more extractions

Participant 39

Some students get lucky with patients who have numerous teeth to extract

Participant 40

Some students show up earlier and therefor get patients first but mostly I think it is just lucky to get patients that need extraction of more than 1 tooth

Participant 41

Some students book patients they know will need a lot of extractions but it is mostly just luck

Participant 42

The luck of the dice as well as being on time

Participant 43

You don't get a choice in the file that you get in the session. It's their luck. A lot of students also book patients from other wards

Participant 44

Luck and because of the roster times. They should check quota before handing out files with dentectomies, like in RAD they check your quota

Retyped Reflection Paper Answers

Participant 45
  Luck of type of patient
Participant 46
  Patient selection and availability

Question 2

Why do you think some students Independence ratios are higher or lower than others?

Participant 1
  Doctors don't want us/me to drill if it is difficult cases so I then get 1-3 instead of 4-6 on GoodX
Participant 2
  They act more confident while working and thus get left alone OR they extract easy teeth
Participant 3
  Some students are better practically than others
Participant 4
  Doctors are too quick to jump in and help. Some students just give up too easy
Participant 5
  I am a bit confused with that ratio so not sure exactly but it depends on the level of difficulty, we can't choose which patients we see and which teeth we extract
Participant 6
  The extraction done by each person I think contribute to the independence ratio. The difficulty of extraction plays a role which makes the difference for each student and that's why it differs
Participant 7
  Those with higher number of teeth extracted have higher independence ratios
Participant 8
  Luck, sometimes you get an impossible tooth or surgical extraction, other times you don't. Some doctors don't want you to drill or there aren't enough doctors to supervise you drilling…
Participant 9
  Some students are afraid to use too much pressure because they feel for the patient
Participant 10
  Self-confidence of students and willingness and patience of doctors. Where some students may believe that they aren't capable of working alone, other doctors have more patience and willingness to help before finishing the procedure themselves
Participant 11
  It's because some people are more persistent than others
Participant 12
  I think they are more confident than others from the start of the year
Participant 13
  Some students are afraid of breaking the teeth and end up asking help unnecessary that affect the independence ratio
Participant 14
  --
Participant 15
  Also luck – some just get very difficult teeth. Confidence in own abilities

Retyped Reflection Paper Answers

Participant 16

Files that are randomly given to students irrespective of the amount of teeth that needs to be extracted thus luck. Also dependent on the type of supervisor that you have. Some supervisors want to challenge you to try it on your own, other supervisors just take over

Participant 17

Also, luck play a big role, some students get easier cases. Some lecturers do the extraction for you if you ask help and all you wanted was advice on how to do it and if you were on the correct path

Participant 18

Level of difficulty with each case is not the same

Participant 19

They may be more comfortable doing it alone while others need help

Participant 20

Because they some students get very nervous when things don't go their way that they immediately give up and call their supervisors before they even think of other alternatives that could be explored to solve the problem at hand

Participant 21

Some patients are difficult to extract and instead of the doctor helping they just extract the tooth for you

Participant 22

Variety in patients we get and the problems we encounter are different sometimes you just need help with doing certain extractions

Participant 23

Because some students are still a bit nervous to extract difficult teeth on their own, it is a fear we have because students don't feel skilled enough. Some doctors automatically want to take over the minute you say you are struggling, which does not give you a chance to do it on your own

Participant 24

Sometimes one gets more difficult extractions than normal extractions and they end up a surgical extractions which knocks ones confidence going forward

Participant 25

Type of patient we all have. And also the confidence each student displays in extraction especially the difficult teeth

Participant 26

Some students just get difficult cases that end up surgical extractions. Also some students are just more skilled

Participant 27

Some doctors help without the students need for help which will lower the independence ratio

Participant 28

Sometimes the doctor doesn't give the student an opportunity to extract on their own the competence of the student is based on the doctor's judgement and not based on the quota book or GoodX. Dr's should only extract a tooth self if student so requests

Participant 29

Some students started with impactions, while we are still doing normal extractions. If we ask for help in the ward some lecturers take over and don't give us the opportunity to struggle ourselves. The higher independence ratios are sometimes just lucky, for we have a lot of perio teeth and not a lot of normal teeth that we have to extract

Appendix B
Retyped Reflection Paper Answers

Participant 30

If you get more 4 = higher independence. Independence decreases with difficult extractions especially impactions in 1st semester 4th years weren't allow to do surgical = independence decreases

Participant 31

Because they try by all means to do the work on their own. They ask for help where it is necessary

Participant 32

It depends on the supervising doctor. Some doctors are more patient than others and are more willing to help you/show you what you must do to extract while other doctors will just take over. It also depends whether you get easy or difficult teeth each time

Participant 33

Some students are more able to complete an extraction without help, sometimes it depends on the doctor and their evaluation of how difficult or easy a tooth may be

Participant 34

Again students extracting more perio/easy teeth. Some have more self confidence

Participant 35

Some students are more skilled than others or more experienced when they work in extra sessions

Participant 36

Some students have more confidence to do extractions completely on their own with others

Participant 37

Some students are better to extract teeth, they also have more confidence while others want more help at first. Also some patients have easier extractions

Participant 38

Some students like to ask more questions and this is sometimes considered as helping them. Also some students just get lucky with patients and others have to do surgical removals which can't be done independently

Participant 39

Skills can differ in the students. Some are also more confident in doing more difficult extractions

Participant 40

Some students are just lucky to get teeth that are easier to extract. Some students are at a higher skill level than others. Some doctors don't give you the opportunity to try I will do the procedure for you

Participant 41

Some doctors are more hands on and when you ask them for advice and just to tell you how you could approach an extraction some doctors will say they'll just show you and then extract the tooth themselves when they could have just told you what to do

Participant 42

Some are more capable than others and some lack self-confidence in certain situations

Participant 43

You can't determine the difficulty of the extraction you're going to get. Some more often get difficult ones than others

Participant 44

Some students are more skilled and out going

Participant 45

Skill/difficulty of extraction

Retyped Reflection Paper Answers

Participant 46
Difficulty of extraction, self-confidence, lecturers are more/less strict regarding what counts as assistance, time constraints may cause a doctor to take over

Question 3

Why do you think some students' level of difficulty achieved is higher or lower than others?

Participant 1
They extract more difficult teeth but you don't really have an option if you want difficult teeth or not you just get patient files randomly
Participant 2
Ladies get better perks because they have a 'flirt factor'! Just joking!! Maybe they try and search out the challenging extractions?
Participant 3
Depends on the patient you get
Participant 4
Luck. It is sometimes possible to check for a file with a difficult tooth already indicated
Participant 5
They get more patients with harder teeth
Participant 6
Confidence play a huge role and knowing what you're doing helps to do difficult cases which increases/decreases one's ability to achieve higher/lower
Participant 7
Again favouritism - some students are liked more by certain doctors and that influences their achievement levels
Participant 8
Luck again! We can't choose the patient we get, also some doctors are stricter than others and give more 4's…
Participant 9
It is higher because they don't focus more on taking out many teeth but rather exploring difficulty in extraction
Participant 10
Some students develop skills quicker than others, it is a matter of being able to learn from supervisors and to reflect these techniques learnt
Participant 11
It's because they got difficult extractions and they do them without supervision
Participant 12
Some are just coincided with teeth where bone loss is severe making the teeth easy to extract
Participant 13
I think this one is all about luck, on the day one might get difficult teeth other not
Participant 14
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Participant 15
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Retyped Reflection Paper Answers

Participant 16

Files that are randomly given to students irrespective of the amount of teeth that needs to be extracted thus luck. Also dependent on the type of supervisor that you have. Some supervisors want to challenge you to try it on your own, other supervisors just take over

Participant 17

Luck again, random assignment of cases

Participant 18

Level of difficulty with each case is not the same

Participant 19

Some may still be difficult for them to do it alone and need help

Participant 20

Because they get difficult teeth

Participant 21

Depends on the patient you get and the marking, the doctor decides to give you any mark. Some doctors prefer to discuss it with you before marking others don't

Participant 22

They are more confident in doing difficult cases and things can just work well

Participant 23

It depends on the student's confidence. The guys are usually not afraid to go for it, whilst the girls are little too sympathetic and scared to go for it

Participant 24

Sometimes us students are quick to give up if an extraction is difficult or don't have the confidence to extract difficult cases without assistance

Participant 25

Confidence and perhaps luck with getting difficult teeth

Participant 26

It all depend on what you are given. We can't choose the difficulty

Participant 27

Patient selection

Participant 28

There is no even distribution of patients. It's all based on luck and the file the sister gives the students, therefor some receive difficult cases and some don't, totally random

Participant 29

Like above, they are just lucky to avoid the perio teeth or are already doing surgical removals by themselves

Participant 30

Level of tooth difficulty differs between doctors. Some will give 5 others a 6. Depends on patient you get

Participant 31

Because they always get difficult cases

Participant 32

It just depends on what patient you get

Participant 33

Depending on the patients that each student gets

Participant 34

Again students extracting more perio/easy teeth on request and not taking or more difficult cases

Retyped Reflection Paper Answers

Participant 35
Students sometimes get to pick and choose which 'file' seems easier or they take on more difficult cases

Participant 36
Depend on the patients you get

Participant 37
Depends on patient you get. Some students get more confidence and extractions are easier for them

Participant 38
Luck

Participant 39
Some students get lucky by getting patients with more difficult teeth to extract, whereas others only get easy and standard teeth to extract. You sometimes don't get the chance to extract the more difficult ones

Participant 40
They are just lucky to extract more teeth that have a more difficult level than others as well as more skill or willingness to do more difficult cases

Participant 41
It is mainly luck because some students get more difficult cases and some students get lots of perio patients where the difficulty is low

Participant 42
Luck of the dice and as well as skill level

Participant 43
Luck/bad luck

Participant 44
More out going

Participant 45
Luck of the type of patient

Participant 46
Depends on the patient you get

Question 4.

    (a) **Do you have certain targets for the Independence ratio, level of difficulty and extraction quota levels?**

Of the 46 participants 39 participants answered "Yes"
Participant numbers:
1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16,18, 20, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 46.

Of the 46 participants six participants answered "No"
Participant numbers:
6, 17, 19, 21, 25, 44.

Of the 46 participants one participant had no answer indicated.
Participant number:
12.

Retyped Reflection Paper Answers

(b)   If "Yes" Please specify separately

Participant 1
Independence of 80%. Difficulty average of 75%. Quote of 65-85

Participant 2
90%. To be a good practitioner you have to be able to do things by yourself and do so diligently and quickly. The more you do the better practitioner you can be!

Participant 3
In order to improve my marks. Independence >80%. Difficulty level >4. Count > than minimum requirement

Participant 4
Independence and difficulty: want it to be high, I want to be able to reach a high personal level and not to be scared to do something. Quota: already enough quota. Rather want to focus on acquiring certain skills

Participant 5
I need a lot more difficult teeth, because I have only seen easy patients

Participant 6
--

Participant 7
Independence ratio: >90%. Level of difficulty: more scores of 6. Extraction quota: >65

Participant 8
I would ultimately like to be the best doctor possible. This means feeling competent in all aspects and being able to remove any tooth given to me or to assess which ones I need to refer. This means the higher all of the above 3 the better

Participant 9
90%

Participant 10
I would like to achieve a level of competence where I am able to extract any number of teeth with any level of difficulty without needing help/supervision

Participant 11
I'd like to get to a point where I can be more independent. Quota wise I just want to learn as much as I can so it's not really stressing me

Participant 12
--

Participant 13
Have a higher level of difficulty in order to develop different strategies to remove different types of teeth

Participant 14
About 85%

Participant 15
As many independent extractions as possible. Fewer easy extractions – more surgical

Particip9ant 16
I want to have a high independence ratio and level of difficulty at the end of the year. The number of extractions are less important for me

Participant 17
I can only extract according to the assigned patient thus can't control my level of difficulty or quota. But I try and do as much as possible on my own (independence)

Retyped Reflection Paper Answers

Participant 18

I would like to keep my independence ratio above 90 throughout the year. The level of difficulty I would like to have more difficult cases even if it means I get them done with assistance because then my skills improve. I would like to reach the 60 teeth stated for us but I would like to go beyond if possible

Participant 19

--

Participant 20

I want to work alone a lot doesn't matter the value given to my work

Participant 21

--

Participant 22

Extraction to be high so that I don't fall behind with the quota. Just push myself and go out of my comfort zone with the difficulty ratio. To first attempt doing the extractions myself before I can ask for assistance so that my independence ratio improves

Participant 23

I want a high independency ratio because I know soon we I will be alone in a state hospital with no supervisor to help me

Participant 24

More than 90% independence ratio. 6 for level of difficulty. Extraction quota >100

Participant 25

--

Participant 26

I want to be independent and competent. Ultimately a good dentist

Participant 27

To achieve the necessary 'quota'

Participant 28

I would like as much exposure as possible

Participant 29

I would like to have a 100% independence ratio that I know I can extract teeth by myself without any help

Participant 30

I would like to extract more 5 and 6 level teeth and extract more than what is required. Unfortunately patients are at random = more 4 at 4th year level = decreased difficulty

Participant 31

Independence ratio: because this will help me assess myself if I can work on my own as I need help always. Level of difficulty: this will help me see if I am ready to go out there in the real world, work by myself without any assistance. Extraction quota: helps me assess how far I am with my school work

Participant 32

I try to keep my ratios as high as possible, because I don't want them to drop below the required values

Participant 33

According to requirements

Participant 34

I would like as high an independence, difficulty and quota levels as possible – if made possible by adequate amount of patients

Retyped Reflection Paper Answers

Participant 35
I'd like an independence ratio of more than 90% and with most of my extractions being standard to difficult. I'd also like to achieve more extractions than 65

Participant 36
I want to extract most teeth alone and progressively extract more difficult teeth and be above the extraction level

Participant 37
I feel I want to extract as much as possible at the highest level while still in university so when we go out I can be confident to be the best dentist I can be

Participant 38
High independence ratio because this means that when I leave the hospital I can hold my own. Same goes for level of difficulty. Extraction quota is purely luck if the draw

Participant 39
Want to improve on my level of difficulty and independence ratio

Participant 40
To be above the class average

Participant 41
I want a 90% independence ratio because I want to do more on my own

Participant 42
I'd like to increase my current quota and level of difficulty and ratio to an amount of which I feel comfortable with

Participant 43
I would like to achieve 60 extractions by the end of the year

Participant 44
--

Participant 45
Independence = 85%. Quota = 90

Participant 46
Independence >90%. Difficulty: at least 25% '6'. Quota: at least 120 teeth for 2017

Question 5

What do you focus on and what goes on in your mind when doing an extraction?

Participant 1
Focus on extracting teeth in most a traumatic way possible with the right technique

Participant 2
I want to say the patient and this is true as soon as I start working. But a small part of me always want to chase difficult extractions

Participant 3
Remembering what you have learned and hoping that the tooth doesn't break!!

Participant 4
Try and keep the patient as calm as possible. Thinking about using the correct technique

Participant 5
I focus really hard on not trying to break the tooth – I never know how far to move the tooth buccally or palatally. I keep asking myself if I'm doing it right. Stress for sure. I still feel very incompetent

Retyped Reflection Paper Answers

Participant 6
I recite what I have to do and how to do the movements

Participant 7
I focus on the patient's well-being. After all it is my duty to ascertain that the patient leaves this facility properly healed and with a happy smile

Participant 8
Proper technique, instruments what would work the best, is the patient comfortable, am I damaging anything etc.

Participant 9
I think about what could go wrong during that session based on how I am either holding a forceps or applying pressure

Participant 10
Patient satisfaction. Efficiency. Good work in a small short of time. Constant problem solving

Participant 11
I focus on making sure I don't break the tooth and also not hurting the patient unnecessary

Participant 12
My main focus is on the patient where I assess level of anxiety. Then on the tooth hoping and praying that it doesn't break

Participant 13
The standard methods of removing the tooth. Apical pressure and the tooth movements, it does/wonders

Participant 14
The tooth I'm about to extract

Participant 15
How to keep the patient in the chair and not running out the door or fighting me

Participant 16
I focus on the theory that we learnt during the lectures in order to do the extraction as best as possible

Participant 17
Focus on patient comfort, angulation of instruments, use of correct instruments and try to do it in my own as far as possible

Participant 18
I focus on the correct movements and grip I need to get the tooth at

Participant 19
When doing an extraction I focus on the technique and the forceps, in order to make sure I don't break it

Participant 20
I'm trying not to hurt the patient too much and if things go wrong I try to keep the patient calm and hide the nervousness in my eyes

Participant 21
Making my patient feel comfortable and relieving their pain that brought them to me

Participant 22
Getting the tooth extracted without any complications and avoid fracture as much as possible

Participant 23
Getting the tooth out successfully and not hurting the patient

Retyped Reflection Paper Answers

Participant 24

The technique that I am using and how much of my strength I need to use

Participant 25

The technique and also focusing on not causing unnecessary trauma to the patient during the extraction

Participant 26

I'm trying my best to concentrate on what I'm busy with. Anticipate what is going to happen. Sometimes it happens that you think of time and that puts unnecessary pressure on a person

Participant 27

Not to hurt the patient

Participant 28

I focus on the task at hand, making sure the patient fully understands. The patient is comfortable. I just focus on a good level of serves regardless of quota…

Participant 29

With perio teeth I mostly think apical pressure and here it comes. Then I think of my rhyme of post-op instructions. With difficult teeth I focus on the movements, my posture (I try to keep a good posture) my wrist movements and focus on apical pressure

Participant 30

Effect of Medical History on treatment. Method of extraction

Participant 31

I make sure about my balance, level of patient and my position. I focus on making sure that I don't break the roots or the alveolar bone

Participant 32

How I can do the extraction as painless and as quick as I can to prevent discomfort and stress for the patient

Participant 33

Mostly the theory and technique behind extracting that tooth, other times if and why I'm struggling, I'll think about what I could be doing wrong

Participant 34

I focus on removing the tooth as a whole (not breaking the tooth)

Participant 35

Firstly I examine the tooth and then the x-ray so that I have a mental plan of how to approach the tooth and what instruments I will use as well as the movements that I will move the tooth in

Participant 36

I focus on my movements and I always hope not to break the crown/roots off

Participant 37

When doing extractions I am usually worried about breaking the tooth/root, I focus in movements and apical pressure…

Participant 38

A clean extraction and not breaking off the crown

Participant 39

I focus on how I am going to extract it (techniques and instruments I will be using). I also focus on whether I will be able to extract the tooth successfully on my own

Participant 40

Remembering all the different steps to follow and to do the procedure correctly

Retyped Reflection Paper Answers

Participant 41

Apply apical pressure, use slow movements and hope that the root or crown doesn't break off. Also I wonder if I griped the tooth deep enough

Participant 42

Doing the correct movements and focusing on my positioning as well as thinking of the patient and taking them into consideration

Participant 43

Is it going to fracture?

Participant 44

Taking the tooth out

Participant 45

Keeping myself calm and relaxed in order to extract teeth patiently. Patience is key

Participant 46

Tooth morphology and patient's medical history. Depth of instrument into sulcus. Relevant movements. Aching muscles and fatigue sometimes with difficult teeth. Where is my supervisor

Question 6

What do you think you can do to improve your ability to extract teeth?

Participant 1

Get more clinical demonstrations in 3rd year

Participant 2

Do more and most of all do more difficult extractions without someone helping me! More important is to learn something with each case and strive to do better

Participant 3

Practise – attend more sessions

Participant 4

I personally don't like it when multiple people come and check to give you their advice and opinions on how to do something without asking

Participant 5

Not really sure – because if I knew I would be doing that. But what would help is having revision practical classes to familiarise ourselves with some of the techniques or videos being put on clickUP a few of the hard teeth e.g. molars… that we can keep watching it not to forget

Participant 6

The more extractions done the more the experience one has. The more difficult/easy cases one sees the more experienced one becomes then this improves one's ability to extract teeth

Participant 7

Work in for extra sessions and get more tips or tutoring from various doctors on their different methods of tooth extraction

Participant 8

Practise! Some doctors are also amazing and discuss how you will approach a certain tooth. I feel like at the beginning this is what we need, also for difficult teeth

Participant 9

Extract more difficult teeth to gain experience

Retyped Reflection Paper Answers

Participant 10
Learn as much as possible from experienced doctors, practise as much as possible. Welcome difficult cases rather than shying away from them

Participant 11
Extract more challenging teeth

Participant 12
At the moment I would like to do a lot of extractions of posterior teeth as I feel I need to improve on them

Participant 13
More extractions I do, the better will become and improve the skill

Participant 14
More sessions especially to suture as some of us have never sutured

Participant 15
Learn surgical techniques for more difficult teeth

Participant 16
Have greater strength to apply greater apical pressure

Participant 17
Practise, practise. Make use of every session. Learn to use the different instruments

Participant 18
Extract more teeth with more time and experience I imagine I will get better

Participant 19
Well I think I'm doing very well, but to improve is that I get to extract more teeth and more than 1 per session

Participant 20
Do more extractions

Participant 21
My ability to extract is ok

Participant 22
Learn to do the movement properly and with more practise I will be better

Participant 23
I just need more experience, no amount of literature can prepare you for this. Or maybe practise on a model especially surgical extractions

Participant 24
Extract more teeth independently

Participant 25
Extract more!

Participant 26
Extract more teeth. Get more experience

Participant 27
Practise, and be more confident

Participant 28
I could probably improve my service turnover and not talk as much with patients

Participant 29
I think I can do hand exercises to strengthen my hands. They still get tired when doing a difficult extraction. I can try and get more difficult teeth when in the ward. If my quota is falling behind I will work in sessions

Retyped Reflection Paper Answers

Participant 30

How to use elevators properly – where to use what/where can help make it easier. Preclinical training on surgical extractions – get to know how bur works and feel in hand. Suturing

Participant 31

I think I am fine so far with extracting teeth

Participant 32

To improve my skills by practising more/ to strengthen my hands more

Participant 33

Practise and revise technique

Participant 34

I need to learn that I can push a lot harder on teeth and should not be afraid of breaking a tooth

Participant 35

Try my best to complete any extraction without help

Participant 36

Have more confidence

Participant 37

Have more confidence in myself. Work in extra sessions to extract more

Participant 38

Exercise to improve strength. Focus on painless injections

Participant 39

I want to improve my confidence during extractions

Participant 40

More opportunity to extract teeth, this will increase my self-confidence to do the procedure

Participant 41

Just be patient and calm

Participant 42

Increase my sessions. Try to see more patients and also observe difficult cases

Participant 43

By improving my apical pressure skills

Participant 44

To extract variety of teeth and different difficulty of teeth

Participant 45

Extract teeth

Participant 46

I am very confident in my ability to extract teeth. Would like to start doing more difficult extractions and develop those skills

Appendix C
Ethics Approval

Appendix C: Ethics Approval

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.
- FWA 00002567, Approved dd 22 May 2002 and Expires 20 Oct 2016.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 22/04/2017.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee

21/04/2016

Approval Certificate
New Application

Ethics Reference No.: 137/2016

Title: Assessing undergraduate dental students' exodontia competencies by employing a novel continuous assessment instrument

Dear KarlHeinz Merbold

The **New Application** as supported by documents specified in your cover letter dated 18/04/2016 for your research received on the 18/04/2016, was approved by the Faculty of Health Sciences Research Ethics Committee on its quorate meeting of 20/04/2016.

Please note the following about your ethics approval:
- Ethics Approval is valid for **4 years**
- Please remember to use your protocol number (**137/2016**) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:
- The ethics approval is conditional on the receipt of 6 monthly written Progress Reports, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

Professor Werdie (CW) Van Staden
MBChB MMed(Psych) MD FCPsych FTCL UPLM
Chairperson: Faculty of Health Sciences Research Ethics Committee

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

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Informed Consent Form

Appendix D: Informed Consent Form

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Faculty of Health Sciences

School of Dentistry

Enquiries: Dr K-H Merbold

        Telephone: 012-3192529

        Dr TC Postma

        Telephone: 012-3192553

PARTICIPANT'S INFORMATION LEAFLET AND INFORMED CONSENT FORM

Name of researcher: Dr K-H Merbold

Contact telephone number: 0824883170

Department of Maxillo-, Facial- and Oral Surgery

School of Dentistry

University of Pretoria

PO Box 1266

Pretoria 0001

TITLE OF THE STUDY

Assessing undergraduate dental students' exodontia competencies by employing a novel continuous assessment instrument

Dear student

This leaflet gives you information to help you decide if you want to participate in the proposed study. Before you agree to participate, make sure you understand exactly what is involved. If you do not understand the information, or if you have any other questions, you are welcome to ask.

PURPOSE OF THE STUDY

The purpose of the study is to assess the newly developed continuous assessment instrument's ability to measure students' abilities to perform tooth extractions independently and to gain an understanding of factors that influence your self-regulated learning in exodontia.

Informed Consent Form

RISKS

There are no risks involved in this study as no change to existing assessment criteria will be implemented

POTENTIAL BENEFITS

If it is found that feedback has a positive effect on changing student performance, this assessment adjunctive can be used to give feedback in a more regular manner. The assessment tool can also be improved for future dental students to enhance their learning and clinical skills. This system might then also be used in other departments or Universities to improve continuous student assessment.

PROCEDURES

The assessment method, to determine a Clinical mark for dental students in the OFC 470 and OFC 570 modules, in the exodontia ward of the Maxillo-, Facial- and Oral Surgery Department, in the School of Dentistry of the University of Pretoria, was changed in 2014. This new assessment method using a computer-based program (GoodX Dental Office Management Software application) was introduced to assess you on a more continuous basis. Feedback on student quotas, independence ratios and levels of difficulty achieved is given in a more frequent manner and you are able to monitor your individual progress, as well as your progress compared to your peers in a more practical way. Your levels of achievement are given in a clearer fashion to make timeous adjustments to correct any shortfalls in clinical quota arrears. The quantitative feedback given to you quarterly is thought to improve reflection on your performance. The idea of an anonymous reflection paper given to you during the assessment process will be done to receive information on your approaches to feedback given and possible adjustments that you might make to improve your clinical performance. This information can be used to improve the clinical assessment procedure further for future generations of dental students. The reflections given in this paper will be anonymous and nobody, not even the researchers will be able to determine who gave these reflections.

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Appendix D
</div>

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Informed Consent Form
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CONFIDENTIALITY

The researchers undertake not to identify you, the participant, in any analysis or publication at any time. A unique number will be assigned to your records to ensure that these are not accessible to a third party. Only lecturing staff will have access to your assessment marks, as done on the GoodX software system, for educational purposes. Your assessment mark will form part of your clinical mark and this mark in turn to your year mark as described in the study guide for the OFC 470 and OFC 570 module that you are enrolled for and will be captured on the University's system. This information will be stored electronically and will be protected by a password. Your course feedback will be anonymous. You will be required to complete a reflection paper during the year to give information on your perspectives, experiences of, reactions to and perceptions of the assessment instrument. Data collected from the reflection paper will be available only to the researchers and analysis results from this information that will be used for the research study will be anonymous. The data given in the reflection paper will not form part of any mark used in any part of the OFC 470 and OFC 570 module and will purely form part of the study on what impact feedback has on student performance in exodontia

PARTICIPANT'S RIGHTS

This study is voluntary and you are under no obligation to participate. You can refuse to participate or you can stop at any time without giving any reason. If you do not participate, or if you withdraw from participating during the study, it will not be held against you in any way.

ETHICAL APPROVAL

Application will be made to the Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria to obtain written approval for the study to be undertaken.

Appendix D
Informed Consent Form

INFORMED CONSENT FORM

By signing this document I confirm that I fully understand the information provided in the information leaflet about the proposed study, its risks and benefits, and my rights to participate in the study or not.

I give consent that my Assessment marks as done on the GoodX system may be used in the analysis and the proposed study.
Yes / No

I give consent that the Reflections I give in the reflection paper may be used in the analysis and proposed study.
Yes / No

Name and Surname of Participant	_____	(Please Print)
Signature of Participant	_____	_____ (Date)
Name and Surname of Researcher	Dr. Karl-Heinz Merbold	
Signature of Researcher	_____	_____ (Date)

Appendix E
Dean's Permission

Appendix E: Dean's Permission

Chairperson:
Prof LM Sykes
Members:
Prof T Swart
Prof SM Dawjee
Dr P Brandt
Prof A Bhayat
Secretary:
Ms C Swart

RESCOM/ NAVKOM

School of Dentistry / Skool vir Tandheelkunde
Faculty of Health Sciences
Fakulteit Gesondheidswetenskappe

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
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Prof AJ Ligthelm   2016-03-24

Dean

School of Dentistry

Dear Professor

PROTOCOL APPROVAL: DENT 2016/7

Name: Dr Merbold

Title: "Assessing undergraduate dental students' exodontia competencies by employing a novel continuous assessment instrument".

The protocol attached hereto was evaluated by the Research Committee of the School of Dentistry. The Research Committee recommends the approval of the title and the protocol.

Yours sincerely

LMSykes

PROF L SYKES

CHAIRPERSON: RESEARCH COMMITTEE

Protocol approved/not approved

PROF AJ LIGTHELM

DEAN: SCHOOL OF DENTISTRY

Extraction Count Results

Appendix F: Extraction Count Results

Figure F.1 BChD 4 2014 (n=42) Extraction Count at first feedback

Figure F.2 BChD 4 2014 (n=42) Extraction Count at second feedback

Figure F.3 BChD 4 2014 (n=42) Extraction Count at third feedback

Extraction Count Results

Figure F.4 BChD 4 2014 (n=42) Extraction Count at fourth feedback

Figure F.5 BChD 4 2014 (n=42) Extraction Count at final feedback

Figure F.6 BChD 4 2014 (n=42) Extraction Count comparison of feedback episodes

Extraction Count Results

Figure F.7 BChD 4 2015 (n=51) Extraction Count at first feedback

Figure F.8 BChD 4 2015 (n=51) Extraction Count at second feedback

Figure F.9 BChD 4 2015 (n=51) Extraction Count at third feedback

Extraction Count Results

Figure F.10 BChD 4 2015 (n=51) Extraction Count at fourth feedback

Figure F.11 BChD 4 2015 (n=51) Extraction Count at final feedback

Figure F.12 BChD 4 2015 (n=51) Extraction Count comparison of feedback episodes

Extraction Count Results

Figure F.13 BChD 4 2016 (n=62) Extraction Count at first feedback

Figure F.14 BChD 4 2016 (n=62) Extraction Count at second feedback
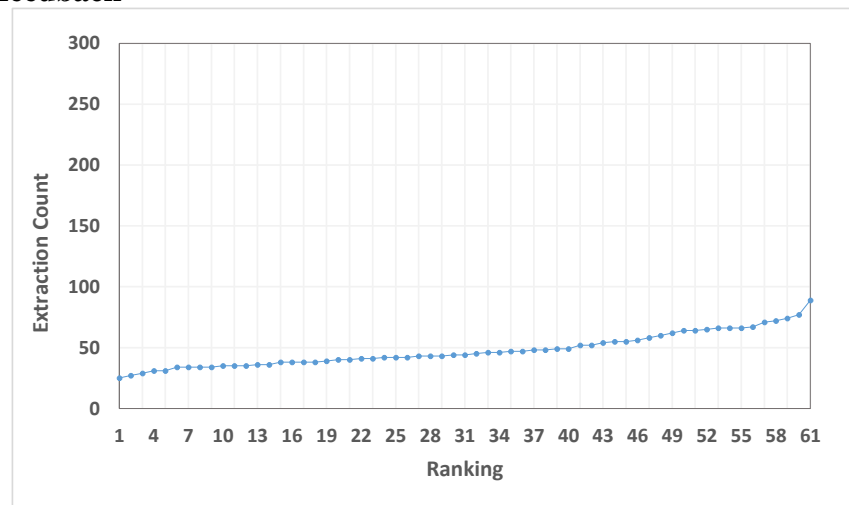
Figure F.15 BChD 4 2016 (n=62) Extraction Count at third feedback

