Talking during a test?! Embracing mobile instant messaging during assessment

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Abstract

This study reports on the incorporation of mobile instant messaging (MIM) in assessments, as a collaborative learning tool, to enable students to socially construct knowledge and develop their collaborative problem solving competence, while being assessed individually. In particular, this study explores: what is the extent and timing of students' use of MIM to communicate with other students while being assessed individually? What communicative activities are evident in the content of students' MIM communications while being assessed individually? How do students experience being able to use MIM while being assessed individually? The results of this study's analysis of the messages sent during various assessments suggests that when incorporating MIM into assessments, instructors should consider the objective of those assessments together with the nature (e.g. essay style) and the stakes of the assessments as these appear to influence the extent, timing and content of the instant messaging communications by the students during the assessment. A survey of the students suggested that their experiences of being able to use MIM during assessments were largely positive due to the learning opportunities, collaboration and teamwork, authenticity and equity that the introduction of instant messaging during assessment enabled.

Keywords: Mobile instant messaging; assessment for learning; social constructivist learning; competency-based learning; collaborative learning

Introduction

The emergence of competencies, as outcome indicators of the education process, has been accompanied by calls for the nature of assessment to expand beyond the traditional measurement and validation of individual students' knowledge (Boud 1990; Schuwirth and Van der Vleuten 2020). Assessment should now also incorporate elements of assessment for learning and the development of competencies (Schuwirth and Van der Vleuten 2011; Van der Vleuten 2015; Broadbent, Panadero, and Boud 2018).

Collaborative problem solving is an example of a competence that instructors need to consider incorporating in their assessments (Tabary 2015; Yuan and Wu 2020). Collaborative problem solving, or the ability to solve problems through interacting with a group of individuals, is a widely sought after twenty-first century skill by employers (Care, Scoular, and Griffin 2016; Organization for Economic Cooperation and Development (OECD)) 2017; Fiore, Graesser, and Greiff 2018; Mehrabi Boshrabadi and Hosseini 2021).

The inclusion of collaborative problem solving in an assessment need not be at the expense of the construction of knowledge, as collaboration among students in solving problems may result in collaborative learning (Van Boxtel, Van der Linden, and Kanselaar 2000). Grounded

in social constructivism (Vygotsky 1978), collaborative learning refers to instances where two or more students learn through communicating with each other (Saab, Van Joolingen, and Van Hout-Wolters 2005; Jang et al. 2017; Wilson, Ho, and Brookes 2018) or the instructor (Kukulska-Hulme and Viberg 2018). Through asking questions and explaining their understanding of the course content in collaborating while solving a problem, students verbalize their thoughts, planning, analysis and decision-making, and internalize these in the elaborative manner necessary for learning (Saab, Van Joolingen, and Van Hout-Wolters 2005; Tullis and Goldstone 2020). Consequently, through communicating with each other, students construct their knowledge (McLoughlin and Luca 2002), improve their academic performance (Opdecam et al. 2014; Jang et al. 2017), obtain greater understanding of concepts and develop various competencies (Damon and Phelps 1989; Jang et al. 2017).

During 2020, the world witnessed a historic shift in the job market due to the Covid-19 pandemic (Castrillon 2020). Working remotely became the norm for most businesses (Castrillon 2020; Choudhury 2020) and collaborative problem solving was increasingly facilitated by embracing mobile technologies, such as mobile instant messaging (MIM). To authentically reflect the practice of the discipline being assessed, and to facilitate collaborative learning, it is submitted that students should be enabled to collaborate while solving a problem during assessments using mobile technologies, such as MIM. There appears to be no research into the use of MIM by students for collaborative learning and problem solving while being assessed individually. This study, therefore, reports on the incorporation of MIM in assessments, in a competency-based learning environment, to enable students to authentically communicate.

