

**An agile approach to the rapid and collaborative  
authoring of educational content**

**by**

**Dawn Crawford**

**Submitted in fulfilment of the requirements for the degree**

**MAGISTER EDUCATIONIS**

**in the Faculty of Education**

**at the**

**UNIVERSITY OF PRETORIA**

**AUGUST 2017**

## **Declaration**

I, Dawn Crawford, student number 28588569 hereby declare that the dissertation “*An agile approach to the rapid and collaborative authoring of educational content*” is submitted in accordance with the requirements for the Magister Educationis: Computer Integrated Education degree at University of Pretoria, is my own original work and has not previously been submitted to any other institution of higher learning. All sources cited or quoted in this research paper are indicated and acknowledged with a comprehensive list of references.

.....

Dawn Crawford

August 2017

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#### DEGREE AND PROJECT

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An agile approach to the rapid and collaborative authoring of educational content

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#### APPROVAL TO COMMENCE STUDY DATE OF CLEARANCE CERTIFICATE

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## **Dedication**

I dedicate this research to:

- My parents, Walter H and Joan B Parkes, who offered me the opportunities to learn and instilled the quest for knowledge in me.
- My husband, Lindsay and daughters, Adrienne and Kaitlyn, who have shown patience and understanding during the long hours I spent in front of the computer while completing this study.

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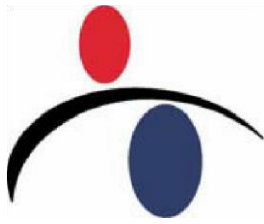
## **Abstract**

An agile approach is most often used in software development but has been applied in other areas such as manufacturing and project management as well. Within literature, there are only a few studies that investigate the use of an agile approach for authoring educational content. This study explores how an agile approach could facilitate rapid and collaborative authoring of educational content. This qualitative study utilised a multiple case study strategy. The data were collected through semi-structured interviews and observations. The insight gained from this study indicated that the agile approach that emerged was a valuable lens through which to explore rapid and collaborative authoring of educational content. The study also revealed that community building among those participating in the authoring process is fundamental to the success of an agile approach. Further insights include offering training and support to the participants of the authoring sprints regarding an agile process, the applications utilised and imminent change. An agile approach in education emerged from the study and could be an alternative to traditional content authoring approaches for educational content. Finally, the study revealed the need for a comprehensive software package that included file sharing, instant messaging, task management, screen sharing and conferencing capabilities alongside the authoring software.

### **Key Terms:**

Agile approach, content authoring, collaborative content authoring, educational content, knowledge creation, Open education resources (OER), rapid content authoring

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## **List of abbreviations**

ADDIE	Analyse Design Develop Implement and Evaluate instructional design model
CAPS	Curriculum Assessment Policy Statement
FHSST	First High School Science Texts
OER	Open Education Resources
PDF	Portable Document Format



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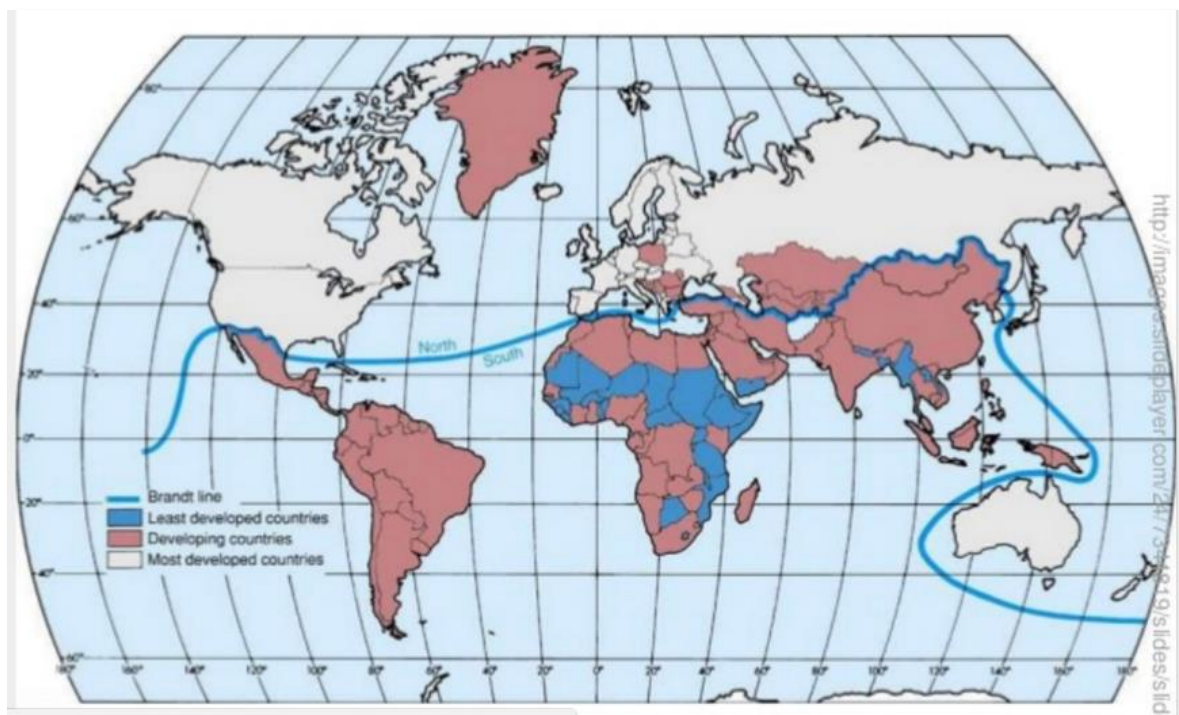
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# 1 GENERAL ORIENTATION

1.1	• Introduction
1.2	• Background to the problem
1.3	• Problem statement
1.4	• Research questions under investigation
1.5	• Nature of the study
1.6	• Purpose of the study
1.7	• Conceptual framework
1.8	• Operational definitions
1.9	• Scope
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## 1.1 Introduction

This study investigated how content could be authored collaboratively and rapidly for education, using an agile approach. Presently the majority of the body of knowledge is created in and by the Global North, with significantly fewer contributions from the Global South. The need exists to create locally relevant content across all levels of education within the context of the Global South. The Global North-South divide is shown in Figure 1.1. An agile approach to content authoring is suggested as a possible solution to this problem. This study set out to discover whether an agile approach to authoring content to assist subject matter experts and communities of practice would be feasible in an educational context.



**Figure 1.1:** Global North-South Divide (Czerniewicz, 2016)

## 1.2 Background to the problem

During 2012, South African education experienced a crisis with regard to the timely delivery of textbooks to schools in some provinces. The non-delivery of textbooks was challenged in court by an organisation named Section 27 (Veriava, 2013). Furthermore, a number of court orders were issued ordering the Department of Basic Education to deliver textbooks to schools in order for learners to have access to such



textbooks from day one of the school year. As at January 2017, the problem has persisted and Section 27 has continued to monitor the delivery of textbooks annually.

A lack of textbooks could have had less of an impact on Mathematics and Physical Science Grades 10 to 12, Natural Sciences Grades 7 to 9 and Natural Sciences and Technology Grades 4 to 6 as there is a South African company, an education publication company based in Cape Town, which publishes their open textbooks electronically. Learners are able to download the textbooks in Portable Document Format (PDF) from the Internet or they can access them via their feature cell phones (Jimes, Weiss, & Keep, 2013). While there are many other publishing companies that publish and distribute books online, it is important to note that the workbooks under discussion here were authored using an agile approach and could be distributed rapidly via electronic means. In addition, the workbooks were produced for the South African schooling system in particular as they were aligned to the South African school curriculum, Curriculum Assessment Policy Statements (CAPS).

There is a need to author content within the Global South contexts, and more specifically within educational contexts. The textbooks published by the South African company, that authored textbooks and workbooks for the South African schooling system, were authored by volunteers who gave of their time freely. The fact that the volunteers freely authored content for the textbooks and workbooks allowed hard copies of the books to be published at a reduced cost. In addition, the PDF copies available on-line and via *MIXIT* were free. The only cost involved to the learners were data costs set by their internet service provider. Adopting an agile approach to content authoring within this context could be a solution to reducing the cost of materials to the learners and students, as it appears to be a rapid and cost-effective way to author educational content.

There appears to be a void in the literature regarding an agile approach that can be followed to author content for educational purposes. This study set about investigating the process of authoring content using an agile approach, in order to identify an agile approach that could be used to assist subject matter experts and communities of practice in authoring educational content, both rapidly and collaboratively.

Much of the literature on collaborative projects tends to aim at learning projects within a classroom context. There appears to be a void in the literature with regard to adopting

an agile approach to content authoring. One example of rapid and collaborative authoring using an agile approach is the physical science texts, known as the First High School Science Text. This specific example was authored by a group of Physical Science students, based at a South African university. Petrides and Jimes (2008) conducted a study of these texts and suggested that other open education projects could develop community-centred technologies, processes and cultures to support experimentation, self-assessment and adaptation of the processes used to author the First High School Science Text. In addition, these authors (2008) called for further research with regards to the processes implemented during the authoring of the First High School Science Text. This study is in answer to this call for further research.

In addition, many Higher Education institutions are presently revising their curricula and are attempting to find ways to reduce the cost of tuition. Authoring content rapidly and collaboratively could assist with these problems (Sapire & Reed, 2011) and as such led to the need for this study.

### **1.3 Problem Statement**

During 2015 and 2016 students virtually brought Higher Education in South Africa to its knees by demanding free education in the *#Feesmustfall* campaigns. Many of the universities had to rapidly find different ways to offer those students who wanted to continue their studies, a means to access the materials they required to do so. Universities placed content on-line. By presenting content on-line students were able to continue their studies and meet their examination commitments. The method this study offers to author content rapidly and collaboratively could possibly have aided the universities in meeting their commitments to students. As such, it is necessary to investigate the potential of an agile approach to authoring content in an educational context.

The 2012 textbook crisis (Veriava, 2013) in South African education underscored the need for content that could be developed rapidly and collaboratively across all facets of education. In addition, the 2011 South African educator strike lead the Department of Basic Education to approach the educational publishing company that evolved from the First High School Science Text to make their Grades 10 to 12 Mathematics and Physical Science textbooks available to learners at short notice. The company had the textbooks which had been authored using an agile approach available in an electronic

format and was able to make these accessible to learners within ten days of receiving the request. The content was offered in PDF format for download and on the then popular social network platform, *MIXIT* (Jimes et al., 2013).

With the method of content authoring suggested by this study, content should be available in a short space of time. At present, there is a void in literature that guides subject matter experts and communities of practice in authoring content material using an agile approach. Damsa and Ludvigsen (2012) noted that there was a need for research into the processes involved in the collaborative creation of knowledge objects.

While there is some literature that describes collaborative learning (Damsa & Ludvigsen, 2012), there appears to be a void in the literature with regard to the rapid and collaborative development of knowledge objects for learning, i.e. textbooks and related knowledge objects. These arguments justify that research be undertaken in this field.

#### **1.4 Research questions**

The main research question for this study is:

*How can an agile approach facilitate rapid and collaborative content authoring of educational content?*

While the sub-research questions which lead to the findings of the study are:

- How can an agile approach be structured to author content?
- Why is it valuable to create a community of practice to author content?
- How can technology assist the content authoring?

#### **1.5 Nature of the study**

This study explores the process in which two cases utilised an agile approach to author textbooks and to develop an instructionally designed eLearning module for implementation at a South African university. The study is limited to a rapid collaborative content authoring process. The hope was that various phenomena would emerge during the study, leading to an agile approach emerging to assist with authoring educational content, especially in a Global South context.

The philosophical framework for the study is interpretivist in nature. Creswell (2013) argues that the interpretivist view focuses on the outcomes of the research and the acts and situations of the inquiry. The worldview of the researcher is that of social constructivism. The methodology of choice for this study is qualitative research making use of a case study strategy. This strategy was used to explore the process in which the identified cases utilised an agile approach to author educational content, namely the Grade 4 to 9 workbooks for the South African schooling system and the instructionally designed eLearning module for a South African university.

**1.6 Purpose of the study**

The purpose of this study was to explore two known cases to identify the structure of an agile approach that could be utilised by subject matter experts and communities of practice to author educational content. Furthermore, the study investigated why communities of practice could add value to an agile approach to authoring educational content. Finally, this study examined how technology could be incorporated into an agile approach when authoring educational content.

**1.7 Conceptual framework**

The four values of the Agile Manifesto (Beck et al., 2001) for software development as set out in Table 1.1, form a starting point for the conceptual framework of this study.

**Table 1.1:** Agile manifesto (Beck et al., 2001)

<b>Agile Manifesto</b>
<p>We are uncovering better ways of developing software by doing it [developing software] and helping others do it [develop software]. Through this work we have come to value:</p>
<b>Agile Values</b>
<ul style="list-style-type: none"> <li>• Individuals and the interactions between them over processes and tools.</li> <li>• Working software over comprehensive documentation.</li> <li>• Customer collaboration over contract negotiation.</li> <li>• Responding to change over following a plan.</li> </ul>

## 12 Principles of agile

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective methods of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity - the art of maximising the amount of work not done – is essential.
11. The best architectures, requirements and designs emerge from self-organising teams.
12. At regular intervals, the team reflects on how to become more effective, then the team tunes and adjusts its behaviour accordingly.

The conceptual framework for this study includes the concept of an agile approach. This concept was unpacked in terms of the four values of agile as set out in the agile manifesto and the twelve principles of agile which are explained in the agile manifesto. The concept of an agile process was scrutinised in terms of book sprints (an agile

process used to author books rapidly and collaboratively), time-boxed sprints, self-organising teams and finally how face-to face interactions aid the authoring process. The concept of a minimum viable product was examined in terms of what products could be considered as minimum viable products when creating content for education.

**1.8 Operational definitions**

Table 1.2 contains definitions of new and, often, confusing terminology used throughout this study with regards to an agile approach.