Extraction Count Results
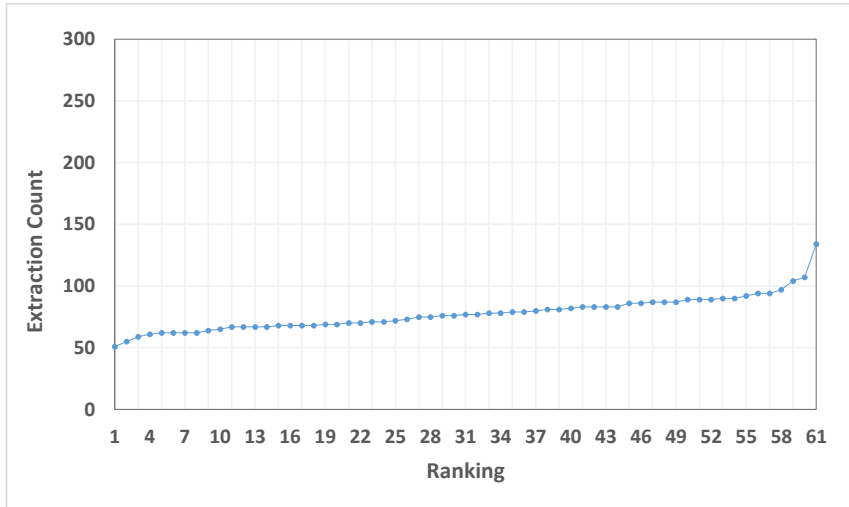
Figure F.16 BChD 4 2016 (n=62) Extraction Count at fourth feedback
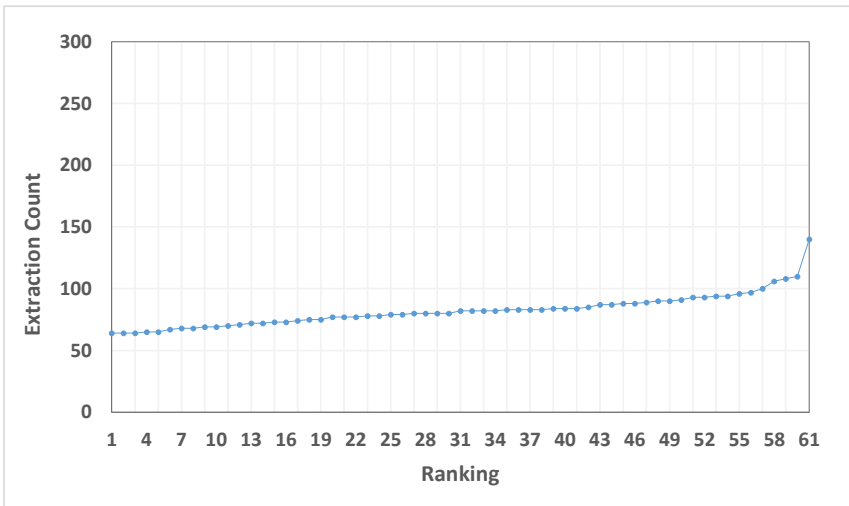
Figure F.17 BChD 4 2016 (n=62) Extraction Count at final feedback
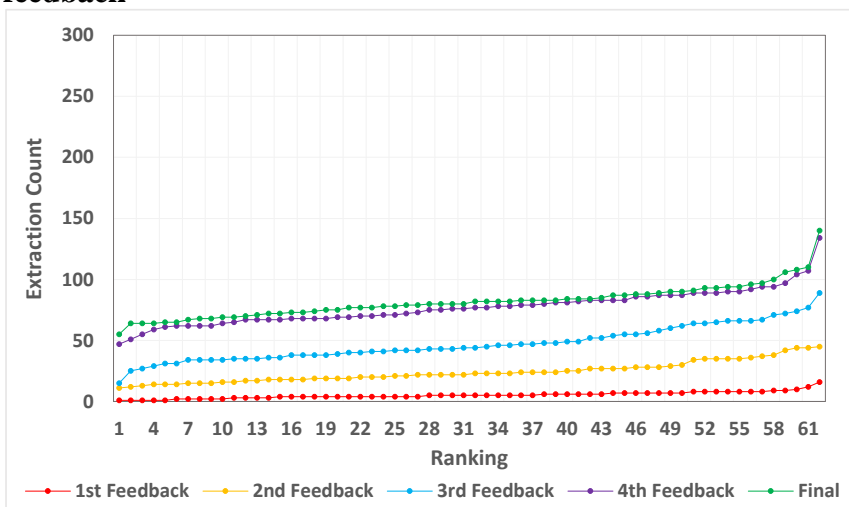
Figure F.18 BChD 4 2016 (n=62) Extraction Count comparison of feedback episodes
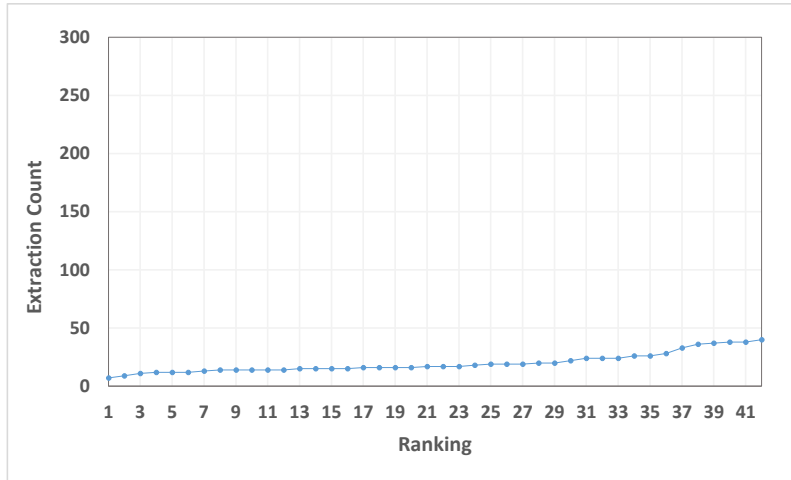
Extraction Count Results
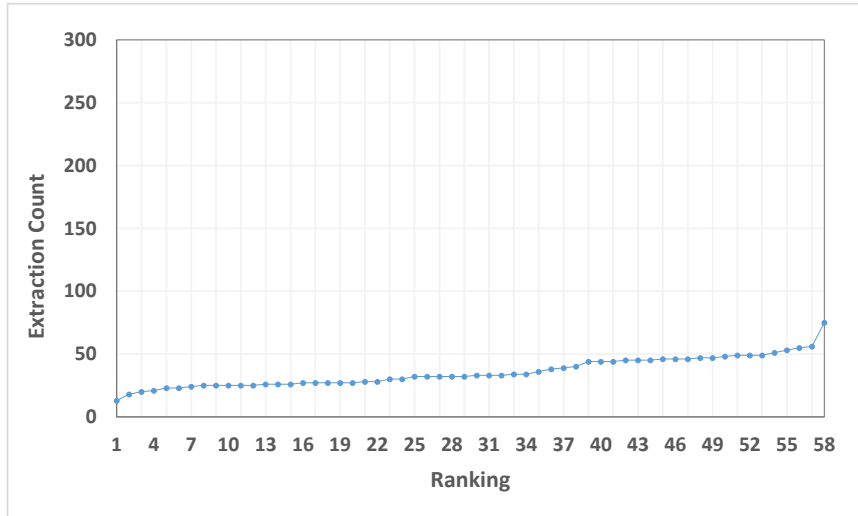
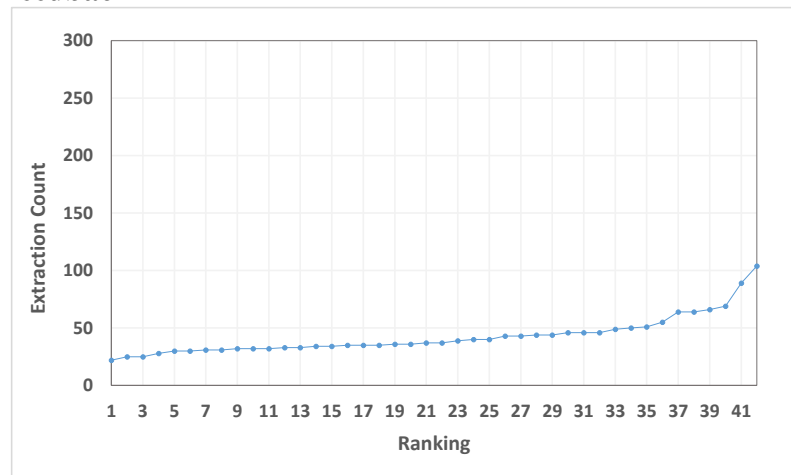**Figure F.19 BChD 5 2014 (n=58) Extraction Count at first feedback**
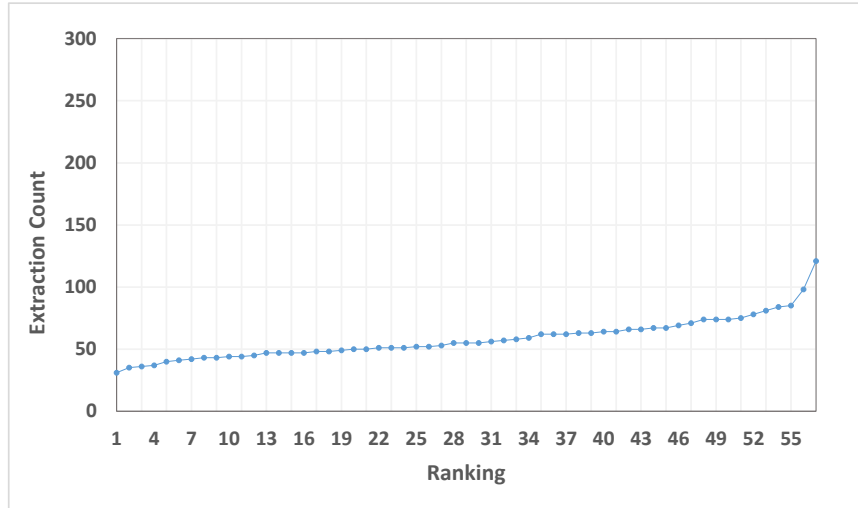
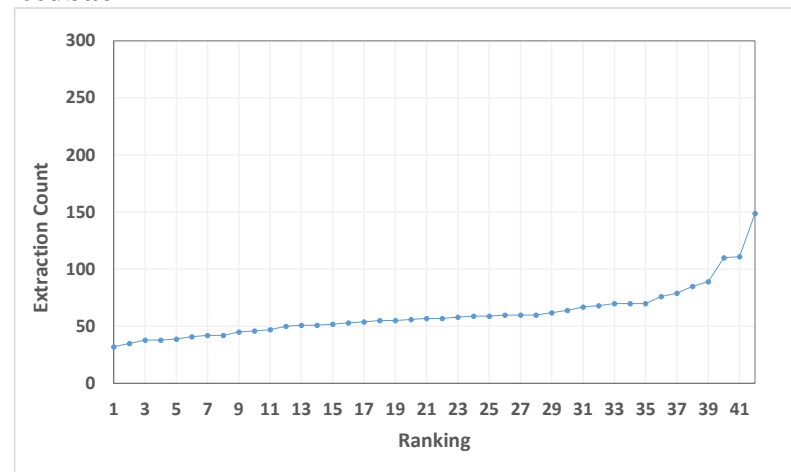**Figure F.20 BChD 5 2014 (n=58) Extraction Count at second feedback**
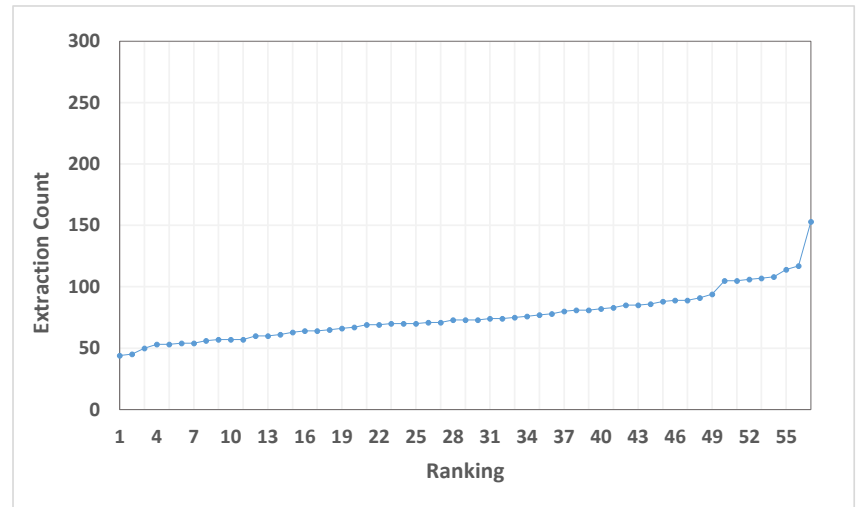
Figure F.21 BChD 5 2014 (n=58) Extraction Count at third feedback

Extraction Count Results
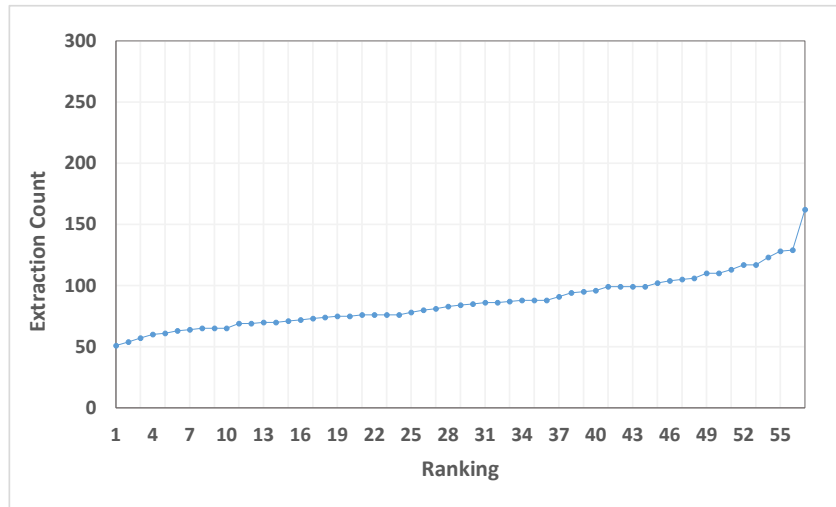
Figure F.22 BChD 5 2014 (n=58) Extraction Count at fourth feedback
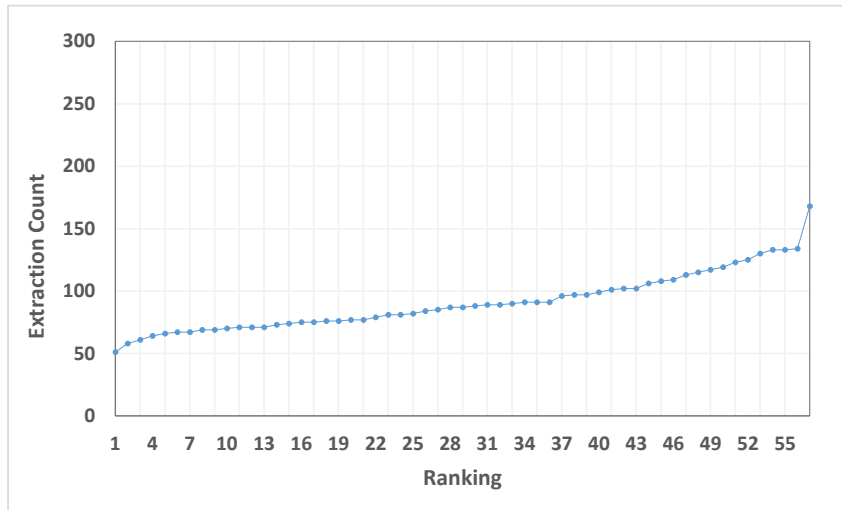
Figure F.23.BChD 5 2014 (n=58) Extraction Count at final feedback
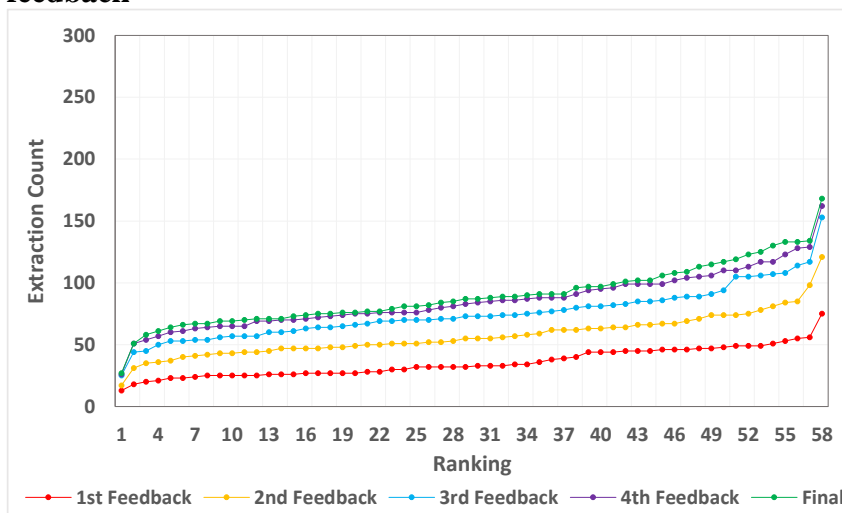
Figure F.24 BChD 5 2014 (n=58) Extraction Count comparison of feedback episodes

Extraction Count Results
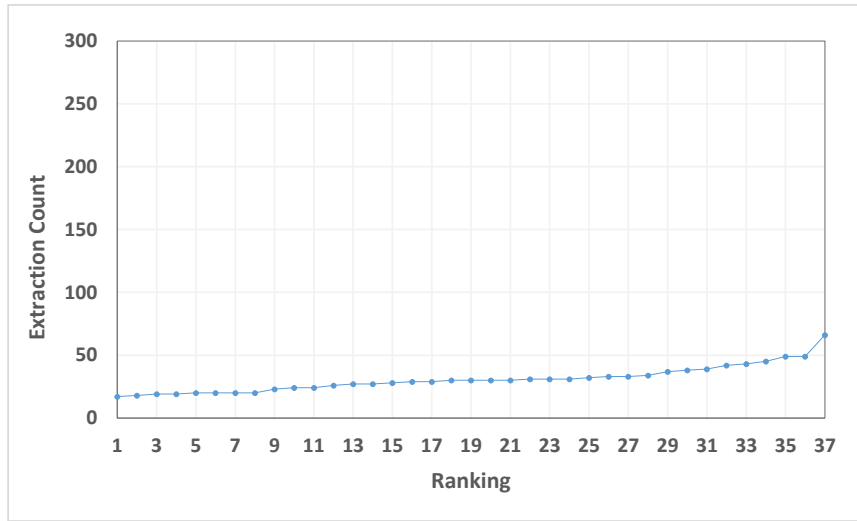
Figure F.25 BChD 5 2015 (n=37) Extraction Count at first feedback
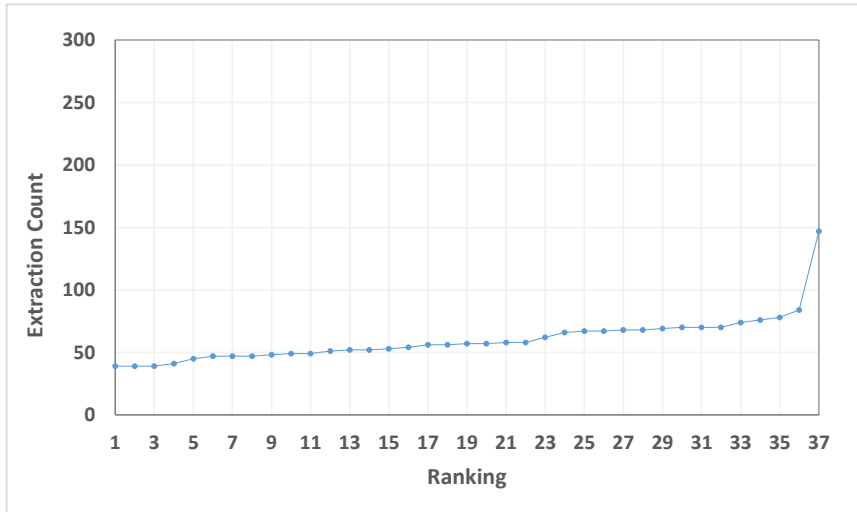
Figure F.26 BChD 5 2015 (n=37) Extraction Count at second feedback
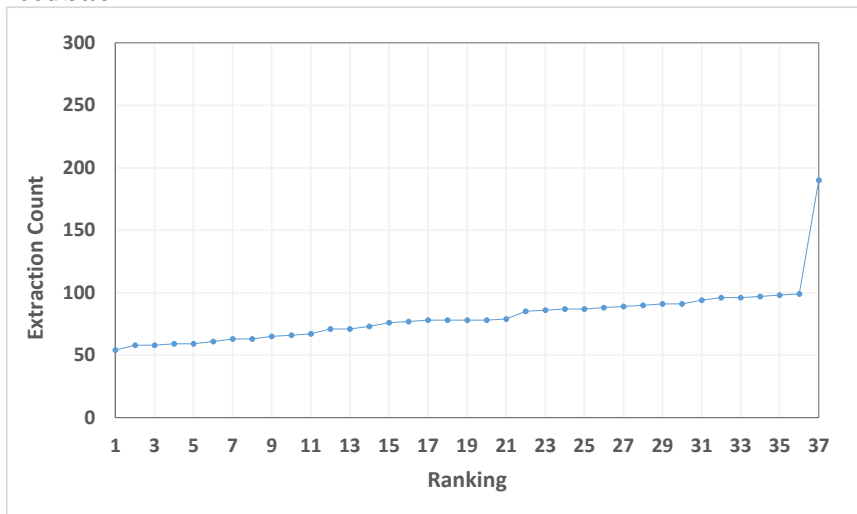
Figure F.27 BChD 5 2015 (n=37) Extraction Count at third feedback
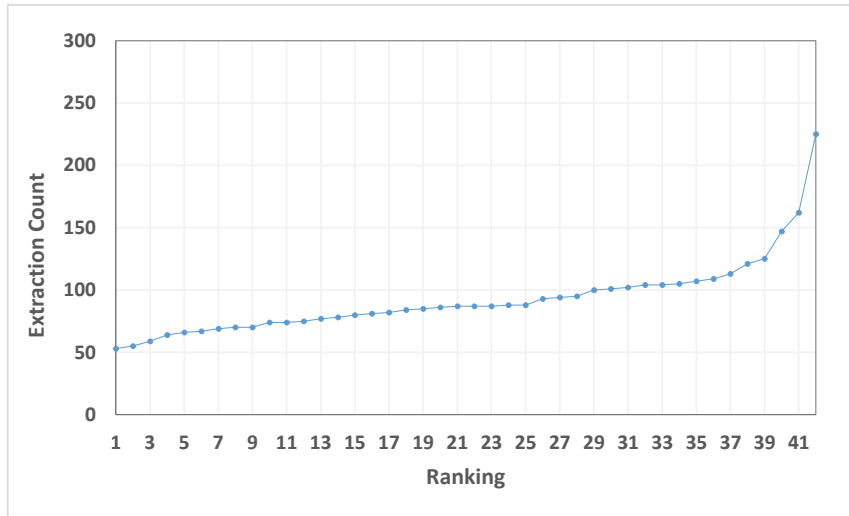
Extraction Count Results
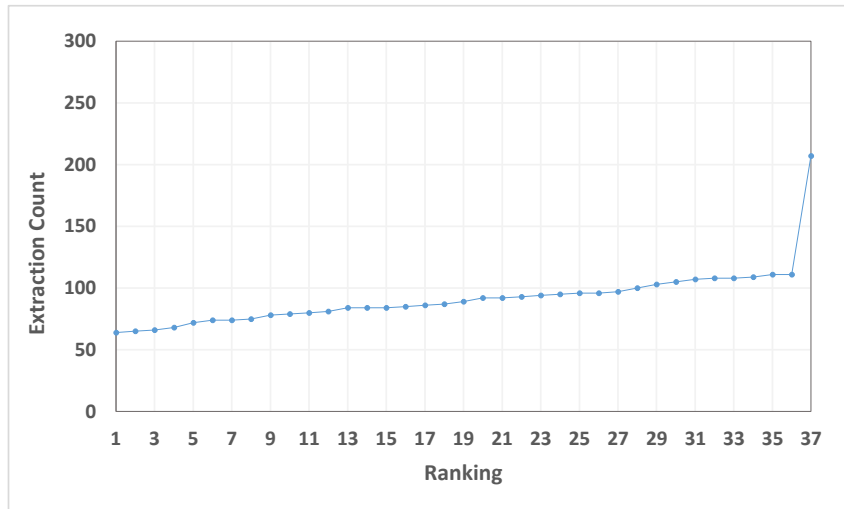
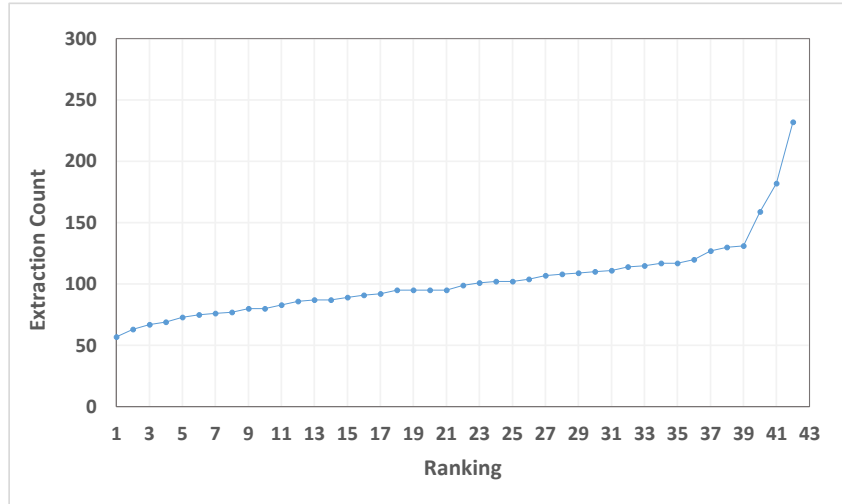**Figure F.28 BChD 5 2015 (n=37) Extraction Count at fourth feedback**
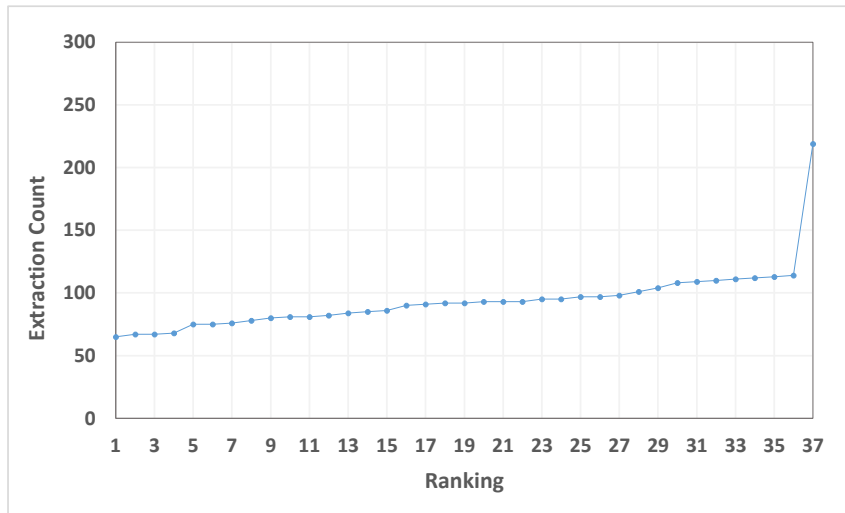
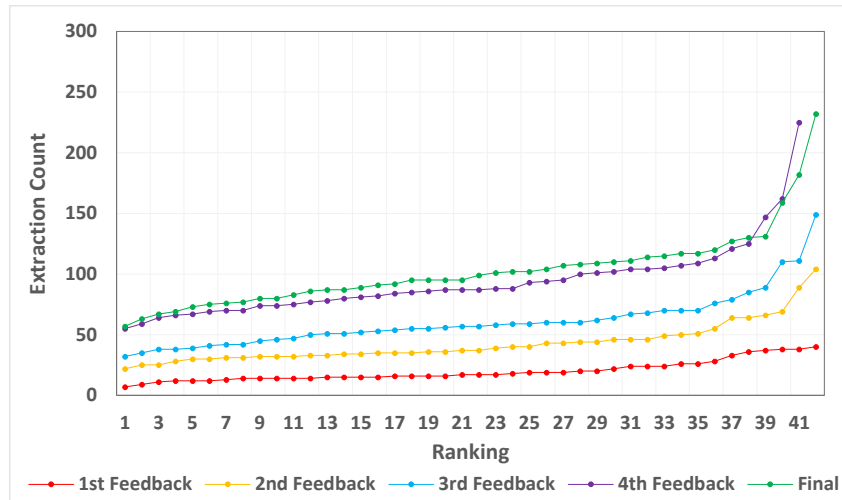**Figure F.29 BChD 5 2015 (n=37) Extraction Count at final feedback**
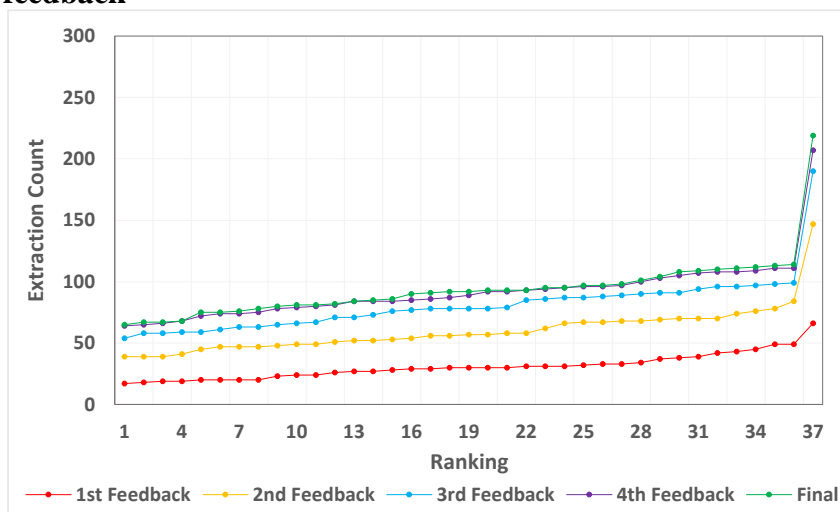
Figure F.30 BChD 5 2015 (n=37) Extraction Count comparison of feedback episodes

Extraction Count Results
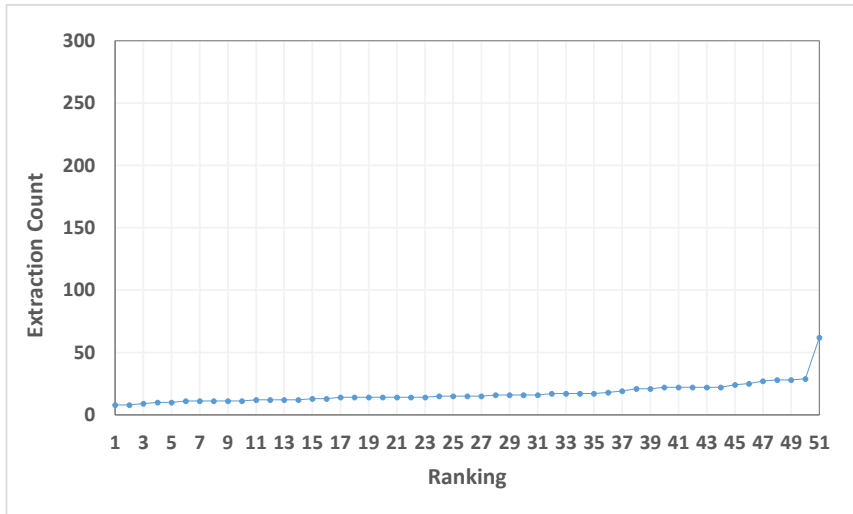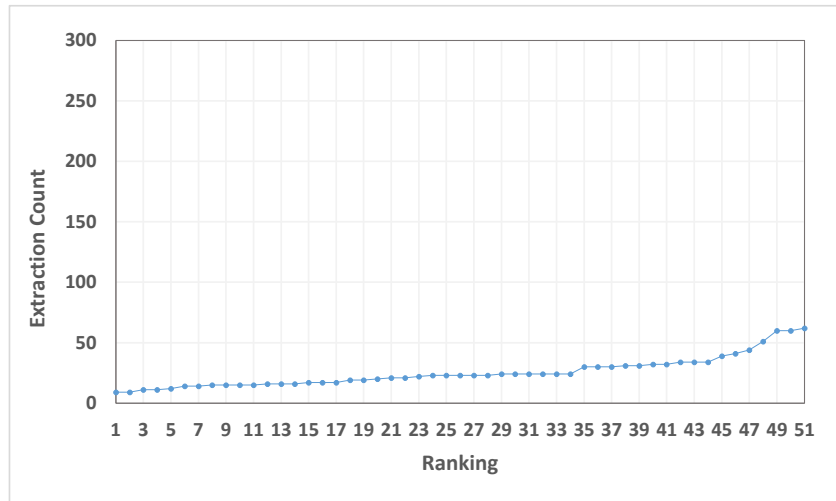

Figure F.31 BChD 5 2016 (n=51) Extraction Count at first feedback
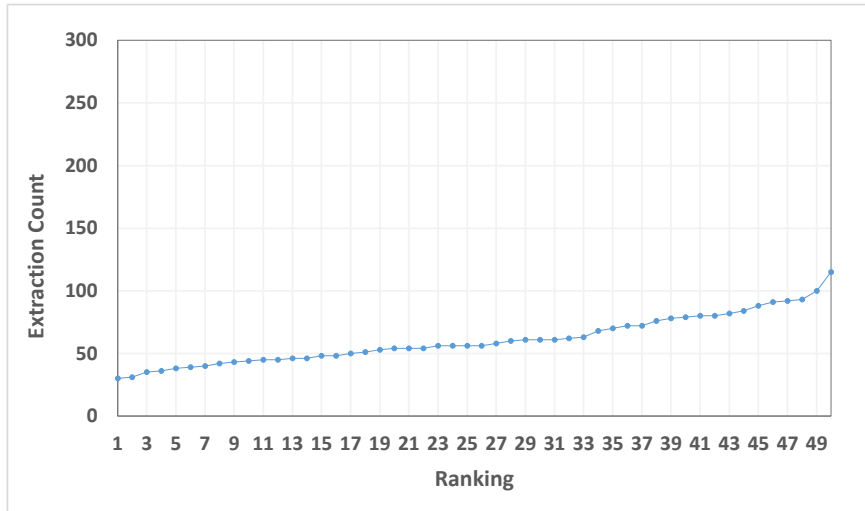
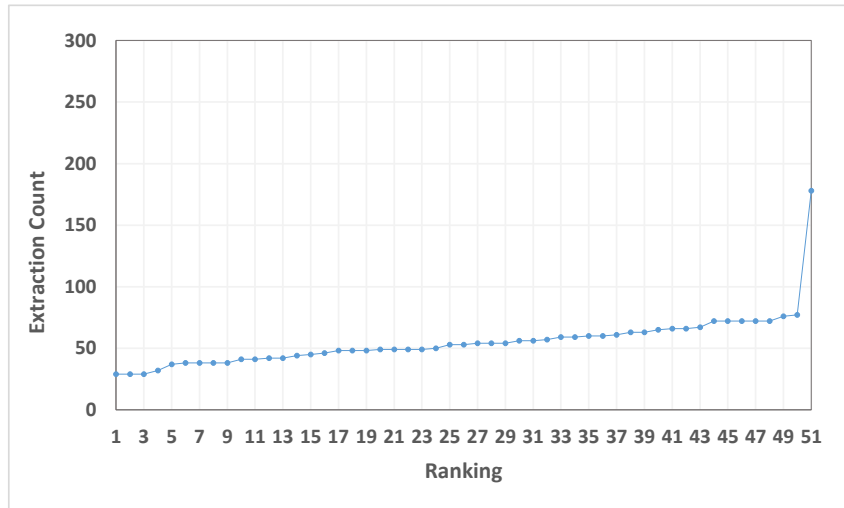**Figure F.32 BChD 5 2016 (n=51) Extraction Count at second feedback**
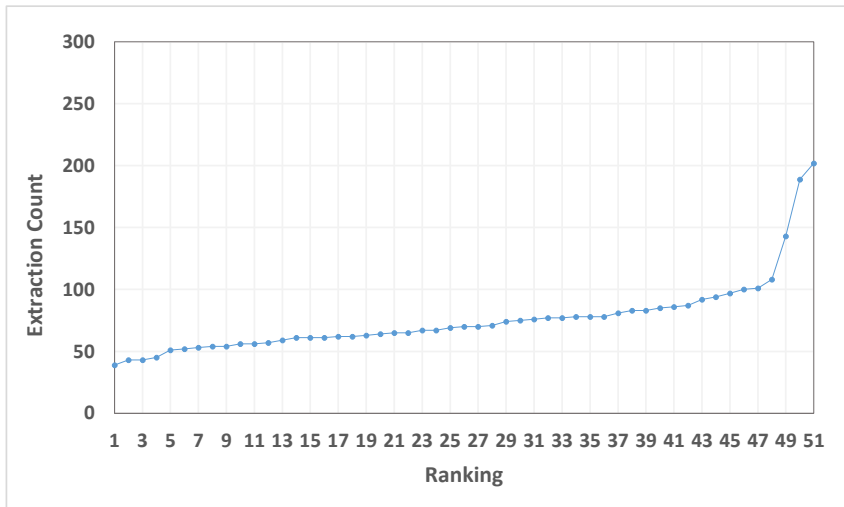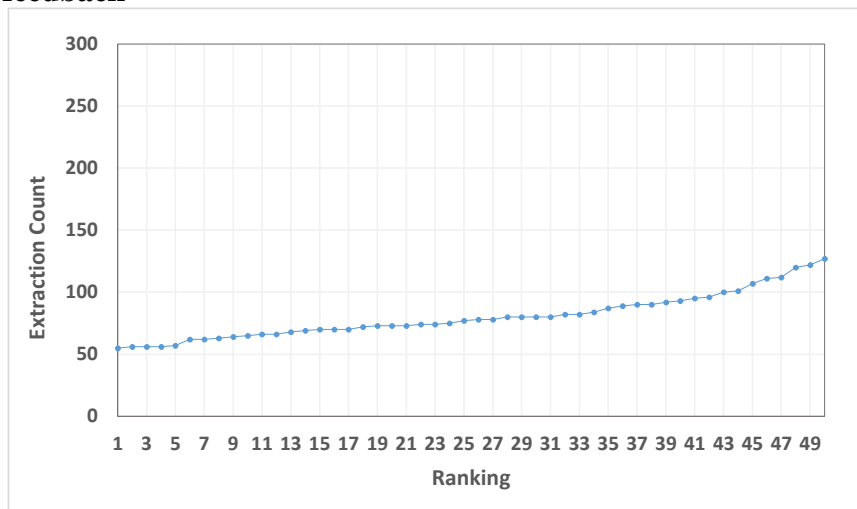

Figure F.33 BChD 5 2016 (n=51) Extraction Count at third feedback

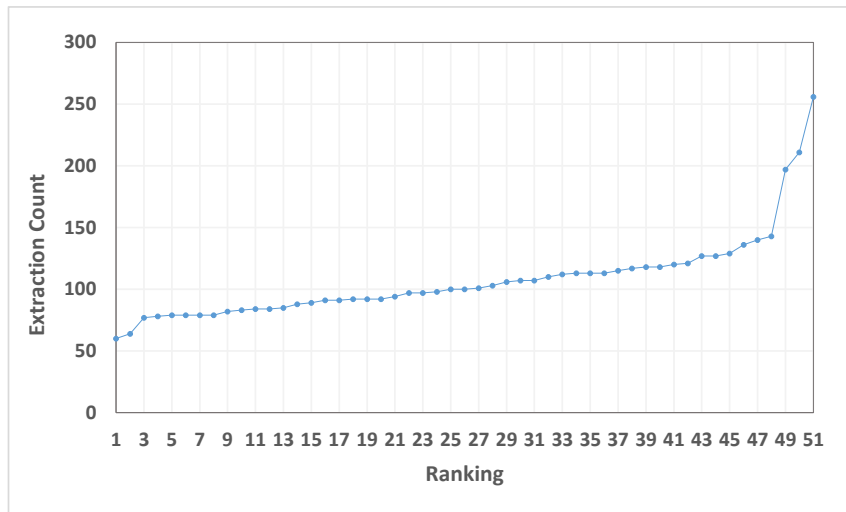# Extraction Count Results
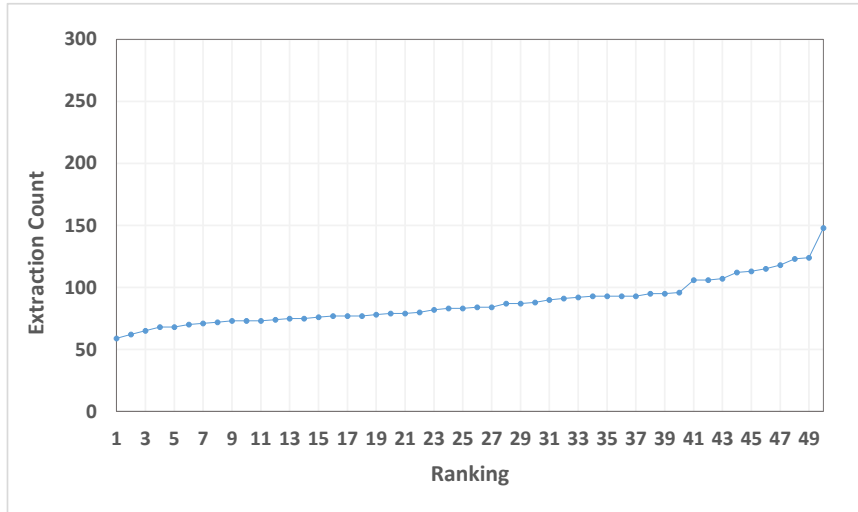
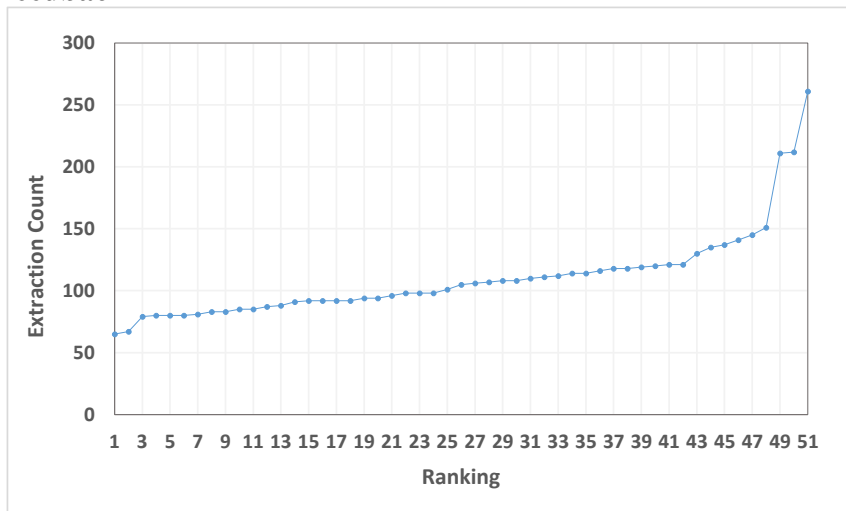**Figure F.34 BChD 5 2016 (n=51) Extraction Count at fourth feedback**
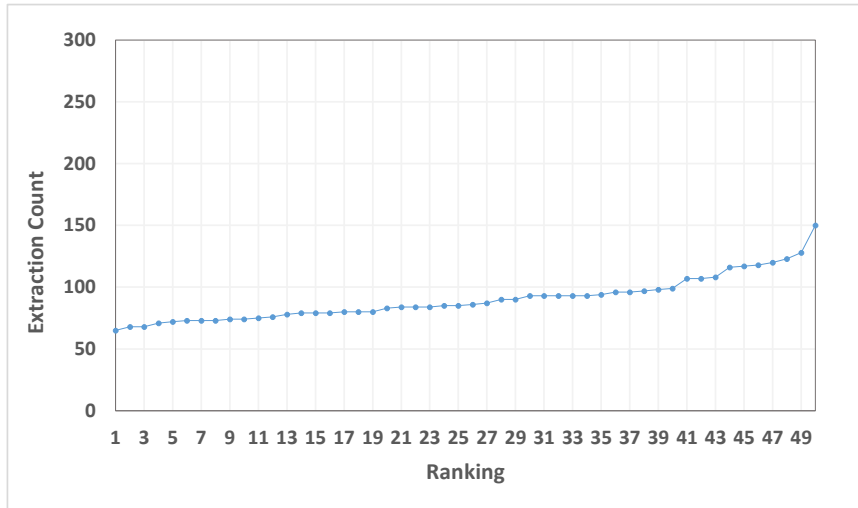
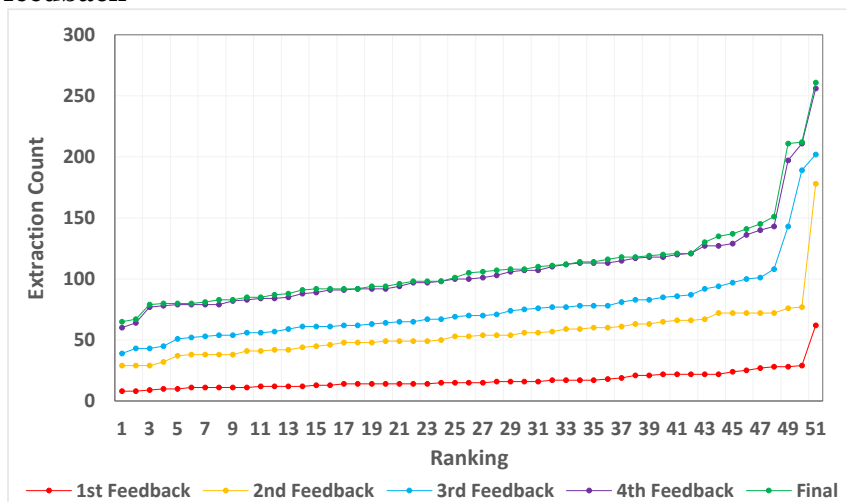**Figure F.35 BChD 5 2016 (n=51) Extraction Count at final feedback**