Literature review

Collaborative learning 'involves groups of learners working together to solve a problem, complete a task, or create a product' (Rodríguez, Riaza, and Gómez 2017, 665). It is not only intended to refer to students learning in groups but also to a student learning from another student or instructor (Kukulska-Hulme and Viberg 2018). As a component of collaborative learning, educational researchers and curriculum designers acknowledge the importance of communication for learning, because communication enables students to actively participate in a social process of knowledge construction (Han and Ellis 2019). When communicating in learning or solving problems together, students first have to organise their existing knowledge (Wegerif and Mercer 1996) and establish common ground between themselves (Tullis and Goldstone 2020). Communicative activities that support organising knowledge and establishing common ground include informative activities, such as issuing statements, elicitative activities, such as asking questions, and responsive activities, such as answering questions (Saab, Van Joolingen, and Van Hout-Wolters 2005). Once existing knowledge has been organised and common ground established, the nature of the communication necessary to extend existing knowledge and to solve a problem must advance to argumentative activities, such as exchanging of existing ideas, new ideas and conjectures (Wegerif and Mercer 1996; Saab, Van Joolingen, and Van Hout-Wolters 2005; Tullis and Goldstone 2020).

The focus on collaborative learning activities has drawn attention to the potential of incorporating these activities into assessment (Rieger and Heiner 2014; Jang et al. 2017). However, collaboration during assessment has historically been considered as cheating, particularly when the purpose of assessment is the measurement and validation of individual students' knowledge (Jang et al. 2017). While the measurement and validation of individual students' knowledge may remain important for professional licencing examinations, in educational settings, assessment for learning should take priority over assessment of learning (Schuwirth and Van der Vleuten 2011), and by incorporating collaborative learning

into the assessment environment students are enabled to learn during assessments (Jang et al. 2017).

MIM, such as *WeChat*, *WhatsApp* and *Facebook Messenger*, can facilitate the communications necessary for both collaborative learning (Kim, Lee, and Kim 2014; Bere 2018; Kukulska-Hulme and Viberg 2018) and collaborative problem solving (Conde et al. 2021). Despite MIM having the potential to support effective collaborative learning (Fattah 2015; Bere and Rambe 2016; So 2016; Sun et al. 2018; Li, Gao, and Guo 2020; Yuan and Wu 2020), the literature recognises that the educational use of MIM has only been studied to a limited extent (Rambe and Bere 2013; Jantjies and Joy 2015; So 2016; Tang and Hew 2017; Bere 2018; Pimmer and Rambe 2018); encouraging further research to create a better understanding thereof and its application in education (Pimmer et al. 2019). Given the absence of research exploring the use of MIM to facilitate authentic communication between students during assessment, the following research questions are raised:

- **RQ1**: What is the extent and timing of students' use of MIM to communicate with other students while being assessed individually?
- **RQ2**: What communicative activities are evident in the content of students' MIM communications while being assessed individually?
- **RQ3**: How do students experience being able to use MIM while being assessed individually?

Method

Target population and teaching environment

The target population for this study comprised of intermediate accounting students ($N = 448$) enrolled for an introductory financial reporting course. As part of this course's 'program of assessments' (see Schuwirth and Van der Vleuten 2011) the students are exposed to no stakes, low stakes and high stakes assessments. Traditionally, most of the high stakes assessments are administered in an invigilated face-to-face, pen-and-paper environment. However, due to the COVID-19 pandemic, assessments were administered in an online environment. These assessments remained in pen-and-paper format, but students sat for the assessments off-campus and were required to scan and submit their answers online. The integrity of high stakes online assessments has, however, presented a challenge for instructors and universities (Daffin and Jones 2018; Butler-Henderson and Crawford 2020). To heighten the integrity of these assessments, collusion and communication among students by using commercial MIM applications during assessments is, generally, not permitted by the institution, particularly during high stakes individual assessments. As was the case with on-campus assessments, the students were authorised to consult *The Annotated International Financial Reporting Standards* during the assessments as their main technical resource.