**Table 1.2:** Terminology relating to an agile approach

Term	Definition
<b>Agile approach</b>	<p><i>“Agile approaches are characterised by their iterative and incremental qualities, relying on short bursts of activity, stakeholder testing, feedback and the incorporation of that feedback to constantly improve the product” (Mathis, 2013).</i></p> <p><i>“An agile approach is an umbrella term used for a group of related approaches to software development based on iterative and incremental development “(Rubin, 2013).</i></p>
<b>Minimum viable product</b>	<p><i>“A product that has just those features that allow the product to be deployed and no more” (Rubin, 2013).</i></p>
<b>Iterative development</b>	<p><i>“A planned rework strategy where multiple passes over the work are used to reach a good solution” (Rubin, 2013).</i></p>
<b>Incremental development</b>	<p><i>“Development based on building part of a solution before building the complete product” (Mathis, 2013).</i></p>
<b>Sprint</b>	<p><i>“A sprint is a short burst of activity involving stakeholders and the team that results in a minimum viable product. The aim of a sprint is to produce a theoretically shippable product” (Mathis, 2013).</i></p>
<b>Sprint review</b>	<p><i>“An inspect-and-adapt activity that occurs after sprint execution where the team shows all interested parties what was accomplished during the sprint. The sprint review gives everyone involved with the minimum viable product development, an opportunity to inspect what</i></p>

Term	Definition
	<p><i>has been built so far and adapt what will be built next” (Rubin, 2013).</i></p> <p>Inspect and adapt is the principle of inspecting an artefact and making adaptations based on what is learned (Rubin, 2013).</p>
<p><b>Definition of done</b></p>	<p><i>“A checklist of types of work a team is expected to successfully complete by the end of a sprint and before it can declare its work shippable.</i></p> <p><i>The bare minimum definition of done is to yield a completed slice of product functionality. One that has been designed, built, integrated, tested, documented and will deliver validated customer value” (Rubin, 2013).</i></p>
<p><b>Daily scrum</b></p>	<p><i>“A synchronisation, inspection and adaptive planning activity that a development team performs each day. It is a core activity in the agile framework. The activity is time-boxed to no more than 15 minutes. Daily scrum is synonymous with stand-up meetings used in other agile frameworks such as Extreme programming (XP) and Kanban. Standing up promotes brevity and helps to ensure the activity does not exceed the time-boxed limit” (Rubin, 2013).</i></p>
<p><b>Time-boxing</b></p>	<p><i>“A time management technique that helps organise the performance of work and manage the scope of the project” (Rubin, 2013).</i></p>
<p><b>Self-organisation</b></p>	<p><i>“Bottom-up emergent property of a complex, adaptive system whereby the organisation of the system emerges over time as a response to the environment. A property of a development team that organises itself over time, without an external dominant force, applying a traditional top-down command-and- control management style” (Rubin, 2013).</i></p>

For a comprehensive list of the terminology used throughout this study see Addendum A. The terms are divided into three groups namely, general terms, role player definitions and finally terms related to technology.

## **1.9 Scope**

With regards to the scope of this study, it is limited to the collaborative and rapid processes used while authoring content within an educational context. These processes include the four values of an agile approach and 12 principles of agile, all of which are discussed in greater detail in Chapter 2. Furthermore, the study investigates the concepts of self-organising groups and face-to-face interactions, both of which are explicit in the 12 principles of agile. Finally, the concept of time-boxed sprints which is central to agile approaches and is implicit in the 12 principles of agile also falls within the scope of the study. The study does not examine the artefacts – workbooks developed for the South African schooling system and the instructionally designed eLearning module developed for a South African university – to ascertain that they are aligned to the curriculum, but does investigate the processes involved in authoring these artefacts, known in this study as the minimum viable product.

Finally the study is limited to two known cases that have implemented agile approaches to author content within educational contexts. The case of the Grade 4 to 9 workbooks is further limited to two iterations of the sprints. The first iteration being the authors writing on-line in a single document, for the Grade 4 to 6 workbooks and named Case1a in the study. While the second iteration was that of workbooks for Grade 7 to 9, where subject matter experts participated in brainstorming sprints to identify content which was later collated and authored by four individual authors each of whom authored a specific section of the content. This iteration was named Case 1b in the study. The workbooks were produced for the South African schooling system. Case 2 consisted of and was limited to a single iteration the instructional design of an eLearning module for a South African university. This iteration was made up of weekly sprints in which the module was developed iteratively and in increments.

## **1.10 Limitations**

One of the philosophical assumptions of this study is that the researcher positions herself within the research (Creswell, 2013). The focus of the study is on a single concept, authoring content using an agile approach. The study investigated the context of various aspects of content authoring in terms of the process utilised.



### **1.11 Ethical considerations**

Before embarking on this study, approval was sought from the Ethics committee of the Faculty of Education at the University of Pretoria. This approval included clearance to conduct the study by obtaining informed consent and voluntary participation from the participants. The study did not make use of data of a sensitive nature, hence it posed a low risk to the participants and adhered to the principle of avoidance of harm. Participants were free to withdraw from the study at any stage in the research.

### **1.12 Protection against bias**

The researcher participated in the sprints for the Grade 4 to 9 workbooks and as such was situated extremely close to the participants interviewed with regards to Case 1a and Case 1b of this study. In order to protect against any bias, member checking was conducted to authenticate the data captured in the transcripts.

All of the participants in this study were able to and chose to waive their anonymity as part of the informed consent for this study. However, the researcher chose to retain anonymity as far as possible to protect other parties involved but who were not participants of the study, e.g. the university for which the instructionally designed eLearning module was developed. While it may be possible for members of the various industries close to this study to identify the cases through prior knowledge of the cases, every effort has been made to preserve the anonymity of all parties involved in the cases.

### **1.13 Chapter summary**

This chapter gave the background to the study and outlined the problem statement and the research questions which led to the findings of the study. It went on to explain the nature and significance of the study, including the research paradigm and methodology utilised. A conceptual framework was identified and brief definitions were offered explaining some of the terminology used in the study. In addition, this chapter offered insight into the scope and limitations of the study. Finally the chapter proposed the ethical considerations taken into account.

For a complete overview of this study, see Addendum B. In the following chapter, Chapter 2, an in depth literature study is conducted which offers further insight into the conceptual framework utilised for this study.

## 2 LITERATURE REVIEW

2.1	• Introduction
2.2	• Previous research
2.3	• ADDIE - Traditional authoring approach
2.4	• Waterfall - Traditional software development approach
2.5	• Conceptual framework
2.6	• Chapter summary

## **2.1 Introduction**

This literature review sets out to examine existing research regarding alternative methods of authoring content in educational contexts. A current and commonly used instructional design method, namely the Analyse, Design, Develop, Implement and Evaluate instructional design model (ADDIE) is explored, as is a popular software development method known as the waterfall method. The agile manifesto, the values and principles of an agile approach as set out in the agile manifesto (Beck et al., 2001), as well as emerging trends in how agile approaches are currently used in education are investigated. In addition, the review examines an agile process for content authoring, namely *book sprints*. The term *book sprints* refers both to a company *Booksprint.net* and a unique method the company uses to author books. The methodology was adapted to develop workbooks for Grade 4 to 9 in the South African schooling system.

Further concepts explored in the agile process included time-boxed sprints, self-organising groups and face-to-face interactions. Minimum viable products are explored as products which could be produced using an agile approach within an educational context. The review further examines market outlets for the minimum viable products. Two possible market outlets are explored, namely Open Education Resources (OER) and commercial publishing. OER and Open Licencing are examined in the light of how OER and Open Licencing could aid the production of content for local contexts, in the Global South. Finally, commercial publishing is explored as a possible outlet for commercially commissioned authoring of educational content.

## **2.2 Previous research**

Petrides and Jimes (2008) researched Free High School Science Text (FHSST). FHSST are texts that were authored by a community of practice of physics students, based at a South African university. The purpose of the texts were to offer high school learners, initially from the Eastern Cape, physics content from which to study as they did not have any form of physics notes or textbooks. The goal of the study undertaken by Petrides and Jimes (2008) was twofold, firstly to examine and analyse practices associated with the successes and challenges encountered by the authors of the FHSST. Secondly, to encourage a participatory and analytic process to assist other open education projects in sharing their practices, processes and strategies (Petrides

& Jimes, 2008). These authors (2008) suggest that other open education projects could develop community-centred technologies, processes and cultures to support the experimentation, self-assessment and adaptation of the processes used by the FHSST authors. In other words, they called for further research of the FHSST authoring processes (Petrides & Jimes, 2008). This study is in answer to this call for further research.

Cartmill (2013) conducted a study of the use of mathematics and physical science textbooks produced by a community of practice in an agile way. The study investigated how these books were used by educators and if a community of practice formed around the use of these textbooks. She (2013) too, called for further research into the way these textbooks were authored, and as such, this current study is a response to that call.

### **2.3 ADDIE – Traditional content authoring method**

ADDIE is a well-known and much used instructional design model (Allen & Sites, 2012). This model is used worldwide to provide structured course content (Shinall, 2010). The ADDIE model is a five step iterative systems approach to instructional design, where, in each iteration, all five steps are completed (Shinall, 2010). According to Gagne, Wagner, Golas and Keller (2005), the steps followed when adopting ADDIE are to analyse the need and design a solution. This is then followed by the development and implementation of the solution, and finally the evaluation. The name ADDIE is essentially an acronym of the first letters of each step (Gagne et al., 2005).

#### **2.3.1 Analyse**

This step includes an instructional needs analysis, the analysis of the learner entering the programme, an analysis of the environment and finally, a task analysis (Shinall, 2010). The time students require to complete the programme and resources available for the programme, are also taken into account during this phase (Gagne et al., 2005).

#### **2.3.2 Design**

During this step course goals are transformed into performance outcomes and unit objectives (Shinall, 2010). The content is divided into topics or units, and any time constraints are taken into account (Gagne et al., 2005). The units are linked to the course objectives. The material for each unit is chosen and the main objectives to be

achieved during each of the units are identified (Gagne et al., 2005). Learning activities and lessons are defined for all of the units. Finally, conditions for assessing what the students have learned, are developed (Shinall, 2010).

### **2.3.3 Development**

This step is where decisions are made with regards to the types of learning activities and the materials to be used within the learning activities (Gagne et al., 2005). Draft materials or activities are developed and tested by members of the target audience. Materials and activities are revised and refined according to the target audience feedback (Shinall, 2010).

### **2.3.4 Implementation**

The materials that were created during the development phase are marketed to any teachers or students to adopt for use in a learning and teaching environment. Any help or support in the use of the materials is provided as needed (Gagne et al., 2005).

### **2.3.5 Evaluate**

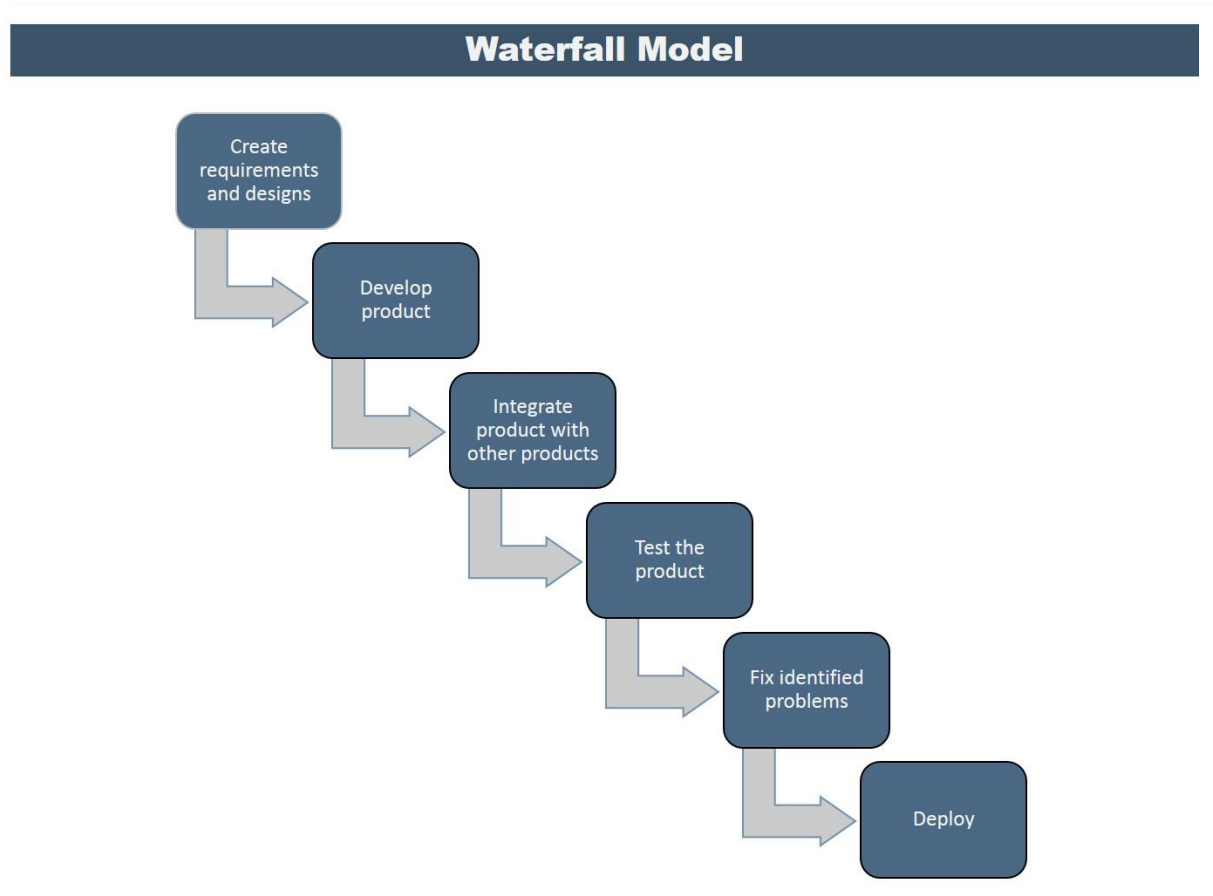
Plans are executed for student evaluation and evaluation of the programme as a whole. In addition, during this step of ADDIE, plans are formulated regarding the maintenance and revision of the developed programme.

There is no clear indication where ADDIE originated, however it is widely used in educational technology (Shinall, 2010). Allen and Sites (2012) state most organisations find it necessary to adapt and change the ADDIE model to meet their requirements, and thus the model is often criticised for being too linear and systematic. In addition, many users find the model constraining and time consuming (Allen & Sites, 2012). This study explores an alternative to the ADDIE model to author content within an educational context.

## **2.4 Waterfall method – Traditional software development method**

Waterfall development (See Figure 2.1) was the most used and well-known software development model from the inception of software development. In this model, a project moves from phase to phase according to a linear plan. Each phase is fully completed before moving on to the next phase (Mathis, 2013). Customers were only involved during the requirements and deployment stages. The exception was if the

requirements changed in the middle of a project.



**Figure 2.1:** Waterfall software development model

## **2.5 Critique of ADDIE and Waterfall software development**

Rubin (2013) views a minimum viable product as a major difference between an agile approach and the traditional approaches currently used, such as the waterfall method used for software development (Mathis, 2013). The concept of a minimum viable product is discussed in detail later in this chapter.