Figure F.36 BChD 5 2016 (n=51) Extraction Count comparison of feedback episodes

Appendix F
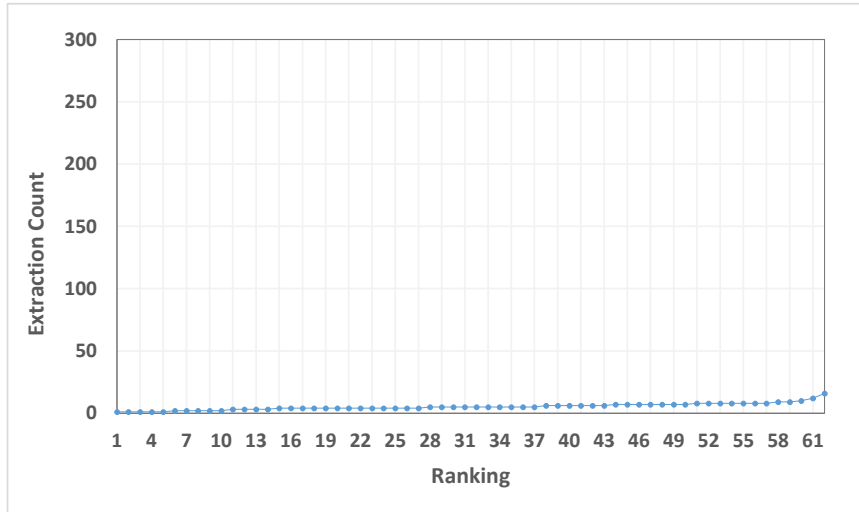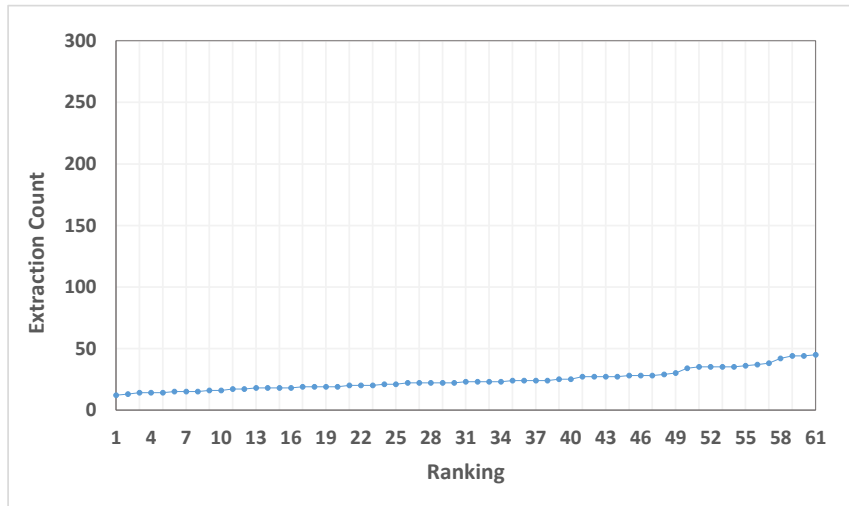## Extraction Count Results
Table F.1 BChD 4 2014 Individual Extraction Counts (n=42)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1279	40	104	149	225	232
1123	33	55	110	162	182
1091	38	89	111	147	159
1039	24	44	70	102	131
1021	36	69	89	125	130
1009	19	64	85	121	127
1181	20	66	79	109	120
1201	16	31	60	101	117
1289	15	46	58	113	117
1283	16	44	64	105	115
1109	37	50	68	104	114
1291	22	46	60	107	111
1259	14	39	59	95	110
1163	28	49	70	104	109
1187	16	30	70	100	108
1097	38	64	76	93	107
1213	26	43	59	94	104
1217	15	51	60	88	102
1223	18	36	50	74	102
1049	24	37	54	80	101
1019	16	43	62	88	99
1063	19	36	67	87	95
1117	15	34	46	87	95
1171	17	35	41	77	95
1249	12	40	56	85	95
1033	12	33	45	87	92
1018	17	46	57	86	91
1031	14	32	51	82	89
1051	14	30	52	81	87
1237	15	35	57	84	87
1193	14	40	55	78	86
1277	20	35	53	74	83
1151	19	33	38	66	80
1229	14	28	55	75	80
1087	13	32	51	70	77
1103	12	25	39	67	76
1153	24	32	42	70	75
1069	9	31	38	69	73
1093	7	22	35	55	69
1061	26	34	47	64	67
1231	17	37	42	59	63
1129	11	25	32	53	57
Mean	19.81	42.74	61.00	92.69	102.60
Standard Deviation	8.47	16.60	22.31	30.74	31.81

Figure F.37 BChD 4 2014 Mean Extraction Counts per Feedback Episode

Appendix F
Extraction Count Results

Table F.2 BChD 4 2015 Individual Extraction Counts (n=51)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1993	62	178	202	256	261
2011	10	54	189	211	212
1789	27	76	143	197	211
1867	21	67	108	143	151
1913	13	63	78	129	145
1879	14	61	97	140	141
1723	29	72	83	136	137
1907	16	72	101	127	135
1741	16	77	100	127	130
1997	22	60	69	118	121
2017	22	56	77	121	121
1811	21	72	86	120	120
1931	17	48	78	117	119
1187	28	66	92	118	118
2053	18	72	94	113	118
1871	12	72	87	115	116
1823	15	54	77	113	114
1973	12	49	67	113	114
2063	13	59	67	112	112
2029	22	65	76	110	111
2083	11	38	65	100	110
1847	22	60	83	107	108
2081	28	66	85	107	108
1873	17	49	59	106	107
1753	16	48	81	103	106
2039	25	49	78	100	105
1889	14	44	61	101	101
1831	14	57	71	97	98
1093	19	41	57	98	98
1933	12	56	70	97	98
1777	15	32	43	92	96
1787	22	53	64	94	94
1861	12	63	74	89	94
1733	14	45	54	92	92
1747	14	49	61	91	92
1783	15	48	62	91	92
2003	24	59	75	92	92
1999	17	38	62	88	91
2069	11	42	53	84	88
1901	8	54	63	82	87
1759	10	38	51	84	85
1877	14	41	56	85	85
1949	14	53	61	83	83
1231	15	38	52	79	83
1129	8	29	43	79	81
1151	11	37	54	77	80
1979	11	42	65	79	80
2027	16	46	56	78	80
1987	17	50	70	79	79
1801	9	29	39	60	67
1951	11	29	45	64	65
Mean	17.18	55.22	76.16	107.73	110.43
Standard Deviation	8.37	21.74	30.79	34.83	35.97

Figure F.38 BChD 4 2015 Mean Extraction Counts per Feedback Episode

Extraction Count Results

Table F.3 BChD 4 2016 Individual Extraction Counts(n=62)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
2549	7	36	89	134	140
2143	3	38	65	107	110
2141	5	20	77	104	108
2309	7	42	66	97	106
2531	2	17	48	86	100
2339	6	18	74	94	97
2399	12	23	41	94	96
2099	5	28	66	89	94
2273	9	27	49	87	94
2383	4	30	71	92	93
2459	2	18	64	90	93
2089	8	44	66	90	91
2129	16	45	58	77	90
2543	2	15	64	89	90
2441	4	22	43	89	89
2137	4	14	38	87	88
2467	7	29	72	87	88
2179	6	17	67	86	87
2269	6	28	56	82	87
2423	8	35	46	83	85
2251	3	20	42	83	84
2381	3	27	52	77	84
2437	7	25	47	83	84
2131	7	21	54	79	83
2153	7	27	42	83	83
2243	10	35	46	81	83
2341	4	20	35	67	83
2087	8	35	49	72	82
2161	5	24	34	78	82
2411	4	22	40	81	82
2521	5	19	38	62	82
2237	6	37	52	78	80
2267	8	25	34	80	80
2539	5	44	55	68	80
2579	8	35	62	76	80
2297	7	15	34	59	79
2351	1	23	42	79	79
2113	8	19	31	76	78
2357	9	34	43	71	78
2371	2	22	48	75	77
2477	5	14	35	68	77
2557	1	18	25	75	77
2333	2	27	55	71	75
2417	8	19	34	73	75
2287	4	24	44	67	74
2221	4	16	60	69	73
2281	4	21	36	70	73
2239	4	22	44	70	72
2447	4	16	43	68	72
2311	6	12	15	55	71
2473	3	28	45	68	70
2293	1	23	38	67	69
2347	1	23	41	69	69
2393	6	24	38	67	68
2503	5	24	40	65	68
2111	4	18	47	62	67
2213	5	19	31	61	65
2389	5	13	36	62	65
2203	5	22	39	62	64
2207	4	15	29	64	64
2551	4	14	35	51	64
2377	1	11	27	47	55
Mean	5.26	24.16	47.37	77.15	81.87
Standard Deviation	2.79	8.44	14.37	14.29	13.58

Figure F.39 BChD 4 2016 Mean Extraction Counts-per Feedback Episode

Appendix F
Extraction Count Results

Table F.4 BChD 5 2014 Individual Extraction Counts (n=58)

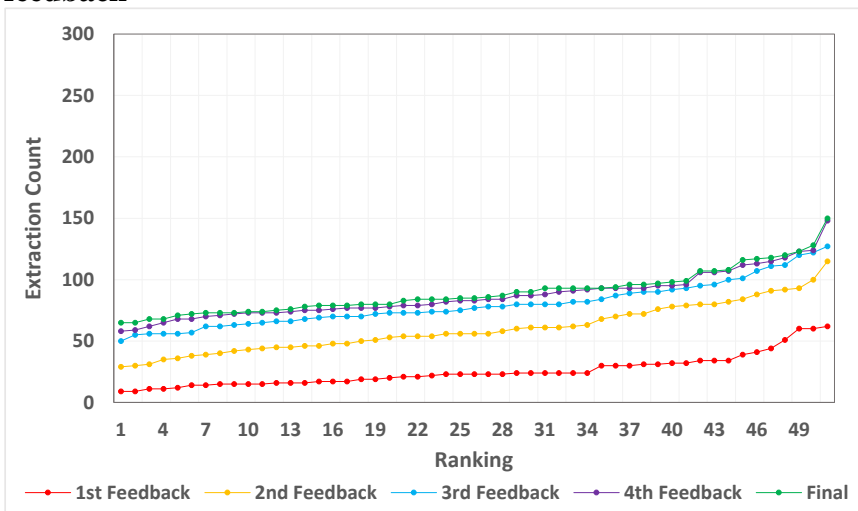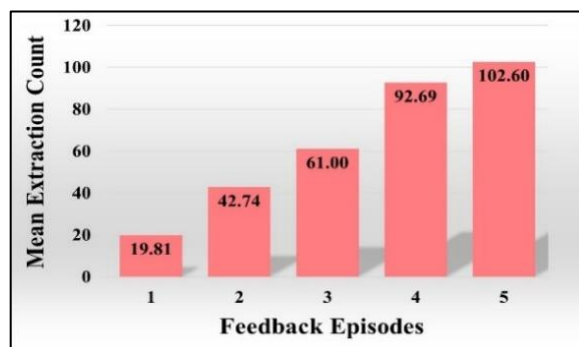| Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1319	56	121	153	162	168
1301	53	78	106	117	134
1367	44	75	114	128	133
1427	32	51	81	106	133
1459	48	85	105	129	130
1531	55	81	105	117	125
1579	75	98	117	123	123
1621	51	84	94	110	119
1327	34	66	108	110	117
1583	47	67	107	113	115
1567	46	64	71	99	113
1471	33	71	88	105	109
1489	45	59	86	104	108
1481	44	74	91	102	106
1297	46	74	85	99	102
1543	49	67	89	99	102
1453	23	52	85	99	101
1429	44	74	89	96	99
1433	26	43	54	76	97
1669	49	63	82	95	97
1637	49	62	80	94	96
1409	33	51	83	86	91
1483	45	63	74	85	91
1699	25	50	73	91	91
1597	28	62	77	88	90
1559	27	42	78	88	89
1571	25	62	81	88	89
1373	45	64	75	86	88
1447	39	56	73	80	87
1523	24	69	76	87	87
1303	34	45	73	84	85
1607	47	58	70	83	84
1439	26	35	74	81	82
1613	32	49	69	78	81
1697	27	51	71	76	81
1601	32	52	67	76	79
1487	36	55	65	76	77
1667	26	47	64	73	77
1549	32	44	69	75	76
1657	30	55	70	74	76
1361	38	53	66	75	75
1381	21	44	60	71	75
1619	28	48	57	65	74
1693	33	48	60	72	73
1493	46	66	70	70	71
1511	25	47	61	69	71
1721	40	57	64	70	71
1307	30	47	56	61	70
1321	20	37	50	65	69
1423	27	55	63	69	69
1399	23	36	54	63	67
1451	27	47	57	64	67
1499	27	43	57	65	66
1663	32	50	53	57	64
1627	25	41	53	60	61
1609	18	31	45	54	58
1553	25	40	44	51	51
1709	13	17	25	26	27
Mean	35.52	57.34	75.29	85.60	89.78
Standard Deviation	11.76	17.06	21.19	22.86	24.46
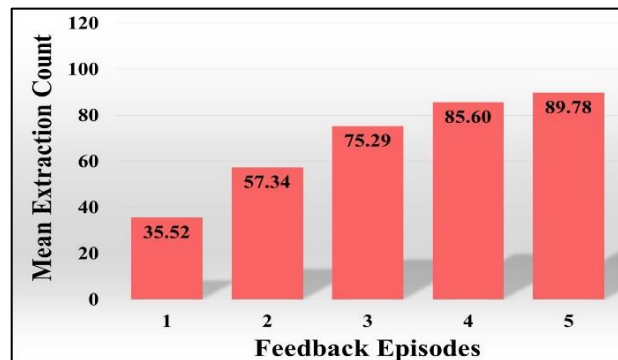
Figure F.40 BChD 5 2014 Mean Extraction Counts per Feedback Episode

Extraction Count Results

Table F.5 BChD 5 2015 Individual Extraction Counts (n=37)

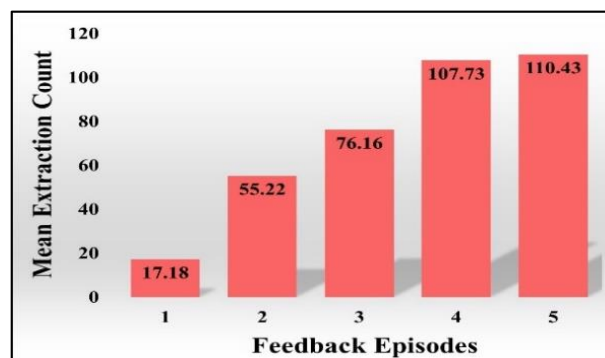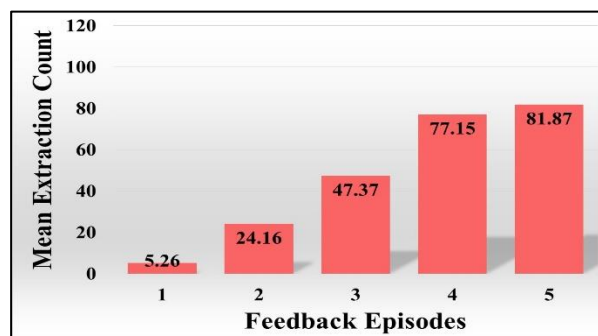| Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1279	66	147	190	207	219
1091	39	68	89	111	114
1283	34	78	94	111	113
1117	32	76	99	108	112
1123	45	67	96	107	111
1249	17	56	97	109	110
1181	49	84	98	108	109
1213	31	53	96	105	108
1019	20	68	90	103	104
1217	31	69	91	100	101
1097	30	48	65	96	98
1039	33	70	87	96	97
1259	19	57	86	97	97
1061	24	66	91	94	95
1171	33	70	88	95	95
1051	30	56	76	87	93
1087	37	58	85	93	93
1193	20	41	87	92	93
1009	28	57	78	92	92
1237	26	62	77	89	92
1018	42	70	79	86	91
1291	27	51	71	84	90
1229	18	47	73	85	86
1069	20	52	78	84	85
1201	49	74	78	84	84
1289	38	58	71	80	82
1049	30	54	66	78	81
1063	43	67	78	81	81
1109	27	52	67	79	80
1153	29	39	58	74	78
1103	19	39	61	75	76
1031	20	49	63	74	75
1163	30	47	63	72	75
1223	24	47	59	68	68
1021	31	49	59	65	67
1033	29	45	58	66	67
1277	23	39	54	64	65
Mean	30.89	60.27	80.97	91.86	93.97
Standard Deviation	10.38	18.80	22.79	23.83	25.33
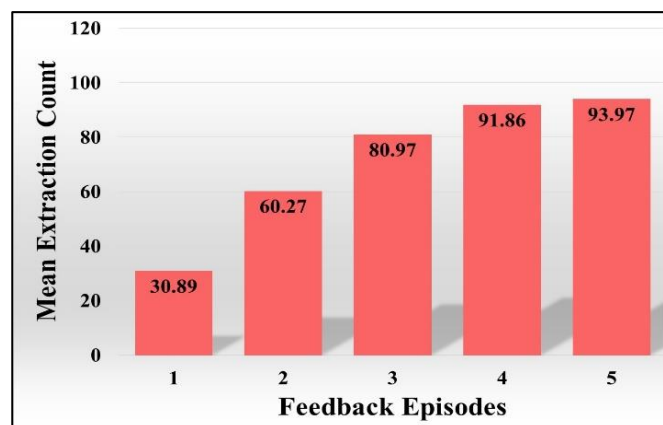
Figure F.41 BChD 5 2015 Mean Extraction Counts-per Feedback Episode

Extraction Count Results

Table F.6 BChD 5 2016 Individual Extraction Counts-(n=51)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1993	51	93	127	148	150
1913	44	92	120	124	128
2011	32	115	122	123	123
1847	20	58	107	118	120
1777	30	100	111	113	118
1999	60	91	112	115	117
1789	32	78	96	112	116
1877	16	72	92	106	108
1879	24	80	101	107	107
1907	30	80	100	106	107
1933	15	70	87	93	99
1723	60	84	89	95	98
1931	41	79	90	95	97
1733	24	54	80	92	96
2029	34	82	95	96	96
2027	12	68	82	93	94
1187	15	72	80	91	93
1951	62	88	93	93	93
1997	23	46	84	90	93
1231	17	60	78	87	93
2017	30	76	90	93	93
1973	31	53	73	87	90
2003	16	31	78	88	90
1753	23	48	82	84	87
1949	24	63	80	83	86
1783	22	50	80	83	85
2069	34	61	77	82	85
1867	23	51	66	73	84
1873	39	61	75	80	84
2053	24	43	74	84	84
1823	21	56	72	79	83
1741	24	46	69	77	80
1787	15	39	73	76	80
1871	9	54	65	73	80
1747	24	45	73	77	79
1811	11	36	56	79	79
2063	15	62	74	78	79
2081	23	40	64	77	78
1801	34	61	70	75	76
1901	14	42	68	75	75
1831	23	45	70	74	74
1889	14	35	56	58	74
1759	19	30	62	73	73
1979	17	56	70	71	73
2083	16	44	55	72	73
1861	21	54	66	70	72
2039	17	56	62	68	71
1093	31	48	57	65	68
1129	19	56	63	68	68
1151	11	29	50	62	65
1987	9	38	56	59	65
Mean	25.39	60.22	79.84	87.06	89.78
Standard Deviation	12.73	19.69	18.31	18.43	17.99
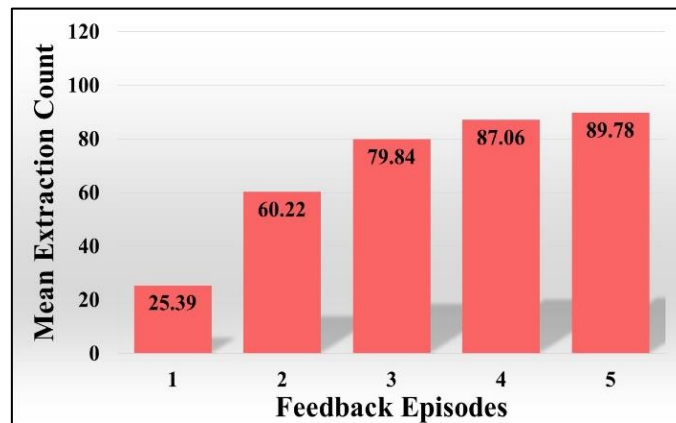
Figure F.42 BChD 5 2016 Mean Extraction Counts per Feedback Episode

Appendix G
Number of Sessions per Student

Appendix G: Number of Sessions per Student

Table G.1 Two-hour sessions worked by BChD 4 cohorts 2014-2016

BChD 4 2014 (n=42)		BChD 4 2015 (n=51)		BChD 4 2016 (n=62)	
Student ID No.	Number of Sessions worked	Student ID No.	Number of Sessions worked	Student ID No.	Number of Sessions worked
1093	26	1093	39	2129	25
1129	29	1951	39	2311	25
1153	40	1987	43	2267	26
1061	41	1151	44	2539	27
1063	42	1801	45	2113	33
1069	43	2083	45	2557	33
1051	44	1787	46	2477	34
1151	44	1901	46	2111	35
1223	44	1231	46	2297	35
1018	45	2027	46	2309	35
1033	45	1847	47	2137	36
1231	45	1873	47	2243	36
1277	45	1723	48	2333	36
1163	46	1949	48	2381	36
1103	48	1759	49	2503	36
1117	48	1811	49	2203	37
1187	48	1877	49	2237	37
1087	49	1783	50	2281	37
1109	50	1889	50	2371	37
1181	50	2003	50	2551	37
1201	50	1747	51	2099	38
1031	51	1753	51	2239	38
1193	51	1789	51	2341	38
1237	51	1129	51	2377	38
1259	51	2063	51	2389	38
1039	52	1933	52	2473	38
1049	52	2081	52	2153	39
1171	52	1861	53	2207	39
1213	52	1871	53	2213	39
1217	52	2011	53	2221	39
1021	53	2017	53	2251	39
1229	53	2069	53	2293	39
1019	54	1831	54	2347	39
1091	55	1879	54	2351	39
1097	55	2053	54	2357	39
1283	55	1979	55	2417	39
1289	55	1733	56	2179	40
1291	55	1777	56	2393	40
1009	58	1187	56	2447	40
1249	59	1999	56	2161	41
1123	64	2029	57	2411	41
1279	68	1741	58	2441	41
		1973	58	2521	41
		1997	58	2531	41
		2039	58	2143	42
		1907	59	2087	43
		1823	60	2269	43
		1931	60	2287	43
		1867	63	2399	43
		1913	67	2089	44
		1993	75	2423	44
				2543	44
				2549	44
				2579	44
				2131	45
				2141	45
				2339	45
				2467	45
				2383	46
				2459	46
				2437	47
				2273	48
Total	**2070**		**2664**		**2417**
Mean	**49.29**		**52.24**		**38.98**

Appendix G
Number of Sessions per Student

Table G.2 Two-hour sessions worked by BChD 5 cohorts 2014-2016

BChD 5 2014 (n=58)		BChD 5 2015 (n=37)		BChD 5 2016 (n=51)	
Student ID No.	Number of Sessions worked	Student ID No.	Number of Sessions worked	Student ID No.	Number of Sessions worked
1709	23	1201	27	1093	25
1553	28	1153	30	1951	25
1361	34	1033	35	1889	31
1423	35	1109	35	1987	31
1493	35	1063	37	1801	32
1399	36	1223	37	1873	32
1549	36	1193	38	1811	33
1627	36	1061	39	2011	33
1663	36	1217	40	1723	35
1721	36	1049	41	1877	35
1307	37	1277	41	2039	35
1321	37	1289	41	2083	35
1453	37	1163	43	1787	36
1583	38	1091	44	1847	36
1613	38	1103	44	1867	36
1303	39	1009	45	1979	36
1697	39	1039	45	2003	36
1607	40	1031	46	1741	37
1609	40	1087	46	1777	37
1571	41	1283	46	1871	37
1693	41	1018	47	1151	37
1427	42	1021	47	2081	37
1439	42	1123	47	1753	38
1489	42	1237	47	2029	38
1567	42	1291	47	1901	39
1451	43	1069	48	1129	39
1459	43	1097	48	1997	39
1487	43	1259	48	2017	39
1499	43	1117	49	2069	39
1523	43	1181	49	1831	40
1531	43	1213	49	1933	40
1579	43	1249	49	1949	40
1637	43	1019	50	2053	40
1373	44	1171	50	1747	41
1381	44	1229	51	1783	41
1433	44	1051	53	1789	41
1621	44	1279	75	1231	41
1559	45			2063	41
1657	45			1931	42
1667	45			2027	42
1409	46			1759	43
1447	46			1861	43
1471	46			1879	43
1511	46			1999	43
1601	46			1733	44
1669	46			1187	45
1429	47			1907	49
1481	47			1993	50
1597	47			1823	51
1297	48			1913	51
1367	48			1973	53
1483	48				
1327	49				
1543	49				
1619	49				
1699	49				
1301	50				
1319	53				
Total	**2445**		**1654**		**1982**
Mean	**42.16**		**44.70**		**38.86**

Graphic Level of Difficulty Index Scores

Appendix H: Graphic Level of Difficulty Index Scores

Figure H.1 BChD 4 2014 (n=42) Level of Difficulty Index scores at first feedback

Figure H.2 BChD 4 2014 (n=42) Level of Difficulty Index scores at second feedback

Figure H.3 BChD 4 2014 (n=42) Level of Difficulty Index scores at third feedback

Graphic Level of Difficulty Index Scores

Figure H.4 BChD 4 2014 (n=42) Level of Difficulty Index scores at fourth feedback

Figure H.5 BChD 4 2014 (n=42) Level of Difficulty Index scores at final feedback

Figure H.6 BChD 4 2014 (n=42) Level of Difficulty Index comparison of feedback episodes

Graphic Level of Difficulty Index Scores

Figure H.7 BChD 4 2015 (n=51) Level of Difficulty Index scores at first feedback

Figure H.8 BChD 4 2015 (n=51) Level of Difficulty Index scores at second feedback

Figure H.9 BChD 4 2015 (n=51) Level of Difficulty Index scores at third feedback

Graphic Level of Difficulty Index Scores

Figure H.10 BChD 4 2015 (n=51) Level of Difficulty Index scores at fourth feedback

Figure H.11 BChD 4 2015 (n=51) Level of Difficulty Index scores at final feedback
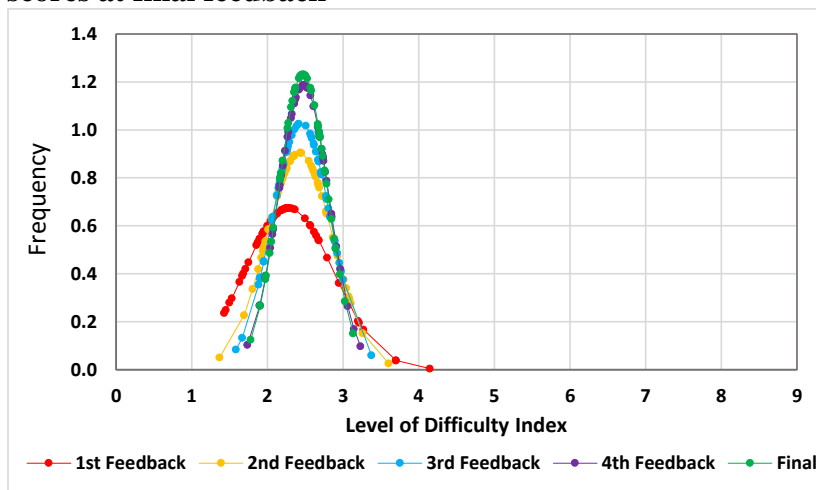
Figure H.12 BChD 4 2015 (n=51) Level of Difficulty Index comparison of feedback episodes

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Graphic Level of Difficulty Index Scores
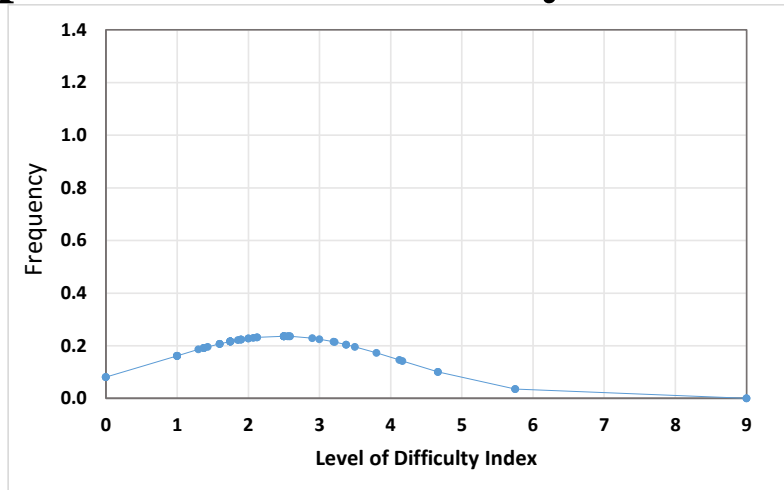
Figure H.13 BChD 4 2016 (n=62) Level of Difficulty Index scores at first feedback
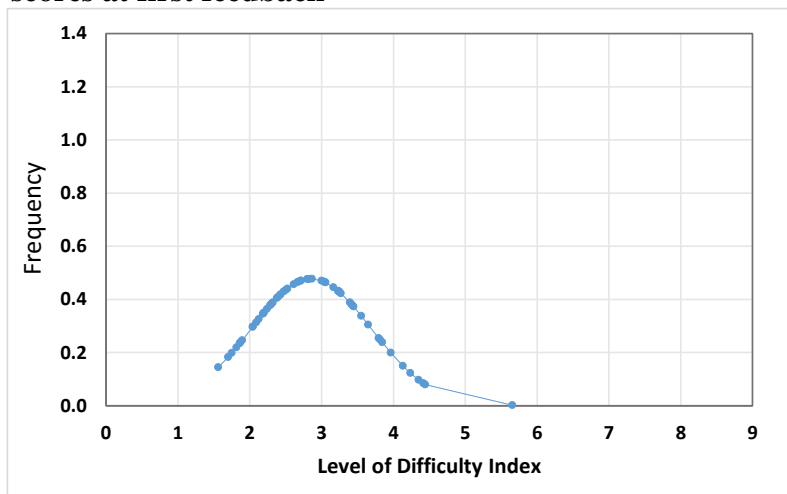
Figure H.14 BChD 4 2016 (n=62) Level of Difficulty Index scores at second feedback
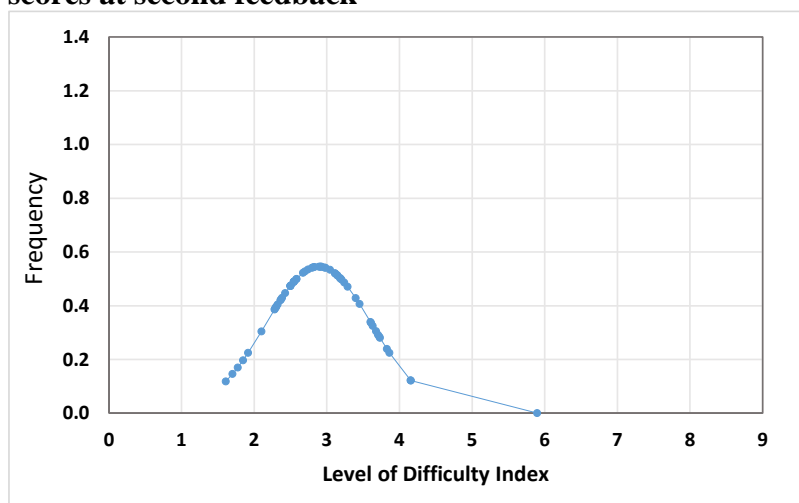
Figure H.15 BChD 4 2016 (n=62) Level of Difficulty Index scores at third feedback