Exploring students' MIM communications (RQ 1 and 2)

In response to Research Question 1, the extent and timing of the students' use of MIM during various assessments were explored through descriptive analysis of the messages sent. In response to Research Question 2, the content of the student MIM communications were analysed deductively at both semantic and interpretative levels and categorised based on the communicative activities evident in collaborative learning (Table 1) (Saab, Van Joolingen, and Van Hout-Wolters 2005). These categories are not mutually exclusive, as a message may be categorised into more than one category.

Table 1. Communicative activities with examples (Saab, Van Joolingen, and Van Hout-Wolters 2005).

Communicative activities	Examples
Informative	'I think the answer is three'
Argumentative	'Because we did it the other time also like this'
Evaluative	'That's really good!'
Elicitative (Asking other students for a response)	'What do you think about this question?'
Verification (checking)	'Do you also think it is 4?'
Critical (checking)	'Do you really think that?'
Responsive	Answer to a question
Confirmation/Acceptance	'Yes, I agree'
Directive	'Try the other one'
Off task	'Yesterday I went to the beach'
Off task technical	'Can you move the upper window, please'

To enable the analysis of the extent, timing and content of the student MIM communications during assessments, a dedicated instant messaging assessment tool (IMAT) was developed and implemented. The IMAT was designed to facilitate the communication necessary for collaborative learning and problem solving, by replicating the communication functionality of commercial MIM applications. By being independent of these applications, the students could, however, communicate free of the distraction of non-education related messages (Junco and Cotten 2011).

During all of the assessments where the IMAT was used, the students' communications could be observed and monitored in real time by the instructors, as communications on the IMAT were visible to all instructors and students logged into the IMAT. These observations served as a source of diagnostic information of the students' learning, as the students' thoughts were made more visible to the instructors through the messages they sent using the platform. Transcripts of MIM communications during the assessments could also be downloaded or printed for inclusion in the students' portfolios, as evidence of their development of collaborative problem solving competence. The use of a self-developed MIM platform also avoided the privacy issues plaguing commercial MIM applications (Steigrad 2021).

Before implementing the IMAT during assessments, the students were given an opportunity to familiarise themselves with the functionalities thereof and they were enabled to engage with these functionalities by, for example, posting messages in a practice scenario. The students were also given instructions on how to use the tool and informed of the purpose behind developing and implementing it during assessments. A description of the development and implementation of the IMAT can be accessed at http://tiny.cc/012ouz and an open-access template of the IMAT is available at: https://bubble.io/template/imat-1619271937738x18210251157038694O?exp=1.

Data collection

The use of a self-developed MIM platform gave the instructors, as developers, access to transcripts of the messages sent during each assessment as the data source for purposes of this study. Following institutional review board approval, data were collected during the following assessments of differing type and stake:

- no stakes essay style assessment;
- no stakes accounting calculation style assessment;
- low stakes essay style assessment;
- low stakes multiple-choice style assessment;
- low stakes accounting journal style assessment; and

- high stakes essay style assessment.

The essay style assessments required the students to discuss the accounting treatment for authentic real-world economic events. The multiple-choice style assessment served as revision of specific basic accounting concepts, as preparation for class. The calculation and journal style assessments were focused on accounting concepts that the students were required to apply in preparing accounting calculations and journal entries. Students were not required to submit their answers for grading for the no stakes assessments but were required to submit, for grading, their own individual answers for the low and high stakes assessments.

The high stakes assessment comprised of two stages. During the first stage, an authentic real-world scenario was provided to the students, without providing the required questions to be answered – unlike the other assessments where the scenario and required questions were immediately provided. The purpose of this was to allow the students time for reading and discussion without the pressure of documenting answers for submission. In the second stage, the students received the required questions to answer. An authentic scenario was used to avoid testing the recollection of facts (Daffin and Jones 2018), and instead required the demonstration of a deeper understanding of the subject (Entwistle 2009). Based on professional judgement and observations of the no and low stakes assessments, the instructors carefully considered the time made available for the students for MIM communication during both stages of the high stakes assessment.