An initial working prototype and iterative, incremental design and development cycles differentiate agile approaches for authoring educational content from the ADDIE instructional design method traditionally used in education (Allen & Sites, 2012). The iterative, incremental cycles and the initial working prototype offer interesting changes to the traditional instructional design models. The interesting changes to content authoring in educational contexts require further investigation.

## 2.6 Conceptual framework

The conceptual framework for this study (Refer to Figure 2.2) is made up of the agile approach leading into the agile process, which includes book sprints, time-boxed sprints, self-organising groups and finally how face-to-face interactions aid the authoring process. A number of possible minimum viable products are offered as content which could be created while using an agile approach. The market outlets as shown in the conceptual framework is not unpacked in this study but is included in the conceptual framework, so as to offer the reader an understanding of where content, created while using an agile approach, could be placed within the market.

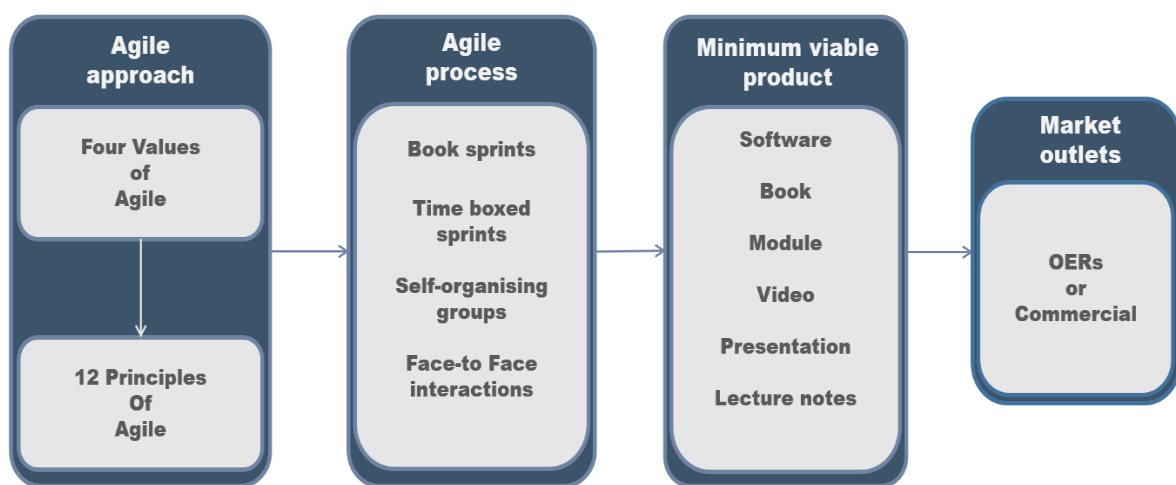


Figure 2.2: Conceptual framework

### 2.6.1 Agile approach

There are a number of agile approaches used in software development and project management (Rubin, 2013). Such approaches include *Scrum*, *Kanban* and *eXtreme Programming (XP)*. However, *Scrum* appears to be one of the most popular agile approaches (Mathis, 2013). Agile approaches are concerned with aggressively delivering what is needed and not merely a way of avoiding paper work as it is often criticised to be (Cockburn, 2007). Teamwork and mutual support are fostered through agile approaches (Mathis, 2013).

An agile approach is a term used for a group of related methods which are based on iterative and incremental processes to develop software (Rubin, 2013). The process relies on short bursts of activity, known as sprints, and the inclusion of stakeholder testing and feedback (Beck et al., 2001). Stakeholder testing and feedback is, in fact,

continuously incorporated to consistently improve the product (Mathis, 2013). With each iteration, which is “*a self-contained development cycle focused on performing all of the work necessary to produce a valuable outcome*” (Rubin, 2013, p.255), a number of passes over the work are carried out, to reach a sound outcome. Incremental development, in turn, is based on building some (small chunks) of the solution, before building the whole completed product (Rubin, 2013). Incremental development involves incorporating the results of stakeholder testing and feedback into the following increment of the solution (Mathis, 2013).

An agile approach sees a working version of the software as done, meaning that it is regarded as complete (Beck et al., 2001). Within an agile approach, such a minimum viable product dictates the success or failure of the project (Rubin, 2013).

## **2.6.2 Agile manifesto**

The agile manifesto contains a set of four values and 12 principles to guide agile development (Beck et al., 2001). During the 1990’s agile approaches such as *Scrum* and *XP* attracted a large following, and 17 developers collaborated to produce the Agile Manifesto (Beck et al., 2001). The agile manifesto is shown in Chapter 1, in Table 1.1.

## **2.6.3 Four values of Agile**

The four values of agile are as follows:

- Individuals and the interactions between them **over** processes and tools.
- Working software **over** comprehensive documentation.
- Client collaboration **over** contract negotiation.
- Responding to change **over** following a plan.

The four agile values are unpacked in detail in the following sections of this chapter.

### **2.6.3.1 Individuals and the interactions between them over processes and tools**

The first value of agile states that individuals and the interactions between them are valued over processes and tools (Beck et al., 2001). Rubin (2013) explains this value as understanding how the group of subject matter experts work together and how each person’s work impacts on the remainder of the group. Cockburn (2007), in turn, argues that it is better to make use of a process that is poorly documented, but where there are good interactions between the group members, than to use a process that is well-



documented but the interactions between the group members are hostile. For this study, this value will be investigated in terms of communities of practice (Lave & Wenger, 1991) and what Wenger-Trayner and Wenger-Trayner (2015) have coined Landscapes of Practice.

The term *communities of practice* was coined by Wenger during the 1990's (Lave & Wenger, 1991). Today, *communities of practice* exist in many organisations as a means of sharing and retaining knowledge within those organisations (Wenger & Snyder, 2000).

Wenger (2000) defines communities of practice as:

“*Communities of practice* are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly”.

He (2000) continues by identifying three characteristics of *communities of practice* as being crucial, namely the domain, practice and community. A *community of practice* is not merely a club of friends or a network of connections between people. It has an identity defined by a shared domain of interest (Wenger, Mc Dermott, & Snyder, 2002) Membership implies a commitment to the domain, and a shared competence that distinguishes members from other people (Farnsworth, Kleanthous, & Wenger-Trayner, 2016). The domain is not necessarily something recognized as expert knowledge outside of the community (Wenger-Trayner & Wenger-Trayner, 2015). For example, a youth group may have cultivated ways of managing their domain and maintaining an identity with which they can live. They value their mutual proficiency and learn from one another, even though few people outside the group may value or even recognize their expert knowledge (Lave & Wenger, 1991).

Members of a *community of practice* are often known as practitioners (Wenger-Trayner & Wenger-Trayner, 2015). The members develop a shared collection of resources, such as experiences, stories, tools and ways of addressing recurring problems (Wenger, 2000). In short, they develop a shared practice. Such a practice develops overtime and through sustained interaction (Wenger et al., 2002). The development of a shared practice may be more, or less, self-conscious. Over time the members develop a shared repertoire for their practice (Lave & Wenger, 1991).

In pursuing an interest in the common domain, members engage in joint activities and discussions, help each other, and share information (Wenger et al., 2002). The members build relationships that enable them to learn from each other whilst, at the same time, they care about their standing with each other (Wenger, 2000). There must be interaction and learning together for a group of like-minded people to form a Communities of Practice. Working together on a daily basis is, however, not a requirement of a community of practice (Lave & Wenger, 1991).

Wenger-Trayner and Wenger-Trayner (2015) argue that the “*body of knowledge*” is a community of people who play a part in the liveliness, purpose and advancement of the particular practice. In addition, these authors (2015) contend that the “body of knowledge” of a profession is realised as *landscapes of practice*, that entails an intricate system of communities of practice and the boundaries that exist between them. Furthermore, competence is used to describe the aspect of knowing that is negotiated and expressed within a single community of practice. Knowledgeability, on the other hand, shows in how a person relates to a diversity of practices across a landscape (Kubiak et al., 2015). According to Kubiak et al (2015), knowledgeability is fostered when cross-boundary interactions take place.

Wenger-Trayner and Wenger-Trayner (2015) describe those who participate in *landscapes of practice*, as practitioners. A trustworthy practitioner is somebody who demonstrates authenticity, prominence, association and participation within a community (Wenger-Trayner & Wenger-Trayner, 2015). These authors (2015) define a responsible practitioner as a person “*whose experience in providing a service reflects the current competence of the community.*” Furthermore, Wenger-Trayner and Wenger-Trayner (2015) contend that competence has a social dimension and that such competence is not static. While competence is both stable and shifting, it resides in the dynamic that exists between the communities’ definition of competence and an individual’s experience of the same competence (Wenger-Trayner & Wenger-Trayner, 2015).

Wenger-Trayner and Wenger-Trayner (2015) claim the boundaries between practices accommodates discussion with regard to how communities of practices’ competence becomes significant (or not) to the competence of other communities of practice. These authors (2015) state that interactions at the boundaries of communities of practice are never simple and without problems. In addition, they (2015) postulate that boundaries

are areas where potential misunderstandings occur, due to the lack of shared history. When practitioners cross boundaries or new ideas are introduced from elsewhere in a landscapes of practice, feelings of inadequacy, remoteness and even personal failure can occur (Kubiak et al., 2015). It is at these boundaries that confusion arises, mainly due to differing ideas as to what constitute values, dedication, proficiency, opinions and praxis (Wenger-Trayner & Wenger-Trayner, 2015). Interacting at the boundaries can develop what communities view as the core of their practice, or of importance to the communities (Wenger-Trayner & Wenger-Trayner, 2015). Finally, Wenger-Trayner and Wenger-Trayner (2015, p. 18) state that boundary interactions are central “*for the interaction of a Landscapes of Practice.*” Kubiak et al (2015), in turn, postulate that interactions at the boundaries or “*boundary objects*” enable collaborative working and a sharing of practice within the Landscapes of Practice. This discussion of landscapes of practice fits in well with the agile value of individuals and the interactions between them.

#### 2.6.3.2 Working software over comprehensive documentation

Rubin (2013) is of the opinion that working software, in terms of the Agile manifesto, should add value to the organisation that has commissioned the project. This author (2013) states that such software (the product of the agile development) should deliver, or save, more revenue than it cost to build. The focus should, therefore, be on working software, as this is the only evidence of what the group has built (Cockburn, 2007). Documentation still has value within a project, but when the focus is on working software instead of paperwork, projects seem to stay on track (Rubin, 2013). In the traditional agile approach, working software is considered to be the minimum viable product (Rubin, 2013) and is considered as “*just enough or barely sufficient*” (Cockburn, 2007). The concept of a minimum viable product is discussed in detail later in this chapter.

#### 2.6.3.3 Client collaboration over contract negotiation

This value leads the group to find innovative ways of collaboration and innovation together with the users of the product being developed (Rubin, 2013). According to Mathis (2013), agile approaches accentuate the involvement of stakeholders as partners throughout the process. Cockburn (2007) argues that collaboration is concerned with community, amicability among the group members, the making of joint

decisions and rapid communication methods. While negotiated contracts can be useful, Cockburn (2007) is of the opinion that collaboration with the client strengthens the product being developed.

Three important aspects of an agile approach that aid collaboration with the client are adaptation, inspection and transparency (Schwaber & Sutherland, 2016). Within adaptation, client feedback is used to adjust the work being conducted and leads to the inspection of the product (Rubin, 2013). Schwaber and Sutherland (2016) believe that inspection is the thoughtful examination and processing of feedback, received through stakeholder participation. Collaboration with the client assists when decisions are made around adaptation regarding the process or product (Schwaber & Sutherland, 2016). Finally, transparency relates to open access by all stakeholders to unbiased information that is required for the inspection and adaptation aspects of the process (Rubin, 2013).

#### 2.6.3.4 Responding to change over following a plan

Within agile approaches it is important to adjust to changing requirements throughout the development process, as such adjustment leads to agility in the process (Cockburn, 2007). Regular reflections on how to become more effective and accommodating of changing requirements both lead to responding to change as a value of an agile approach (Beck et al., 2001). Agile approaches promote change as an integral part of the process. Stakeholders and the development group are able to communicate often regarding the minimum viable product and its features (Mathis, 2013). Each of the agile approaches contain planning activities and mechanisms for dealing with changes in the requirements for the project (Cockburn, 2007). Rubin (2013) states that groups making use of agile approaches, often use project boards to display their tasks and track the progress of those tasks. These boards assist the group in making the important decisions with regards to changing requirements (Torrance, 2016).

A mind-set exists that agile approaches go beyond the practices and groups, to incorporate the ideas behind the agile development. (Rubin, 2013). Furthermore, agile approaches find better ways of collaborating and interacting with all of the stakeholders (Rubin, 2013). The next section discusses the 12 principle of agile in detail.

## 2.6.4 Twelve principles of agile

After developing the agile manifesto the original 17 signatories, in conjunction with other stakeholders in the software development world, developed the 12 principles of agile approaches (Cockburn, 2007). The purpose of the principles was to add value to the agile manifesto and to assist others who wish to implement and agile approach (Beck et al., 2001). The 12 principles which strengthen the agile manifesto are displayed in Table 2.1, and the table includes an explanation of each of the principles.

**Table 2.1:** List of the 12 principles of agile and explanation of the principles

Principle (Beck et al., 2001)	Explanation (Cockburn, 2007)
<b>Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.</b>	Agile approaches centre on delivery which in turn equates to quick wins for the group developing the project. The emphasis should be on delivering items that have the greatest value to the customer. There will always be working software available for deployment when value is delivered early, even if funding is lost at some point in the project.
<b>We welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.</b>	Agile approaches welcome late changes to the project requirements. Factors such as early and frequent delivery of working software, the use of iterative and time-boxing techniques, attention to architecture and the willingness to update the design, all aid embracing late changes to the project. All agile approaches have mechanisms in place to include late changes in the requirements but these differ for each approach.
<b>Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.</b>	Early and frequent delivery specifies the length of the work cycles, or time-boxing, of the sprints. When delivery is early and continuous the development group is able to match on-going change requests. Feedback cycles are shorter which leads to agility.