Graphic Level of Difficulty Index Scores
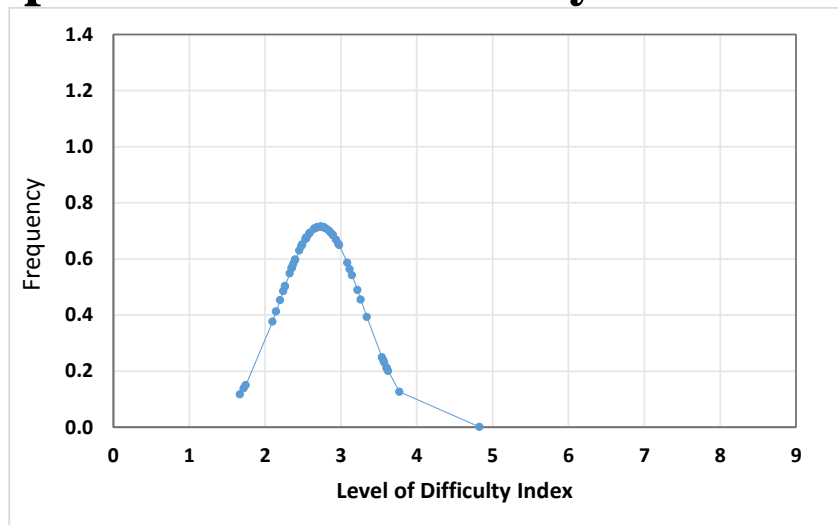
Figure H.16 BChD 4 2016 (n=62) Level of Difficulty Index scores at fourth feedback
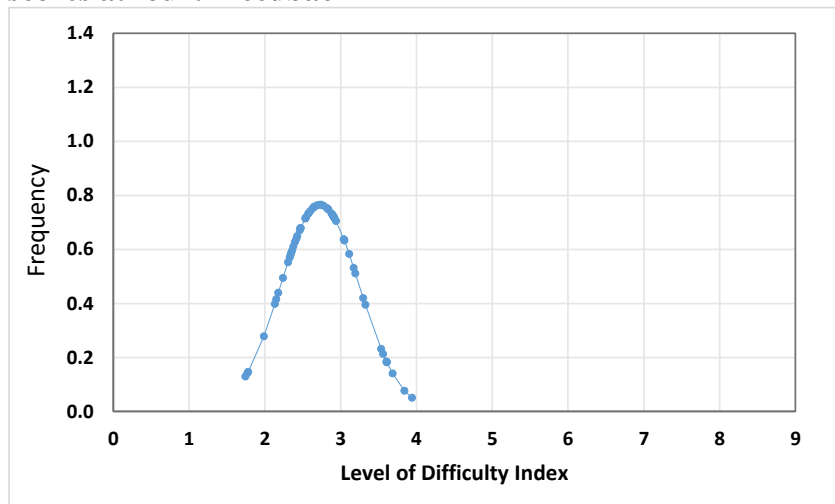
Figure H.17 BChD 4 2016 (n=62) Level of Difficulty Index scores at final feedback
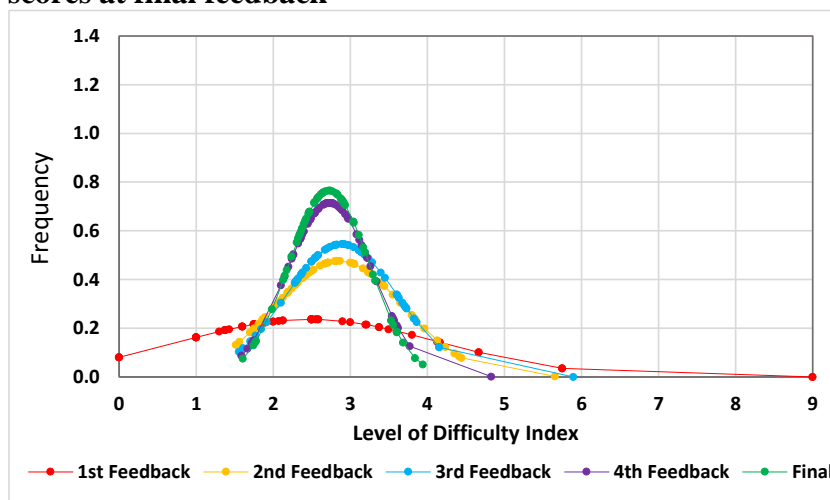
Figure H.18 BChD 4 2016 (n=62) Level of Difficulty Index comparison of feedback episodes

Graphic Level of Difficulty Index Scores
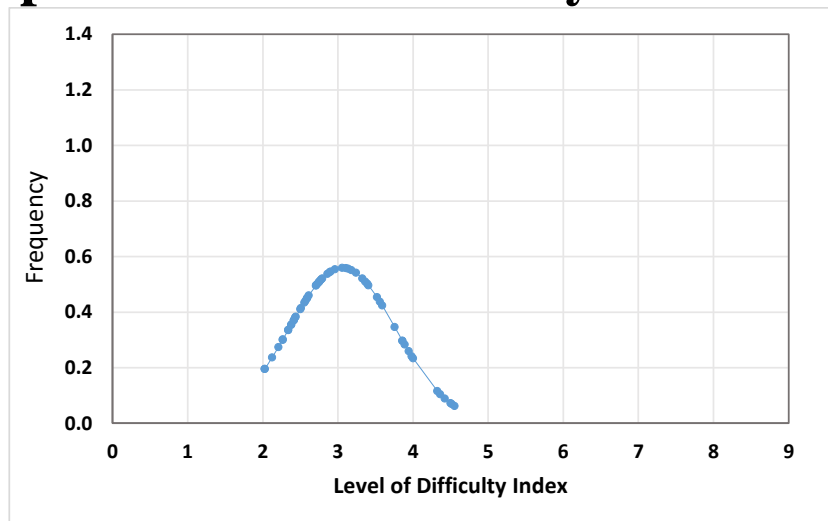
Figure H.19 BChD 5 2014 (n=58) Level of Difficulty Index scores at first feedback
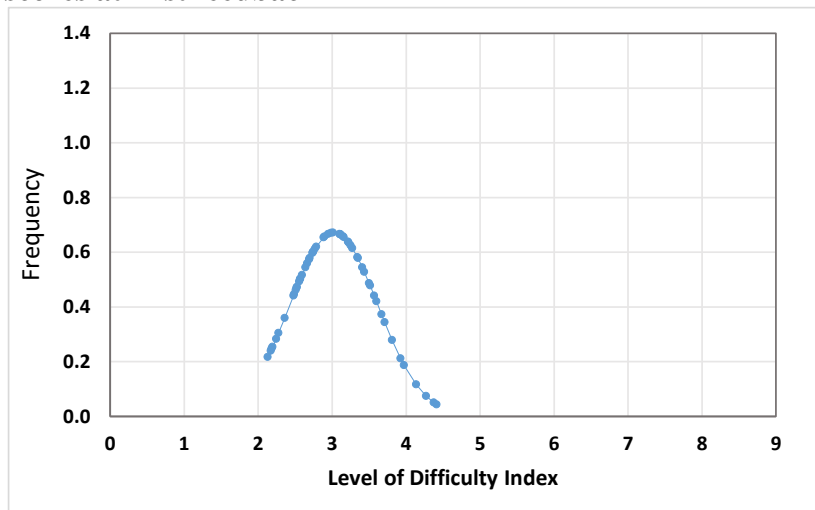
Figure H.20 BChD 5 2014 (n=58) Level of Difficulty Index scores at second feedback
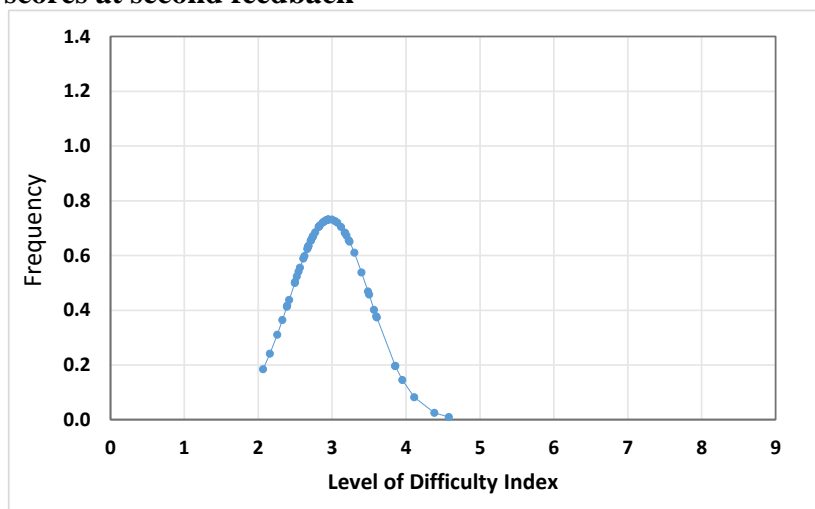
Figure H.21 BChD 5 2014 (n=58) Level of Difficulty Index scores at third feedback

Graphic Level of Difficulty Index Scores
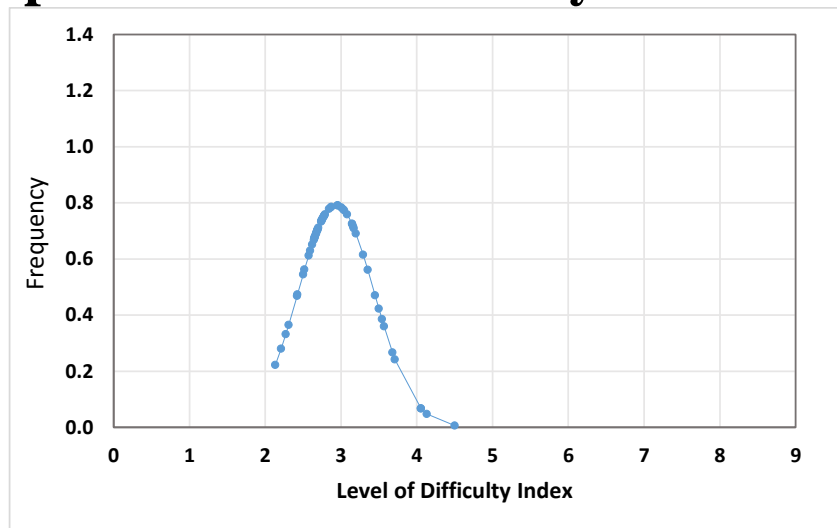
Figure H.22 BChD 5 2014 (n=58) Level of Difficulty Index scores at fourth feedback
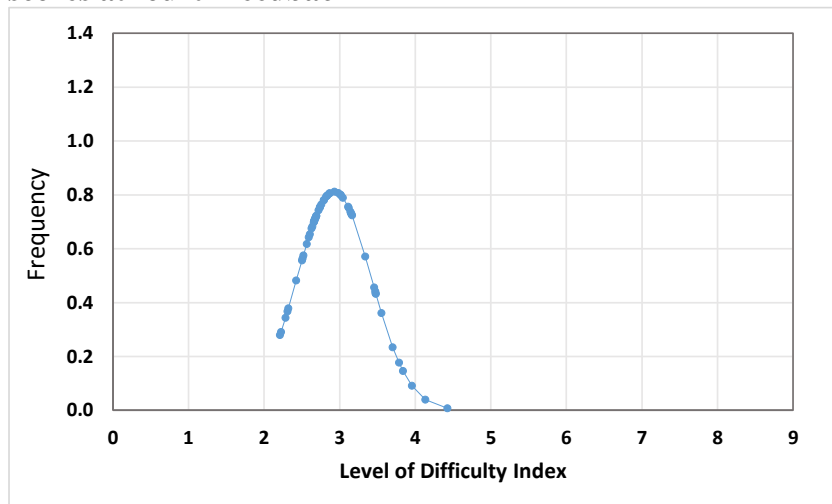
Figure H.23 BChD 5 2014 (n=58) Level of Difficulty Index scores at final feedback
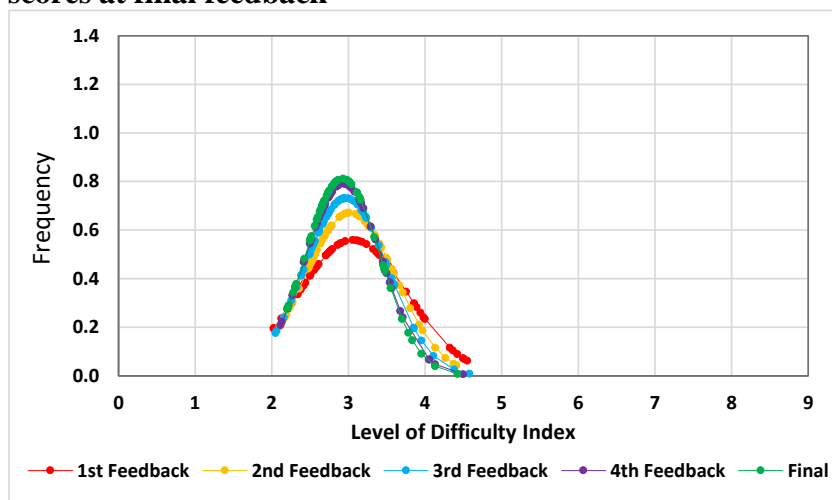
Figure H.24 BChD 5 2014 (n=58) Level of Difficulty Index comparison of feedback episodes

Graphic Level of Difficulty Index Scores
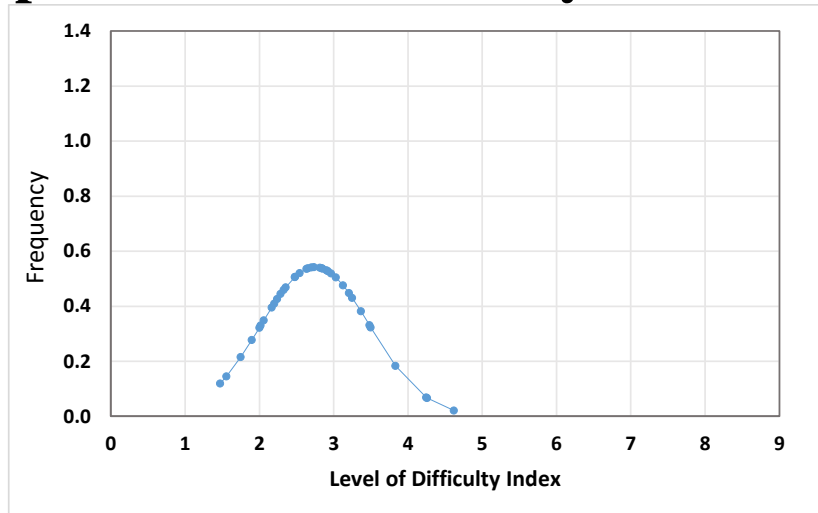
Figure H.25 BChD 5 2015 (n=37) Level of Difficulty Index scores at first feedback
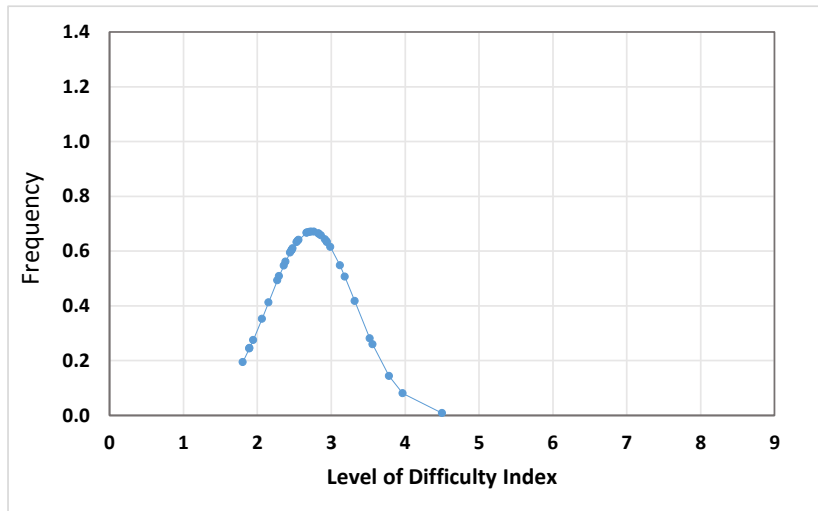
Figure H.26 BChD 5 2015 (n=37) Level of Difficulty Index scores at second feedback
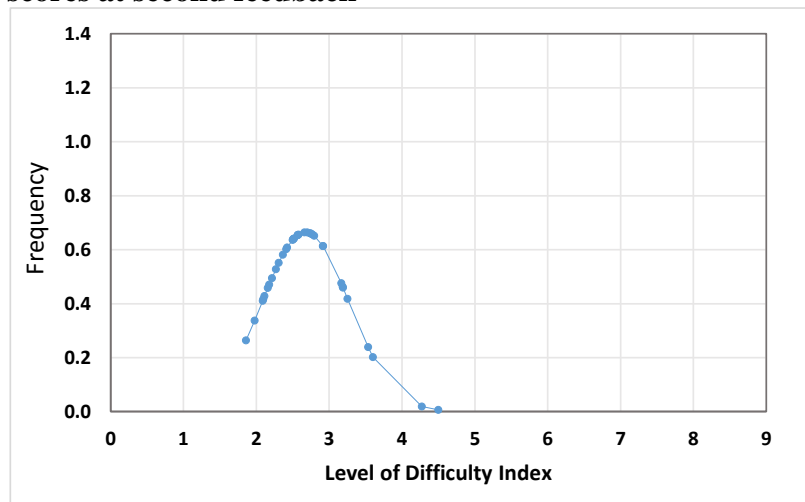
Figure H.27 BChD 5 2015 (n=37) Level of Difficulty Index scores at third feedback

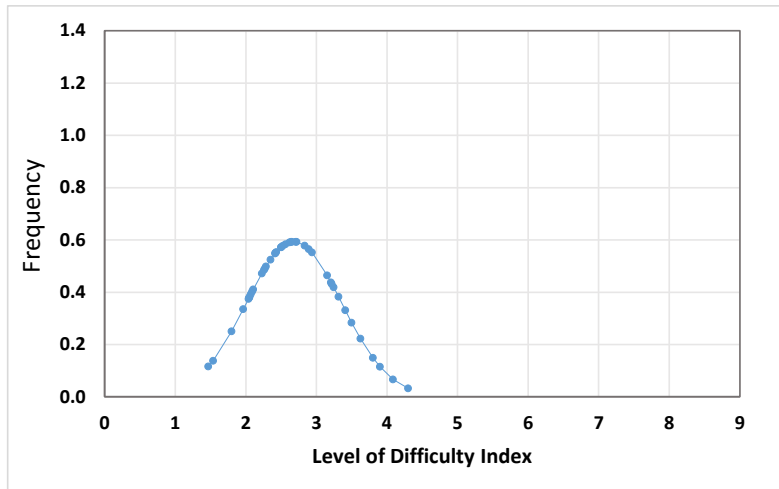# Graphic Level of Difficulty Index Scores
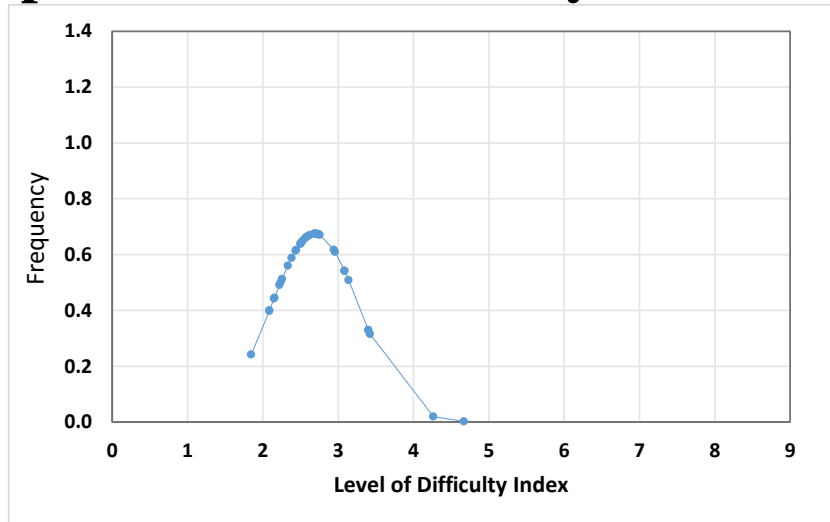
Figure H.28 BChD 5 2015 (n=37) Level of Difficulty Index scores at fourth feedback
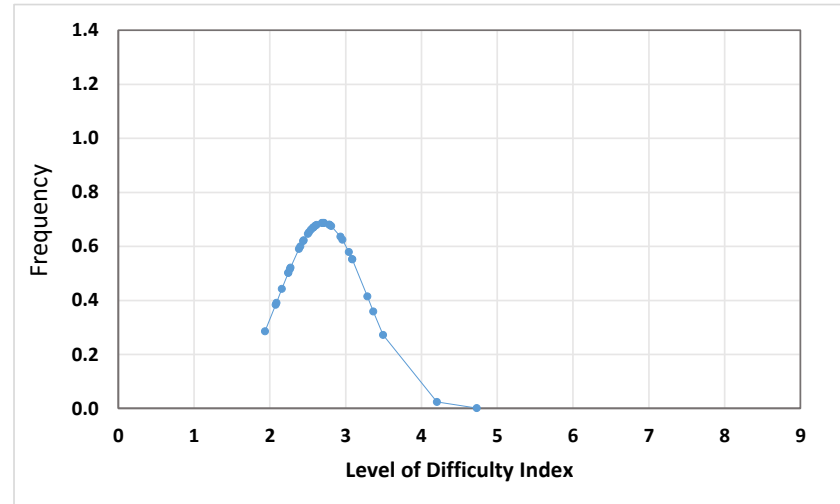
Figure H.29 BChD 5 2015 (n=37) Level of Difficulty Index scores at final feedback
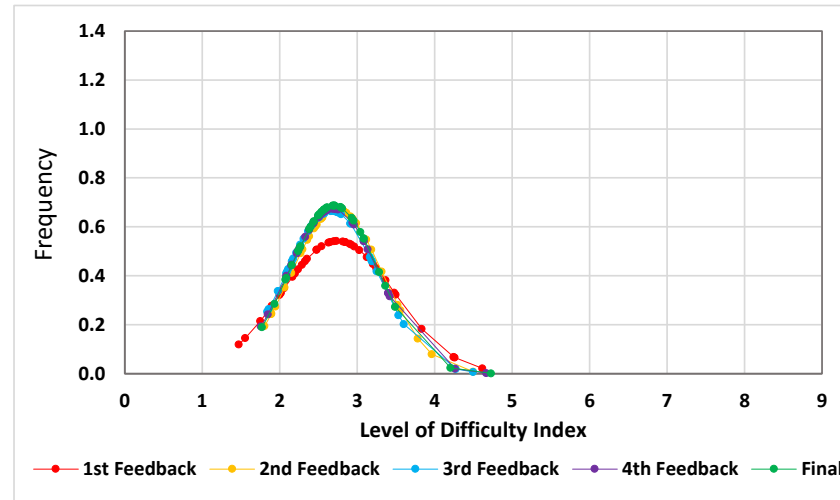
Figure H.30 BChD 5 2015 (n=37) Level of Difficulty Index comparison of feedback episodes

Graphic Level of Difficulty Index Scores
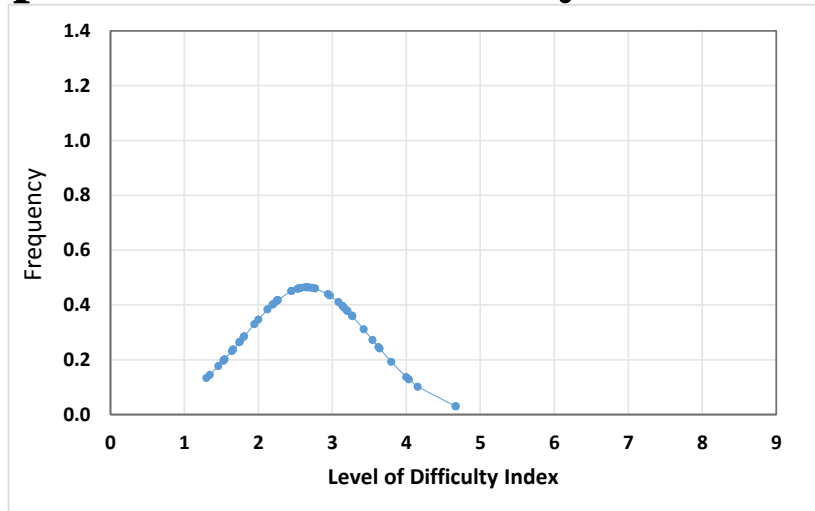
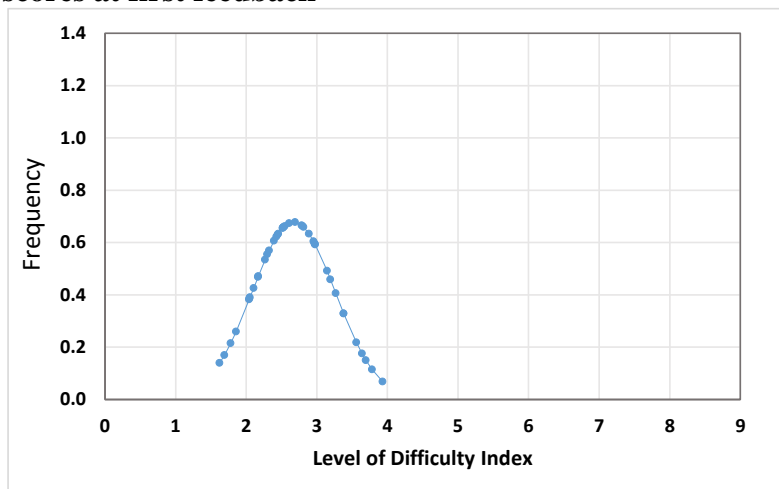**Figure H.31 BChD 5 2016 (n=51) Level of Difficulty Index scores at first feedback**
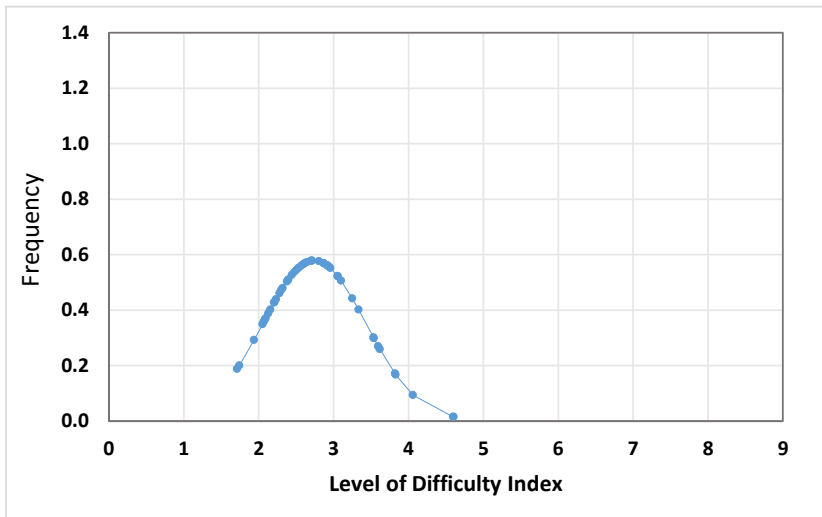
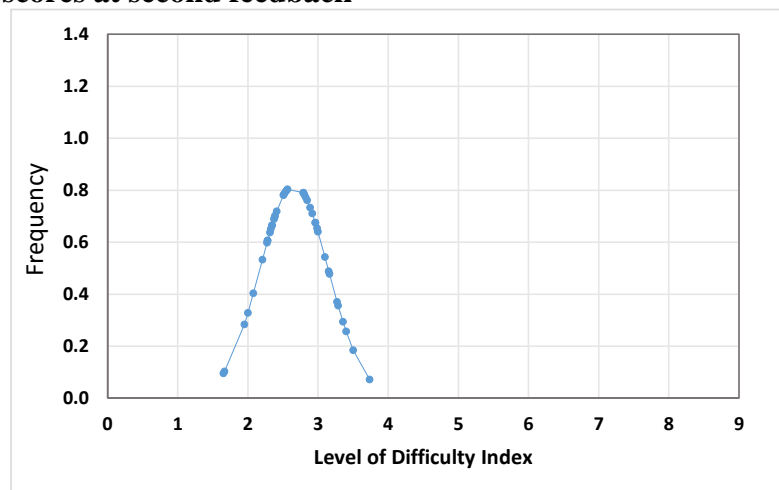**Figure H.32 BChD 5 2016 (n=51) Level of Difficulty Index scores at second feedback**
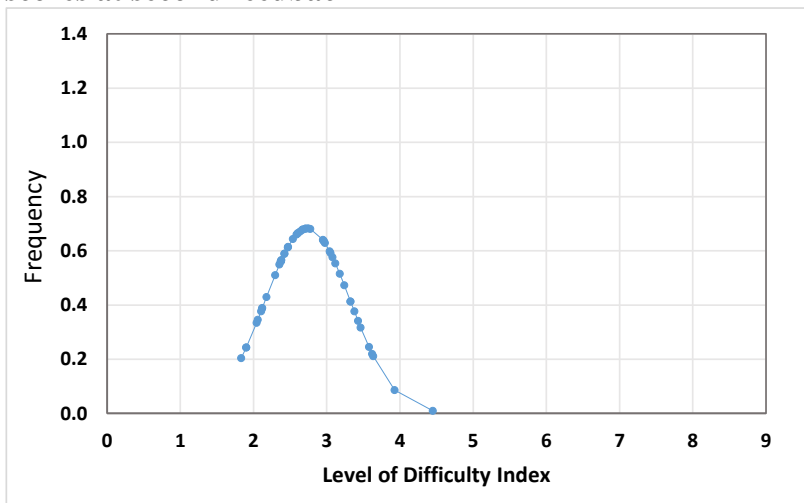
Figure H.33 BChD 5 2016 (n=51) Level of Difficulty Index scores at third feedback

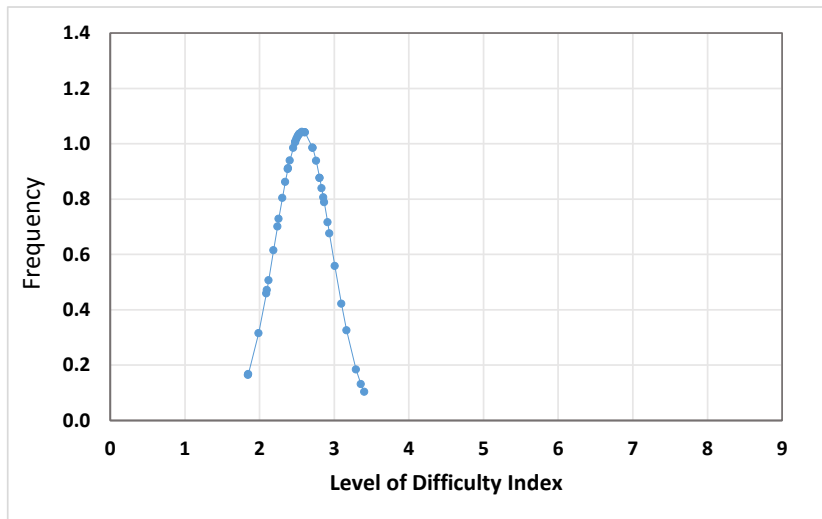# Graphic Level of Difficulty Index Scores
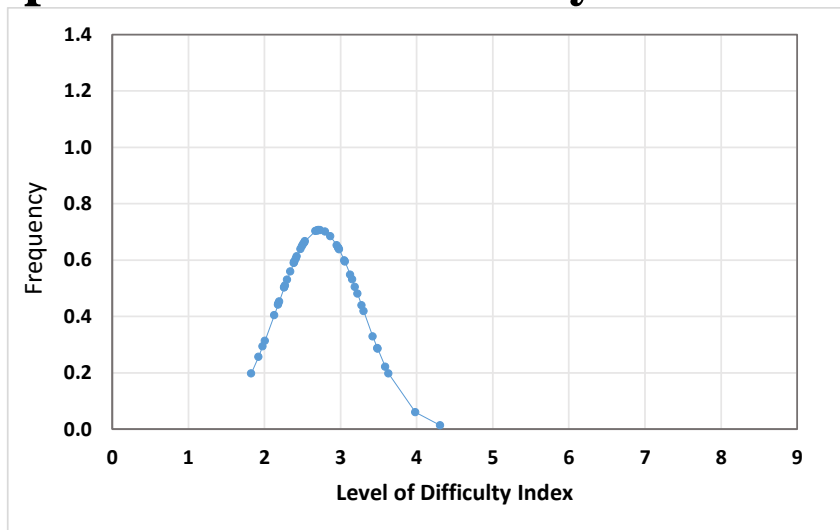
Figure H.34 BChD 5 2016 (n=51) Level of Difficulty Index scores at fourth feedback
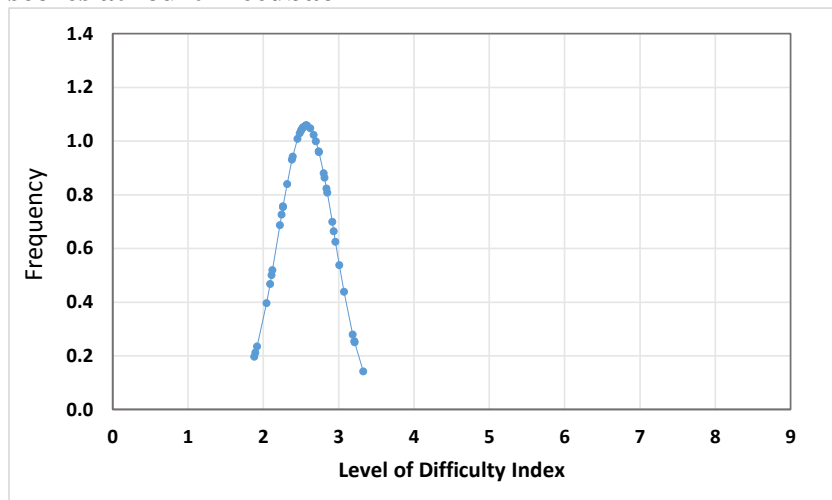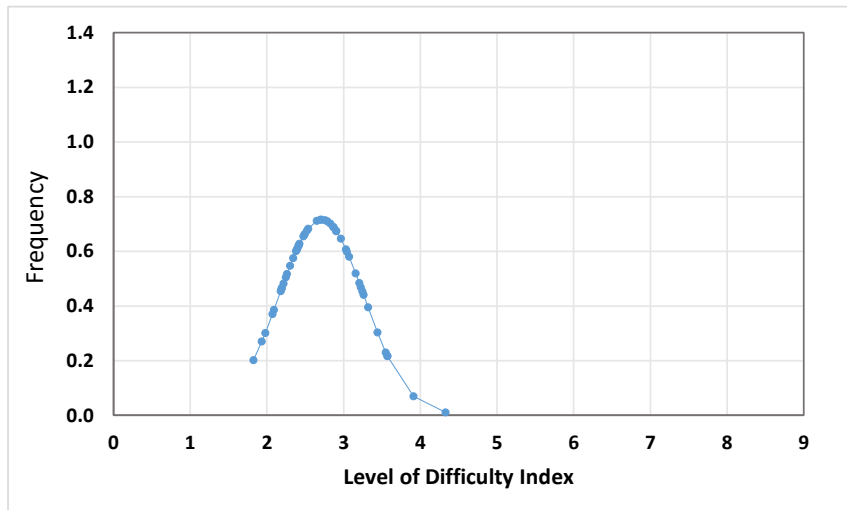

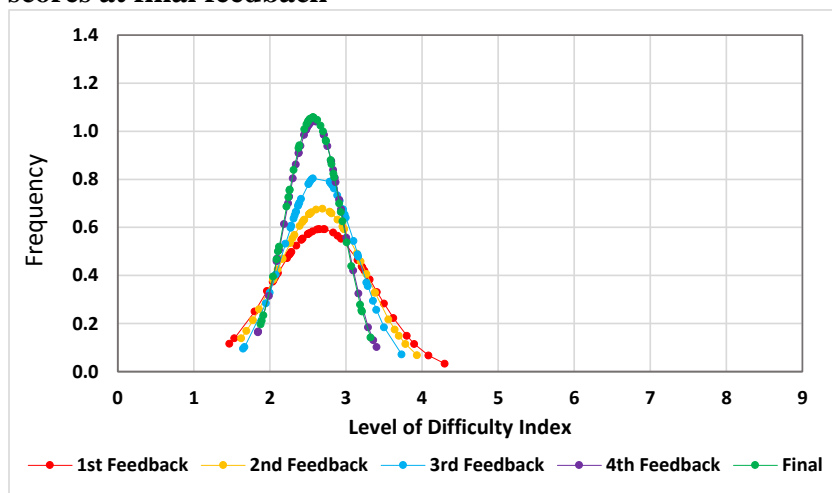**Figure H.35 BChD 5 2016 (n=51) Level of Difficulty Index scores at final feedback**