Students' experiences (RQ 3)

Survey approach

As active and responsible stakeholders in the assessment process (Boud 1990), the students' experiences of being able to use MIM during their assessments were explored through an online survey. Quantitative data were generated from a question using a scaled Likert-attitude response (1 – *extremely negative* to 7 – *extremely positive*) and a number of Yes/No response questions. Qualitative data were collected through open ended questions. The survey included items by Schmulian and Coetzee (2019), who explored a collaborative assessment for learning, and items by Feiden (2015), who explored the use of a social annotation platform. These items were modified to reflect the focus of this study. To establish content validity of the survey instrument (McKenzie et al. 1999), two accounting education experts reviewed the survey instrument. Each expert considered the extent to which the items addressed the construct of interest. Suggested additions and/or deletions from the list of items, and recommended changes to ensure clarity of all the items, were incorporated into the survey instrument. As existing survey items were used, minimal changes were made as a result of this review.

The survey instrument was delivered online through *Google Forms*, following institutional review board approval. To maximise the response to the survey (Phillips, Reddy, and Durning 2016), the students were pre-notified that the survey would be made available to them and three reminders were sent. 164 students responded to the survey, exceeding the minimum number of respondents (50–75 students) necessary to achieve reasonable population estimates in populations smaller than 500 students (Fosnacht et al. 2017).

The quantitative data collected were analysed using *Microsoft Excel (2021)*. An initial data integrity check was performed and descriptive statistics were calculated. The qualitative data collected were analysed through a content analysis (Cooper 2017) of the reflections provided by the students, coded for analysis using *NVivo 12*.

Results and discussion

Exploring students' MIM communications (RQ 1 and 2)

Extent and timing (RQ 1)

The percentage of students that elected to use MIM during the assessments (users) ranged between 40% and 71% (Table 2). The assessments with the highest percentage of users, were the essay style low stakes ($n = 282$, 71%) and high stakes assessments ($n = 277$, 64%). The low stakes accounting journal style assessment ($n = 194$, 47%) and the no stakes accounting calculation style assessment ($n = 179$, 40%) had the lowest percentage of users (Table 2). Not all the users sent messages during the assessments (range: 11% − 40% of the users) (Table 2). Many users may have had their question, comment or response pre-empted and/or they may have viewed the communications purely as an additional source of information during the assessments.

Table 2. Students' use of MIM during the assessments.

ASSESSMENT	Total population*	MIM Users	Users as % of total population	Duration of assessment	Number of messages	Number of Users sending messages	% of Users sending messages
	N	***n***		***minutes***	***n***	***n***	
NO STAKES							
Essay	448	260	58%	60	253	96	37%
Accounting calculation	448	179	40%	30	174	71	40%
LOW STAKES							
Essay	398	282	71%	60	141	62	22%
Multiple-choice	422	225	53%	60	46	24	11%
Accounting journal	412	194	47%	60	65	24	12%
HIGH STAKES							
Essay – Stage 1	433	277	64%	15	64	33	12%
Essay – Stage 2	433	277	64%	60	152	48	17%

*For the no stakes assessments, where the students were not required to submit an answer, the total population represents all the students registered for the course. For the low and high stakes assessments, where the students were required to submit answers, the total population represents the number of students that submitted an answer for the assessment.

The no stakes assessments had the highest percentage of users sending messages (37% and 40%) and the most messages sent ($n = 253$ and $n = 174$) (Table 2). A decline in both the percentage of users sending messages and the number of messages sent was evident when the stakes were elevated from no stakes to either low or high stakes. The two stages of the high stakes assessment yielded two of the lowest percentages of users sending messages − 12% and 17%, respectively – despite the instructors allowing time for communication during both stages of this assessment. Further, during most of the assessments, the number of messages sent over time declined (Figure 1), except during the no stakes assessments ($n = 2$), where the number of messages increased until the 15–29th and 30–44th minute periods. The decline in the number of messages, number of users sending messages and messages sent over time, may be due to the users' perception of having less time for communication in the low and high stakes assessments, as they were required to submit their answers for grading and, therefore, might have focused more on clearly documenting their answers.