Principle (Beck et al., 2001)	Explanation (Cockburn, 2007)
<b>Business people and developers must work together daily throughout the project.</b>	Discussions should be ongoing and occur on demand, the best timeframe is daily. It could be damaging to the project if it takes a long time for information to flow amongst the stakeholders and the developers.
<b>Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.</b>	Individuals make projects work. Agile approaches consider motivated, skilled people communicating well and using no fixed process, better than a well-documented process used by unmotivated individuals.
<b>The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.</b>	The cheapest and fastest way to exchange information is through interactive face-to-face communication.
<b>Working software is the primary measure of progress.</b>	Agile approaches place a premium on getting a project up and running early, and then evolving the project over time.
<b>Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.</b>	This principle has two sides to it, firstly it involves social responsibility. Secondly, it speaks to project effectiveness. Working long hours often leads to tiredness. When the group is tired, progress slows down and errors creep in. Alert and engaged groups are more agile than tired, plodding groups. Working long hours indicate something has gone wrong with the project.
<b>Continuous attention to technical excellence and good design enhances agility.</b>	A tidy, well-encapsulated design is easier to change and maintain, this leads to greater agility for the project. It is important to design as well as the knowledge at hand permits, but it should be done incrementally.

Principle (Beck et al., 2001)	Explanation (Cockburn, 2007)
<b>Simplicity - the art of maximizing the amount of work not done - is essential.</b>	Simplicity is a necessity in agile approaches - it can be subjective. Designing development processes to include simplicity assists with producing good working software. Producing simple designs that can handle change effectively, is extremely difficult and speaks to the amount of work that can be completed within a time-boxed sprint.
<b>The best architectures, requirements, and designs emerge from self-organizing teams.</b>	Good ideas can come from anyone, at any time. Architectures should be allowed to change over time as architectures grow in steps, in line with the changing knowledge of the group, and needs of the user community. Self-organising teams are central to agile approaches. Individuals in self-organising teams have flexibility in how their results are delivered and display self-discipline with regards to their accountability for the results. Finally, self-organising teams work within frameworks that are flexible. Teams which are self-organising do not lack leadership but are characterised by collaborative decision making.
<b>At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.</b>	Agile approaches include reflection. When groups spend time together regularly on their work habits, they are able to evolve their practice into being agile, effective and fitting. If the group is unable to reflect in this manner, they could encounter stagnation.

### 2.6.5 Applications of agile approaches in education

Following on from the previous section which discussed agile approaches in general, this section explores the application agile approaches to instructional design in education. The key advocates of agile approaches in Education are Allen and Sites (2012), Arimoto, Barroca and Barbosa (2015) and Torrance (2016).

Allen and Sites (2012), Arimoto, Barroca and Barbosa (2015) and Torrance (2016) have each tailored the agile approach to their specific needs and philosophy. Allen and Sites (2012) have named their approach the Successive Approximation Model. The approach used by Arimoto, Barroca and Barbosa (2015) is known as the Agile Learning Design method. Torrance, in turn, has named her approach, Lot Like the Agile Management Approach, or LLAMA (Torrance, 2016). Within each of these approaches to agile instructional design there is an analysis, or content collection phase. Allen and Sites (2012) and Torrance (2016) implement this phase first. Allen and Sites (2012) call this phase of their approach the “*savvy start*”. Arimoto, Barroca and Barbosa (2015) collect content during the third phase of their approach and name the phase “*refine the structure or create the content*”. Torrance (2016) names this phase “*analysis*”. Torrance (2016) has adapted the agile manifesto for agile learning development as shown in Table 2.2.

**Table 2.2:** Agile manifesto as adapted by Torrance (2016) for learning development

Agile manifesto (Beck et al., 2001)	Learning design manifesto (Torrance, 2016)
We are uncovering better ways of <b>developing software</b> by doing it and helping others to do it.	We are uncovering better ways of <b>creating learning experiences</b> by doing it and helping others to do it.

## 2.6.6 Agile Process

The agile process as used for the conceptual framework for the study will be discussed in terms of book sprints, time-boxed sprints, self-organising teams and face-to-face interactions. These concepts are discussed in greater detail in the following sections.

### 2.6.6.1 Book sprints

The term *book sprints* was coined by Tomas Krag (Hyde, n.d.). The *book sprint* methodology is based on similar code sprints used in software development (Horner & Blyth, 2008). Hyde (n.d.) explains that Krag found that there was a need for a book to consolidate his teaching and workshop material in the field of Wireless Networking. The book envisioned, was a starting manual for people wishing to venture into Wireless Networking and was specifically targeted towards the developing world. Krag realised the book would need to be published under a free license, with no limitations on its use (Hyde, n.d.).



The *book sprint* methodology entails a group of like-minded people coming together to produce a book in a short space of time (Hyde, n.d.). The group is guided by a facilitator, who steers the process from no content to a published, high quality, peer-reviewed book within a short period of time. Books, authored and published in this manner, are immediately available as print on demand, or electronic books (Hyde, n.d.).

This study is in reply to the call by Hyde (n.d.), of *BookSprints.net*, to document, explore and improve the *book sprint* methodology.

2.6.6.2 Time-boxing

Time-boxing is a way to manage the work which has been started but not yet completed (Rubin, 2013). Early and continuous delivery links to the concept of time-boxing and to the agile manifesto through developers working in short bursts of activity called sprints (Beck et al., 2001). According to Rubin (2013) time boxing is a time management system used to organise work performance and to manage scope.

Specific timeframes are dictated through time boxing, with a start and end date, which leads to groups working at a sustained pace, to complete the chosen work that aligns to the sprint goal (Rubin, 2013). Time-boxing helps with establishing a limit to the work in progress as each group devise a plan to work on chunks of the project that the group believes it can start and finish within the time allocated to the sprint (Rubin, 2013). Finally, the benefits of time boxing and short duration sprints as set out in Table 2.3.

**Table 2.3:** Benefits of time boxing and short duration sprints (Rubin, 2013)

Benefits of time boxing	Benefits of short duration sprints
Establish a limit to the work in process	Ease of planning
Forces prioritisation	Fast feedback
Demonstrates progress	Increased return on investment
Avoids unnecessary perfectionism	Errors are bounded within the sprint
Motivates closure	Rejuvenated excitement
Improves predictability	Frequent checkpoints

According to Rubin (2013) time-boxing forces stakeholders to prioritise and work on the small chunks of work that matter most, in turn, prioritisation sharpens the group’s focus on completing something valuable rapidly. Time-boxing can demonstrate

progress by placing emphasis on completing and validating important sections of work by a known date (Rubin, 2013). By forcing a fixed end date, time-boxing avoids unnecessary perfectionism through forcing the completion of a good solution by the end of the sprint (Cockburn, 2007). Again, the fixed end date for the sprint forces closure through developing a sense of urgency (Rubin, 2013). Finally, stakeholders are able to predict the work that should be completed during the following sprint.

Sprints of short duration aid planning in that it is easier to plan for a week or two than for a six month period (Rubin, 2013). Fast feedback is generated when short duration sprints are in place. Short duration sprints offer opportunities to inspect and adapt the work that has been completed. In turn, this leads to the group being able to make timely decisions regarding the project (Schwaber & Sutherland, 2016). Early and frequent delivery generates revenue sooner than later, leading to an improved return on investment (Rubin, 2013). If a sprint is fumbled for any reason, the fact that only two weeks of work is in jeopardy, means that the error is bounded (Rubin, 2013). When work is carried out within a short duration the excitement within the group remains high leading to feeling of early gratification (Rubin, 2013).

#### 2.6.6.3 Self-organising groups

The concept of self-organising groups, links to the fact that the agile manifesto states that self-organising teams encourage great architectures, requirements and designs (Beck et al., 2001). In other words, self-organising groups often deliver innovative projects, as each person is able to work to his or her strengths. Rubin (2013) describes self-organising groups as group members determining the best way to achieve the sprint goal. Self-organisation is an evolving, bottom-up feature of an agile approach (Rubin, 2013).

#### 2.6.6.4 Face-to-face communication

Cockburn (2007) postulates that face-to-face interactions are valuable due to the fact that they reduce the cost of communication with, and from, members of the group. This author (2007) discusses communication amongst the group members in terms of the metaphor of convection currents.

Face-to-face communication is considered premium as this reduces the cost of communication. However, other forms of communication in the form of information

radiators are important to limit unplanned disruptions (Cockburn, 2007). The terminology used to discuss face-to-face interactions in terms of the convection current metaphor is summarised in Table 2.4.

**Table 2.4:** Face-to-face communication terminology (Cockburn, 2007)

Term	Explanation
<b>Flow of information</b>	The rate of progress of a project is a relationship of the time it takes to transfer information from one person’s mind to a colleagues mind. When group members need to walk to a colleague’s office to ask a question, time is lost. If the colleague is not available, the question may remain unasked, resulting in a lost-opportunity cost to the project. The largest rate of information flow happens when group members are seated side by side. Describing a concept on the phone requires more time and energy than would face-to-face interactions.
<b>Osmotic communication</b>	Osmotic communication is the background communication that happens while reading, typing and conducting our daily tasks. Osmotic communication is what is overheard while not actually participating in the situation - what we overhear when a group is collocated. Group members often overhear something that is of use to their current situation. Osmotic communication can have a negative effect if the rhetoric is negative.
<b>Drafts</b>	Drafts are any form of unwanted information, overheard information that is not useful to the group members.
<b>Osmosis across distances</b>	Technology can simulate the feeling of being there and cognisance.

Term	Explanation
<b>Information radiators</b>	These are other forms of communications that keep all group members informed, such as project boards. Often teams find they are being interrupted and losing time, or even worse, their train of thought. Information radiators are physical forms of communication that lessen the disruptions encountered at times.

Daily scrum, or stand up meetings, an important form of face-to-face interaction should be at a specific time each day. In turn, being able to plan to specific times would enable group members to both plan and work efficiently (Cockburn, 2007).

### **2.6.7 Minimum viable product**

The minimum viable product (working software) is linked to one of the four values of the agile manifesto (Beck et al., 2001). This value links to the principles of simplicity and the principle of a minimum viable product as the primary measure of that which is “done” in an agile approach (Rubin, 2013). In an educational setting, such a minimum viable product could be a book as created in a book sprint, raw content for a textbook or workbook, open education resources which make use of open licencing, or an instructionally designed module for eLearning purposes.

Peschl and Fundneider (2014) argue that artefacts (minimum viable products in this study) emanate from the process of creation which is the cognitive process liable for the creation of a plan, goals for, and meaning of such a minimum viable product. These authors (2014) continue by stating that the material world is moulded according to cognitive processes or knowledge, and is closely related to an understanding of the processes required to bring a plan, or idea, to fruition, by giving it shape and form in the concrete world. This idea of an artefact, leads to the examination of a variety of artefacts that could be created using an agile approach.

The final concept in the conceptual framework for this study, market outlets, is discussed in this section of the chapter as it is closely related to the minimum viable product. This review scrutinises open education resources and commercial publishing as possible market outlets for the minimum viable products produced when utilising an agile approach within an educational context.

### 2.6.7.1 Open education resources and Open licencing

All aspects of Open education resources (OER) are set out in declarations such as the Cape Town Open Education Declaration (2007) and the Paris Open Education Declaration (UNESCO, 2016) which offer guiding principles to governments and other interested parties regarding OER. OER are educational materials, produced by a party, which are licensed to be used free of charge by others (Wiley, Green, & Soares, 2012) and are best defined by the William and Flora Hewlett Foundation (“Open education resources,” 2016) as:

“...teaching, learning, and research resources that reside in the public domain or are released under an intellectual property license that permits their free use and re-purposing by others. OER include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge.”

The Cape Town Open Education Declaration arose from a meeting convened by the Open Society Institute and the Shuttleworth Foundation. The meeting was held in Cape Town in September 2007 and was attended by global open education activists. The aim was to accelerate efforts to promote open resources, technology and teaching practices in education globally (Cape Town Open Education Declaration, 2007).

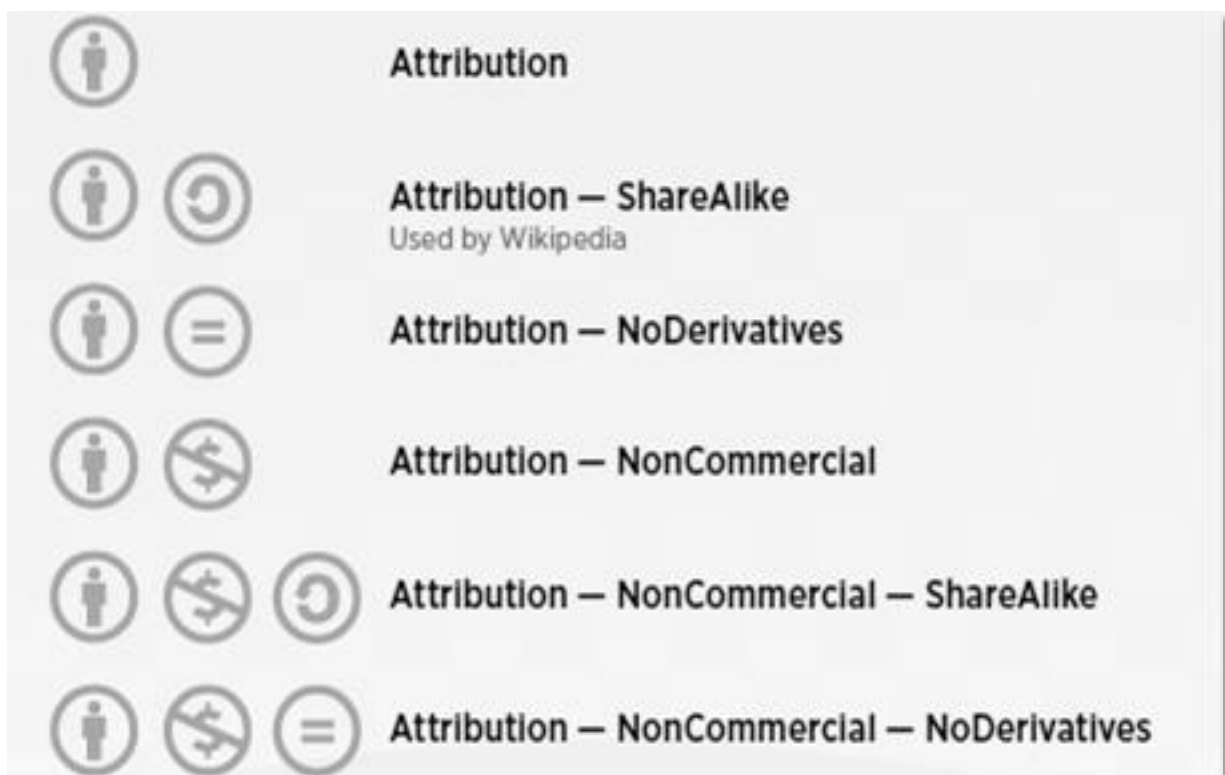
The emerging open education movement combines the established tradition of sharing good ideas with fellow educators and the collaborative, interactive culture of the internet. It is built on the belief that everyone should have the freedom to use, customise, improve and redistribute educational resources without constraint. Educational stakeholders who shared this belief, gathered together as part of a worldwide effort to make education both more accessible and more effective (Cape Town Open Education Declaration, 2007).