Figure H.36 BChD 5 2016 (n=51) Level of Difficulty Index comparison of feedback episodes
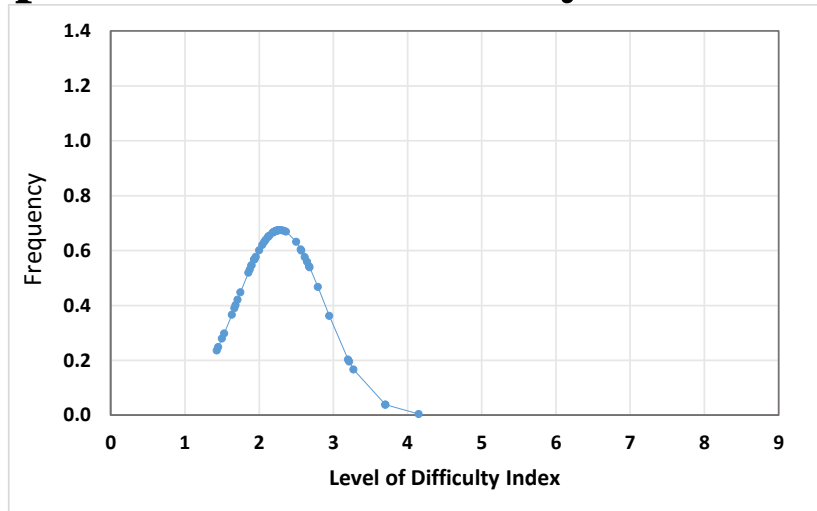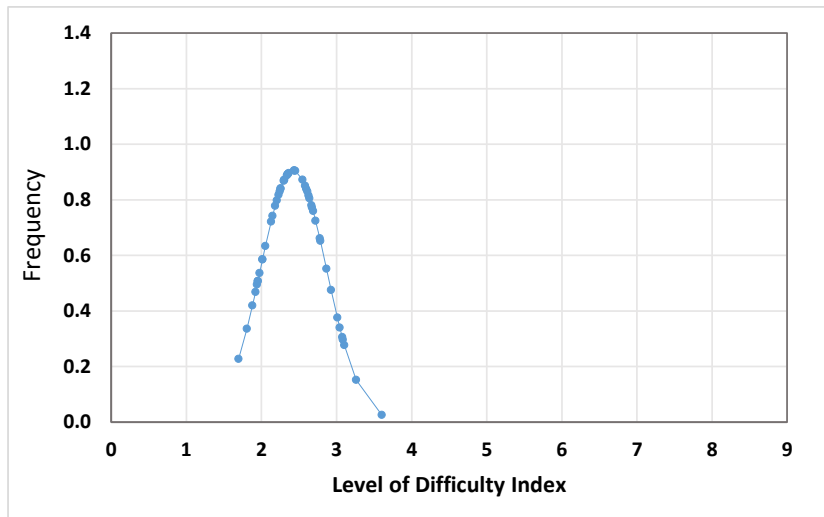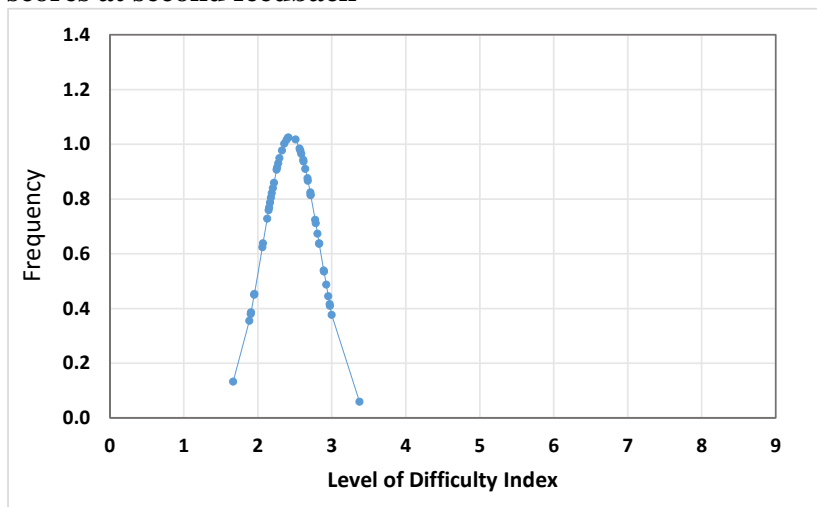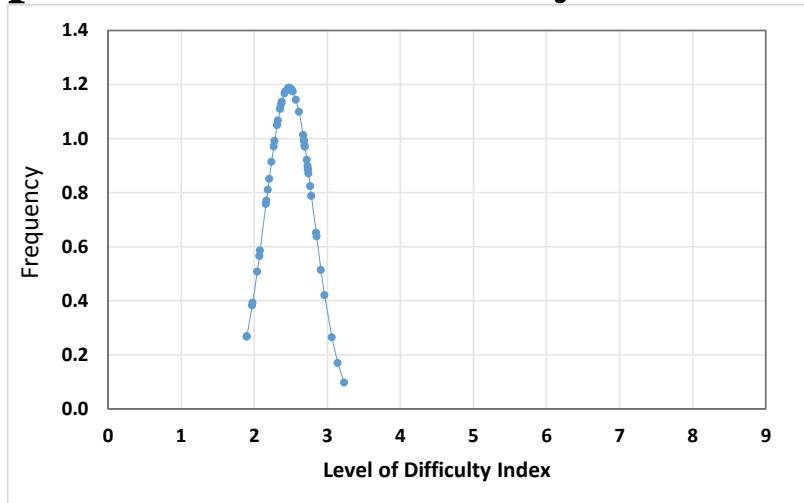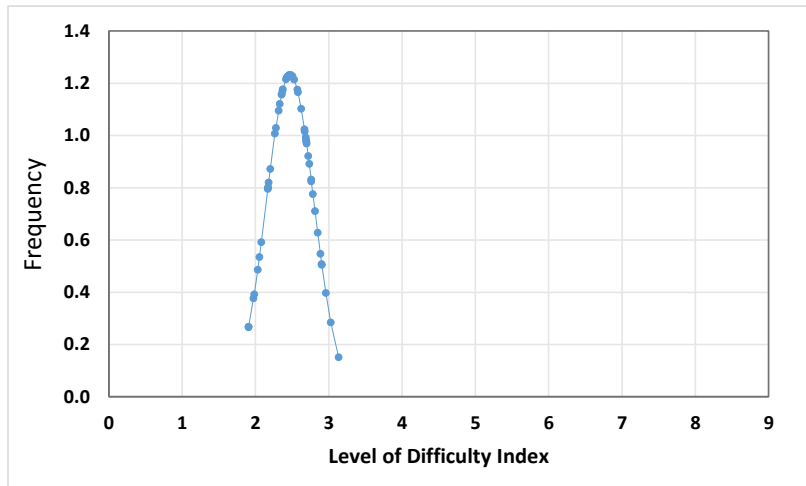
Graphic Level of Difficulty Index Scores

Table H.1 BChD 4 2014 Individual Level of Difficulty Index Scores
(n=42)

| Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1229	2.05	2.45	3.27	3.36	3.33
1291	3.90	3.64	3.36	3.16	3.21
1049	3.80	3.94	3.73	3.40	3.21
1277	3.22	3.78	3.40	3.29	3.19
1061	4.09	3.70	3.50	3.10	3.07
1279	3.24	2.89	2.89	2.94	3.01
1151	1.96	2.17	2.33	3.01	2.96
1109	2.83	3.27	3.16	2.86	2.94
1163	3.31	2.98	2.79	2.87	2.91
1231	2.89	2.53	2.53	2.71	2.85
1181	2.42	2.80	2.84	2.81	2.84
1039	3.63	3.19	3.10	2.91	2.81
1193	4.30	2.55	2.92	2.83	2.80
1033	3.21	3.15	2.96	2.61	2.74
1019	3.15	2.97	2.96	2.81	2.74
1091	2.62	2.81	2.80	2.76	2.70
1117	2.35	2.52	2.39	2.53	2.67
1283	2.64	2.45	2.56	2.49	2.62
1021	2.26	2.05	2.51	2.54	2.58
1051	2.50	2.04	2.28	2.48	2.57
1087	2.94	3.38	2.79	2.60	2.57
1031	3.41	3.56	3.29	2.57	2.56
1259	2.56	2.52	2.27	2.48	2.53
1123	2.71	2.79	2.82	2.71	2.52
1009	2.23	2.39	2.41	2.51	2.51
1249	2.05	2.53	2.34	2.52	2.50
1213	2.52	2.96	3.00	2.60	2.48
1153	2.42	2.98	2.99	2.45	2.45
1187	2.65	2.61	2.55	2.38	2.39
1097	2.72	2.69	2.51	2.38	2.38
1171	2.27	2.30	2.28	2.30	2.31
1103	2.09	2.11	2.38	2.41	2.26
1129	3.50	3.38	3.15	2.34	2.26
1018	2.43	2.17	2.37	2.26	2.24
1201	1.80	2.27	2.21	2.24	2.22
1289	2.07	2.33	2.31	2.12	2.12
1237	2.11	2.05	1.95	2.10	2.11
1063	2.04	1.78	2.00	2.09	2.09
1093	2.29	2.43	2.34	1.99	2.04
1217	1.54	1.63	1.67	1.85	1.92
1223	1.47	1.86	2.08	2.19	1.90
1069	2.50	1.69	1.65	1.85	1.88
Mean	2.68	2.67	2.66	2.58	2.57
Standard Deviation	0.67	0.59	0.49	0.38	0.38

Figure H.37 BChD 4 2014 Mean Level of
Difficulty Index Scores per Feedback Episode

Graphic Level of Difficulty Index Scores
Table H.2 BChD 4 2015 Individual Level of Difficulty Index Scores (n=51)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1747	3.27	2.72	2.71	3.14	3.14
1801	2.57	3.04	2.61	3.23	3.03
1973	3.21	3.09	2.83	2.96	2.96
1931	2.25	3.01	2.72	2.85	2.90
1129	2.25	2.67	2.83	2.91	2.90
2083	1.67	3.60	3.38	3.06	2.88
2027	2.07	2.68	2.78	2.85	2.85
1783	1.95	2.05	2.19	2.73	2.81
1877	1.50	2.93	3.00	2.78	2.78
1951	3.20	3.26	2.98	2.77	2.76
1993	2.04	2.63	2.68	2.74	2.76
1999	2.23	2.69	2.92	2.74	2.73
1949	2.68	2.30	2.57	2.72	2.72
2039	2.68	2.86	2.36	2.74	2.70
2003	2.65	2.44	2.78	2.69	2.69
1811	2.33	2.44	2.41	2.69	2.69
1867	1.90	3.08	2.89	2.68	2.69
2053	4.15	2.30	2.81	2.68	2.67
1913	3.70	2.55	2.59	2.52	2.67
1151	2.36	2.78	2.39	2.67	2.63
1997	1.71	2.58	2.89	2.61	2.58
1933	2.56	3.10	2.97	2.57	2.57
2069	2.50	2.36	2.71	2.53	2.53
2017	1.53	2.20	2.33	2.50	2.50
2029	1.63	2.13	2.15	2.48	2.48
1879	2.13	1.95	2.06	2.47	2.46
2081	2.14	2.35	2.41	2.47	2.45
1231	2.13	2.34	2.67	2.52	2.44
1987	3.70	2.24	2.51	2.43	2.43
1187	2.30	2.23	2.29	2.42	2.42
1759	1.75	2.45	2.62	2.37	2.37
1741	2.27	2.15	2.15	2.38	2.37
1787	2.22	2.15	2.13	2.36	2.36
1871	1.94	2.30	2.28	2.36	2.36
1861	1.43	2.25	2.22	2.32	2.33
1873	2.09	2.64	2.58	2.31	2.31
1733	1.94	2.26	2.26	2.28	2.28
1093	2.62	2.61	2.95	2.27	2.27
1901	2.25	1.81	1.91	2.19	2.20
1789	2.19	2.01	2.18	2.20	2.18
1753	2.19	2.35	2.20	2.16	2.17
1777	1.86	1.98	2.17	2.24	2.17
1723	2.94	2.78	2.64	2.17	2.17
1889	1.68	2.18	2.26	2.08	2.08
1979	1.45	2.02	1.95	2.07	2.05
1823	2.20	1.94	1.88	2.04	2.03
2011	1.94	2.60	1.95	1.98	1.98
2063	2.00	1.88	1.90	1.97	1.97
1831	2.79	1.92	2.07	1.90	1.91
1847	1.88	1.69	1.67	1.90	1.91
1907	1.90	1.37	1.58	1.74	1.78
Mean	2.28	2.43	2.45	2.48	2.47
Standard deviation	0.59	0.44	0.39	0.34	0.32

Figure H.38 BChD 4 2015 Mean Level of Difficulty Index Scores per Feedback Episode

Graphic Level of Difficulty Index Scores

Table H.3 BChD 4 2016 Individual Level of Difficulty Index Scores (n=62)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
2551	1.75	4.42	5.90	4.83	3.94
2131	2.58	4.35	3.68	3.77	3.84
2459	5.75	5.66	3.86	3.57	3.69
2089	2.56	2.20	2.98	3.62	3.61
2383	3.38	3.80	3.73	3.61	3.61
2347	0.00	3.42	3.71	3.60	3.60
2441	1.75	3.44	4.15	3.56	3.56
2381	2.50	4.13	3.61	3.54	3.53
2371	1.75	3.84	3.15	3.15	3.33
2579	3.50	3.96	3.60	3.34	3.30
2203	2.90	3.05	3.63	3.22	3.19
2113	3.21	4.24	3.83	3.12	3.17
2521	1.30	4.44	3.72	3.26	3.11
2447	2.13	3.27	3.14	3.08	3.05
2269	2.50	2.83	2.97	2.69	3.04
2099	1.90	2.52	2.38	2.75	3.04
2393	1.90	3.43	2.83	2.94	2.94
2179	1.75	2.87	2.93	2.84	2.92
2503	1.38	1.89	2.50	2.81	2.91
2221	1.75	3.25	2.58	2.98	2.90
2137	2.50	2.20	4.16	2.90	2.90
2399	2.55	3.24	2.81	2.89	2.89
2287	1.75	2.71	3.12	2.97	2.88
2339	1.90	2.29	2.79	2.77	2.84
2437	1.38	2.18	2.28	2.74	2.83
2411	1.38	2.47	3.20	2.73	2.82
2351	1.00	2.61	3.19	2.77	2.77
2129	2.07	3.23	2.91	2.87	2.74
2557	0.00	3.03	3.04	2.73	2.72
2239	2.13	3.17	2.55	2.69	2.69
2161	4.67	3.55	3.29	2.60	2.66
2333	9.00	2.82	2.54	2.54	2.65
2467	1.38	1.87	2.67	2.65	2.65
2143	1.75	2.38	2.58	2.66	2.63
2389	4.13	3.65	2.74	2.69	2.60
2273	2.58	3.24	3.18	2.58	2.58
2111	1.00	3.06	2.50	2.45	2.57
2141	3.80	2.29	2.50	2.49	2.54
2153	1.00	2.80	3.40	2.54	2.54
2473	2.00	1.81	2.32	2.54	2.53
2539	4.17	2.71	2.91	2.77	2.47
2281	2.50	3.39	2.89	2.49	2.47
2213	2.50	2.42	2.55	2.35	2.47
2237	1.60	1.86	2.30	2.48	2.46
2311	2.00	2.13	2.10	2.27	2.43
2531	2.50	2.09	2.37	2.40	2.41
2543	2.50	2.04	2.30	2.40	2.40
2267	1.86	3.81	3.45	2.38	2.38
2207	1.75	2.68	3.24	2.36	2.36
2341	4.67	3.00	3.11	2.55	2.35
2087	1.60	2.24	2.43	2.54	2.34
2251	1.75	2.32	2.70	2.33	2.33
2477	3.20	2.31	1.92	2.35	2.31
2377	9.00	2.39	2.55	2.26	2.24
2549	5.75	2.67	2.36	2.20	2.18
2423	3.38	2.50	2.29	2.15	2.15
2357	3.00	2.43	2.50	2.24	2.13
2297	1.00	1.56	1.56	2.10	1.99
2243	1.00	1.52	1.77	1.67	1.78
2293	0.00	1.75	1.70	1.75	1.77
2309	1.60	2.05	1.85	1.72	1.74
2417	1.43	1.70	1.61	1.59	1.60
Mean	2.47	2.86	2.89	2.73	2.73
Standard Deviation	1.69	0.84	0.73	0.56	0.52

Figure H.39 BChD 4 2016 Mean Level of Difficulty Index Scores per Feedback Episode

Graphic Level of Difficulty Index Scores

Table H.4 BChD 5 2014 Individual Level of Difficulty Index Scores (n=58)

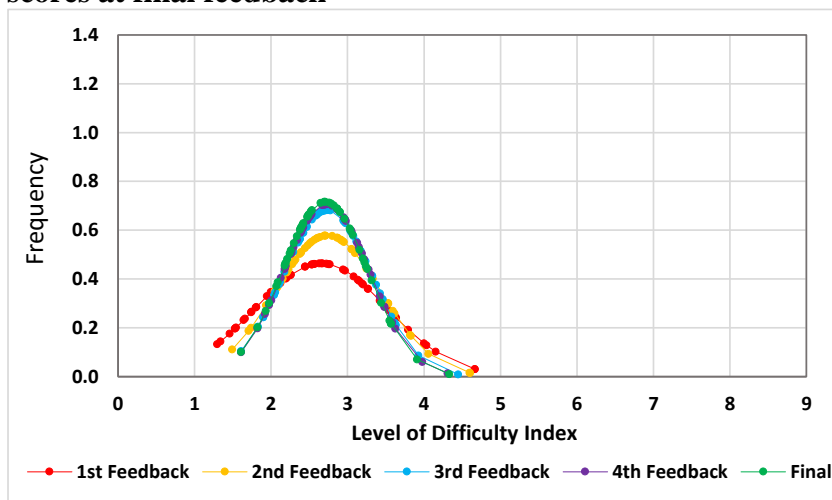| Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1709	4.50	4.41	4.58	4.50	4.43
1423	2.79	3.81	3.85	4.13	4.13
1301	4.42	4.38	4.11	4.06	3.95
1619	4.36	4.27	4.38	4.05	3.84
1487	4.51	4.13	3.95	3.71	3.78
1447	3.98	3.67	3.60	3.68	3.70
1493	3.14	3.50	3.57	3.57	3.55
1489	3.86	3.93	3.60	3.45	3.48
1669	3.76	3.35	3.49	3.50	3.48
1511	2.75	3.21	3.17	3.29	3.47
1381	4.32	3.71	3.86	3.54	3.45
1627	3.52	3.51	3.50	3.35	3.34
1303	4.55	3.97	3.17	3.17	3.16
1667	3.86	3.57	3.40	3.20	3.16
1571	3.56	3.34	3.12	3.15	3.15
1657	3.37	3.41	3.23	3.16	3.14
1607	3.06	3.16	3.23	3.04	3.12
1697	3.94	3.11	3.19	3.15	3.11
1609	4.00	3.43	3.30	3.08	3.04
1597	3.41	3.11	2.95	3.03	3.02
1481	3.59	2.99	2.95	2.96	3.01
1327	3.39	3.25	2.94	3.01	2.98
1451	2.89	3.10	2.94	2.95	2.93
1523	2.61	2.89	3.04	2.87	2.87
1637	3.11	3.22	3.00	2.87	2.86
1693	2.96	2.70	2.82	2.84	2.84
1543	2.73	2.77	2.82	2.77	2.83
1367	2.90	2.55	2.83	2.78	2.82
1579	2.38	2.59	2.75	2.79	2.79
1531	2.71	2.52	2.49	2.75	2.79
1621	2.77	2.95	2.92	2.78	2.76
1559	2.38	3.27	2.89	2.76	2.74
1459	2.71	2.57	2.74	2.74	2.74
1297	2.78	2.74	2.73	2.65	2.72
1483	2.86	3.01	2.87	2.75	2.69
1319	2.51	2.57	2.66	2.66	2.69
1613	3.24	3.12	2.71	2.69	2.68
1321	2.50	2.36	2.63	2.69	2.68
1499	2.41	2.74	2.92	2.68	2.67
1409	2.27	2.69	2.68	2.67	2.66
1549	2.55	2.66	2.68	2.66	2.66
1307	2.21	2.49	2.57	2.69	2.66
1427	3.89	3.60	3.07	2.70	2.66
1429	2.59	2.73	2.67	2.64	2.64
1439	3.33	3.15	2.61	2.65	2.63
1453	3.18	2.90	2.71	2.62	2.60
1471	2.43	2.64	2.55	2.59	2.59
1663	2.59	2.78	2.77	2.76	2.56
1699	2.75	2.53	2.52	2.52	2.52
1601	2.34	2.48	2.33	2.57	2.51
1399	2.13	2.24	2.50	2.50	2.50
1721	2.44	2.28	2.42	2.43	2.43
1583	2.57	2.51	2.26	2.27	2.32
1553	2.34	2.19	2.39	2.31	2.31
1567	2.03	2.17	2.16	2.42	2.28
1433	2.03	2.11	2.39	2.13	2.22
1361	2.26	2.18	2.07	2.21	2.21
1373	2.41	2.13	2.05	2.11	2.20
Mean	3.06	3.02	2.97	2.94	2.93
Standard Deviation	0.71	0.59	0.55	0.50	0.49
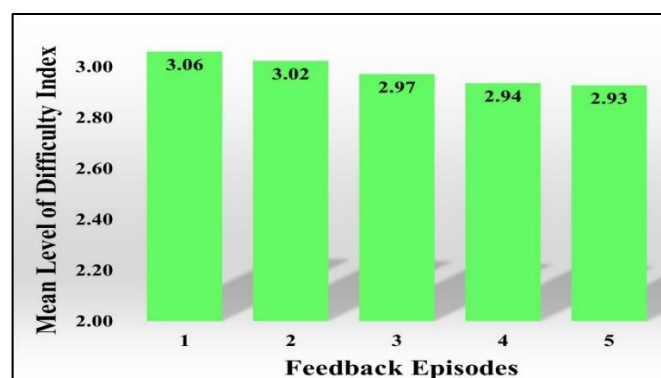
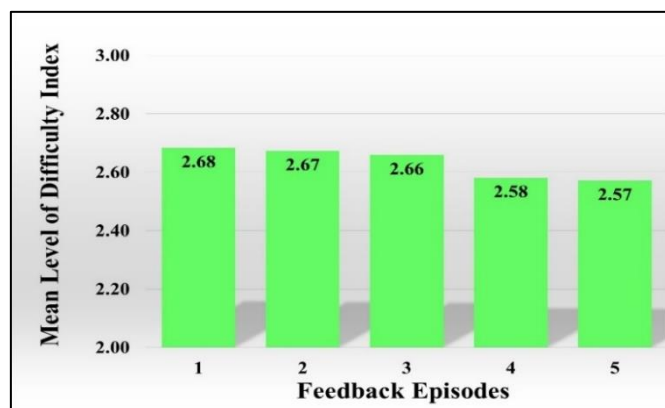**Figure H.40 BChD 5 2014 Mean Level of Difficulty Index Scores per Feedback Episode**

Graphic Level of Difficulty Index Scores

Table H.5 BChD 5 2015 Individual Level of Difficulty Index Scores (n=37)

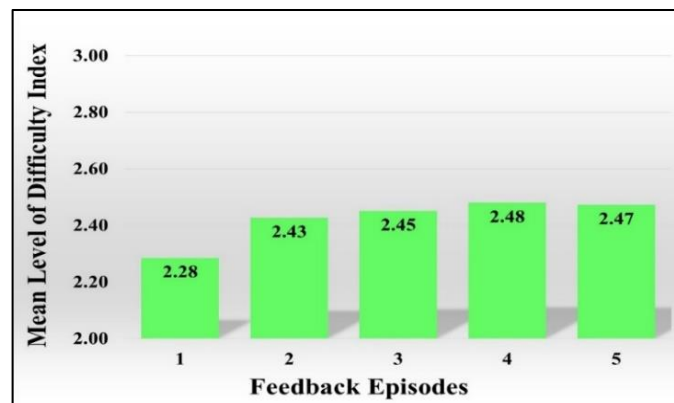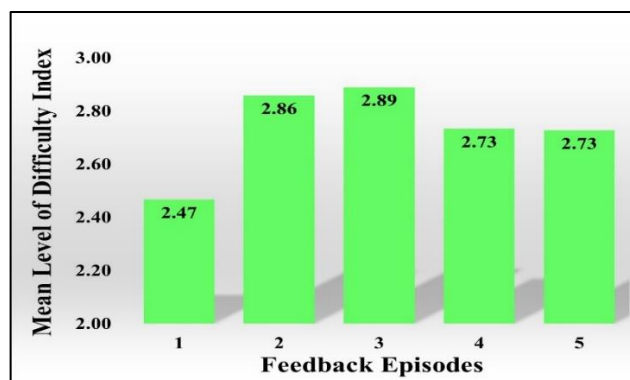| Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1279	4.25	4.50	4.50	4.67	4.73
1021	4.26	3.97	4.27	4.26	4.20
1033	3.83	3.52	3.60	3.40	3.49
1163	3.13	3.78	3.53	3.40	3.36
1291	3.48	3.56	3.25	3.42	3.29
1009	2.48	3.19	3.19	3.09	3.09
1153	2.97	3.12	3.19	3.14	3.09
1051	2.54	3.32	3.17	3.09	3.04
1181	2.70	2.92	2.92	2.96	2.96
1049	2.90	2.94	2.92	2.94	2.93
1283	2.92	2.70	2.66	2.75	2.81
1018	2.17	2.53	2.58	2.72	2.79
1031	3.21	2.73	2.77	2.69	2.78
1039	3.37	2.83	2.75	2.73	2.71
1091	2.65	2.55	2.74	2.75	2.71
1229	3.03	2.99	2.70	2.72	2.69
1217	3.25	2.86	2.80	2.69	2.69
1213	2.82	2.84	2.51	2.50	2.62
1201	2.29	2.36	2.37	2.60	2.60
1069	4.62	2.94	2.51	2.58	2.57
1237	2.48	2.46	2.57	2.63	2.57
1259	2.63	2.48	2.41	2.54	2.54
1171	2.00	2.46	2.57	2.52	2.52
1277	2.85	2.76	2.50	2.50	2.50
1223	2.35	2.45	2.52	2.45	2.45
1019	3.50	2.67	2.42	2.44	2.44
1117	2.02	1.89	2.18	2.33	2.40
1087	2.06	2.30	2.31	2.38	2.38
1123	1.56	2.38	2.27	2.22	2.27
1289	1.47	1.94	2.22	2.26	2.26
1109	2.24	1.90	1.86	2.15	2.24
1097	2.33	2.27	2.11	2.24	2.24
1249	2.73	2.67	2.16	2.16	2.16
1063	1.75	2.15	2.10	2.09	2.09
1193	2.84	2.56	2.09	2.09	2.08
1061	2.20	2.06	1.84	1.85	1.93
1103	1.90	1.80	1.98	1.76	1.77
Mean	2.75	2.74	2.68	2.69	2.70
Standard deviation	0.74	0.59	0.60	0.59	0.58
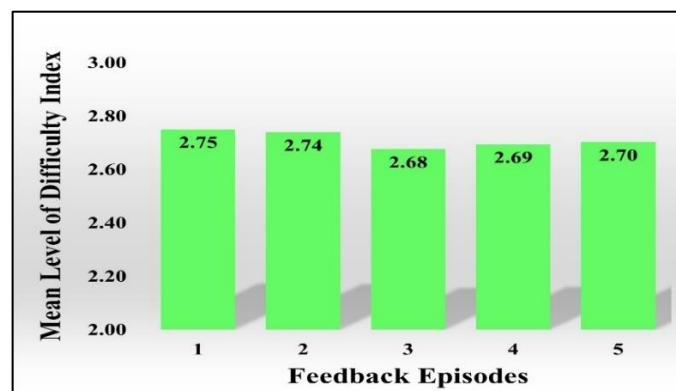
Figure H.41 BChD 5 2015 Mean Level of Difficulty Index Scores per Feedback Episode

Appendix H
Graphic Level of Difficulty Index Scores

Table H.6 BChD 5 2016 Individual Level of Difficulty Index Scores (n=51)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1993	3.64	4.60	4.45	4.31	4.33
1997	4.00	4.06	3.93	3.98	3.91
2063	1.46	3.83	3.62	3.59	3.57
1861	2.63	3.53	3.58	3.63	3.57
1913	3.21	3.62	3.46	3.49	3.55
2039	4.04	3.82	3.64	3.48	3.44
1823	2.13	3.33	3.33	3.42	3.32
2003	1.64	2.05	3.18	3.28	3.26
1787	3.27	4.61	3.33	3.30	3.24
1747	1.81	2.87	3.12	3.15	3.22
1783	3.43	2.96	3.08	3.22	3.20
1187	3.15	3.25	3.43	3.19	3.16
1733	2.66	2.88	3.24	3.06	3.07
1867	2.45	2.94	3.04	3.13	3.04
1973	3.80	3.60	3.38	3.05	3.03
1931	2.76	3.06	3.05	2.97	2.96
1987	4.67	3.10	2.74	2.98	2.91
1753	2.26	2.92	2.98	2.97	2.90
1759	3.63	3.54	2.96	2.87	2.87
2027	3.14	2.60	2.78	2.80	2.87
1151	3.55	3.05	2.95	2.73	2.83
1801	2.97	2.57	2.71	2.70	2.79
1979	2.53	2.71	2.67	2.67	2.76
2053	2.45	2.80	2.67	2.71	2.71
1949	3.27	2.40	2.71	2.71	2.70
1741	2.58	2.71	2.54	2.70	2.65
1871	4.67	2.44	2.61	2.53	2.54
1093	1.74	2.70	2.64	2.52	2.52
1907	2.94	2.28	2.42	2.49	2.49
1889	1.55	2.92	2.96	2.95	2.49
2069	1.53	2.16	2.47	2.47	2.48
2017	2.54	2.32	2.42	2.43	2.43
1933	2.77	2.61	2.60	2.51	2.42
1879	2.73	2.21	2.35	2.41	2.41
2083	3.19	2.64	2.59	2.40	2.40
1877	4.15	2.08	2.12	2.39	2.39
1789	2.21	2.38	2.37	2.39	2.38
1129	2.19	2.48	2.38	2.34	2.34
2081	2.26	2.51	2.47	2.30	2.30
1831	2.25	2.13	2.06	2.26	2.26
1231	2.56	2.53	2.37	2.26	2.24
1777	1.95	2.23	2.29	2.27	2.21
1811	2.00	2.39	2.38	2.19	2.19
1999	1.66	2.07	2.12	2.18	2.19
1901	3.08	2.09	2.18	2.18	2.18
1723	1.53	1.94	2.04	2.01	2.09
1873	1.34	2.21	2.10	2.13	2.07
2029	1.80	1.71	1.90	1.98	1.98
1847	2.68	2.30	1.90	1.92	1.93
2011	1.75	1.74	1.83	1.82	1.82
1951	1.30	1.49	1.61	1.61	1.61
Mean	2.66	2.74	2.74	2.73	2.71
Standsrd Deviation	0.86	0.69	0.58	0.57	0.56
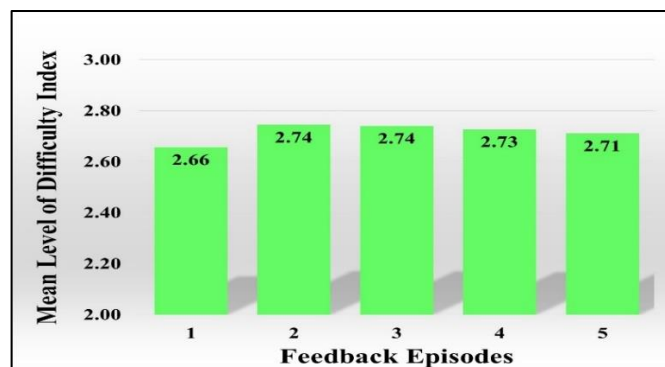
Figure H.42 BChD 5 2016 Mean Level of Difficulty Index Scores per Feedback Episode

Graphic Independence Ratio Results

Appendix I: Graphic Independence Ratio Results
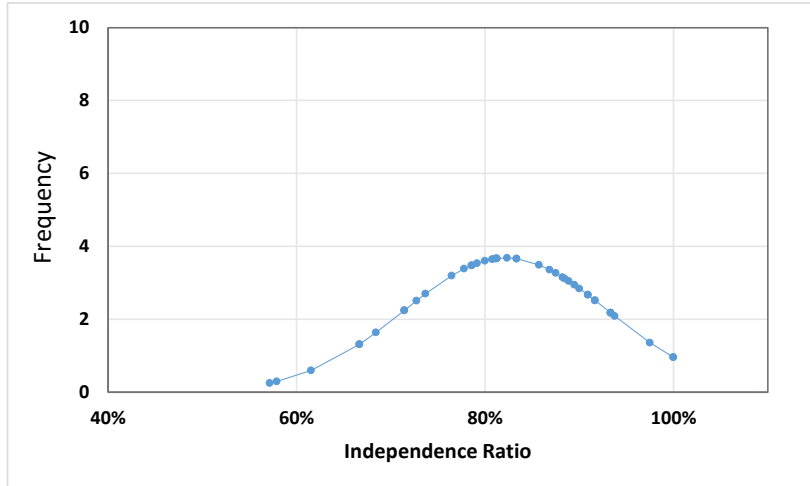
Figure I.1 BChD 4 2014 (n=42) Independence Ratio results at first feedback
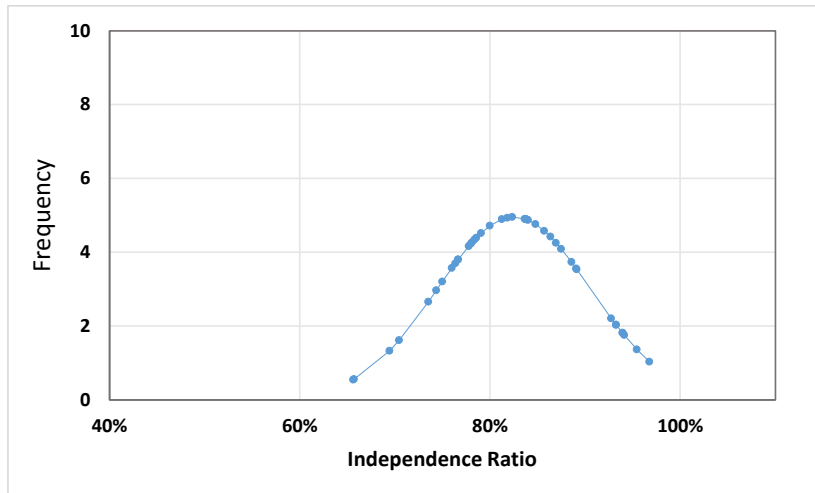
Figure I.2 BChD 4 2014 (n=42) Independence Ratio results at second feedback
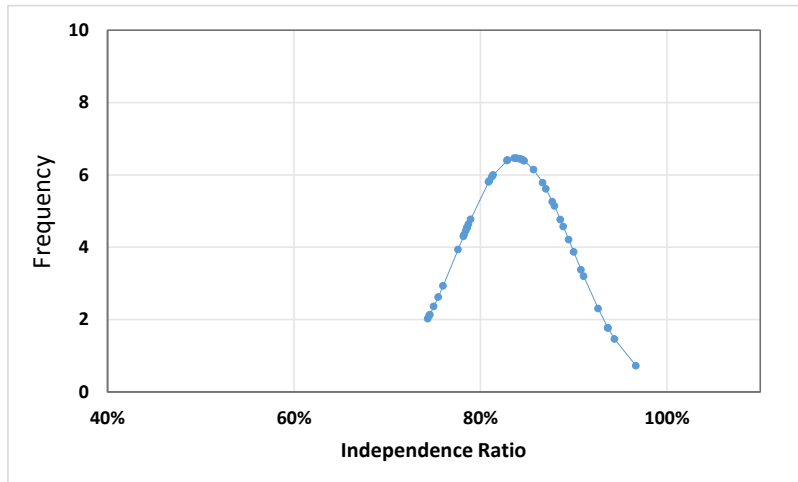
Figure I.3 BChD 4 2014 (n=42) Independence Ratio results at third feedback

Graphic Independence Ratio Results
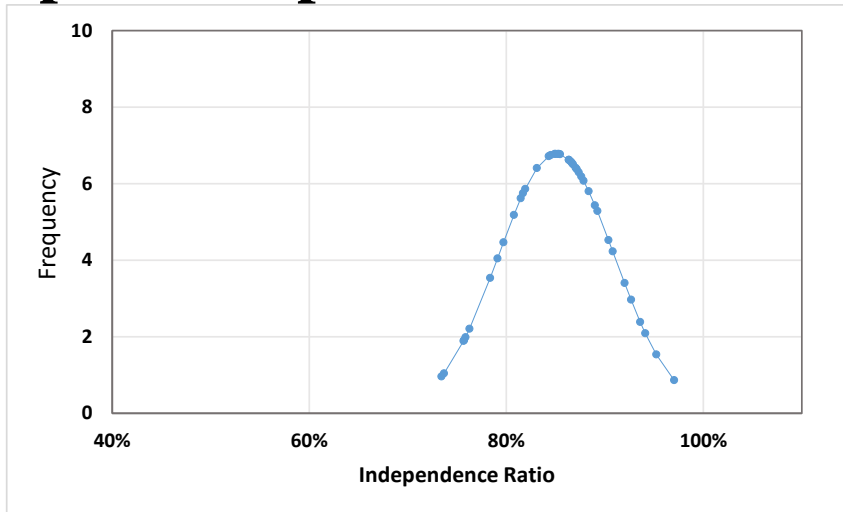
Figure I.4 BChD 4 2014 (n=42) Independence Ratio results at fourth feedback
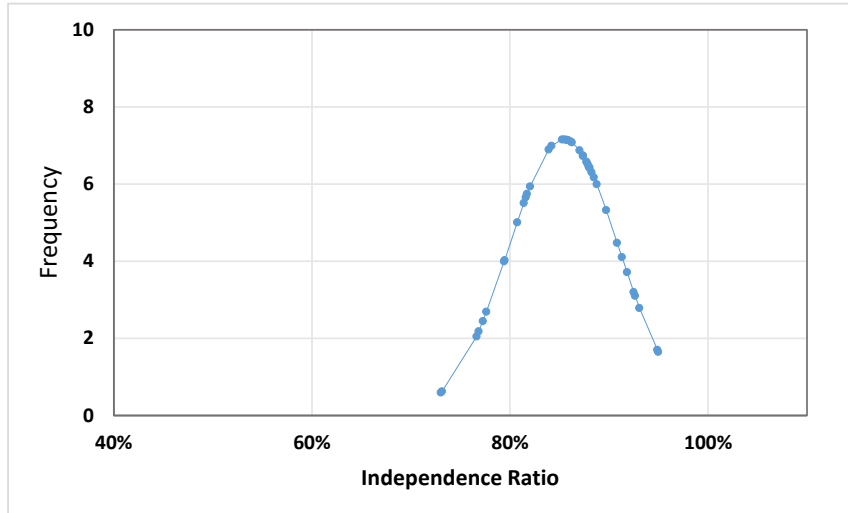
Figure I.5 BChD 4 2014 (n=42) Independence Ratio results at final feedback
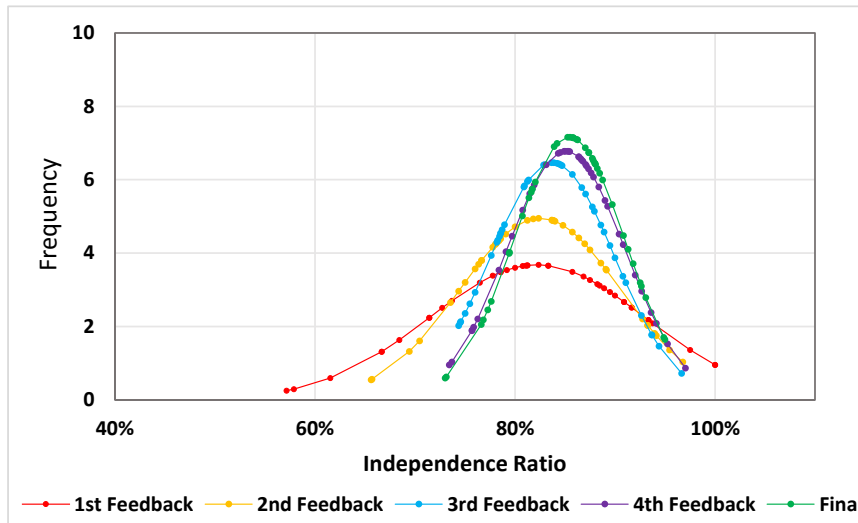
Figure I.6 BChD 4 2014 (n=42) Independence Ratio results comparison of feedback episodes