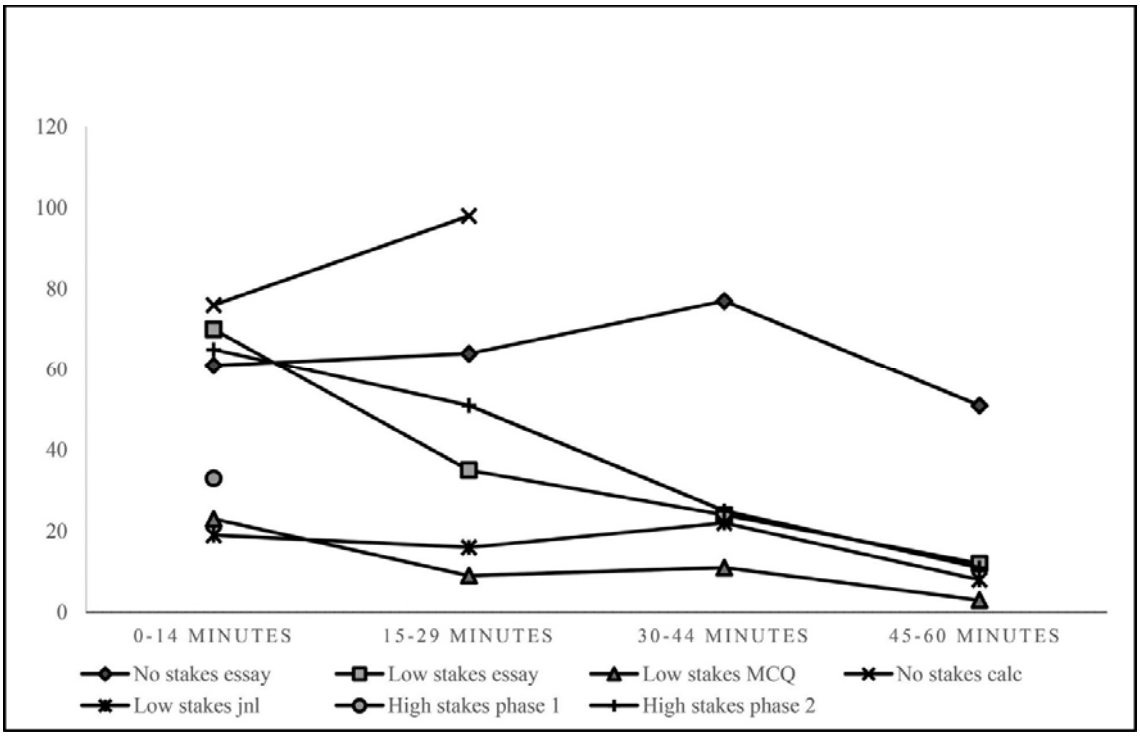

Figure 1. Timing of student messages.

The low stakes multiple-choice style assessment had the least number of messages ($n = 46$) and the lowest percentage of users sending messages (11%). However, the low stakes essay style assessment, of identical duration, yielded many more messages ($n = 141$) and a higher percentage of users sending messages (22%). It is, therefore, submitted that essay style assessments provide greater opportunity for discussion, resulting in the higher percentage of users sending messages and higher number of messages sent. Although less messages were sent during the low stakes multiple-choice style and accounting journal style assessments, those messages were spread more evenly over the duration of the assessments. This suggests that the type of assessments may affect the extent and timing of the users' MIM communications. The accounting journal style and multiple-choice style assessments consistently engaged the users with new challenges throughout the assessment as they developed each journal entry or responded to each multiple-choice question.