There are many forms of OER including, but not limited to curricula material, homework assignments and textbooks. The formats in which resources are published should encourage use and editing while accommodating diverse technology platforms (UNESCO, 2016). Globally, OER exist at all levels of education from pre-school through to university level (Wiley et al., 2012). As far as possible, OER should also be available to those with disabilities and those without internet access (Cape Town Open Education Declaration, 2007). Learners across the world use OER for self-study, while

educators are using them to enhance classroom-learning activities and education providers implement them to reduce the cost of instruction (Wiley et al., 2012). The Paris Open Education Declaration encouraged governments to foster research into the development, use, evaluation and re-contextualisation of OER (UNESCO, 2016).

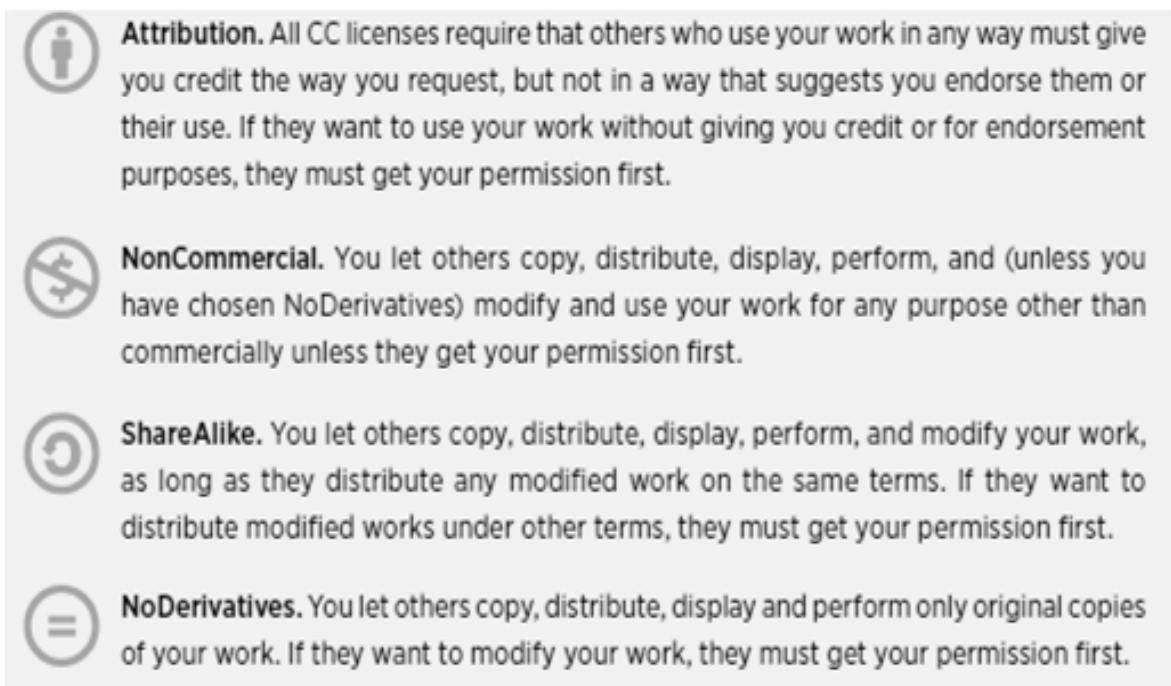
One of the three strategies identified by the Cape Town Open Education Declaration (2007) is for educational stakeholders to make their resources freely available through open licencing. The Paris Open Education Declaration called for the use of open licences to promote the use, adaption, revision, translation and sharing of OER (UNESCO, 2016).

Many OERs are published under the Creative Commons licences (See Figure 2.3). These licences allow authors to retain their copyright but to share their creativity with others and to choose how they wish to share and publish their works (“Creative Commons,” 2016).



**Figure 2.3:** Creative Commons licences (“Creative Commons,” 2016)

Figure 2.4 offers brief descriptions of the symbols used on the Creative Commons licences.



**Figure 2.4:** Descriptions of the Creative Commons licences (“Creative Commons,” 2016)

Free and open licencing could assist within the South African context, and the recent fee crisis in Higher education by reducing the cost of resources (Wiley et al., 2012). Of importance is for the country as a whole and specifically academia to consider producing and using OERs (UNESCO, 2016). Publishing OERs under free and open licences could be offered as a means to assist with the inequalities that exist in the South African educational context (Cape Town Open Education Declaration, 2007).

Patterson of Public Library of Science, the publisher of peer reviewed open scholarly science journals was quoted on Creative Commons licences as follows (“The Power of Open,” 2011):

“Creative Commons has provided a strong, consistent signal that you can use openly published research to do with what you want. Because the Creative Commons licenses are created by experts and have a solid legal foundation, they have become the gold standard in open access publishing.”

#### 2.6.7.2 Commercial publishing

Two prominent educational publishing firms in South Africa were investigated as possible commercial market outlets for content authored using an agile approach. Both of the publishing firms specialise in educational content (“About us,” 2017; Du Toit &

Links, 2017). These publishers have both ventured into offering digital content to their customers (“About us,” 2017; Du Toit & Links, 2017).

UCT Press is a scholarly publisher associated with one of the publishers investigated (Du Toit & Links, 2017). This scholarly publisher, publishes content “in print, e-book and digital formats” and promotes “open access to publications” (Du Toit & Links, 2017, p. 1). The second publisher investigated for this review stated that there had been a rise of e-books globally and within the realm of publishing and books as a whole (“About us,” 2017). Both of these publishers could be market outlets for content authored using an agile approach as they both have ventured into the production of e-books and digital content.

## **2.7 Chapter summary**

The review investigated previous research on textbooks produced for the South African schooling system that had been authored by a community of practice of Physical Science students. The ADDIE instructional design model was explored to highlight the differences between an existing instructional design model and the proposed agile approach to content creation in education. The Waterfall development method was scrutinised and contrasted against the ADDIE instructional design model.

The conceptual framework for this study included the agile approach. The concept of an agile approach was unpacked in terms of the four values of agile as set out in the agile manifesto and the associated twelve principles of agile. The concept of an agile process scrutinised book sprints, time-boxing, self-organising teams and how face-to-face interactions contribute to the agile process.

The concept of a minimum viable product was examined in terms of what products could be considered as minimum viable products when authoring content within an educational context. Finally, the conceptual framework offers two possible market outlets for the minimum viable product, namely OERs and commercial market outlets.

The next chapter explains methodological choices and the research design of the study.



### **3 RESEARCH METHODOLOGY**

<b>3.1</b>	<b>• Introduction</b>
<b>3.2</b>	<b>• Research philosophy</b>
<b>3.3</b>	<b>• Methodological choice</b>
<b>3.4</b>	<b>• Research strategy</b>
<b>3.5</b>	<b>• Research design</b>
<b>3.6</b>	<b>• Data collection methods</b>
<b>3.7</b>	<b>• Data analysis and synthesis</b>
<b>3.8</b>	<b>• Ethical considerations</b>
<b>3.9</b>	<b>• Chapter summary</b>

### **3.1 Introduction**

This chapter discusses the choices made regarding the researcher's research philosophy, the methodology for the research, the research strategy and the research design. Included in the research design are the aspects of ethical considerations and academic rigour. Finally, a brief chapter summary concludes the chapter.

The purpose of this study is to explore a rapid and unique method of collaborative content authoring by subject matter experts and communities or landscapes of practice using an agile approach. Two cases were analysed with the express purpose of attempting to identify an agile approach that subject matter experts and communities or landscapes of practice could use to rapidly and collaboratively author content in a similar manner within an educational context. It is the researcher's belief that such an agile approach would assist in authoring open educational resources within an education context and for the Global South in particular. The following section discusses the research philosophy for this study.

### **3.2 Research philosophy**

Research philosophies represent a particular worldview through which researchers see the situation they set out to study (Denzin & Lincoln, 2013). The researcher's point of departure for this study was that of social constructivism. According to Merriam and Tisdell (2016) constructivism and an interpretivist outlook are often used interchangeably to describe a social constructivist research philosophy. The researcher chose to discuss her worldview through a social constructivist stance, which in turn implies an interpretivist paradigm.

Creswell (2013) explains social constructivism by stating that individuals seek an understanding of the world in which they live and work. According to Corbin and Strauss (2008) individuals try to explain and make sense of their experiences through constructing stories. Nieuwenhuis (2010) concurs with Creswell (2013) and Corbin and Strauss (2008) in that he sees an interpretivist view as individuals finding understanding of the world within their social context. Bloomberg and Volpe (2008) state that research carried out from a social constructivist worldview endeavours to appreciate social phenomena from a context-specific point of view. This research was conducted by examining the social interactions within the specific cases in question, to make sense of data collected within the natural setting of each of them.

Creswell (2013) furthermore argues that within social constructivism, the implications of experiences are wide-ranging and numerous, while Lincoln, Lynham and Guba (2013) postulate that multiple realities exist within contexts due to diverse mental constructions within social constructs. On the other hand, Nieuwenhuis (2010) argues that reality is socially constructed as he emphasises that an understanding of the multiple views of situations in which participants are involved, is the ultimate goal. The role of the researcher is to make sense of the multiple meanings through the participants' points of view (Corbin & Strauss, 2008). This study constructed meaning from the data collected from the participants which involved multiple realities of an agile approach to content authoring.

Meanings are construed through interactions with others (social constructivism) and through past and ethnic standards that organise the individuals' lives (Creswell, 2013). Nieuwenhuis (2010), in turn, argues that participants are investigated while they construct meaning in their situations. Corbin and Strauss (2008) state that multiple interpretations of complex phenomena are constructed from the data while examining problematic and everyday situations or happenings. Everyday events of the cases studied were explored and compared in this study to construct meaning with regards to an agile approach to content authoring.

Finally, Creswell (2009) argues that researchers are unable to detach themselves from the research, meaning that the researchers' own personal histories shape how they decipher the data. The main assumption is that there is a relationship between the knower and what is known (Nieuwenhuis, 2010). According to Bloomberg and Volpe (2008) constructivist investigators most often speak to the process of interactions among individuals. These authors (2008) concur with Creswell (2009) and Corbin and Strauss (2008) that researchers' own backgrounds shape their understanding of the phenomena under study.

In research, making use of a constructivist worldview, participants are studied in order to interpret how and why they construct actions and meanings in certain situations (Corbin & Strauss, 2008). Researchers with constructivist worldviews typically position themselves as close to the participants of the experience as possible (Creswell, 2009). Qualitative researchers, specifically, understand that the research participants' experiences cannot be replicated in a laboratory or similar clinical environment (Chamaz, 2006). This author (2006) furthermore, postulates that one advantage of a

constructivist philosophical orientation is that such a constructivist approach is utilised while creating content. Creating content in a constructivist manner leads to free participation in shared experiences (Chamaz, 2006). This postulation is in line with this study, which is concerned with authoring content using an agile approach.

This study was based on Creswell's (2013) interpretation of social constructivism as the orientation for this study. The researcher believes that the world has many realities, that knowledge is constructed through both the researcher's view and the views of the world. In turn, reality is presented in the data. The researcher's view and sense of reality are deeply embedded in a social constructivist philosophy. This worldview lends itself well to qualitative research (Nieuwenhuis, 2010) and is interpretivist in nature (Creswell, 2013). Data collected were interpreted to make sense of the data and this interpretation led to the conclusions that were drawn from the data.

The methodological choice for this study is discussed in the following section.

### **3.3 Methodological choice**

The methodological choice for this study was qualitative by nature. The researcher chose to conduct research within a social constructivist worldview which led to using qualitative research methodology. According to Denzin and Lincoln (2013) qualitative research exists as lived experiences, where culture traverses an individual's actions and beliefs. Merriam and Tisdell (2016) define qualitative research based on the idea that people construct meaning in a lasting way while participating in, and creating meaning of their lived experiences, phenomena encountered and the activities in which they participate.

According to Nieuwenhuis (2010), an interpretivist view is seen as an alternative to positivist ways of thinking. Positivist thinking was the lens used most often during the early 20<sup>th</sup> Century (Nieuwenhuis, 2010).

Denzin and Lincoln (2013) state that a qualitative method places the observer within the world being studied. Qualitative research includes emerging questions and procedures (Creswell, 2013). Within qualitative research methods, data is typically collected in natural settings (Creswell, 2013), while data analysis is usually inductive (Creswell, 2009). The differences between positivist and interpretivist views are shown in Table 3.1.

**Table 3.1:** Differences between positivist and interpretivist views (Dudovskiy, 2016)

<b>Assumptions</b>	<b>Positivist view</b>	<b>Interpretivist view</b>
<b>Nature of reality</b>	Objective, tangible, single	Socially constructed, multiple
<b>Goal of research</b>	Explanation, strong prediction	Understanding, weak prediction
<b>Focus of interest</b>	What is general, average and representative?	What is specific, unique and deviant?
<b>Knowledge generated</b>	Laws	Findings are tentative and relative (Nieuwenhuis, 2010)

Furthermore, researchers interpret the data to make meaning thereof, while at the end of the research, the written report has a flexible structure (Creswell, 2009). According to Nieuwenhuis (2010) findings that are tentative and relative, are a characteristic of qualitative research. Denzin and Lincoln (2013), in turn, state that qualitative research is an interpretive and naturalistic way to see the world.

To uncover and interpret meaning is seen as the primary goal of qualitative research (Merriam & Tisdell, 2016). The goal of this study was to uncover an agile approach to assist subject matter experts and communities or landscapes of practice when authoring content rapidly and collaboratively within an educational context.

The lens of the qualitative researcher is one of an inductive style, with the focus on the individual meaning of the data, and the importance of representing the complexity of the situation (Creswell, 2009). Nieuwenhuis (2010) concurs with Creswell (2009, 2013) through his belief that qualitative research acknowledges the complexities that have interdependence and are mutually caused by specific phenomena. This, in turn, offers different interpretations and perspectives of reality.

As this study fulfilled most of the characteristics highlighted above, the researcher was of the opinion that a qualitative stance was the best choice for this study. The study is interpretive in nature and data were collected in their natural environment in keeping with Denzin and Lincoln's (2013) views. Data analysis was similarly conducted inductively in accordance with Creswell's recommendation (2009).

Section 3.4 discusses the research strategy for this study.