Graphic Independence Ratio Results
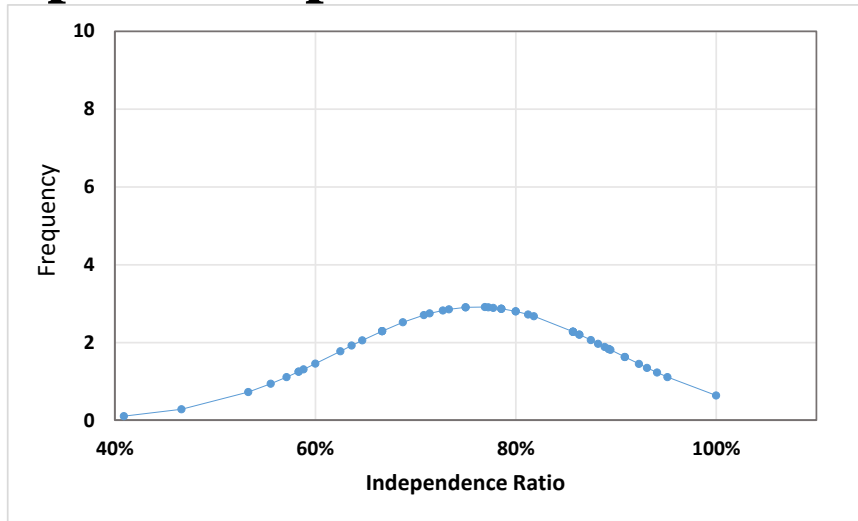
Figure I.7 BChD 4 2015 (n=51) Independence Ratio results at first feedback
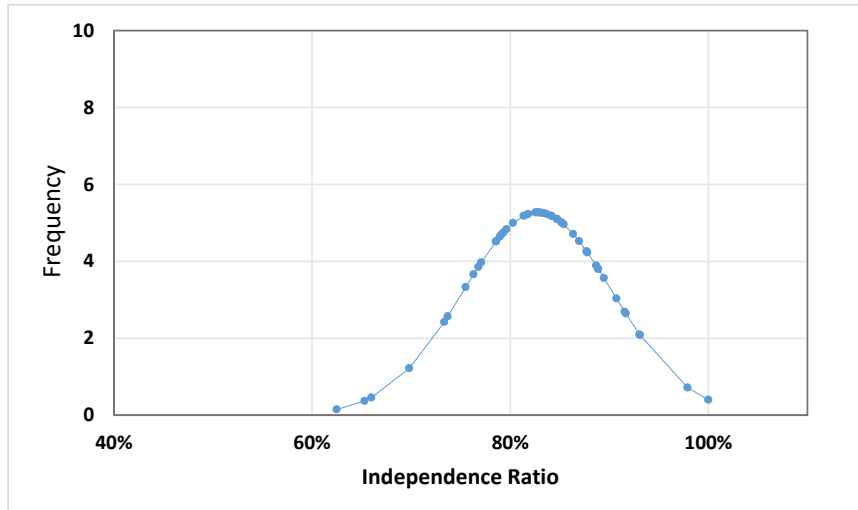
Figure I.8 BChD 4 2015 (n=51) Independence Ratio results at second feedback
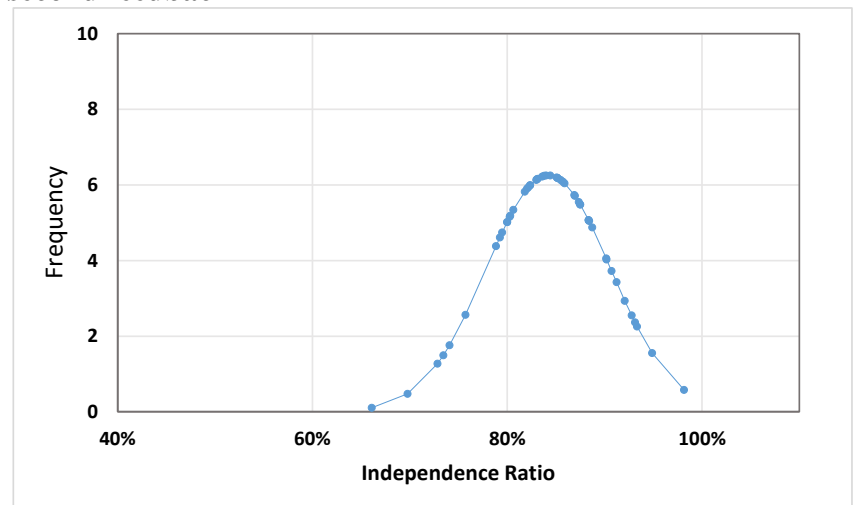
Figure I.9 BChD 4 2015 (n=51) Independence Ratio results at third feedback

Graphic Independence Ratio Results
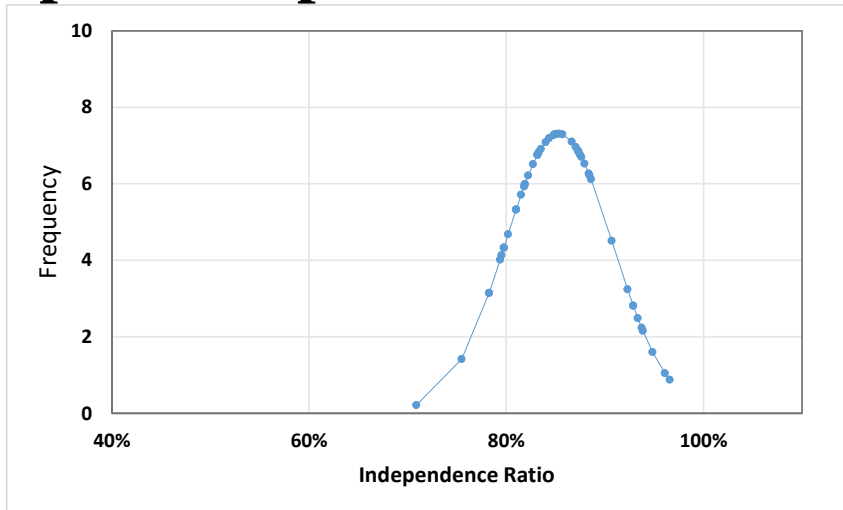
Figure I.10 BChD 4 2015 (n=51) Independence Ratio results at fourth feedback
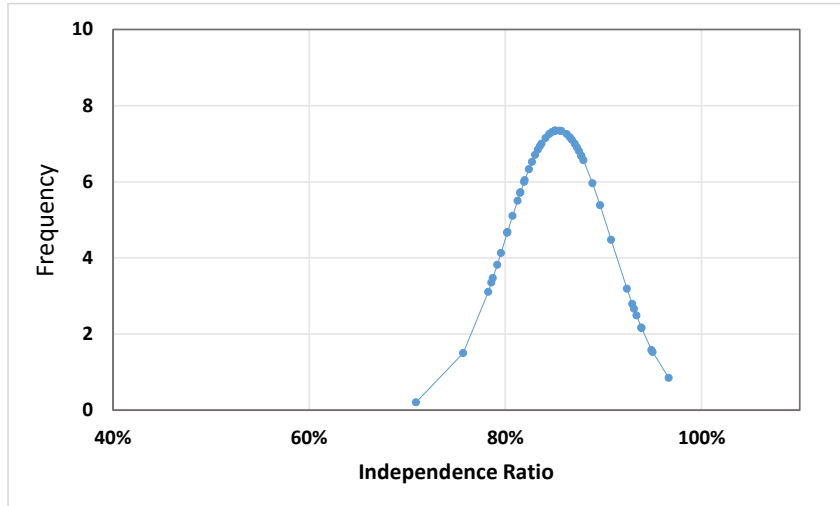
Figure I.11 BChD 4 2015 (n=51) Independence Ratio results at final feedback
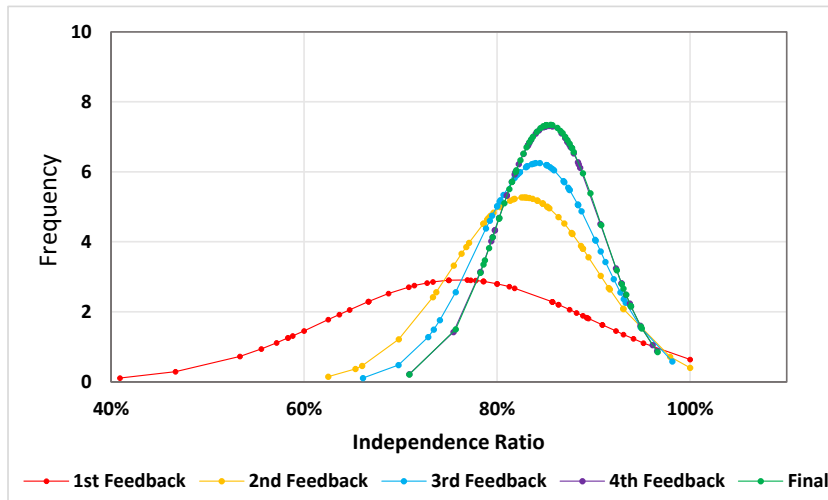
Figure I.12 BChD 4 2015 (n=51) Independence Ratio results comparison of feedback episodes

Graphic Independence Ratio Results
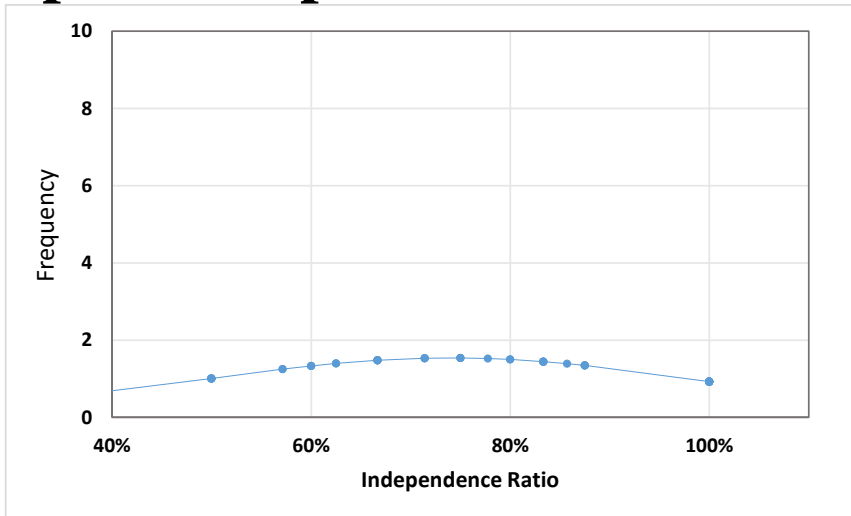
Figure I.13 BChD 4 2016 (n=62) Independence Ratio results at first feedback
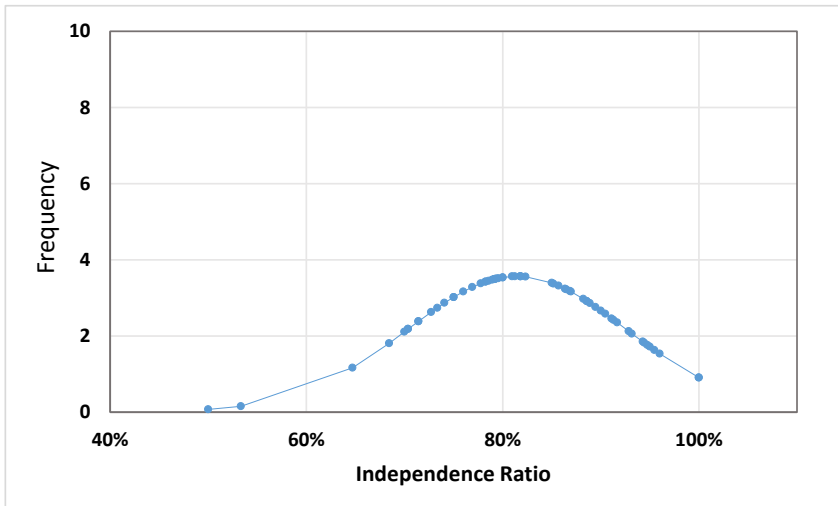
Figure I.14 BChD 4 2016 (n=62) Independence Ratio results at second feedback
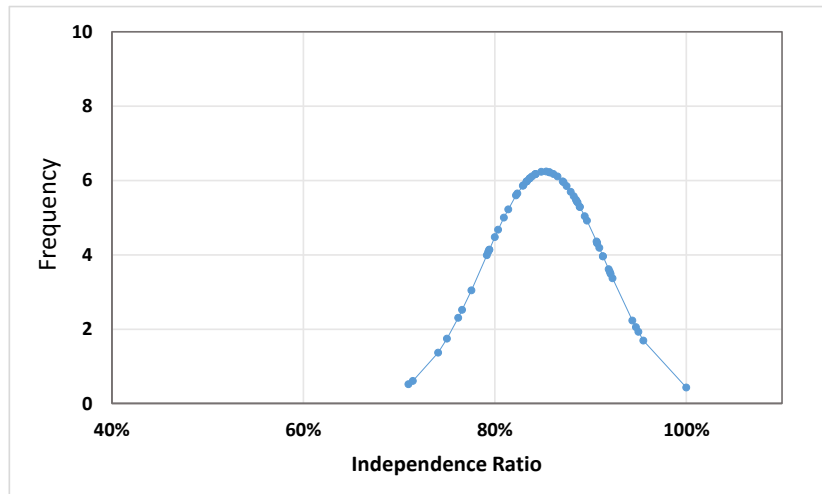
Figure I.15 BChD 4 2016 (n=62) Independence Ratio results at third feedback

Graphic Independence Ratio Results
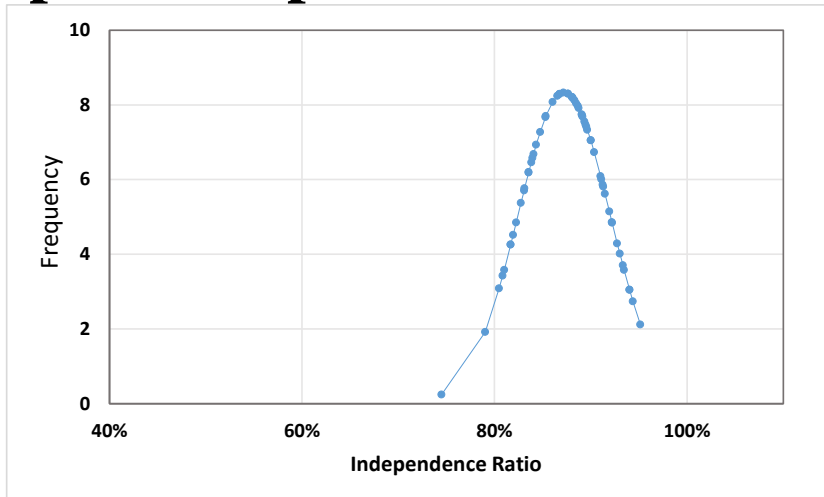
Figure I.16 BChD 4 2016 (n=62) Independence Ratio results at fourth feedback
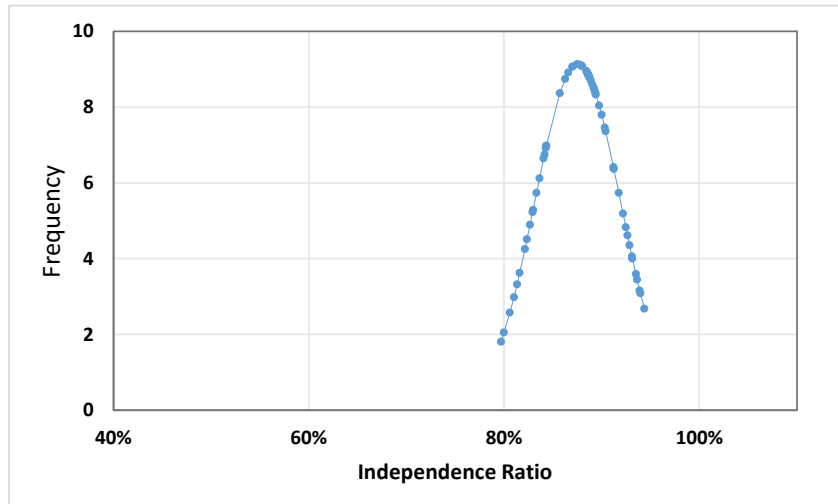
Figure I.17 BChD 4 2016 (n=62) Independence Ratio results at final feedback
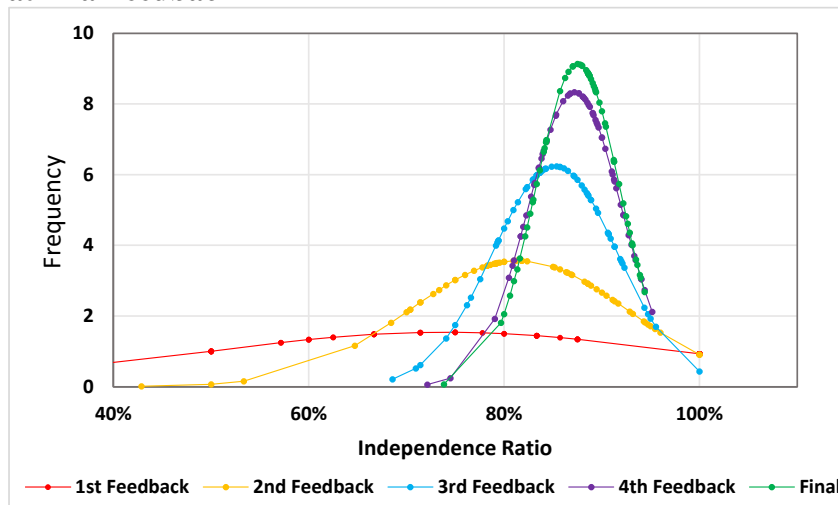
Figure I.18 BChD 4 2016 (n=62) Independence Ratio results comparison of feedback episodes

Graphic Independence Ratio Results
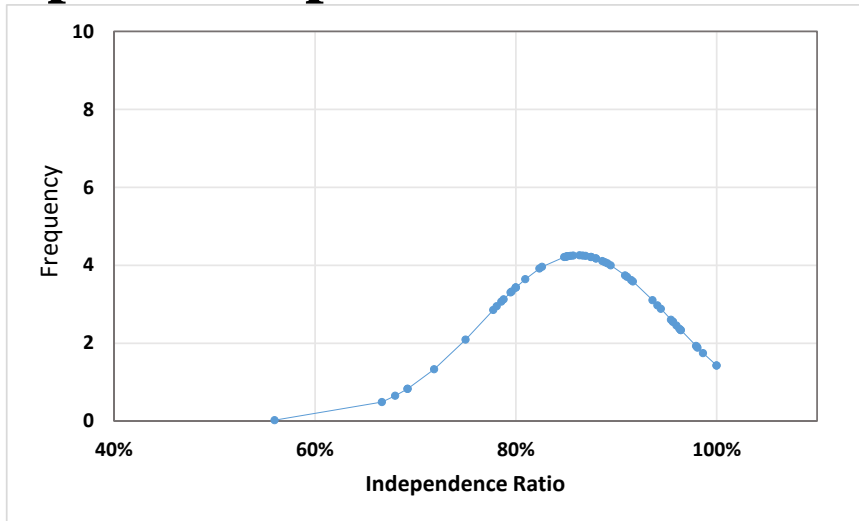
Figure I.19 BChD 5 2014 (n=58) Independence Ratio results at first feedback
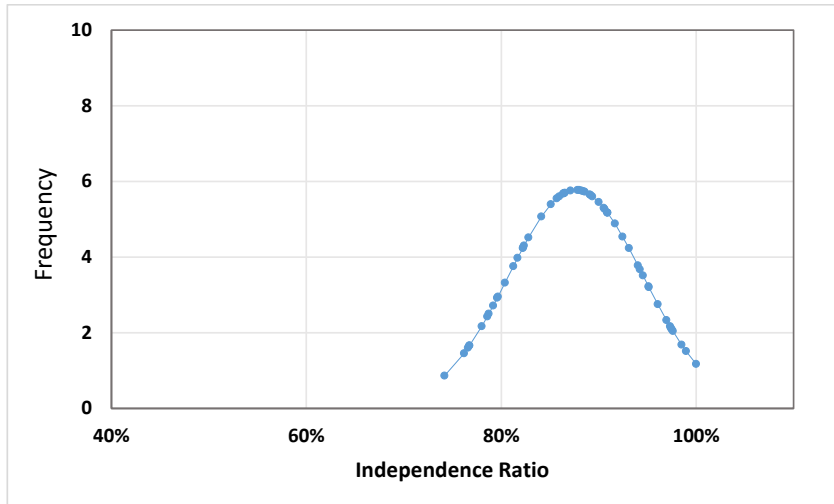
Figure I.20 BChD 5 2014 (n=58) Independence Ratio results at second feedback
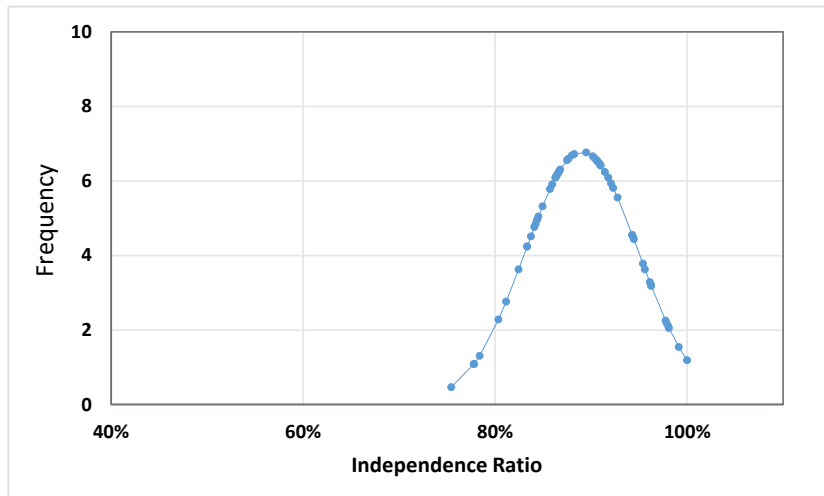
Figure I.21 BChD 5 2014 (n=58) Independence Ratio results at third feedback

Graphic Independence Ratio Results
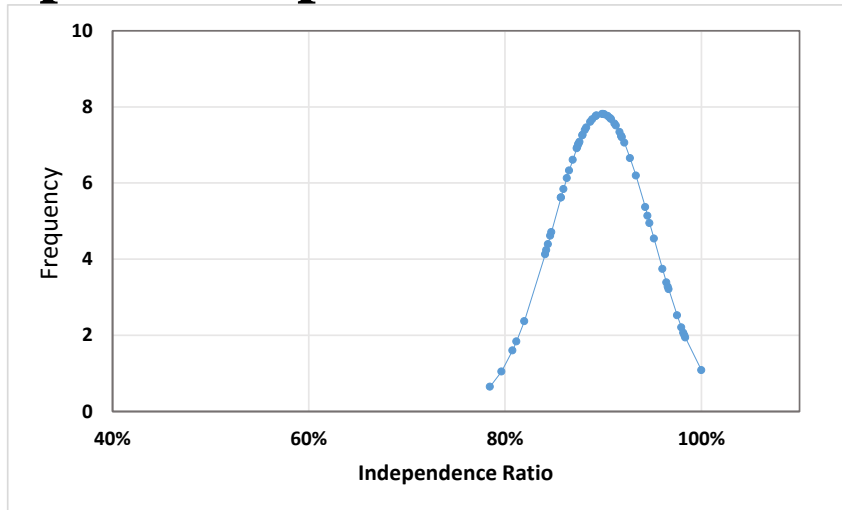
Figure I.22 BChD 5 2014 (n=58) Independence Ratio results at fourth feedback
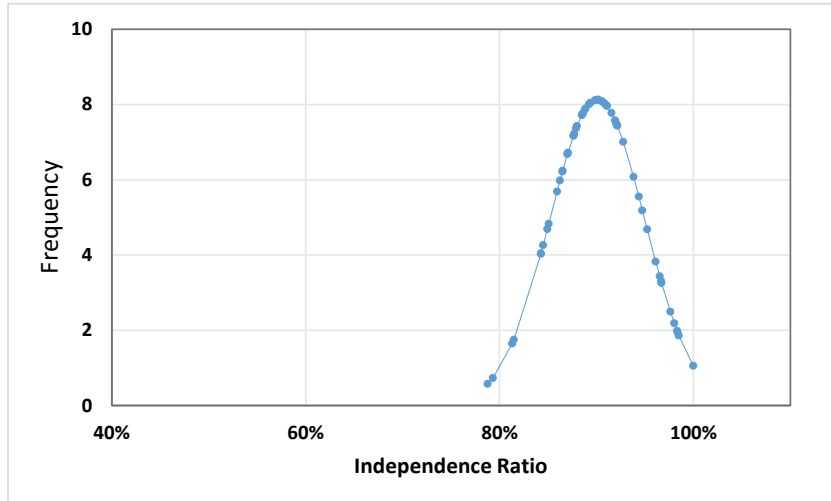
Figure I.23 BChD 5 2014 (n=58) Independence Ratio results at final feedback
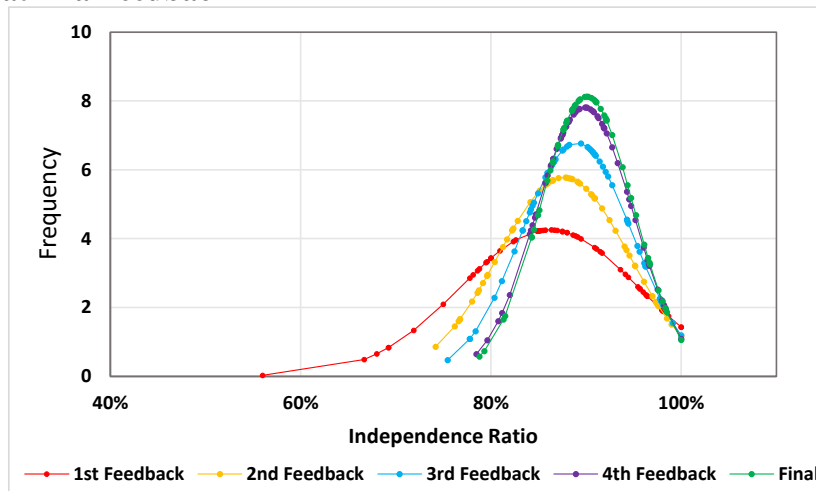
Figure I.24 BChD 5 2014 (n=58) Independence Ratio results comparison of feedback episodes

Graphic Independence Ratio Results
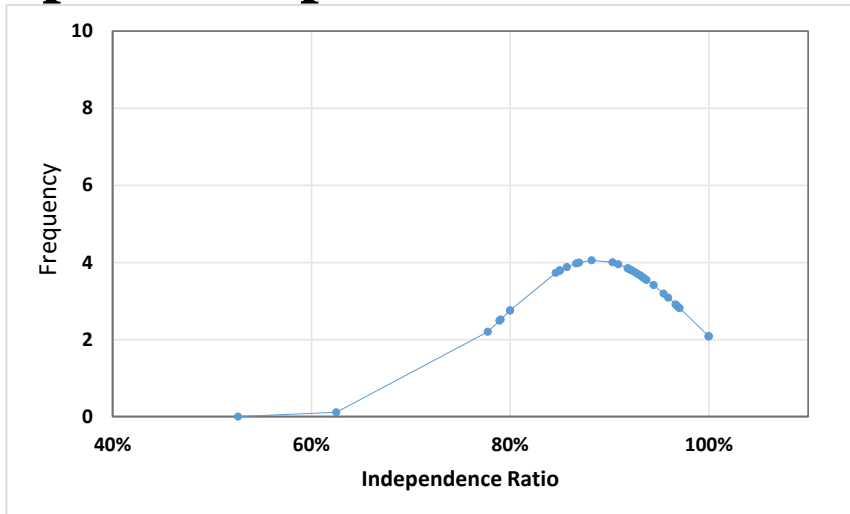
Figure I.25 BChD 5 2015 (n=37) Independence Ratio results at first feedback
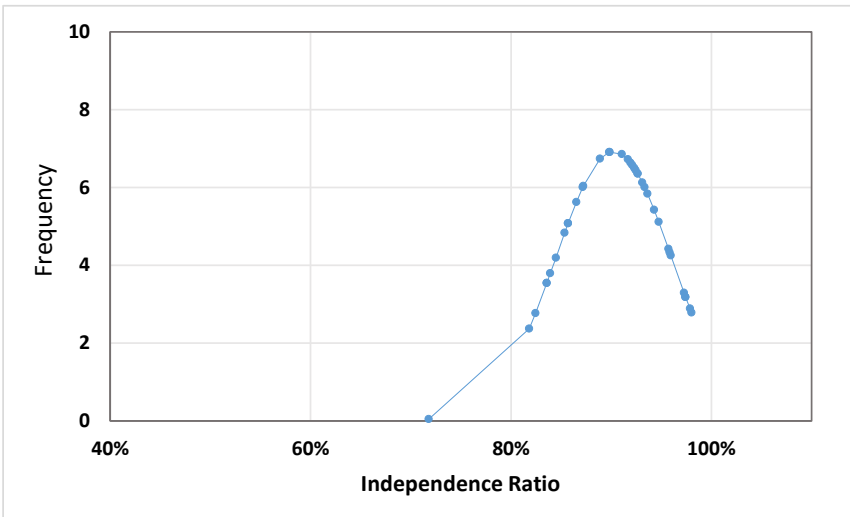
Figure I.26 BChD 5 2015 (n=37) Independence Ratio results at second feedback
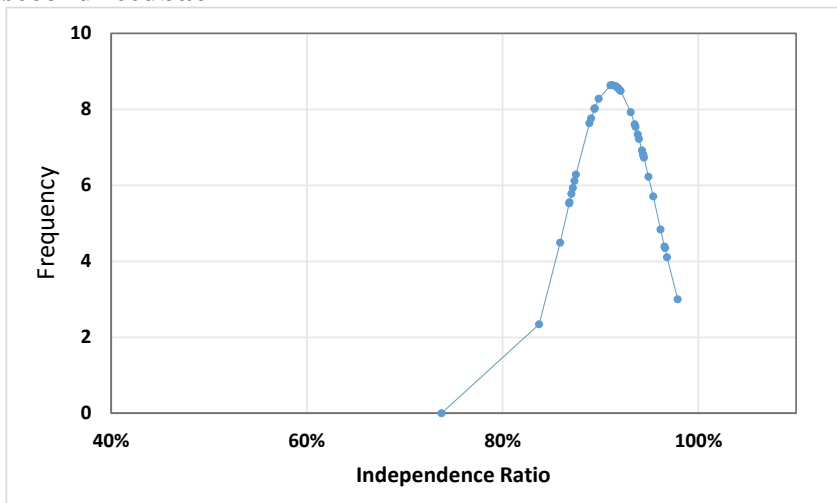
Figure I.27 BChD 5 2015 (n=37) Independence Ratio results at third feedback

Graphic Independence Ratio Results
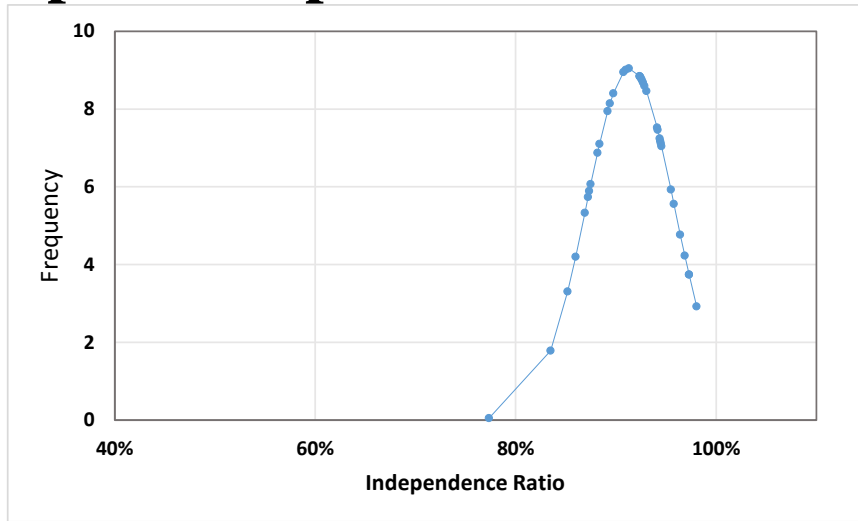
Figure I.28 BChD 5 2015 (n=37) Independence Ratio results at fourth feedback
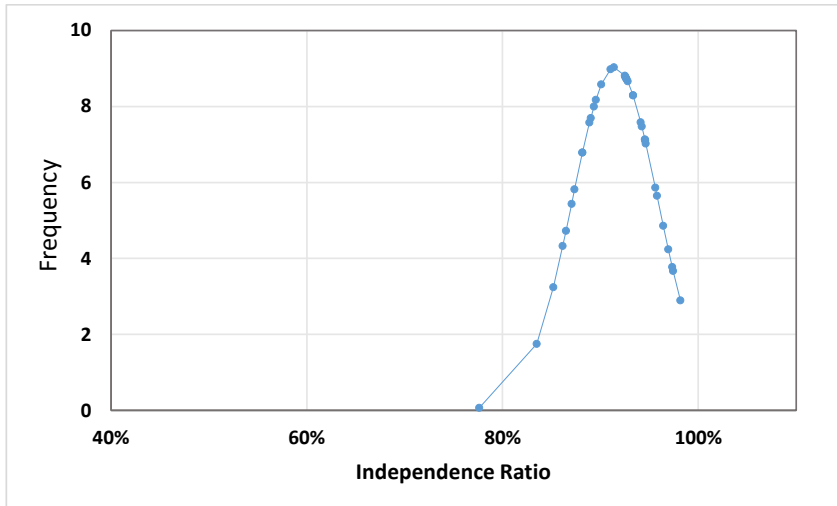
Figure I.29 BChD 5 2015 (n=37) Independence Ratio results at final feedback
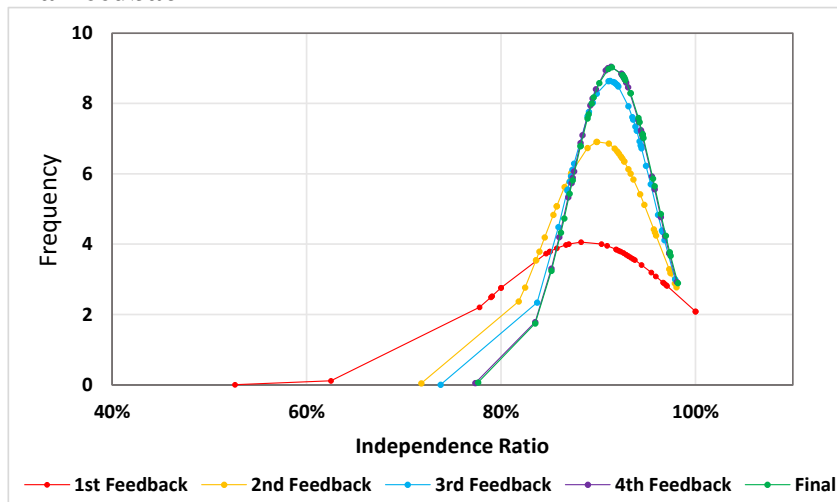
Figure I.30 BChD 5 2015 (n=37) Independence Ratio results comparison of feedback episodes