During the first stage of the essay style high stakes assessment, scheduled for 15 minutes, 33 users contributed 64 messages. As the users did not receive the required questions during this time, it was anticipated, based on the no and low stakes essay style assessments, that the number of messages sent and the number of users sending messages (12%) would be higher. However, in hindsight, novice learners base their representation and approaches on a problem's literal features, derived from the required questions, as opposed to expert learners, where the status of the unknown is secondary to that of deciding which principles have their conditions of applicability met in the problem (Chi, Feltovich, and Glaser 1981). Consequently, the low number of messages during the reading and discussion time may be a consequence of the required questions not being provided. During the second stage of the assessment, where the required questions were available, 152 messages were sent and the participation rate increased to 17% (Table 2).

Content (RQ 2)

During the assessments, organising their existing knowledge and establishing common ground appears to have been the main function or goal of the student communications (Table 3), as many messages sent during the assessments elicited verification of specific questions ($n = 208$; 22%), such as, '*What would be the recognition exemption in IFRS 16, Leases?'* or were responsive to questions ($n = 223$; 23%), such as, '*No, I think leave the specific asset out. We know they're both assets and that's all we have to prove for now*'.

Table 3. Frequencies of communicative activities.

ASSESSMENT	Informative	Argumentative	Elicitative	Elicitative Verification	Responsive	Confirmation/ acceptance	Directive	Off task technical
NO STAKES								
Essay	26	79	2	66	35	37	1	16
Accounting calculation	38	3	8	32	45	37	3	9
LOW STAKES								
Essay	18	14	3	37	34	15	13	8
Multiple-choice	0	1	1	12	16	4	0	12
Accounting journal	1	0	2	23	31	3	1	4
HIGH STAKES								
Essay – Stage 1	7	0	2	6	28	9	0	12
Essay– Stage 2	14	11	7	32	34	14	5	37
TOTAL**	**104**	**108**	**25**	**208**	**223**	**119**	**23**	**98**
	11%	**11%**	**3%**	**22%**	**23%**	**12%**	**2%**	**10%**

*The communications did not include any, or very few, evaluative ($n = 3$, 0%) and elicitative critical ($n = 0$, 0%) activities. Off task activities ($n = 44$, 5%) mainly comprised student greetings. These activities are not reported.
**Communicative activities are not mutually exclusive with some comments categorised under more than one activity.

Progress towards extending knowledge and collaborative problem solving was evident in the number of argumentative messages ($n = 108$; 11%), characterised by statements that are supported by a reason, such as, '*I think it is not a liability but rather a[sic] equity, as there is no present obligation to pay the money*'. However, most of the argumentative messages were sent during the essay style questions ($n = 104$ of 108, 96%). The messages sent during the multiple-choice style and accounting journal style assessments, for example, contained little or no argumentative messages ($n = 1$; $n = 0$) and more messages eliciting verification ($n = 12$; $n = 23$). It is submitted that essay style questions are more suited to argumentative messages as they stimulate discussion and problem solving in the authentic scenarios provided. Argumentative messages were primarily sent during the no stakes essay style assessment ($n = 79$ of 108, 73%). When the stakes are raised, students appeared less argumentative and more inclined to elicit verification of specific questions.

The remainder of the messages were largely informative ($n = 104$, 11%), such as, '*I think it's a provision'*, or confirmation or acceptance ($n = 119$, 12%) of informative messages or earlier responsive messages, such as '*Yes, I agree'* or '*I also don't think any of the points affect profit*'. Off task technical messages, such as '*Will we be allowed to use our textbooks during texts[sic] for definitions?'*, or '*Where are we suppose[sic] to submit answers?'* accounted for 10% ($n = 98$) of the total messages. These messages were sent primarily during the high stakes essay style assessment where submission of an answer had the most at stake ($n = 49$). The stakes and type of assessment, therefore, appear to influence the extent, timing and content of the messages.

Students' experiences (RQ 3)

Descriptive statistics

The respondent students' (n = 164) overall experiences of being able to use MIM during assessments were positive (M = 4.57; SD = 1.40; median = 5) (Table 4). Most respondents confirmed that they read the messages (n = 129, 79%) and wanted to use MIM again during assessments (n = 122, 74%).