### **3.4 Research strategy**

This study was conducted using a case study methodology. Case studies tend to focus on an individual unit or case (Strake, 2006). According to Strake (2008), such a unit could be an active feature, or a system, which has well-defined boundaries. Yin (2014), in turn, suggests the necessity for a case study arises from a desire to understand complex social phenomena.

Numerous definitions are offered in case study literature, these range from the definition offered by Strake (2006) and Creswell (2009), to the twofold definition offered by Yin (2014). According to Strake (2006), case study research is not a methodology, but a choice of what is to be studied (i.e. a case within a bounded system, bounded by time or place).

Creswell (Creswell, 2009, pp 97-98) offers the following definition for case study research:

“Case study research is a qualitative approach where the investigator explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in depth data collection involving multiple sources of information such as observations, interviews, audio-visual material, and documents or reports and reports a case description and case themes. The unit of analysis in case studies are multiple cases (multisite study) or a single case.”

Yin's (2014) all-encompassing methodology covers the design logic and data collection techniques, and includes specific data analysis approaches. Yin (2014), in turn, offers the following twofold definition for case study research that covers the scope and features of case study research:

“A case study is an empirical inquiry that investigates a contemporary phenomenon (case) in depth and within a real world context, especially where the boundaries leading to the phenomenon and context are not clearly evident (Yin, 2014, p. 16).”

Yin (2014, p. 17) continues by stating that:

“A case study inquiry copes with a technically distinctive situation where there

are many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangular fashion, and another result benefits from prior development of theoretical propositions to guide data collection and analysis.”

Yin (2014) labels multiple case study designs as Type 3. Studies conducted using a similar design involve more than one case, within its own context (See figure 3.1).

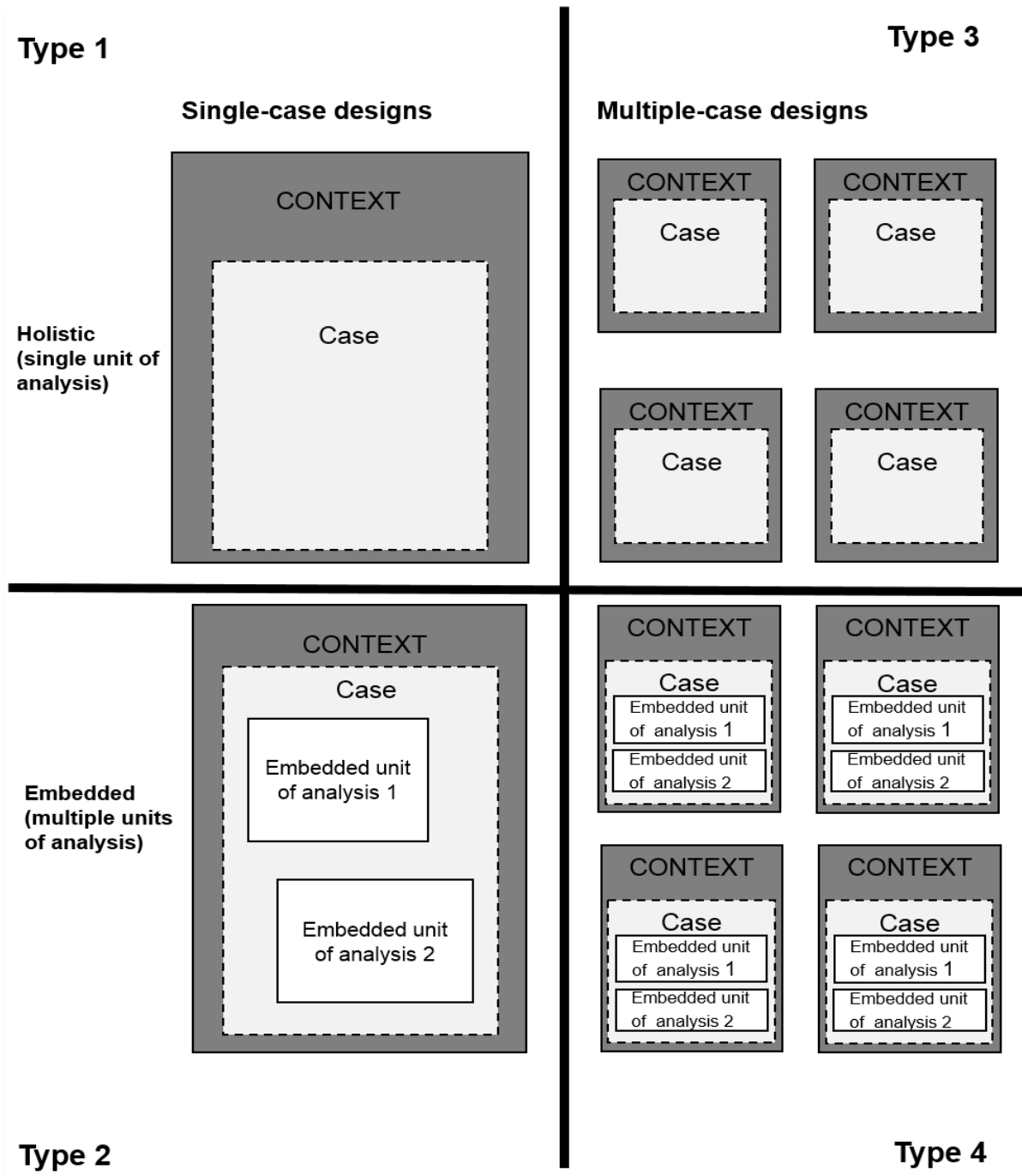


Figure 3.1: Types of case study (Yin, 2014)

Yin (2014) explains case study research as consisting of the case study questions, propositions and the unit(s) of analysis. This author furthermore advocates that logic links the collected data to the propositions and suggests criteria for interpreting the findings (Yin, 2014). Two separate cases were identified for this study. Case 1 consisted of a single holistic case with two distinct iterations of the case, while Case 2 was a single holistic case with one iteration of the case.

The following section of this study describes the research design for this study.

### **3.5 Research design**

This study utilised a multiple case study design involving two cases, one of which was a single case consisting of two iterations, while the second case was a single case involving a single iteration. The two known cases, both linked to agile development, were chosen as the sample for this study. This choice resulted in purposeful sampling. This type of sampling is based on the supposition that the researcher wants to gain insight to and understand the phenomena under investigation (Miles, Huberman, & Saldana, 2014). With this purpose in mind, the researcher had to select the sample from which the most could be learned (Merriam & Tisdell, 2016).

The participants in both cases under investigation, as part of this study, were key role players in the development of a minimum viable product within an educational context. Firstly, in **Case 1**, the minimum viable products were workbooks produced for the South African schooling system. This case was further divided into

- **Case 1a**, Natural Science and Technology workbooks for Grades 4 to 6, and
- **Case 1b**, Natural Science workbooks for Grades 7 to 9.

Secondly, in **Case 2**, an eLearning module which was instructionally designed for a South African university. Multiple case studies are often considered more convincing and the evidence is regarded as more robust than a single case study (Yin, 2014).

#### **3.5.1 Case 1**

As mentioned above, this case was about a publishing company who were tasked to author workbooks for Grade 4 to 9 of the South African schooling system. The company used a unique method to gather content for the workbooks that they were tasked to author for the South African schooling system. It was necessary to gather



and author content rapidly, as at the time, a new iteration of the South African school curriculum was about to be implemented. The workbooks were in answer to the presidency’s call for all learners to have their own workbook. A short turnaround time was therefore required for the delivery of the books.

An eclectic mix of paid and volunteer authors was utilised during this process. The philosophy was to gather a group of like-minded people together in one venue (in this case at an independent school situated in Johannesburg) to author content. The reasoning being that more is often achieved by a group working together than by individuals. In other words, the thinking was that a single person authoring content alone would take much longer than a group of people working on the same content. This is in line with Hyde (n.d.) whose *book sprint* methodology was adapted to author the workbooks in question in Case 1. In addition, other benefits included that the volunteer authors were practicing educators who were aware of the learners needs at a grassroots level, and were able to offer a different perspective to the specific content that was of value in the classroom.

### 3.5.1.1 Case 1a

A total of three content authoring sprints were conducted to capture and author content for the Natural Science and Technology Grades 4 to 6 workbooks. At these content authoring sprints, educator volunteers were utilised as **subject matter experts** (See Table 3.2) over a three day period, usually from a Friday afternoon until Sunday midday. A summary of the role-players and their affiliations is given in Table 3.2.

**Table 3.2:** Summary of the authoring sprint role-players and their affiliations.

Role-player	Affiliation	Role
<b>Content coordinator</b>	Publishing company employee	Attended to all content-related aspects before, during and after the authoring sprints.
<b>Community coordinator</b>	Publishing company employee	Attended to all aspects of the sprint which related to the people involved and task management.

Role-player	Affiliation	Role
<b>Facilitator</b>	Independent contractor, contracted by the publishing company	Chaired all scrum meetings and facilitated sessions on group interactions and how SMEs should respond to others when commenting online.
<b>Subject matter experts</b>	Volunteers	These practicing educators with sufficient knowledge of the discipline and phase volunteered their time and were willing to share their classroom successes to be included in the workbooks.
<b>Book reviewers</b>	Volunteers	Some were subject matter experts from the authoring sessions and others volunteered as book reviewers only due to their knowledge of the discipline or phase.
<b>Book editors</b>	Paid book editors	Edited the books after they had been typeset The editing was to verify the clarity and age-appropriateness of the content.

Each authoring sprint was organised by the **community coordinator** (See Table 3.2), an employee of the publishing company. The community coordinator managed all of the communication with the subject matter experts and any aspect relating to the people involved in the sprints, including ensuring the **subject matter experts** (See Table 3.2) were well fed and received refreshments regularly.

There were 40 **subject matter experts** (See Table 3.2) in attendance. These subject matter experts were divided into smaller, self-organising groups of between eight and ten per group. The groups were allocated one of the four strands of the South African Natural Science and Technology curriculum (CAPS) for Grade 4 to 6. The content the group authored was specific to the particular strand (See Table 3.3).

**Table 3.3:** Natural Science and Technology strands in CAPS

Natural Science and Technology strands in CAPS			
Life and Living	Matter and materials	Energy and change	Earth and beyond

Between the second and third authoring sprints, SMEs were encouraged to continue to work on their sections for the period of three weeks between the sprints. This was due to the fact that a great deal of time was lost during the sprint ensuring all of the subject matter experts had a *Gmail* account in order to work on the shared document. Only a small core group (four to six in total) used this opportunity to complete their sections of work, this is in keeping with a core group within a community of practice (Wenger et al., 2002). See Table 3.4 for a summary of the content authoring sprints.

**Table 3.4:** Summary of content authoring sprints for the Grade 4 to 6 workbooks.

Content authoring sprints	
<b>Total group size</b>	40 subject matter experts.
<b>Small group size</b>	Eight to ten subject matter experts per group, no hierarchy within the group.
<b>Technology</b>	Content authored online using <i>Google Docs</i> , and reviewed online using <i>a.nnotate</i> (See Addendum A). The content was typeset using <i>LaTeX</i> .
<b>Subject matter experts</b>	Eclectic mix volunteer authors.
<b>Work division</b>	Each group contributed to a strand of the curriculum. Groups were self-organising.
<b>Networking</b>	Subject matter experts networked during free time.

Within each of the small groups, the subject matter experts decided amongst themselves which section of the particular strand they would author. The topic was usually one with which they felt comfortable and were confident that they had the necessary content knowledge to author. The groups were self-organising and there was no hierarchy within the groups. Content was authored online using *Google Docs* within the context of the small groups. In addition to the subject matter experts present

at the authoring sprints, two paid **book editors** (See Table 3.2) who revised the content, were contributing online (remotely from Cape Town), to assist the subject matter experts when they needed any assistance to word the content correctly, specifically for clarity and for the content to be age-appropriate.

3.5.1.2 Case 1b

In keeping with an agile approach during the authoring sprint reviews, the publishing company made a conscious decision that future content authoring sprints would take the form of brainstorming sprints. The sprint review process is an integral step within an agile approach.

Brainstorming sprints were the approach adopted to gather content for the Grade 7 to 9 Natural Sciences workbooks. These workbooks were developed in a similar manner to the Grade 4 to 6 workbooks and after the Grade 4 to 6 workbooks were completed. In this scenario only one brainstorming sprint was held and was hosted at an independent school, in Johannesburg. These brainstorming sprints were attended by **subject matter experts** (See Table 3.2) and the **paid authors** (See Table 3.5), who authored the strands of the workbook in line with the Natural Science strands of the curriculum.

**Table 3.5:** Additional role players for the brainstorming sprints

Role player	Affiliation	Role
<b>Four authors</b>	Publishing company employee	Authored content for each strand of the Grade 7 to 9 Natural Science curriculum.

A paid author was appointed for each of the four Natural Science strands (See Table 3.5). The paid authors were present at the brainstorming sprint. The presence of the paid authors at the brainstorming sprint was in order for the authors to fully understand what was discussed during the sprint and to identify with the content generated in this way. Furthermore in this scenario, a paid author wrote all of the content for the particular strand. Once the content authoring was completed, the content was made available to the subject matter experts, online for comment and review. An application called *a.nnotate* (See Addendum A) was used for this purpose. The subject matter experts were able to leave comments, but were not able to change the content.

A group of 40 subject matter experts volunteered to participate in the brainstorming sprint. The subject matter experts were divided into smaller groups of eight to ten each and each group was allocated one of the Natural Science strands to brainstorm. Each group contributed content for a particular strand - the strands for Natural Science Grade 7 to 9 are the same as those for Grade 4 to 6 (See Table 3.3). There was still no hierarchy within the groups. A summary of the brainstorming sprints is given in Table 3.6.

**Table 3.6:** Description of brainstorming sprints.

Brainstorming sprints	
<b>Total group size</b>	40 subject matter experts.
<b>Small group size</b>	Eight to ten subject matter experts per group, no hierarchy within the group.
<b>Paid author</b>	Paid author participated in the small groups.
<b>Content</b>	Content was gathered during brainstorming sprints on flipchart sheets of paper and the group interactions were recorded using a dicta-phone.
<b>Technology</b>	Content was authored by a paid author using <i>Google Docs</i> and typeset in <i>LaTeX</i> . Finally, the content was reviewed online using <i>a.nnotate</i> .
<b>Work division</b>	Each group contributed to a strand of the curriculum. Groups were self-organising.
<b>Networking</b>	Subject matter experts were able to network during free time.