Graphic Independence Ratio Results
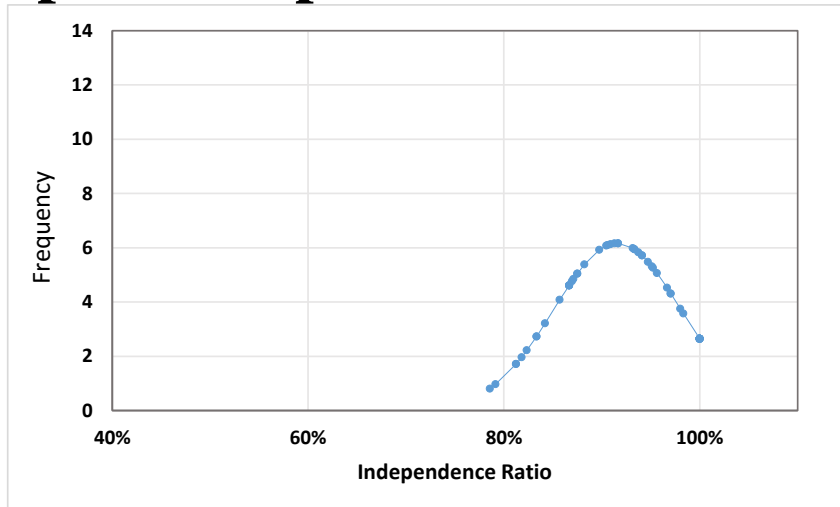
Figure I.31 BChD 5 2016 (n=51) Independence Ratio results at first feedback
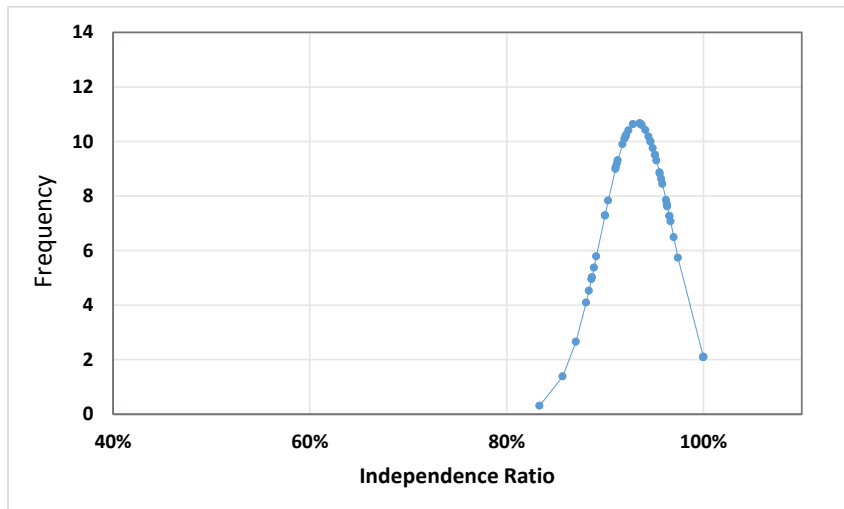
Figure I.32 BChD 5 2016 (n=51) Independence Ratio results at second feedback
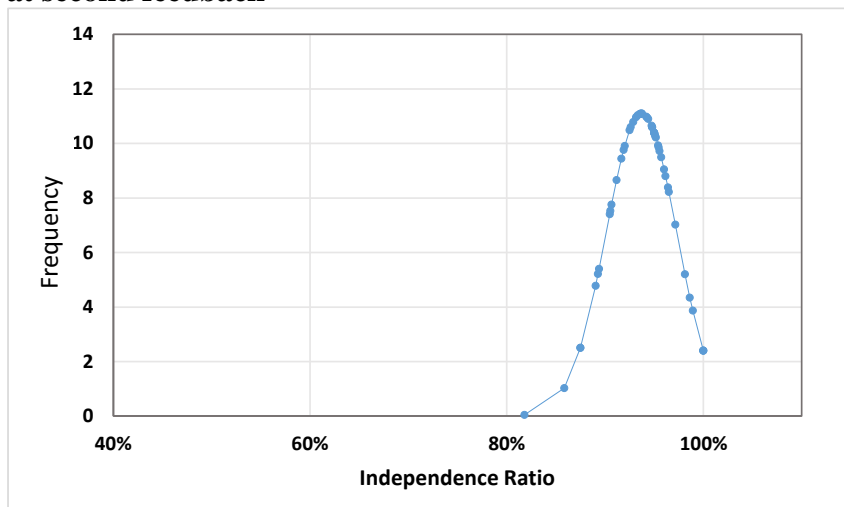
Figure I.33 BChD 5 2016 (n=51) Independence Ratio results at third feedback

Graphic Independence Ratio Results
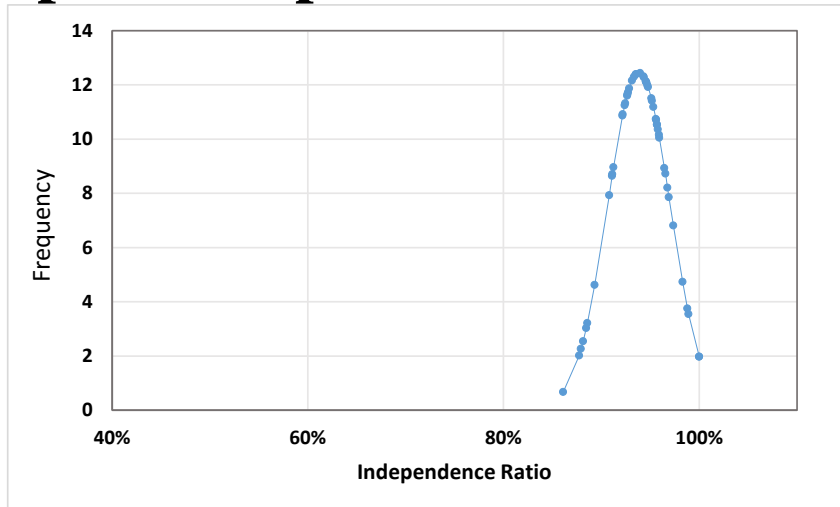
Figure I.34 BChD 5 2016 (n=51) Independence Ratio results at fourth feedback
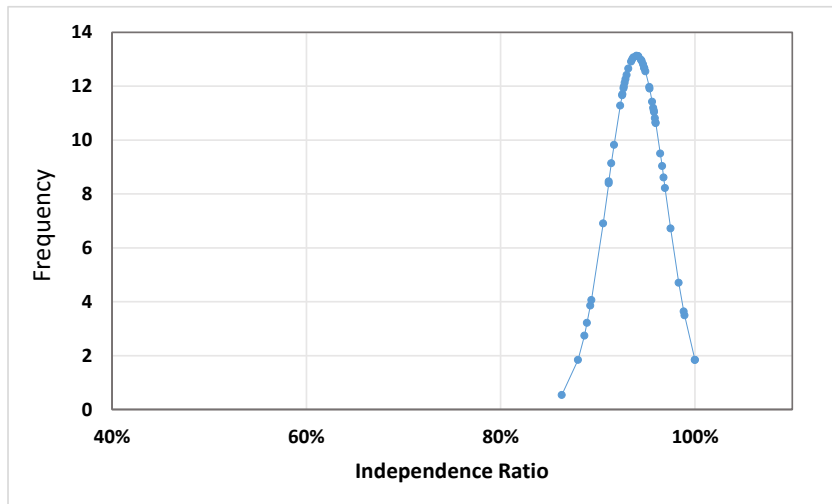
Figure I.35 BChD 5 2016 (n=51) Independence Ratio results at final feedback

Figure I.36 BChD 5 2016 (n=51) Independence Ratio results comparison of feedback episodes

Independence Ratio Results

Table I.1 BChD 4 2014 Individual Independence Ratios (n=42)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1091	87%	93%	94%	95%	95%
1201	94%	97%	97%	97%	95%
1021	92%	93%	94%	94%	93%
1249	83%	88%	91%	94%	93%
1181	90%	94%	94%	93%	93%
1279	98%	93%	93%	92%	92%
1033	100%	94%	89%	91%	91%
1163	86%	84%	89%	90%	91%
1097	89%	89%	91%	89%	90%
1151	74%	82%	84%	86%	89%
1123	73%	76%	85%	87%	88%
1217	93%	94%	90%	86%	88%
1289	93%	87%	88%	88%	88%
1153	79%	75%	81%	87%	88%
1187	81%	77%	86%	89%	88%
1283	88%	86%	84%	87%	88%
1109	81%	78%	81%	87%	88%
1291	91%	85%	87%	88%	87%
1117	67%	74%	78%	87%	87%
1039	67%	70%	79%	84%	87%
1229	71%	79%	84%	85%	86%
1049	83%	84%	87%	85%	86%
1019	81%	84%	84%	85%	86%
1009	58%	81%	85%	87%	86%
1018	88%	89%	89%	88%	86%
1093	100%	95%	83%	85%	86%
1171	76%	86%	83%	83%	85%
1129	91%	84%	81%	85%	84%
1237	93%	89%	88%	85%	84%
1031	79%	78%	78%	82%	82%
1213	81%	79%	81%	82%	82%
1051	79%	77%	75%	81%	82%
1193	71%	80%	78%	81%	81%
1277	80%	66%	75%	78%	81%
1069	78%	84%	79%	80%	79%
1223	89%	78%	76%	76%	79%
1103	92%	76%	74%	79%	78%
1259	57%	74%	75%	74%	77%
1063	68%	69%	78%	76%	77%
1087	62%	66%	75%	76%	77%
1061	88%	82%	79%	73%	73%
1231	82%	78%	79%	76%	73%
Mean	82%	83%	84%	85%	85%
Standard Deviation	11%	8%	6%	6%	6%

Figure I.37 BChD 4 2014 Mean Independence Ratio Results per Feedback Episode

Independence Ratio Results

Table I.2 BChD 4 2015 Individual Independence Ratios (n=51)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1931	94%	98%	95%	97%	97%
1151	100%	100%	98%	96%	95%
1723	93%	93%	93%	95%	95%
1093	89%	88%	91%	94%	94%
1951	91%	93%	93%	94%	94%
1789	89%	89%	90%	93%	93%
1993	95%	92%	92%	93%	93%
2011	80%	85%	93%	93%	93%
1747	79%	88%	90%	92%	92%
1879	86%	85%	91%	91%	91%
1913	77%	83%	86%	88%	90%
1129	75%	83%	88%	89%	89%
1949	79%	89%	87%	88%	88%
1831	86%	88%	89%	88%	88%
1753	81%	85%	85%	87%	88%
1811	86%	89%	88%	88%	88%
1187	89%	83%	87%	87%	87%
1877	86%	83%	88%	87%	87%
1997	86%	92%	88%	87%	87%
1801	78%	79%	79%	87%	87%
2027	88%	87%	88%	88%	86%
2063	92%	85%	85%	86%	86%
1231	53%	74%	79%	85%	86%
2017	77%	79%	82%	85%	85%
1823	67%	80%	84%	85%	85%
1973	58%	84%	84%	85%	85%
1901	75%	91%	86%	85%	85%
2039	80%	76%	82%	84%	85%
1871	67%	89%	87%	84%	84%
1867	71%	79%	85%	83%	84%
1783	73%	77%	81%	84%	84%
1759	60%	79%	82%	83%	84%
1847	73%	82%	83%	83%	83%
2053	56%	85%	83%	83%	83%
2083	82%	76%	80%	81%	83%
2081	89%	80%	82%	82%	82%
2029	86%	83%	80%	83%	82%
1787	41%	70%	73%	82%	82%
1741	69%	82%	84%	82%	82%
2003	71%	81%	80%	82%	82%
1979	91%	79%	83%	81%	81%
1907	63%	85%	82%	80%	81%
1999	88%	84%	85%	82%	80%
1889	79%	86%	80%	80%	80%
2069	64%	79%	79%	80%	80%
1777	47%	63%	70%	78%	79%
1861	58%	84%	84%	80%	79%
1933	67%	77%	76%	79%	79%
1733	57%	73%	74%	78%	78%
1873	65%	65%	66%	75%	76%
1987	59%	66%	73%	71%	71%
Mean	76%	83%	84%	85%	85%
Standard Deviation	14%	8%	6%	5%	5%

Figure I.38 BChD 4 2015 Mean Independence Ratio Results per Feedback Episode

Appendix I
Independence Ratio Results
Table I.3 BChD 4 2016 Individual Independence Ratios (n=62)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
2441	100%	82%	91%	94%	94%
2341	75%	85%	89%	94%	94%
2521	100%	95%	95%	95%	94%
2143	67%	87%	92%	93%	94%
2557	0%	94%	92%	93%	94%
2221	100%	100%	95%	93%	93%
2179	67%	88%	96%	93%	93%
2381	67%	85%	88%	92%	93%
2393	83%	92%	92%	94%	93%
2459	100%	89%	91%	92%	92%
2203	100%	86%	87%	92%	92%
2339	83%	78%	92%	91%	92%
2237	83%	86%	87%	91%	91%
2267	88%	96%	88%	91%	91%
2089	100%	93%	89%	91%	91%
2281	75%	90%	89%	90%	90%
2383	100%	90%	94%	91%	90%
2129	88%	91%	88%	88%	90%
2113	88%	89%	84%	89%	90%
2423	50%	89%	91%	90%	89%
2099	100%	75%	85%	89%	89%
2437	57%	76%	83%	89%	89%
2287	50%	79%	89%	90%	89%
2207	50%	73%	79%	89%	89%
2239	100%	95%	91%	90%	89%
2539	60%	80%	84%	87%	89%
2311	100%	100%	100%	89%	89%
2309	71%	79%	83%	89%	89%
2137	75%	71%	84%	90%	89%
2467	57%	79%	89%	89%	89%
2297	71%	53%	79%	85%	89%
2549	29%	75%	84%	88%	89%
2399	83%	91%	85%	89%	89%
2293	0%	87%	84%	88%	88%
2531	50%	65%	79%	86%	88%
2243	100%	94%	91%	88%	88%
2543	50%	80%	88%	88%	88%
2447	100%	81%	91%	87%	88%
2141	100%	95%	90%	87%	87%
2477	100%	93%	86%	85%	87%
2161	60%	79%	82%	87%	87%
2579	63%	80%	87%	88%	86%
2371	100%	73%	83%	85%	86%
2131	86%	81%	83%	84%	84%
2153	71%	74%	81%	84%	84%
2473	100%	86%	82%	84%	84%
2411	100%	82%	80%	84%	84%
2347	0%	78%	83%	84%	84%
2377	100%	82%	74%	81%	84%
2357	78%	82%	81%	82%	83%
2273	67%	70%	78%	83%	83%
2087	63%	89%	86%	82%	83%
2417	88%	79%	79%	84%	83%
2503	80%	79%	75%	83%	82%
2251	67%	70%	71%	83%	82%
2269	83%	71%	80%	80%	82%
2333	50%	70%	84%	82%	81%
2351	100%	78%	76%	81%	81%
2111	25%	50%	77%	82%	81%
2389	80%	77%	86%	79%	80%
2551	50%	43%	69%	75%	80%
2213	60%	68%	71%	72%	74%
Mean	74%	81%	85%	87%	88%
Standard Deviation	26%	11%	6%	5%	4%
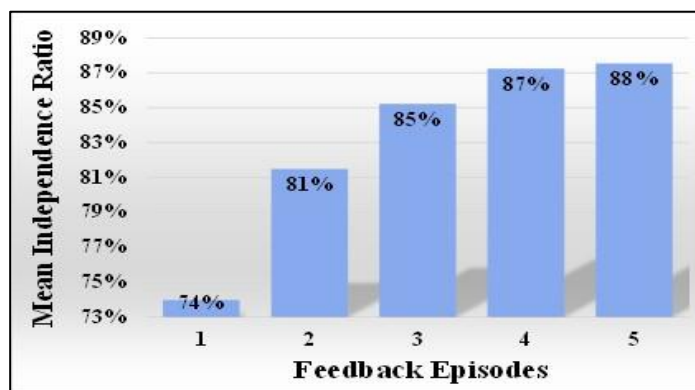
Figure I.39 BChD 4 2016 Mean Independence Ratio Results per Feedback Episode

Independence Ratio Results

Table I.4 BChD 5 2014 Individual Independence Ratios (n=58)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1709	100%	100%	100%	100%	100%
1301	98%	97%	98%	98%	99%
1579	99%	99%	99%	98%	98%
1621	98%	98%	98%	98%	98%
1543	98%	99%	98%	98%	98%
1319	96%	98%	98%	98%	98%
1627	96%	95%	96%	97%	97%
1597	96%	95%	96%	97%	97%
1583	94%	94%	96%	96%	97%
1487	94%	95%	95%	96%	96%
1607	91%	93%	94%	95%	95%
1367	95%	97%	96%	95%	95%
1493	96%	97%	94%	94%	94%
1697	96%	96%	94%	95%	94%
1423	89%	91%	92%	93%	93%
1553	88%	90%	91%	92%	92%
1549	88%	91%	93%	93%	92%
1657	87%	89%	91%	92%	92%
1373	91%	91%	91%	92%	92%
1429	86%	89%	91%	92%	92%
1511	88%	89%	90%	91%	92%
1453	96%	94%	92%	92%	91%
1399	87%	92%	94%	90%	91%
1427	72%	80%	86%	89%	91%
1523	92%	88%	89%	91%	91%
1481	89%	91%	92%	91%	91%
1439	100%	89%	91%	90%	90%
1409	85%	88%	90%	91%	90%
1321	85%	86%	88%	89%	90%
1567	83%	83%	85%	88%	89%
1361	89%	92%	91%	89%	89%
1297	89%	88%	88%	90%	89%
1327	94%	91%	91%	90%	89%
1531	85%	86%	88%	89%	89%
1601	88%	87%	87%	88%	89%
1637	86%	87%	88%	88%	89%
1447	79%	86%	86%	88%	89%
1381	81%	86%	87%	87%	88%
1699	56%	78%	85%	88%	88%
1459	75%	82%	86%	88%	88%
1433	69%	77%	78%	84%	88%
1669	80%	84%	87%	87%	88%
1303	82%	82%	86%	87%	87%
1489	80%	80%	84%	87%	87%
1667	69%	79%	84%	86%	87%
1571	68%	82%	86%	88%	87%
1619	79%	81%	82%	85%	86%
1471	91%	82%	84%	86%	86%
1663	88%	88%	87%	86%	86%
1451	85%	85%	84%	84%	85%
1693	79%	79%	83%	85%	85%
1721	85%	86%	86%	86%	85%
1307	80%	77%	80%	82%	84%
1559	78%	79%	83%	84%	84%
1613	78%	80%	81%	81%	81%
1483	80%	76%	78%	81%	81%
1609	67%	74%	78%	80%	79%
1499	85%	77%	75%	78%	79%
Mean	86%	88%	89%	90%	90%
Standard Deviation	9%	7%	6%	5%	5%
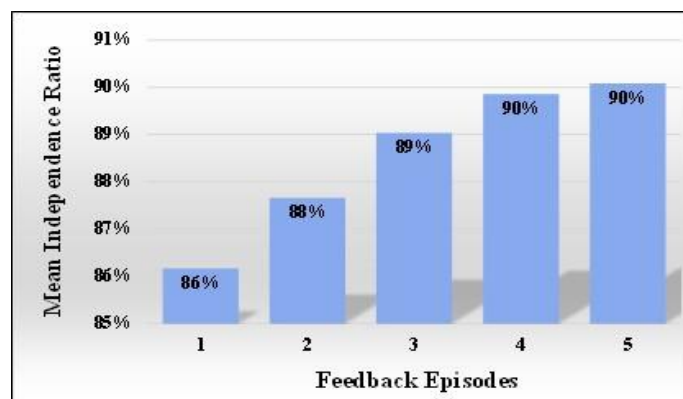
Figure I.40 BChD 5 2014 Mean Independence Ratio Results per Feedback Episode

Independence Ratio Results

Table I.5 BChD 5 2015 Individual Independence Ratios (n=37)

Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1279	95%	97%	98%	98%	98%
1153	100%	97%	97%	97%	97%
1283	97%	97%	97%	97%	97%
1097	97%	96%	95%	97%	97%
1201	96%	96%	96%	96%	96%
1171	97%	96%	97%	96%	96%
1091	92%	93%	94%	95%	96%
1117	94%	92%	94%	94%	95%
1009	93%	95%	94%	95%	95%
1237	85%	92%	94%	94%	95%
1249	88%	91%	94%	94%	95%
1019	85%	93%	94%	94%	94%
1223	100%	98%	95%	94%	94%
1163	93%	94%	92%	93%	93%
1291	100%	98%	94%	93%	93%
1039	91%	94%	94%	93%	93%
1289	92%	93%	92%	93%	93%
1181	92%	92%	92%	93%	93%
1213	97%	92%	92%	92%	93%
1033	93%	93%	93%	92%	93%
1109	93%	92%	91%	92%	93%
1193	80%	85%	92%	91%	91%
1021	94%	90%	90%	91%	91%
1217	90%	90%	91%	91%	90%
1229	94%	87%	89%	89%	90%
1031	85%	86%	89%	89%	89%
1018	86%	86%	87%	88%	89%
1049	87%	89%	89%	90%	89%
1051	80%	84%	87%	87%	88%
1087	92%	84%	89%	88%	88%
1061	63%	82%	87%	87%	87%
1069	85%	87%	87%	87%	87%
1123	78%	84%	88%	86%	86%
1277	87%	87%	87%	88%	86%
1063	79%	84%	86%	85%	85%
1259	79%	82%	84%	84%	84%
1103	53%	72%	74%	77%	78%
Mean	89%	90%	91%	91%	92%
Standard Deviation	10%	6%	5%	4%	4%
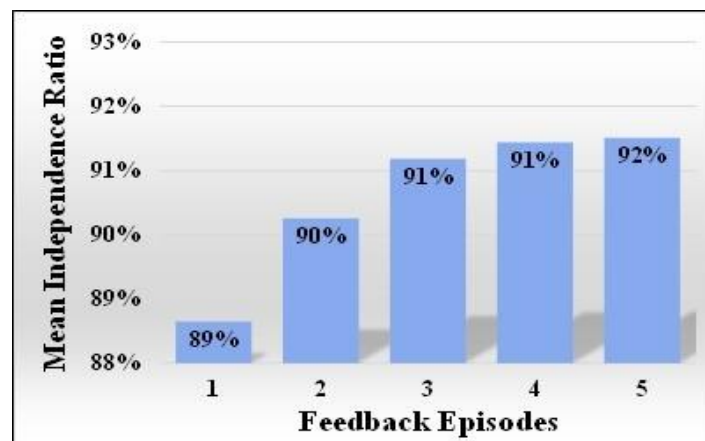
Figure I.41 BChD 5 2015 Mean Independence Ratio Results per Feedback Episode

Independence Ratio Results

Table I.6 BChD 5 2016 Individual Independence Ratios (n=51)
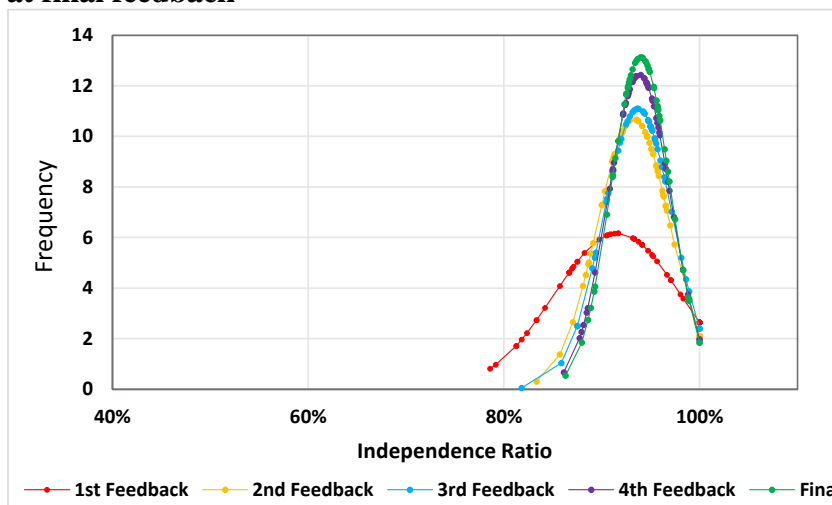
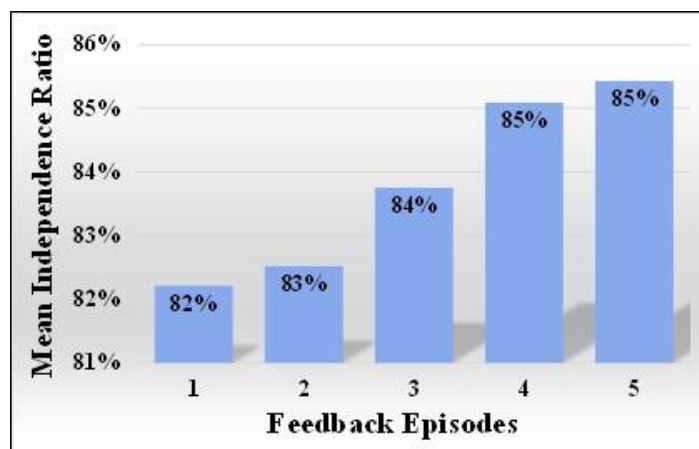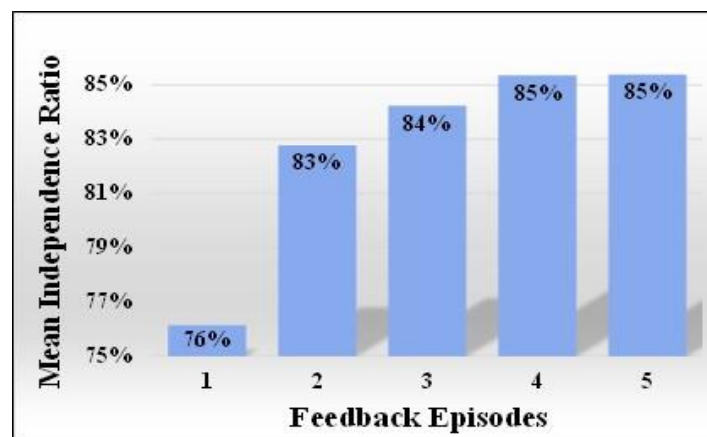| Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1871	100%	100%	100%	100%	100%
2081	100%	100%	100%	100%	100%
1951	100%	100%	99%	99%	99%
1753	100%	100%	100%	99%	99%
1847	100%	97%	98%	98%	98%
1787	100%	97%	99%	97%	98%
1151	100%	97%	96%	97%	97%
1231	94%	97%	96%	97%	97%
1777	93%	97%	96%	96%	97%
1867	87%	94%	95%	96%	96%
1933	87%	96%	95%	96%	96%
1831	96%	96%	97%	96%	96%
1931	95%	96%	96%	96%	96%
2039	82%	95%	95%	96%	96%
2027	92%	96%	95%	96%	96%
1187	87%	94%	95%	96%	96%
1093	100%	96%	96%	97%	96%
1879	83%	94%	95%	95%	95%
1783	91%	92%	95%	95%	95%
1723	97%	95%	94%	95%	95%
1733	92%	96%	94%	95%	95%
2029	97%	96%	95%	95%	95%
1993	98%	94%	94%	95%	95%
1979	88%	95%	94%	94%	95%
2003	88%	94%	94%	94%	94%
1949	100%	94%	95%	94%	94%
2069	97%	95%	95%	95%	94%
1789	91%	95%	95%	95%	94%
1747	88%	91%	93%	94%	94%
2017	93%	92%	93%	94%	94%
1801	94%	95%	96%	93%	93%
1759	84%	90%	94%	93%	93%
1913	93%	92%	93%	93%	93%
2053	79%	88%	92%	93%	93%
1823	95%	91%	92%	92%	93%
2011	94%	92%	93%	93%	93%
1129	95%	93%	94%	93%	93%
1907	87%	90%	92%	92%	93%
1741	83%	91%	94%	92%	93%
1999	98%	91%	93%	92%	92%
1873	90%	92%	91%	91%	92%
1997	91%	89%	90%	91%	91%
1811	82%	89%	88%	91%	91%
1973	87%	89%	89%	91%	91%
1889	79%	86%	89%	88%	91%
1901	86%	88%	91%	89%	89%
1987	100%	92%	88%	88%	89%
1861	90%	87%	89%	89%	89%
2063	87%	90%	91%	88%	89%
1877	81%	83%	86%	88%	88%
2083	81%	89%	82%	86%	86%
Mean	92%	93%	94%	94%	94%
Standard Deviation	6%	4%	4%	3%	3%

Figure I.42 BChD 5 2016 Mean Independence Ratio Results per Feedback Episode

Independence Ratio Results

Table I.7 Changes in Individual Independence Ratios for BChD 4 2014 cohort followed until 2015

BChD 4 Individual Independence Ratio 2014						BChD 5 Individual Independence Ratio 2015					
Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final	Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1279	98%	93%	93%	92%	92%	1279	95%	97%	98%	98%	98%
1153	79%	75%	81%	87%	88%	1153	100%	97%	97%	97%	97%
1283	88%	86%	84%	87%	88%	1283	97%	97%	97%	97%	97%
1097	89%	89%	91%	89%	90%	1097	97%	96%	95%	97%	97%
1201	94%	97%	97%	97%	95%	1201	96%	96%	96%	96%	96%
1171	76%	86%	83%	83%	85%	1171	97%	96%	97%	96%	96%
1091	87%	93%	94%	95%	95%	1091	92%	93%	94%	95%	96%
1117	67%	74%	78%	87%	87%	1117	94%	92%	94%	94%	95%
1009	58%	81%	85%	87%	86%	1009	93%	95%	94%	95%	95%
1237	93%	89%	88%	85%	84%	1237	85%	92%	94%	94%	95%
1249	83%	88%	91%	94%	93%	1249	88%	91%	94%	94%	95%
1019	81%	84%	84%	85%	86%	1019	85%	93%	94%	94%	94%
1223	89%	78%	76%	76%	79%	1223	100%	98%	95%	94%	94%
1163	86%	84%	89%	90%	91%	1163	93%	94%	92%	93%	93%
1291	91%	85%	87%	88%	87%	1291	100%	98%	94%	93%	93%
1039	67%	70%	79%	84%	87%	1039	91%	94%	94%	93%	93%
1289	93%	87%	88%	88%	88%	1289	92%	93%	92%	93%	93%
1181	90%	94%	94%	93%	93%	1181	92%	92%	92%	93%	93%
1213	81%	79%	81%	82%	82%	1213	97%	92%	92%	92%	93%
1033	100%	94%	89%	91%	91%	1033	93%	93%	93%	92%	93%
1109	81%	78%	81%	87%	88%	1109	93%	92%	91%	92%	93%
1193	71%	80%	78%	81%	81%	1193	80%	85%	92%	91%	91%
1021	92%	93%	94%	94%	93%	1021	94%	90%	90%	91%	91%
1217	93%	94%	90%	86%	88%	1217	90%	90%	91%	91%	90%
1229	71%	79%	84%	85%	86%	1229	94%	87%	89%	89%	90%
1031	79%	78%	78%	82%	82%	1031	85%	86%	89%	89%	89%
1018	88%	89%	89%	88%	86%	1018	86%	86%	87%	88%	89%
1049	83%	84%	87%	85%	86%	1049	87%	89%	89%	90%	89%
1051	79%	77%	75%	81%	82%	1051	80%	84%	87%	87%	88%
1087	62%	66%	75%	76%	77%	1087	92%	84%	89%	88%	88%
1061	88%	82%	79%	73%	73%	1061	63%	82%	87%	87%	87%
1069	78%	84%	79%	80%	79%	1069	85%	87%	87%	87%	87%
1123	73%	76%	85%	87%	88%	1123	78%	84%	88%	86%	86%
1277	80%	66%	75%	78%	81%	1277	87%	87%	87%	88%	86%
1063	68%	69%	78%	76%	77%	1063	79%	84%	86%	85%	85%
1259	57%	74%	75%	74%	77%	1259	79%	82%	84%	84%	84%
1103	92%	76%	74%	79%	78%	1103	53%	72%	74%	77%	78%
1093	100%	95%	83%	85%	86%						
1129	91%	84%	81%	85%	84%						
1151	74%	82%	84%	86%	89%						
1187	81%	77%	86%	89%	88%						
1231	82%	78%	79%	76%	73%						
Mean	82%	83%	84%	85%	85%	Mean	89%	90%	91%	91%	92%
Standard deviation	11%	8%	6%	6%	6%	Standard deviation	10%	6%	5%	4%	4%

Independence Ratio Results
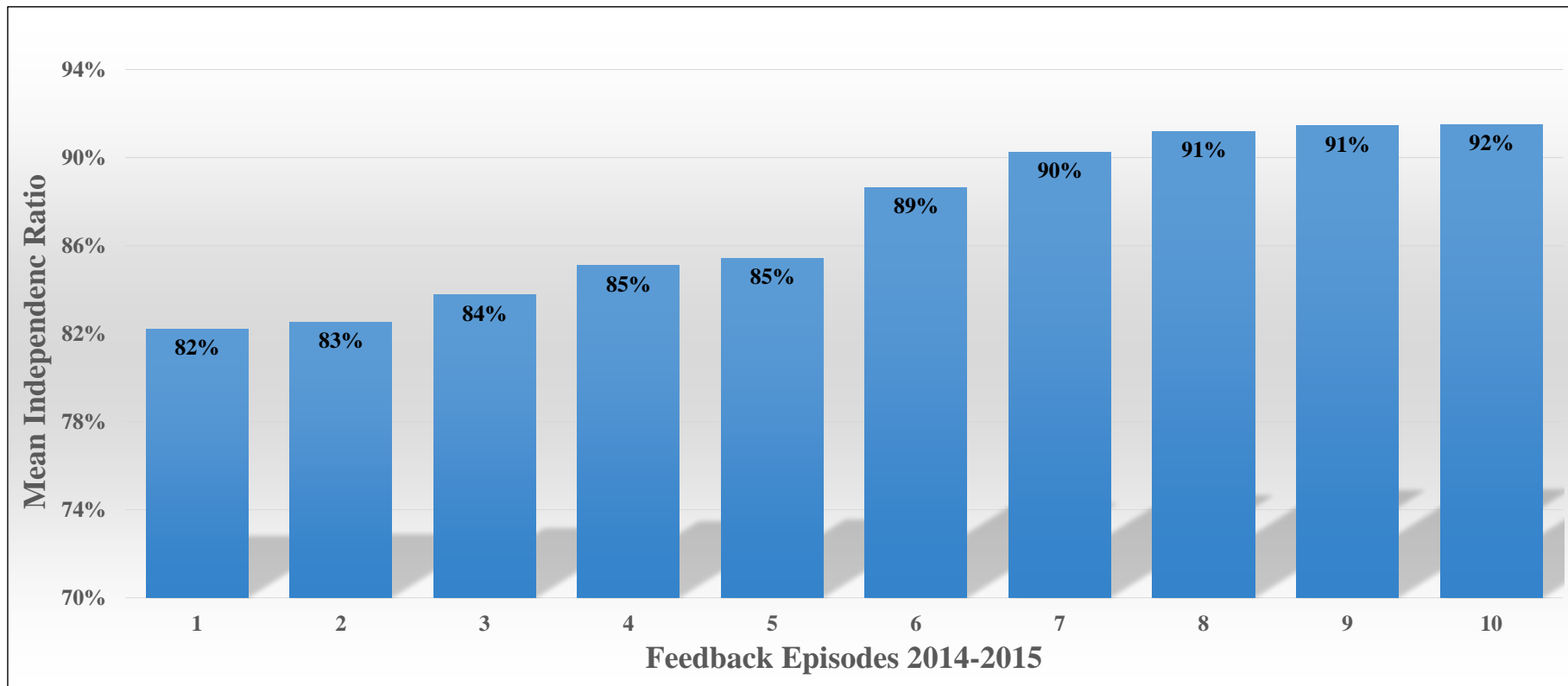
Figure I.43 Mean Independence Ratio Results per feedback episode of BChD 4 2014 cohort followed until 2015

Independence Ratio Results

Table I.8 Changes in Individual Independence Ratios for BChD 4 2015 cohort followed until 2016

BChD 4 Individual Independence Ratio 2015					
Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1871	67%	89%	87%	84%	84%
2081	89%	80%	82%	82%	82%
1951	91%	93%	93%	94%	94%
1753	81%	85%	85%	87%	88%
1847	73%	82%	83%	83%	83%
1787	41%	70%	73%	82%	82%
1151	100%	100%	98%	96%	95%
1231	53%	74%	79%	85%	86%
1777	47%	63%	70%	78%	79%
1867	71%	79%	85%	83%	84%
1933	67%	77%	76%	79%	79%
1831	86%	88%	89%	88%	88%
1931	94%	98%	95%	97%	97%
2039	80%	76%	82%	84%	85%
2027	88%	87%	88%	88%	86%
1187	89%	83%	87%	87%	87%
1093	89%	88%	91%	94%	94%
1879	86%	85%	91%	91%	91%
1783	73%	77%	81%	84%	84%
1723	93%	93%	93%	95%	95%
1733	57%	73%	74%	78%	78%
2029	86%	83%	80%	83%	82%
1993	95%	92%	92%	93%	93%
1979	91%	79%	83%	81%	81%
2003	71%	81%	80%	82%	82%
1949	79%	89%	87%	88%	88%
2069	64%	79%	79%	80%	80%
1789	89%	89%	90%	93%	93%
1747	79%	88%	90%	92%	92%
2017	77%	79%	82%	85%	85%
1801	78%	79%	79%	87%	87%
1759	60%	79%	82%	83%	84%
1913	77%	83%	86%	88%	90%
2053	56%	85%	83%	83%	83%
1823	67%	80%	84%	85%	85%
2011	80%	85%	93%	93%	93%
1129	75%	83%	88%	89%	89%
1907	63%	85%	82%	80%	81%
1741	69%	82%	84%	82%	82%
1999	88%	84%	85%	82%	80%
1873	65%	65%	66%	75%	76%
1997	86%	92%	88%	87%	87%
1811	86%	89%	88%	88%	88%
1973	58%	84%	84%	85%	85%
1889	79%	86%	80%	80%	80%
1901	75%	91%	86%	85%	85%
1987	59%	66%	73%	71%	71%
1861	58%	84%	84%	80%	79%
2063	92%	85%	85%	86%	86%
1877	86%	83%	88%	87%	87%
2083	82%	76%	80%	81%	83%
Mean	76%	83%	84%	85%	85%
Standard Deviation	14%	8%	6%	5%	5%