Table 4. Students' experiences of using MIM during assessments.

Quantitative survey questions			
Q1. On a scale of 1 (extremely negative) to 7 (extremely positive) rate your overall experience of being enabled to communicate with other students using MIM during an assessment.			M = 4.57 (SD = 1.40) / Median = 5
			Total (n = 164)
			n / %
7 Extremely positive			14 / 8.54
6			28 / 17.07
5			44 / 26.83
4			47 / 28.66
3			19 / 11.59
2			7 / 4.27
1 Extremely negative			5 / 3.05
	Q4. Did you read any of the communication posted in the MIM during the assessments?	**Q6.** Did you *initiate* any communication using the MIM during the assessments?	**Q8.** Did you *respond* to any communication using the MIM during the assessments?	**Q10.** Did you adjust / revise your own individual answer based on communication posted in the MIM during the assessments?
Yes	***n*** **= 129 (79%)**	***n*** **= 46 (28%)**	***n*** **= 68 (41%)**	***n*** **= 74 (45%)**
No	***n*** **= 35 (21%)**	***n*** **= 118 (72%)**	***n*** **= 96 (59%)**	***n*** **= 90 (55%)**
	Q12. Did communication posted in the MIM during the assessments, improve your understanding of information provided in the question papers?	**Q14.** Did communication posted in the MIM during the assessments, improve your understanding of the content assessed?	**Q16.** Would you want to experience assessments similar to the assessments that enabled student communication using the MIM during assessment, again during your agree?	
Yes	***n*** **= 107 (65%)**	***n*** **= 93 (57%)**	***n*** **= 122 (74%)**	
No	***n*** **= 57 (35%)**	***n*** **= 71 (43%)**	***n*** **= 42 (26%)**	

As not all the users sent messages during the assessments (range: 11% − 40% of users) (Table 2), only 28% (n = 46) of the respondents indicated that they *initiated* MIM communications, while 41% of the respondents (n = 68) *responded* to messages (). Although not necessarily through sending messages themselves, many respondents indicated that MIM communications improved their understanding of the question (65%; n = 107) and/or the content assessed (57%; n = 93). 45% (n = 74) of the respondents indicated that they adjusted or revised their own individual answer prior to submission as a consequence of the MIM communications (Table 4).

Qualitative analysis

The qualitative analysis provided deeper insights and understanding of the students' experiences of using MIM during assessments, and confirmed their overall positivity thereto. The **learning opportunity**, **collaboration** and **teamwork** afforded by MIM during the assessments contributed significantly to the students' positive experience. Being '*able to communicate with other students and obtain a different point of view to my own… enhanced*

my understanding and knowledge of the work'. The messages '*provide[d] different manners of approaching the required and enhanced exam technique'* and also offered re-assurance when '*I wanted to see if I was on the right track regarding my thought process'*.

MIM contributed to a sense of **authenticity** of the assessments as '*it is quite nice having a virtual classroom of students working together, solving a problem that will help us engage in a similar problem in a real world scenario'. 'It is good practice and beneficial for us to communicate and help each other because I believe in workplace teamwork and conversing over work will make it a lot easi[e]r and prepare us for working in a team'.*

As many respondent students are not English first language speakers and have vastly different levels of exposure to economic activities as a consequence of their own economic status (Coetzee, Schmulian, and Kotze 2014; Jantjies and Joy 2015), MIM allowed students to seek clarification on the meaning of words, or for assistance in understanding the economic event to be accounted for. '*The terminology in the question paper was confusing as English is not my first language'* and the '*difficult language would prevent me from easily understanding the scenario presented'.* The use of MIM during the assessments may, therefore, have improved the accessibility and **equity** of assessment in the diverse student cohort.