### 3.5.1.3 Comparison of Case 1a and Case 1b

The major difference between Cases 1a and 1b was how the content was captured and reviewed. During Case 1a volunteer subject matter experts authored and captured the content online using *Google Docs*. The volunteer subject matter experts were able to review and comment on the content that others had captured in real time. This real time review and commenting led to the content being constantly under peer review. The final step in this process was for the minimum viable product to be reviewed using *a.nnotate*.

Unfortunately, a great deal of time was lost during the sprints ensuring all of the subject matter experts had a *Gmail* account so as to be able to work on the shared *Google Docs* document. Another limiting aspect of the sprints was that the subject matter experts had differing levels of computer literacy which led to time being spent on showing the subject matter experts how to search for images on *Flickr* for example. Thus during the sprint review which took place at the end of the authoring sprints consensus was reached that a change was needed in the way the content was captured for future sprints. This change aligns very well with an agile approach (Schwaber & Sutherland, 2016).

In contrast, during Case 1b the content to be included in the workbooks was identified through brainstorming activities and captured on flip charts. The content was later collated and authored by paid authors. Finally, the content was reviewed by volunteers, some of whom had attended the brainstorming sprints, using *a.nnotate* before the minimum viable product was finalised. These differences are highlighted in Table 3.7.

**Table 3.7:** Comparison of Case 1a and Case 1b

Criteria	Authoring sprints	Brainstorming sprints
<b>Sprint participants</b>	Volunteer subject matter experts.	Volunteer subject matter experts.  Four paid authors.
<b>Capture method</b>	Individual volunteers authored content using <i>Google Docs</i> . The content was refined and collated by the content coordinator.	Brainstorming sprints were conducted where the paid author was present. Content was captured by recording the content on flip charts and later captured by the individual paid author for each strand. The group interactions were captured electronically, by recording group conversations.

Criteria	Authoring sprints	Brainstorming sprints
<b>Review method</b>	Subject matter experts some of whom participated in the authoring sprints reviewed the content using <i>a.nnotate</i> .	Subject matter experts who participated in the brainstorming sprints reviewed the content using <i>a.nnotate</i> , as a means of verification.  This alludes to member checking as is often conducted in qualitative research.

During both iterations of the sprints subject matter experts were able to mingle during the free time built into the schedule. This, in turn, led to the subject matter experts networking amongst themselves and with members from other groups. Face-to-face interactions are a vital aspect of an agile approach (Beck et al., 2001; Cockburn, 2007).

### 3.5.2 Case 2

This is the case of an eLearning module which was instructionally designed for a South African university. The module was rolled out in tandem with a traditional face-to-face module with the same content at the university. The module was content specific and consisted of eight distinct content areas within the specific course. The content for this case was not authored from scratch but the focus was on the instructional design component of the content, so as to prepare the content for use in an online learning environment. The role-players, their affiliation and the roles they fulfilled are displayed in Table 3.8.

**Table 3.8:** Case 2 role-players and their affiliation

Role-player	Affiliation	Role
<b>Project sponsor</b>	University employee	Owned the project and was required to approve and accept the iterations of the module.

Role-player	Affiliation	Role
<b>Team leader</b>	Independent contractor	Acted as the team lead and developed the assessments in the minimum viable product.
<b>Instructional designers</b>	Contracted by the independent contractor	Developed the module for online delivery according to recognised instructional design principles.
<b>Subject matter experts</b>	University lecturers	Supplied the content that was developed into the instructionally designed eLearning module.

The group was made up of a **project sponsor**, a **team leader** and two **instructional designers** (see Table 3.8). The instructional design group was geographically distributed and worked remotely (some group members were situated in Cape Town, while others were situated in Pretoria). Due to the distributed nature of the team, they seldom met face-to-face, but they did have regular weekly scrum meetings. Since the content developers were not able to meet for face-to-face scrum meetings, they met on a weekly basis via Skype, to inform one another as to which tasks they had completed, which they were still working on, or what aspects of the tasks were blocking them from making the required progress. These Skype meetings did not make use of the video feature of Skype and only utilised the voice feature of the application.

An agile approach to develop the online module was chosen by the team lead in collaboration with stakeholders at the university. Client collaboration such as this is vital to an agile approach (Beck et al., 2001). One reason for the choice of an agile approach to manage this development, was to focus on communication amongst group members. Regular communication led to all team members being informed as to the development progress at all times, as opposed to waiting for milestones (that could have been far into the future) as in a traditional approach to development.



*Trello* was used to keep track of the tasks within a given sprint. Sprints were of a seven day duration. Each team member managed their own tasks on *Trello* and reported progress at the weekly scrum meeting, via *Skype*. Aspects of the module were completed iteratively and incrementally, in keeping with an agile approach. During weekly scrum meetings each increment was discussed and if need be was improved during a next iteration of the module.

### **3.6 Data collection methods**

Data collection for Case 1 was primarily in the format of data collected from the transcripts of two face-to-face, semi-structured interviews. These interviews were conducted concurrently due to the availability of the interviewees.

Interviewee01 and Interviewee02 were both associated with the education publishing company that produced the workbooks for Grade 4 to 9 of the South African schooling system. Interviewee01 was interviewed as he was the founder of the educational publishing company responsible for authoring the workbooks. Interviewee02 was the content coordinator for the workbooks published for both the Grade 4 to 6 and the Grade 7 to 9 workbooks.

Data for Case 2 was collected from the transcript of the semi-structured *Skype* interview conducted with Interviewee03, who was associated with the group that developed the eLearning module that was instructionally designed and intended for online delivery at a South African university. In keeping with case study methods, data collection and data analysis occurred concurrently (Miles et al., 2014).

### **3.7 Data analysis and synthesis**

In the analysis and interpretation phases of the study, data from transcript of the semi-structured interviews were analysed. Initial coding was conducted according to the conceptual framework identified in Chapter 2. These codes were compared for similarities and differences between the two cases under study. This action was in line with Yin's (2014) position that states that case study methods utilise constant comparison of data, simultaneous data collection and data analysis.

Data analysis for this study followed the data analysis guidelines for case study methods (Merriam & Tisdell, 2016). These guidelines include the coding of the collected texts, or transcripts, according to initial codes identified in the conceptual

framework for the study (See Chapter 2) and the identification of emerging patterns through constant comparison of the data (Yin, 2014).

A matrix was used to compare the two cases under study (See Chapter 4). This matrix was used to make sense of the data. The researcher revisited the data numerous times to understand what the data was revealing as described by Saldana (2009). The actions, interactions or emotions within the interview transcripts were linked to the research questions through the conceptual framework for this study (See Chapter 2).

### **3.8 Ethical considerations**

Ethical clearance was sought from the ethics committee of the Faculty of Education at the University of Pretoria. Ethical considerations for the study included informed consent, voluntary participation and the avoidance of harm. The study did not make use of data of a sensitive nature, hence it posed a low risk to the participants. The identified participants were free to withdraw from the study at any stage in the research.

#### **3.8.1 Informed consent and voluntary participation**

Informed consent was obtained from each of the participants interviewed in the two cases investigated. This was obtained electronically by means of an informed consent leaflet, which was sent to participants electronically once they had agreed to participate in the study (See Appendix C). The informed consent leaflet explained the purpose of the study, the voluntary participation and the ethical issues presented by the study. The identified participants were informed that they were free to ask questions in order to seek further clarity regarding any stage of the research.

Participants completed the informed consent form and returned the signed form to the researcher. It was made clear to the identified participants that their participation in the study was entirely voluntary and that they were free to withdraw from the study at any stage. The study did not expose any of the identified participants to any harm as it did not involve any harmful physical activity or emotionally hazardous conduct.

#### **3.8.2 Privacy, confidentiality and anonymity**

It was important for the researcher and the identified participants to clearly understand all aspects pertaining to confidentiality of the results and findings of the study. All responses and information submitted by the participants during the study were treated as private and were presented in an anonymous way. Only the transcripts of the

interviews, both Skype and face-to-face, have been retained. At all times, the researcher conducted all aspects of the research study in accordance with the Ethics and Research Statement provided by the Faculty of Education of the University of Pretoria (Maree, 2010).

The participants were able to waive their anonymity on the informed consent form, initially this was offered to the participants in keeping with OERs practice and attribution was offered in return for this waiver. All of the participants were willing to waive their anonymity. However, during the study it became evident that anonymity should be retained to protect other parties involved such as university for which the instructionally designed eLearning module was developed, in Case 2. While every effort has been made to preserve anonymity, industry stakeholders may be able to identify the cases investigated for this study.

### **3.8.3 Academic Rigour**

Academic rigor is discussed in terms of trustworthiness, dependability, confirmability, transferability and credibility. Denzin and Lincoln (2013) put forward the ideas of dependability, confirmability, transferability and credibility, with regard to the concept of trustworthiness, as a constructivist lens on internal and external validity as described in positivist research.

*Trustworthiness* is the rigour with which the insights and conclusions are constructed and presented (Merriam & Tisdell, 2016). The trustworthiness of the study was seen in this light. Member checking was conducted to ensure trustworthiness. The interviewees were requested to peruse the initial transcripts to ensure their utterances had been correctly captured in the transcripts.

*Dependability* is used with reference to the stability and consistency of the research process and methods over time (Di Fabio & Maree, 2012). Triangulation of data within the identified cases led to the stability and consistency of the research process and methods. In this study, data was triangulated through in-depth comparison of the two cases under study, to identify similarities and differences. In addition, multiple sources were used to collect the data, i.e. individual and group semi-structured interviews using an interview schedule (See Appendix D) and the researcher's personal reflections on the authoring process used by Case 1. A rich description of the cases was recorded to assist future researchers to replicate the study (Shenton, 2004).

*Confirmability* can be defined as the objectivity of the data and the absence of research errors (Di Fabio & Maree, 2012). The researcher's self-awareness is documented throughout the study by stating her own beliefs, values and biases upfront. Biases included being close to Case 1 which in turn led to the researcher having set ideas with regards to the outcomes of the study (Creswell, 2013). As a participant in the authoring sprints, the researcher guarded against biases through using multiple sources of data collection (Shenton, 2004). The choice of a multiple case study and the interviews with multiple participants were an attempt to limit any bias in this study. Furthermore, the researcher's own beliefs and reflections were triangulated with the utterances of the participants in an attempt to protect the study from the researcher's own bias.

*Transferability* is used with reference to the extent to which results can be extended and generalised to other contexts, other subject matter or content (Denzin & Lincoln, 2013). All aspects of the study were described in great depth, leading to the reader being able to assess if the results are transferable to their own contexts, subject matter or content. The researcher is of the opinion that the cases were described in sufficient detail to allow the insights gained during the study to be transferred to similar studies (Shenton, 2004).

*Credibility* of data bears reference to the significance of the results and whether the results of the study are found credible to enable replication of the study (Di Fabio & Maree, 2012). The data obtained from the identified cases was triangulated. A variety of sources of data were incorporated into the study, these included individual and group semi-structured interviews and researcher reflection.

A tried and tested research strategy was adopted, namely that of a case study. Two specific cases were explored, leading to a comparison of the methods used by the two cases (Shenton, 2004). If data received from Case 1 is similar to, or the same as that received from Case 2, then this would make the proposed study credible through triangulation. The interviewees were requested to inspect data after the preliminary analysis in order to validate the analysis, and this speaks to member checking as described by Merriam and Tisdell (2016).

Finally, all data pertaining to this study will be retained by the University of Pretoria (Di Fabio & Maree, 2012). The stipulated timeframe for the retention of the data is a period of 15 years from the commencement of the study.

### **3.9 Chapter summary**

The chapter highlighted the research methodology implemented for the study. Discussions regarding the choices made about the research philosophy, the methodology for the research, the research strategy and the research design. The research design included ethical considerations and academic rigor. The study was a qualitative study making use of an interpretive and social constructivist world view. The purpose of this study was to explore two cases which utilised approaches similar to the agile approach to author content for workbooks (Case 1) and to instructionally design an eLearning module for a South African university (Case 2).

Chapter 4 discusses the cases investigated and presents the insights gained.

## 4 FINDINGS AND DISCUSSION

4.1	• Introduction
4.2	• Case1: Development of workbooks for the South African schooling system
4.3	• Case 1a: Development of Grade 4 to 6 workbooks for the South African schooling system
4.4	• Case 1b: Development of Grade 7 to 9 workbooks for the South African schooling system
4.5	• Comparison of Case 1a and Case 1b
4.6	• Case 2: Instructional design of an eLearning module for a South African university using an agile approach
4.7	• Discussion of insights gained during the study
4.8	• Chapter summary

## 4.1 Introduction

The values and the principles of an agile approach (See Table 1.1) were used to make sense of the data from the interviews conducted with the participants. In this chapter, an attempt is made to answer the following question:

*How can an agile approach facilitate rapid and collaborative content authoring?*

In addition to the data collected from interviews, the analysis of Case 1a and Case 1b included the researcher's own experiences and perceptions of the authoring process. As mentioned earlier, the researcher participated in the authoring sprints of the Grade 4 to 6 workbooks, and the brainstorming sprints for the Grade 7 to 9 workbooks for the South African education system.

## 4.2 Case 1: Development of workbooks for the South African schooling system

The researcher participated in the authoring of workbooks, for Natural Sciences and Technology Gr 4 to Gr 6, based on the CAPS revision of the South African School curriculum. At the time, the researcher was the technology subject advisor for the Tshwane South District of the Gauteng Education Department. Her participation in the authoring of the books was, however, of a voluntary nature.

The researcher found the method of authoring the books intriguing and this interest led to the current study. Upon examining the methodology used to author content collaboratively, the researcher came across the Agile Manifesto (Beck et al., 2001) for software development. In doing so, she found a number of interesting similarities in the methods used in an agile approach to software development and the methods used to author content collaboratively for the Grade 4 to 6 workbooks.

Within an agile approach to software development, a number of sprints are conducted. Sprints are defined as short iterations that are time-boxed; typically between a week and a calendar month in duration (Rubin, 2013). Adam Hyde, the owner of a publishing company, *Booksprints.net*, that facilitates content authoring sprints, used a similar approach to develop software user manuals (Interviewee01, 04 October 2016).

Adam Hyde conceptualised the process [of authoring books during sprints] and his *Book sprints* were said to be close to the agile framework, *Scrum*.

For the sake of clarity Case 1 was investigated in terms of a single case with two iterations (Yin, 2014). Case 1a was the instance of the development of Grade 4 to 6 workbooks, while Case 1b was the development of Grade 7 to 9 workbooks, both within the context of the South African schooling system.