BChD 5 Inidividual Independence Ratio 2016					
Student ID No.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Final
1871	100%	100%	100%	100%	100%
2081	100%	100%	100%	100%	100%
1951	100%	100%	99%	99%	99%
1753	100%	100%	100%	99%	99%
1847	100%	97%	98%	98%	98%
1787	100%	97%	99%	97%	98%
1151	100%	97%	96%	97%	97%
1231	94%	97%	96%	97%	97%
1777	93%	97%	96%	96%	97%
1867	87%	94%	95%	96%	96%
1933	87%	96%	95%	96%	96%
1831	96%	96%	97%	96%	96%
1931	95%	96%	96%	96%	96%
2039	82%	95%	95%	96%	96%
2027	92%	96%	95%	96%	96%
1187	87%	94%	95%	96%	96%
1093	100%	96%	96%	97%	96%
1879	83%	94%	95%	95%	95%
1783	91%	92%	95%	95%	95%
1723	97%	95%	94%	95%	95%
1733	92%	96%	94%	95%	95%
2029	97%	96%	95%	95%	95%
1993	98%	94%	94%	95%	95%
1979	88%	95%	94%	94%	95%
2003	88%	94%	94%	94%	94%
1949	100%	94%	95%	94%	94%
2069	97%	95%	95%	95%	94%
1789	91%	95%	95%	95%	94%
1747	88%	91%	93%	94%	94%
2017	93%	92%	93%	94%	94%
1801	94%	95%	96%	93%	93%
1759	84%	90%	94%	93%	93%
1913	93%	92%	93%	93%	93%
2053	79%	88%	92%	93%	93%
1823	95%	91%	92%	92%	93%
2011	94%	92%	93%	93%	93%
1129	95%	93%	94%	93%	93%
1907	87%	90%	92%	92%	93%
1741	83%	91%	94%	92%	93%
1999	98%	91%	93%	92%	92%
1873	90%	92%	91%	91%	92%
1997	91%	89%	90%	91%	91%
1811	82%	89%	88%	91%	91%
1973	87%	89%	89%	91%	91%
1889	79%	86%	89%	88%	91%
1901	86%	88%	91%	89%	89%
1987	100%	92%	88%	88%	89%
1861	90%	87%	89%	89%	89%
2063	87%	90%	91%	88%	89%
1877	81%	83%	86%	88%	88%
2083	81%	89%	82%	86%	86%
Mean	92%	93%	94%	94%	94%
Standard Deviation	6%	4%	4%	3%	3%

Independence Ratio Results
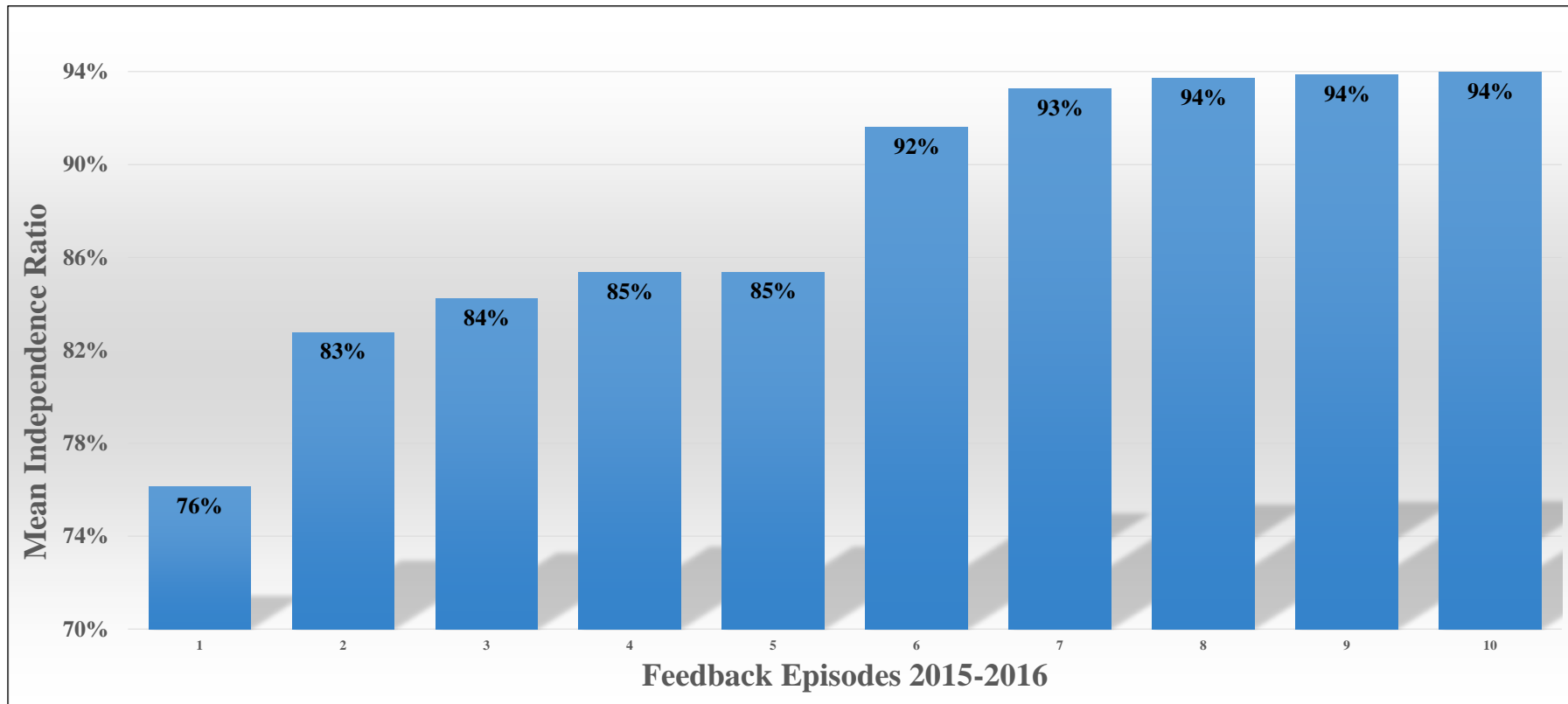
Figure I.44 Mean Independence Ratio Results per feedback episode of BChD 4 2015 cohort followed until 2016

Students' exposure to Assessors

Appendix J: Student's Exposure to Assessors

Table J.1 BChD 4 2014 (n=42) Number of encounters students were exposed to supervisors/assessors

Student ID No.	Assessors										Total No. of Assessments	Total No. of Assessors exposed to	Percentage Exposure
	Investigator *	1	2	3	4	5	6	7	8	9			
1109	3	3	8	9	23	40	3	1	7	7	104	10	100%
1039	3	3	22	18	28	29	2	1	3	9	118	10	100%
1279	63	3	8	34	55	9	4	1	34	4	215	10	100%
1049	23	2	27	2	4	11	3	8	12	1	93	10	100%
1018	10	4	27	11	15	4	4	2	9	3	89	10	100%
1123	13	3	40	22	29	25	15	1	16	11	175	10	100%
1291	16	2	13	11	33	13	3	1	8	8	108	10	100%
1187	6	6	9	16	29	8	4	3	12	10	103	10	100%
1283	11	5	27	10	15	10	3	1	11	17	110	10	100%
1087	15	2	6	8	10	14	8		5	5	73	9	90%
1201	24	21	11	16	5	3	5		21	8	114	9	90%
1229	12	1	17	10	6	13	2		2	12	75	9	90%
1051	11	1	5	9	33	12	4		2	3	80	9	90%
1091	19	11	24	6	20	51	8		3	6	148	9	90%
1237	7	5	35	13	10	6	2		2	3	83	9	90%
1193	6	3	30	3	16	2	9	1	9		79	9	90%
1117	9	9	18	6	13	13	6		11	4	89	9	90%
1171	22	9	10	22	10	5	2		4	5	89	9	90%
1213	13	1	22	13	11	27	3		1	4	95	9	90%
1063	12	9	18	4	25	5	9		6	1	89	9	90%
1249	12	6	23	18	8	3	7		12	2	91	9	90%
1031	13	8	8	11	14	2	4	4	21		85	9	90%
1009	19	5	9	3	40	20	6		7	11	120	9	90%
1097	4		15	4	37	12	14	6	8	5	105	9	90%
1151	5		6	15	10	22	2		11	6	77	8	80%
1021	15	2	18	17	39	4			13	13	121	8	80%
1259	15		24	13	14	9	8		8	6	97	8	80%
1019	20		15	17	14	16	3	3	6		94	8	80%
1277	3	1	29	2	10	28	3		2		78	8	80%
1223	18		15	8	13	15	15		3	3	90	8	80%
1217	13	3	49	20	6	4			3	1	99	8	80%
1061	2		24	9	10	6		5	5	4	65	8	80%
1103	10		24	7	5	7	4		6	4	67	8	80%
1033	17	1	19	9	30	8		1		3	88	8	80%
1289	13		7	30	25	13		1	9	14	112	8	80%
1181	17	10	36	12	18	9	2		9		113	8	80%
1093	13	5	13	6	10	5	4			12	68	8	80%
1231	14	1	8	3	16	3			5	6	56	8	80%
1069	13		29	8	17		1		1	2	71	7	70%
1153			15	10	15	15	5		11	2	73	7	70%
1163	12		2	7	19	51	7		6		104	7	70%
1129	13		13	12	7	3			5		53	6	60%
Total	559	145	778	484	767	555	184	40	329	215	4056	10	
Mean	14	5	19	12	18	14	5	3	8	6	97	9	87%

*Investigator = Primary Researcher (Control)

Students' exposure to Assessors

Table J.2 BChD 4 2015 (n=51) Number of encounters students were exposed to supervisors/assessors

Student ID No.	Assessors													Total No. of Assessments	Total No. of Assessors exposed to	Percentage Exposure
	Investigator *	1	2	3	4	5	6	7	8	9	10	11	12			
1913	4	10	18	44	11	8	3	9	8	11	1	10	1	138	13	100%
1933	21	5	18	7	4	1	1	6	3	8	9	9		92	12	92%
1783	10	2	6	26	3	4	2	5	4	9	1	13		85	12	92%
1993	70	8	32	36	13	10		8	15	23	1	28	1	245	12	92%
1759	9	15	10	20	2	4		2	11	1	2	4	1	81	12	92%
2053	24	2	11	16	1	17		2	9	10		17	2	111	11	85%
2069	4	2	19	16	10	4		3	12	2	1	7		80	11	85%
1861	14	3	7	10	13	5	3		5	9	1	18		88	11	85%
2029	11	12	18	3	11	7		3	2	12	5	17		101	11	85%
1789	46	9	25	18	16	26		15	40	2	1	9		207	11	85%
2003	5	4	22	5	13	8		3	9	1	1	12		83	11	85%
1867	8	9		53	7	7	1	4	30	7		10	1	137	11	85%
1873	1	7	17	22	5	12		2	4	13		17	1	101	11	85%
1777	8	1	8	9	6	4		4	13	7		20	4	84	11	85%
1811	10	2	9	9	36	8		1	19	15	1	4		114	11	85%
1093	18	2	4	29	1	16		1	9	6		9	2	97	11	85%
1949	20	8	4	4	8	4		3	11	11	5	1		79	11	85%
1129	3	3	12	8	5	5		1	6	14		15	3	75	11	85%
1879	14	3	22	34	9	6		2	25	6		16		137	10	77%
1723	20		20	53	3	1		3	5	9	2	17		133	10	77%
1901	2	5	15	11	10	5		6	11	5		10		80	10	77%
1931	7	1	24	33	3	1		4	18	5		17		113	10	77%
1889	10	3	3	7	2	5		10	14	25		10		89	10	77%
1747	19	4	4	21	2	14		5	3	4		8		84	10	77%
1987	8	3	6	4	20		1	3	13	2		10		70	10	77%
1907	17	15	26	18	4	2		7	23	7		6		125	10	77%
1787	5	2	8	30	2	4		9	16	2		6		84	10	77%
1973	14	7	14	17	11	1		7	9	18		10		108	10	77%
1733	12	6	13	4	10	2		2	6		1	28		84	10	77%
1877	1	6	13	15	4	13		2	5	13		7		79	10	77%
2081	9	1	16	27	5	11		2	14	9		9		103	10	77%
1997	14	9	7	27	5			6	9	2	2	34		115	10	77%
2039	5	2	20	23	9	11	2	13		4		9		98	10	77%
1999	3	3	21	12	6	3		4	14	13		7		86	10	77%
2027	3	1	24	6	1	20		4	5	3		11		78	10	77%
1979	5	1	20	7	2	23		2	8	3		8		79	10	77%
1187	13	6	19	12	7	4		7	15	6		21		110	10	77%
1231	7	3	3	8	3	14			13	14		7	3	75	10	77%
2083	23	4		21	8	3		6	3		1	27		96	9	69%
1151	2	4	10	16	9	11			11	8		6		77	9	69%
2011	8	15	88	1	39	1		4	5			46		207	9	69%
1823	14	5	31	26	11			5	6	2		7		107	9	69%
1801	7	2	10	6	2	7			20		2	7		63	9	69%
1847	20	12	31	4	3	3		4	5			23		105	9	69%
1831	3	3	23	10	14	9			2	2		29		95	9	69%
2017	12	10	5	51	10			1	8	8		9		114	9	69%
2063	30		28	17	3	9		2	4	7		7		107	9	69%
1753	1	3	25	11	19	10			12	2		15		98	9	69%
1871	16	7	4	21	12	16			8	4		17		105	9	69%
1741	26	6	3	12	18			14	3	15		22		119	9	69%
1951	5		20	5	3	1		4	11			14		63	8	62%
Total	641	256	816	905	434	360	13	210	534	359	37	700	19	5284	13	
Mean	13	5	17	18	9	8	2	5	11	8	2	14	2	104	10	78%

*Investigator = Primary Researcher (Control)

Students' exposure to Assessors

Table J.3 BChD 4 2016 (n=62) Number of encounters students were exposed to supervisors/assessors

Student ID No.	Assessors											Total No. of Assessments	Total No. of Assessors exposed to	Percentage Exposure
	Investigator *	1	2	3	7	8	9	10	11	12	13			
2351	6	10	3	13	1	2	15	4	5	11	7	77	11	100%
2467	15	2	2	10	1	4	4	2	10	4	28	82	11	100%
2129	7	4	5	28		1	5	11	2	2	15	80	10	91%
2521	19	6	10	17		3	2	1	7	1	9	75	10	91%
2273	1	1	3	22		4	4	1	9	6	33	84	10	91%
2357	3	2	12	5		4	14	8	7	5	13	73	10	91%
2207	7	1	10	6		1	3	5	16	1	13	63	10	91%
2269	11	2	14	12		1	11	1	10	4	16	82	10	91%
2297	5	2	5	12		3	19	1	2	3	23	75	10	91%
2437	5	1	6	12		4	14	1	5	5	28	81	10	91%
2141	5	1	4	8		4	7	3	24	11	30	97	10	91%
2113	13	2	10	7		3	15		2	1	19	72	9	82%
2267	11	5	11	4			4	10	14	1	18	78	9	82%
2417	7	12	9	25			3	1	10	2	2	71	9	82%
2339	3	5	19	8			12	3	9	1	32	92	9	82%
2389	7	1	6	4		1	15		16	5	6	61	9	82%
2333	10	2	1	9		4	20		9	1	13	69	9	82%
2293	12	8	5	10		1		3	14	2	11	66	9	82%
2237	1	7	21	9		4	5		10	2	17	76	9	82%
2137	7	2	17	6			3	2	4	21	22	84	9	82%
2579	7	9	5	6		2	9	15	8		13	74	9	82%
2473	5	2	9	22			9	2	8	3	8	68	9	82%
2179	4	9	21	7			1	4	4	8	23	81	9	82%
2543		2	7	14		2	7	1	23	5	24	85	9	82%
2411	4	3	19	8		3	4		2	3	29	75	9	82%
2099	2		39	10		1	6	1	3	3	23	88	9	82%
2503	3	6	10	5		2	12		10	4	8	60	9	82%
2243	29	1	9	5			4	5	16	1	9	79	9	82%
2383	18	1	18	6			11	3	6	5	13	81	9	82%
2551	1	2	11	20		1	3		1	14	5	58	9	82%
2087	7	10	9	9		1		5	4	1	32	78	9	82%
2089	6	6	3	37		1	5	3	8		7	76	9	82%
2161	7	3	9	10		1	2		7	1	36	76	9	82%
2131	13		5	3		1	9	2	9	9	24	75	9	82%
2251	13	3	9	10			7	3	21	5	9	80	9	82%
2423	9	5	30	9		6	7		7	4	6	83	9	82%
2287	3	10	5			1	11	4	22	10	1	67	9	82%
2447	1	1	6	7			6	6	9	3	28	67	9	82%
2441	4	11	8	15		2	8	3	9		15	75	9	82%
2347		3	6	18		1	14	5	5	4	10	66	9	82%
2477	7	4	19	13		2	5		4	1	21	76	9	82%
2111	6	10	3	8		1	1	5	9		21	64	9	82%
2399	16	3	6	1		2	14		5	5	31	83	9	82%
2341	5	1	31	7			2	1	22	3	8	80	9	82%
2557	1		55	4	1		1		6	1	8	77	8	73%
2239	3	3	22	20		3	4		2		10	67	8	73%
2393	7		24	9		1	7	1	4		13	66	8	73%
2377	10	2	6	14		1	2		5		13	53	8	73%
2459	2	8	35	3			4		4	2	29	87	8	73%
2309	2	1	54	18		2	2		11		12	102	8	73%
2549	3	1	34	15		1			32	6	39	131	8	73%
2281		2	14	16		1	1		9	1	24	68	8	73%
2143	10	1	5	18			19		14	3	32	102	8	73%
2153	1	1	4	16			9	5	11		26	73	8	73%
2213	5	5	14	6			4		19	2	6	61	8	73%
2539	3	3	19	15			13		12	1	14	80	8	73%
2381	1	1	37	2			5	12			19	77	7	64%
2371	3			24			3	7	9	6	17	69	7	64%
2311	11	1	8				11		13	14	9	67	7	64%
2203	2		5	22				5	4	1	21	60	7	64%
2531	10		61	3			2		10		8	94	6	55%
2221	8		29	2			5		13		11	68	6	55%
Total	407	210	896	684	3	83	424	155	585	218	1070	4735	11	
Mean	7	4	15	11	1	2	7	4	10	4	17	76	9	80%

*Investigator = Primary Researcher (Control)

Students' exposure to Assessors

Table J.4 BChD 5 2014 (n=58) Number of encounters students were exposed to supervisors/assessors

Student ID No.	Investigator *	1	2	3	4	5	6	7	8	9	Total No. of Assessments	Total No. of Assessors exposed to	Percentage Exposure
1483	9	3	15	6	21	11	1	1	4	10	81	10	100%
1427	19	7	34	34	14	9	2	2	4	3	128	10	100%
1447	6	4	23	12	8	10	7	1	8	1	80	10	100%
1669	15	7	15	17	5	1	3	3	15	5	86	10	100%
1327	15	1	19	2	15	33	8	4	8	4	109	10	100%
1567	5	1	18	21	23	25	1	2	11	1	108	10	100%
1627	3	2	10	13	7	12	2	1	4	4	58	10	100%
1481	14	5	18	13	6	7	11	3	15	9	101	10	100%
1523	6	13	15	5	6	13	5	3	4	10	80	10	100%
1637	14	3	25	15	15	4	8	1	6	1	92	10	100%
1543	3	6	22	17	14	12	5	2	2	15	98	10	100%
1381	12	11	10	5	1	17	2	1	5	4	68	10	100%
1579	8	4	16	29	31	5	21	1	1	2	118	10	100%
1367	27	8	14	11	15	13	1	14	21	3	127	10	100%
1319	40	10	37	13	3	12	18		23	9	165	9	90%
1459	19	1	21	11	6	47	1	1		10	117	9	90%
1303	20		5	15	11	12	2	3	11	1	80	9	90%
1301	12	9	10	58	1	4	12		16	2	124	9	90%
1453	16	5	8	37	13	4	3	2	3		91	9	90%
1613	7	1	10	27	4	8	10		2	1	70	9	90%
1423	5	2	7	3	16	17	1		11	5	67	9	90%
1511	13	6	11	6	1	16	7		6	2	68	9	90%
1621	2	5	3	1	32	15	16		40	1	115	9	90%
1619	16	6	12	3	17	3	3		4	3	67	9	90%
1297	8	2	19	6	26	11	2		10	1	85	9	90%
1321	11	7	10	1	9	8	2		7	6	61	9	90%
1409	7	4	20	3	10	23	1		13	3	84	9	90%
1471	23	2	16	12	21	8	3		6	3	94	9	90%
1601	6	4	10	4	12	28	3		3	6	76	9	90%
1597	6	3	20	19	8	12	6		10	1	85	9	90%
1699	16	8	13	5	23	5	4	3	6		83	9	90%
1607	6	2	2	11	17	10	10		16	6	80	9	90%
1559	12	5	22	7	20	5	2		5	3	81	9	90%
1657	16	17	15	1	4	5	3		2	11	74	9	90%
1531	13	4	20	19	16	15	9		10	11	117	9	90%
1667	16	7	6	10	4	14	6		1	9	73	9	90%
1373	8	8	23	4	16	6	1		4	13	83	9	90%
1361	7	11	7	9	9	10	3		12	4	72	9	90%
1439	19	7	35	1	4	2	4		1	1	74	9	90%
1489	21	2	33	9	6	24	3		3		101	8	80%
1487	10	6	19	19	3	5	3		4		69	8	80%
1399	16	3	5	8	6	12	3		9		62	8	80%
1429	10	7	16		30	13	3		6	13	98	8	80%
1499	12	7	14	8	9	4			1	3	58	8	80%
1693	5	9	12	3	18	6			13	2	68	8	80%
1583	27	8	19	3	28	12	1		12		110	8	80%
1307	5	1	6	12	5	23	1		10		63	8	80%
1697	10	12	28		6	4	2		12	2	76	8	80%
1433	23	4	4	26	15	6	5		7		90	8	80%
1493	7	4	10	3	10	29	3		3		69	8	80%
1451	2	5	12		19	9	1		8	5	61	8	80%
1663	10	3	11	16	7	11		1	3		62	8	80%
1721	12		5	13	18	8			6	7	69	7	70%
1571	28	10	10	8	6	17				1	80	7	70%
1553	14	3	14			8	5		4	3	51	7	70%
1609	8	1	14	7		10			2	11	53	7	70%
1549	26		15	5	6	14				4	70	6	60%
1709	3	1	3	7	9	1					24	6	60%
Total	729	297	866	633	685	688	239	49	433	235	4854	10	
Mean	13	5	15	12	12	12	5	3	8	5	84	9	88%

***Investigator = Primary Researcher (Control)**

Appendix J
Students' exposure to Assessors

Table J.5 BChD 5 2015 (n=37) Number of encounters students were exposed to supervisors/assessors

Student ID No.	Assessors											Total No. of Assessments	Total No. of Assessors exposed to	Percent Exposu
	Investigator *	1	2	3	4	5	6	7	8	9	11			
1291	10	13	10	1	2	12	2	5	21	5	4	85	11	100%
1087	9	6	8	23	6	24		5	2	2	4	89	10	91%
1229	5	5	11	2	5	8		1	15	7	20	79	10	91%
1091	7	9	7	13	26	20		3	18	1	7	111	10	91%
1021	6	3	12	6	4	2		7	5	4	1	50	10	91%
1019	14	1	12	22	2	4		3	1	3	35	97	10	91%
1223	2	4	13	2	3	17		1	9	2	7	60	10	91%
1069	2	1	27	3	6	2		6	3	6	24	80	10	91%
1039	9	2	10	27	4	18		2	6	7	4	89	10	91%
1279	29	18	10	34	17	6		4	5	15	10	148	10	91%
1049	3	1	5	3	10	15		13	4	7	11	72	10	91%
1103		6	11	8	15	7	1	3	5	11	5	72	10	91%
1033	7	1	11	17	3	3	1		2	4	14	63	10	91%
1289	2	3	19	3	5	6		4	9	4	25	80	10	91%
1117	21	7	23	10	9	3		3	4	7	18	105	10	91%
1171	2	5	9	3	16	19		7	8	8	16	93	10	91%
1123	12	18	12	24	2	5	3	4		15	8	103	10	91%
1153	15	2	10	8	10	2		4	9	5	12	77	10	91%
1063	4	7	5	20	5	13		9	4	1	8	76	10	91%
1283	1	7	35	27	8	3		2	8	1	17	109	10	91%
1249	11	6	42	8	9	11	4	6	2		7	106	10	91%
1163	3	6	10	6	8	16	1		2	5	9	66	10	91%
1009	10	9	8	4	10	26		3	7	4	5	86	10	91%
1097	10	2	13	26	4	3		8	11	1	16	94	10	91%
1051	3	2	19	8	20	15			5	3	10	85	9	82%
1109	4	9	18	16		4	1	17	2		4	75	9	82%
1237	11		7	13	10	3		14	13	3	13	87	9	82%
1259	8		22	7	5	8		2	14	3	15	84	9	82%
1277	2	3	25		7	9		3	1	1	10	61	9	82%
1193	6	3	7	9	5	6			3	7	45	91	9	82%
1181	10	6	8	20	22	13		2	5		17	103	9	82%
1213	2	9	13		8	17		11	4	10	28	102	9	82%
1031	9	11	9	17	6	2		2	7		8	71	9	82%
1201		2	2	5	39			1	24	2	3	78	8	73%
1217	1		38	16		6		20	3	1	11	96	8	73%
1061	1		11		15	4		12	2	1	35	81	8	73%
1018	9	12	21	3	5				17	3	15	85	8	73%
Total	260	199	533	414	331	332	13	187	260	159	501	3189	11	
Mean	7	6	14	12	9	9	2	6	7	5	14	86	10	87%

*Investigator = Primary Researcher (Control)

Students' exposure to Assessors

**Table J.6 BChD 5 2016 (n=51) Number of encounters students were exposed to supervisors/assessors**

Student ID No.	Assessors										Total No. of Assessments	Total No. of Assessors exposed to	Percentage Exposure
	Investigator *	1	2	3	8	9	10	11	12	13			
1879	1	10	3	24	10	9	3	33	2	5	100	10	100%
2083	2	3	3	13	6	8	5	14	1	12	67	10	100%
2011	5	5	39	30	2	6	2	5	19	1	114	10	100%
1913	8	22	19	26	13	14	3	4	3	3	115	10	100%
1901	4	15	1	19	6	3	2	5	7	10	72	10	100%
1823	4	4	22	3	6	5	5	19	6	5	79	10	100%
1931	3	17	5	20	7	14	17	4	1	7	95	10	100%
1747	7	10	8	13	1	10	6	9	1	4	69	10	100%
2017	2	3	21	20	1	4	9	16	2	10	88	10	100%
1907	7	3	26	3	11	14	4	12	1	16	97	10	100%
1787	6	3	8	34	1	7	1	6	3	2	71	10	100%
1973	5	5	14	10	1	12	9	15	8	6	85	10	100%
2069	1	4	34	4	9	7	6	3	2	12	82	10	100%
1877	2	11	4	10	2	14	1	32	2	20	98	10	100%
2029	5	5	24	18	4	24	1	5	1	5	92	10	100%
2063	3	6	8	8	5	5	14	2	2	24	77	10	100%
1789	7	7	24	20	10	11	9	8	5	9	110	10	100%
1867	1	9	18	13	12	9	2	4	2	11	81	10	100%
1993	6	7	10	15	13	15	14	17	1	24	122	10	100%
1093	11	3	11	1	17	5	3	10	2	3	66	10	100%
1723	10	2	8	22	3	8	2	38		2	95	9	90%
1801	1	4	33	2	6		1	12	4	10	73	9	90%
2053		8	3	9	1	2	4	28	10	14	79	9	90%
1889	2	6	24	5	6	13	4	3		7	70	9	90%
1987	7	2	3	12	2	4		9	8	15	62	9	90%
1733	23	1	6	11	1		14	6	4	24	90	9	90%
1861	7	2	8	6	2	2	6	12		18	63	9	90%
2081	1		8	10	22	4	3	12	1	16	77	9	90%
1997	1		1	26	3	7	9	6	11	15	79	9	90%
1873	3	4	43	3	7	8		7	3	2	80	9	90%
2027	6	1	12	3	3	15		33	15	2	90	9	90%
1759	6	5	5	2	4		3	8	11	19	63	9	90%
1187	1	6	9	12	10	18	2	19		12	89	9	90%
1951	7	1	47	12	2	1	1	10		9	90	9	90%
1231	3	2	3	14	4	9		28	3	21	87	9	90%
1129	12	14	13	8	1	2		7	8	1	66	9	90%
1151	5	5	7	14	5	15		4		7	62	8	80%
1933		1	49	5	1	2	4	14		22	98	8	80%
1847	5	13	42	24	4	7		4		19	118	8	80%
1753	3	2	8		9	15		12	3	31	83	8	80%
1777	6	6	45	14	6	1		18		19	115	8	80%
1741	11	4	6	6	7			28	2	10	74	8	80%
1979	6		17	6	5	16		7	6	6	69	8	80%
1811	16	1	24	3		18		10	1	3	76	8	80%
1949	9	9	5	17	5	5	5	24			79	8	80%
1831			16	8	7		5	29	1	6	72	7	70%
1783			8	5	20	4	6		18		14	75	7	70%
2003		5	47	8	7	7		3		11	88	7	70%
1871	4		2	21		7		19	1	24	78	7	70%
2039		12		23		2	10	5	2	10	64	7	70%
1999		17	65	3	6		3	6		7	107	7	70%
Total	245	293	866	633	280	390	192	662	165	565	4291	10	
Mean	6	6	17	13	6	9	5	13	4	11	84	9	90%

*Investigator = Primary Researcher (Control)

Animated Videos

Appendix K Animated Videos

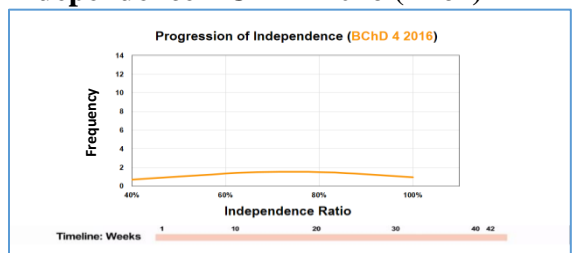**Animated Video K.1 Progression of Independence BChD 4 2014 (n=42)**

https://youtu.be/Gu8419mIgNU
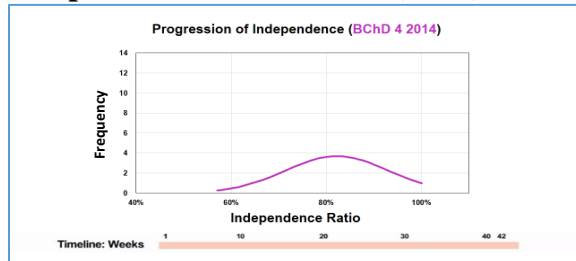
Animated Video K.2 Progression of Independence BChD 4 2015 (n=51)

https://youtu.be/JuEkxQk8roE
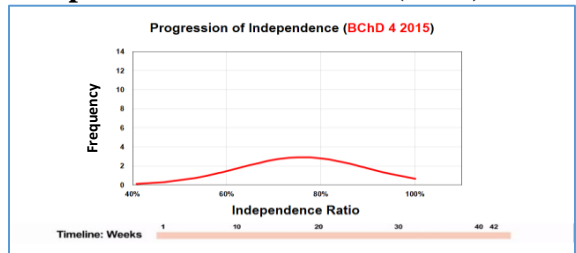
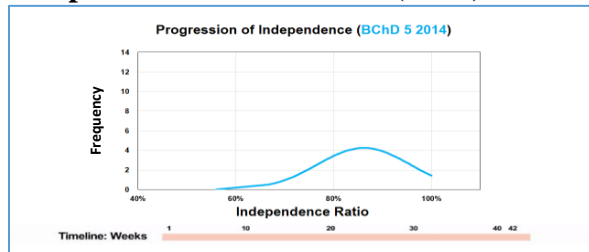**Animated Video K.3 Progression of Independence BChD 4 2016 (n=62)**

https://youtu.be/Fy9UOOCMsJA

Animated Video with Audio K.4 Combined Progression of Independence BChD 4 2014 (n=42), 2015 (n=51) and 2016 (n=62)
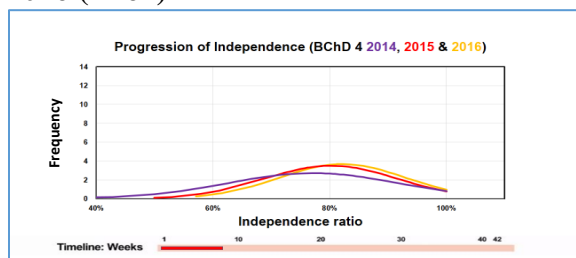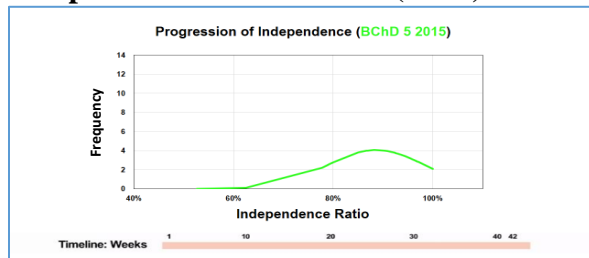

https://youtu.be/VPdc1-_dV2w

Appendix K
Animated Videos

Animated Video K.5 Progression of Independence BChD 5 2014 (n=58)

https://youtu.be/lrtJrm_QAXI

Animated Video K.6 Progression of Independence BChD 5 2015 (n=37)

https://youtu.be/0ioGFa78L3E

Animated Video K.7 Progression of Independence BChD 5 2016 (n=51)

https://youtu.be/o5K6IJdE-fc
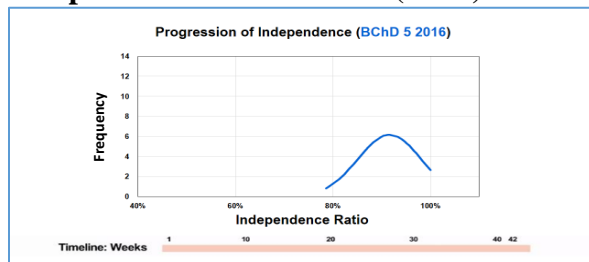
Animated Video with Audio K.8 Combined Progression of Independence BChD 5 2014 (n=58), 2015 (n=37) and 2016 (n=51)
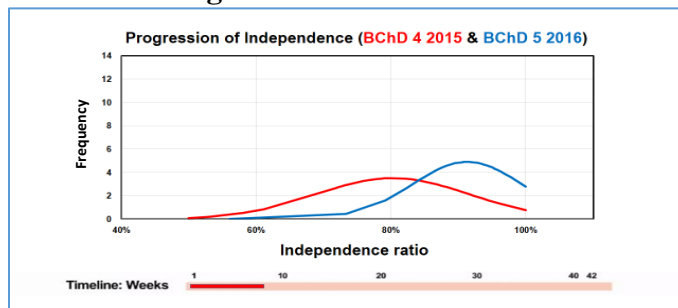

https://youtu.be/YVD-RIDty3U
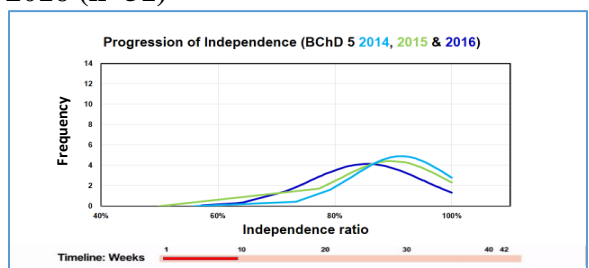
Animated Videos

Animated Video K.9 Combined Progression of Independence for BChD 4 2014 followed through as BChD 5 2015

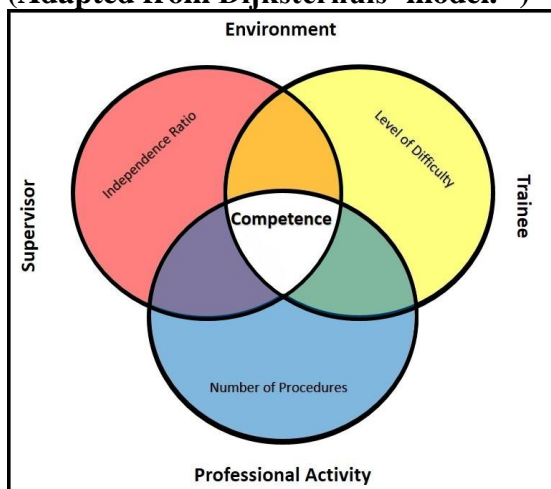

https://youtu.be/H-pSUtIsStQ
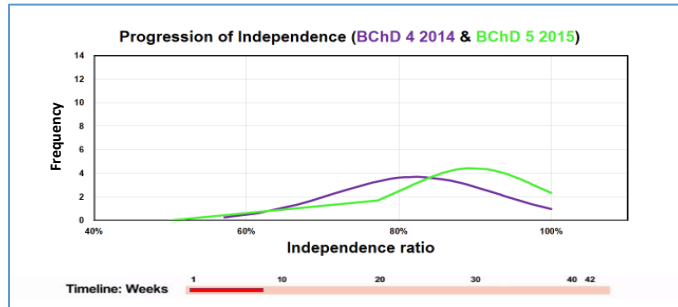
Animated Video with Audio K.10 Combined Progression of Independence for BChD 4 2015 followed through as BChD 5 2016

https://youtu.be/BvoFi3ap_kw

Animated video with audio K.11 Design of a Workplace-based Assessment Instrument within a Clinical setting. (Adapted from Dijksterhuis' model.[25])

https://youtu.be/rou8l9VD0Hw