A number of reasons were put forth by the students who preferred not to use MIM during the assessments. The primary reason for not using MIM was the perceived time constraints: '*I was afraid that I would waste time typing messages instead of completing the assignment on time'.* Some students prefer to focus on acquiring technical accounting knowledge individually in preparation for their professional examinations (Coetzee and Schmulian 2012) at the expense of developing the competencies needed for practice (Tabary 2015). '*Group work is what we will do in our career[sic] but I will be alone when I write final exams so I have to be dependant[sic] on myself and not others'.* A few students expressed a lack of trust in their classmates and a fear of being confused by them, although acknowledging that '*it encourages you to know your work so well to prevent other students' comments from confusing you'*.

The earlier observation of the students' perception of having more time for communication in the no stakes assessment and/or when there is less pressure of having to submit an individual answer (Table 2) was corroborated by comments such as '*I feel as if [it] did not work for me during [higher stakes] assessments because it was a distraction. I had to distribute my attention between what other students were saying and the question paper/required. I feel as if [it] is most effective during formative assessments rather than [high stakes] class tests, as formative assessments usually have a longer period in which to submit, therefore, students can communicate with other students at any time and not be rushed to communicate during a short time period'*; and '*this works well for weekly class discussion questions where there is time and not under as much pressure to answer'*. Despite these reservations, the majority of students' experiences of using MIM during assessments, were positive and '*although it did delay me in answering my question I think having the chat function was really helpful. Students aren't sharing their answers but rather their thought process which could help others either trigger something that will help them answer the question or help them develop their own thought process to answering questions'.*

Conclusion

The nature of assessments in a competency-based learning environment should expand beyond traditional knowledge testing formats to also include elements of assessment for learning and the development of competencies. Collaborative problem solving has been

identified as a much needed and sought-after competence in recent graduates. To enable students to learn and to develop the necessary collaborative problem solving competence, while being assessed individually, this study reports on the use of MIM during assessments of varying type and stakes in a competency-based learning environment.

The results of this study suggest that the students' experiences of being able to use MIM during assessments were largely positive due to the learning opportunities, the authentic collaboration and the equity that the introduction of MIM during assessments enabled. An inverse relationship between the stakes and type of assessment and the extent and timing of the messages was identified. The no stakes assessments, for example, were characterized by more users sending messages and more messages being sent than the higher stakes assessments. Furthermore, in terms of the content of the messages, the no stakes assessments and essay style assessments were characterized by more argumentative messages, that are necessary for the extension of knowledge and problem solving, than the low or high stakes assessments.

Despite the opportunity created by the use of MIM during assessments for students to learn and develop their collaborative problem solving competence, many students did not yet demonstrate communicative activities at a level that extended knowledge or elicited problem solving, regardless of the assessment stakes involved. The students may, therefore, need to be trained in being able to engage in communicative activities conducive to extending knowledge and problem solving, through focused workshops and by providing them with exemplars of the argumentative activities necessary when collaborating for extending knowledge and solving problems.

It is acknowledged that the generalizability of the students' use and perception of being able to use MIM during the assessments reported in this study may be limited, given the exploratory nature of this study at a single university. Future exploration of MIM during assessments in other contexts may, therefore, add external validity to this study. It is also acknowledged that the students may have used other commercial MIM applications that are not permitted by the institution during the assessments, particularly during high stakes individual assessments.

Despite these limitations, this research contributes to the understanding of the use of MIM as a collaborative learning tool during assessment in a competency-based learning environment. Effective implementation of MIM during assessments can assist students in learning authentically and developing the collaborative problem solving competence required for success in the rapidly changing future world of work. Future research might explore the use of MIM in smaller student groups and for in-person assessments, as opposed to online assessments. Further, while this exploratory study reported on self-perceived learning and competency development, future experimental research into actual learning gains and competency development resulting from the use of MIM during assessments is encouraged.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Cecile Janse van Rensburg is conducting a Ph.D. study at the Department of Accounting at the University of Pretoria (UP), South Africa on the topic of "approaches to digital learning and authentic assessment in accounting education".

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