### **4.3 Case1a: Development of Grade 4 to 6 workbooks for the South African schooling system**

The authoring sprints took place over a weekend, from Friday afternoon until Sunday midday. The timeframe of the authoring sprints was thus significantly shorter than the normal duration of the sprints within the software development environment, which are described as being between one to four weeks in duration (Schwaber & Sutherland, 2016).

#### **4.3.1 Authoring Process**

A total of 40 authors participated in the authoring sprints. This large group of authors was, however, divided into smaller self-organising groups which comprised of seven to ten members each. Interviewee01 (04 October 2016) is the founder of the publishing company responsible for publishing the workbooks examined in this study and he recommended a smaller group size of between seven and ten people.

Once they're over 15 it becomes a very complex dynamic. The smaller they are the faster they can establish rapport (Interviewee01, 04 October 2016).

He also mentioned that it is, therefore, important to have clear sections of content, so that it is possible to break the authors up in smaller groups of seven to ten people per topic.

On arrival at the sprint venue each subject matter expert was issued with a documentation pack. This documentation package included a proposed table of contents for the books, information on Bloom's taxonomy, guiding principles for authoring and on developing assessments and a style guide. The documentation package further included an agenda for the sprints (See Table 4.1).



**Table 4.1:** Content authoring and brainstorming sprint agenda

Time	Description	Action
9:00 – 9:15	Scrum Meeting (Whole group)	Discuss tasks for the day, any concerns or queries.
9-15 – 10:45	Authoring session with small self-organising groups (Case 1a)  or  Brainstorming sessions with small self-organising groups (Case 1b)	Author agreed upon content, group discussions regarding content.
10:45 – 11:15	Tea Break	Social interaction and free time.
11:15 – 12:45	Authoring session with small self-organising groups (Case 1a)  or  Brainstorming sessions with small self-organising groups (Case 1b)	Author agreed upon content, group discussions regarding content.
12:45 -13:00	Scrum meeting (Whole group)	What did you achieve? What challenges did you have? What will you do next? Questions were answered in group context.
13:00 – 14:00	Lunch break	Social interaction, free time.

Time	Description	Action
14:00 – 15:15	Authoring session with small self-organising groups (Case 1a) or Brainstorming sessions with small self-organising groups (Case 1b)	Author agreed upon content, group discussions regarding content.
15:15 – 15:30	Tea Break	Social interaction and free time.
15:30 – 17:15	Authoring session with small self-organising groups (Case 1a) or Brainstorming sessions with small self-organising groups (Case 1b))	Author agreed upon content, group discussions regarding content.
17:15 – 17:30	Scrum Meeting (Whole group)	What did you achieve? What challenges did you have? What will you do next? Questions were answered in group context. Time to report next day.

In addition to the document pack each subject matter expert received, the groups were also provided concept maps for their particular strands of the Natural Sciences and Technology curriculum (See Table 3.3). These concept maps aided the authors in understanding where their specific section of work fitted into the curriculum. The concept maps also informed the authors of any prior knowledge that may have been covered in a previous grade. Furthermore, the maps ensured that the content authored

was grade appropriate (See Appendix E). Interviewee01 (04 October 2016) commented that the concept maps indicated the flow of the content from Grade 4 to Grade 9. Interviewee01 (04 October 2016) continued by stating that the subject matter experts required a framework that could be “digested very rapidly”. The concept maps provided such a framework. Figure 4.1 shows subject matter experts making use of one of the concept maps for discussion and planning purposes.



**Figure 4.1:** Subject matter experts using the concept map

The maps were therefore high level visual frameworks that was “a crucial ingredient” in assisting the subject matter experts to decide exactly which sections of content they wanted to discuss (Interviewee01, 04 October 2016). Interviewee01 (04 October 2016) continued by stating:

Those topic maps [allowed subject matter experts to] see the flow [of the curriculum] without having to digest a curriculum statement that many of them might not have seen before.

A typical agile approach consists of a number of sprints which are time-boxed and conducted by self-organising teams. In addition, sprints involve scrum meetings which ensure everybody is working towards the goal of the sprint (Rubin, 2013). While the authoring sprints in Case 1a were not consciously modelled on those of an agile approach, the rhythm fits in well with such an approach. The sprint agenda both for Case 1a and Case 1b (See Table 4.1) demonstrated that the rhythm within the authoring sprint mirrored a typical agile approach. Interviewee01 (04 October 2016) reflected on the rhythm of the sprints by stating:

We provide a lot of overall process structures – always at the start of the day, always before breaking for lunch just in case something has come up. [This is] so you don't let some issue or concern or undercurrent kind of evolve in a lunch break. It's more about flagging concerns, making sure they [the concerns] get acknowledged and they [the concerns] get addressed and everybody else can see what is happening.

Between the second and third authoring sprints, the subject matter experts were offered the three week period to continue working their section of the workbook. During this time the subject matter experts worked remotely from their offices or homes. This change was made to the sprint as a number of subject matter experts had indicated that they wished to continue working on their section in their own time. Not all of the sections had been completed by the end of the authoring sprint and as such, it made sense to give the subject matter experts the additional time to complete their work. It should be noted here that only a small core group of six subject matter experts actually continued authoring in this manner, during this time. This is in keeping with literature on communities of practice that states that there is often only low levels of sustained participation in communities of practice (Wenger et al., 2002).

Much time had been lost during the authoring sprints while the content coordinator ensured all subject matter experts had access to the shared document on *Google Docs*. Many of the subject matter experts did not have a *Gmail* account and needed to sign up for an account. This fact and that a great deal of time was spent showing the subject matter experts how to search for images on *Flickr* led to a small group of subject matter experts continuing to work on their sections of content. Working outside of a sprint is not normally an accepted practice within an agile approach but was necessary in this case to complete the content.

### 4.3.2 Role-players

The authoring sprints were always supported by a **facilitator** whose role it was to explain to the groups how to behave within a group context. Additionally, the facilitator informed the subject matter experts on how to make use of the online commenting system to comment on what others had written, in a non-threatening way. The scrum meeting was chaired by the facilitator at the start and end of each mini-sprint throughout the day. The presence of a facilitator was extremely valuable as mentioned by Interviewee01 (04 October 2016):

My sense is the facilitation always substantially improved the outcome and the process.

Facilitation appears to be an important aspect related to the authoring sprints. The facilitator gave the subject matter experts a sense that their contributions were valued and that the group was taken seriously. As one participant (Interviewee01, 04 October 2016) commented:

It just generated a lot of buy in and social capital which goes into the contributions.

Interviewee02 (04 October 2016) responded that her own role in the sprint was that of **content coordinator**. She (04 October 2016) stated that she specifically managed all content-related aspects of authoring, such as she responded to any queries with regards to the content. The content coordinator was also responsible for the final collation of the content, the graphic design of the workbooks and assisting with the typesetting in *LaTeX*.

At the time of authoring a **community coordinator**, who managed the authors and allocated tasks for reviewing the various drafts of the books, was employed by the publishing company. It was important to build and foster a community who could understand the vision and would then volunteer to participate. The community coordinator was responsible for communicating with the community to follow up on any remote work that had to be completed after the sprints. For example, the review of the various drafts of the books had to be coordinated. Also, the community coordinator communicated with the authors after the sprints with regard to other events hosted as part of the community building strategy, e.g. a *WordPress* blogging seminar.

### 4.3.3 Technology

The authoring of the Grade 4 to 6 workbooks was conducted in an online environment. *Google Docs*, a free web-based application in which documents can be created and edited, was the software application used for authoring content during the sprints. All of the subject matter experts worked on a single shared document online. With regards to the use of *Google Docs* to capture raw content, Interviewee01 (04 October 2016) commented:

*Google Docs* is robust, works and is scalable. Nothing beats them... Two people could be writing in the same sentence at the same time and *Google Docs* can handle it.

The technology aspect of authoring in this manner was challenging at times and some of the participants were somewhat intimidated by having to author live, in real time. One of the major challenges was ensuring that all of the subject matter experts had access to the internet and that they were registered on *Gmail* in order to have access to the shared documents. This aspect took up a great deal of time during the sprints and resulted in everybody not being as productive as they possibly could have been. As one participant (Interviewee02, 04 October 2016) responded:

There were some technical difficulties there, for example, making sure that everyone had a *Gmail* account.

Some authors wanted to create a perfect offline version of their content before putting their work online, possibly due to personal insecurities and a fear of working online in full public view of others. Interviewee02 (04 October 2016) stated that it was particularly hard for some of the participants to feel comfortable about sharing “straight up” and reflected on this phenomena by commented “...*that was definitely a big one*”. The **facilitator** was essential in allaying some of these fears and building trust with regards to these feelings of insecurity about working online and in a shared document.

The collaborative aspects of the process included working in small self-organising groups, each focusing on a strand of the Natural Sciences and Technology curriculum (See Table 3.4). The subject matter experts were able to comment on what others were writing and discuss a particular point online using *Google Docs* commenting function.

Interviewee01 (04 October 2016) commented on the discussions that arose within *Google Docs* comments, during the authoring sprints:

I saw a curriculum specialist from a particular province have a long debate with a PhD student in Physics, about the definition of Doppler Effect, using Google Docs commenting function. One of our staff members got involved and they had a really constructive conversation. They actually converged on something which was a very valuable discussion. Everybody who read it could benefit from it and we could feed it into the book.

#### 4.3.4 Computer Literacy

The participating subject matter experts had varying degrees of computer literacy, which also impacted on their contributions and their experience of authoring online in a safe environment. During one of the weekend sprints, authors were required to insert images sourced from *Flickr*, an online image sharing application where open images were sourced under a Creative Commons licence. A number of the authors had not previously used *Flickr*, which led to the content coordinator having to spend valuable authoring time demonstrating how to search for appropriate images.

At a later weekend sprint, students from the host school, assisted in sourcing rich media licenced under *Creative Commons* licences. This media was to be included in the workbooks. This was described by Interviewee02 (04 October 2016) as follows:

Learners from the host school joined in to help with the technology side and finding resources on line. They were quick and more tech-savvy. There was quite a mix of age. The learners that were meant to be learning that content, helped to produce it.

The learners' assistance was valuable as they were more comfortable using the technology and were able to source the images and videos much faster than the subject matter experts. All of the images sourced by the learners, were however checked for quality and age-appropriateness by the relevant subject matter experts before being added to the content in the workbooks.

One of the important aspects of an agile approach is to review a sprint once the sprint has been completed and to embrace any changes to the approach that would benefit future sprints (Schwaber & Sutherland, 2016). The lessons learnt are then implemented in a future authoring sprint.

During the review process of the authoring sprints, it was decided that due to the fact that the subject matter experts experienced challenges with the technology, any future sprints should rather focus on the brainstorming of content and ideas in small groups. In bringing about a change such as the brainstorming sprints, the publishers were still able to tap into the wealth of experience and unique perspectives that the subject matter experts brought to the table. The change did, however, pave the way to a more streamlined authoring approach. The result of the change was that unnecessary time was not wasted while solving the technical difficulties such as those encountered during the online authoring sprints.

Unfortunately, a great deal of time was lost during the authoring sprints ensuring all of the subject matter experts had a *Gmail* account. A *Gmail* account was necessary to be able to work on the shared *Google Docs* document. The time wasted ensuring access to the shared document led to only a few committed subject matter experts continuing to work on completing their section of the content. Another limiting aspect of the sprints was that the subject matter experts had differing levels of computer literacy which led to much time being spent on showing the subject matter experts how to search for images on *Flickr*, for example. Thus, during the sprint review which took place at the end of the authoring sprints consensus was reached that a change was needed in the way the content was captured for future sprints. This change aligns very well with an agile approach (Schwaber & Sutherland, 2016).

#### **4.4 Case 1b: Development of Grade 7 to 9 workbooks for the South African schooling system**

The sprint review after the first content authoring sprints in Case 1a, led to the use of brainstorming sprints for the identification of appropriate content for the Grade 7 to 9 workbooks in Case 1b. The change was due to the fact that a great deal of time had been wasted during the Grade 4 to 6 workbook sprints caused by technical issues of ensuring all of the subject matter experts had a *Gmail* account and were able to access the internet. In addition, the differing levels of computer literacy of the contributing subject matter experts also contributed to the decision to conduct brainstorming sprints for the Grade 7 to 9 workbooks.



#### 4.4.1 Authoring Process

The brainstorming sprints were conducted according to the schedule shown in Table 4.1, this is the same schedule as the content authoring sprints. The brainstorming activities were found to be a valuable way to collect ideas and raw content for the books. No time was wasted on technology issues.

One person was contracted to author each strand of the workbooks based on the ideas and content collected during the brainstorming sprints. This paid author was present during the brainstorming sessions and was able to participate in, and contribute to, the discussions. Being part of the brainstorming sprints led to the paid authors having a sense of ownership towards the content they authored for the workbooks. Furthermore, these authors were able to identify with aspects of the content in ways that would not have been possible were they not involved in the brainstorming sprints. As stated by Interviewee02 (04 October 2017):

Those who are going to do the authoring must be at the brainstorming sprints, otherwise they won't have any ownership.

In the case of the modified sprints, the paid author already had the necessary computer literacy and skills. Each contracted author focused on a specific section of the book from the contributions recorded at the brainstorming sessions. Essentially, for these books there were, therefore, only four authors to manage in an office environment, as opposed to the 40 volunteer subject matter experts at the initial authoring sprints.

The 40 subject matter experts were, however, actively involved during the brainstorming sprints and the review process by reviewing sections of the content. The input offered by these experienced content specialists and subject teachers added to the quality of the final product. The significant change from authoring sprints to brainstorming sprints seemed to make the entire process much more manageable.

Value was found in using an online review method to verify content and for updating the editions of the workbooks. Once the chapters of the workbooks, for both Case 1a and Case 1b, had been typeset using *Latex*, the chapters were reviewed by subject matter experts to verify that the content was age-appropriate and scientifically correct. Interviewee01 (04 October 2016) stated that book reviewers were able to log into the application, *a.nnotate*, and spend an hour or two reviewing sections of the books. At

times, there were up to 100 reviewers reviewing sections of the books simultaneously. The book reviewers were a combination of the subject matter experts who participated in the authoring and brainstorming sprints and other knowledgeable persons who had volunteered their time to assist with the reviewing process.

Interviewee01 (04 October 2016) mentioned that book reviewers should not be able to edit the text, but that they should be able to annotate the text, or respond to other reviewers' annotations. Once the reviewers had been given access to the review application and the text, they were able to annotate the text using a method similar to that used to comment on a MS Word document or a PDF document.

#### **4.4.2 Role-players**

As with the Grade 4 to 6 workbook sprints, the **community co-ordinator** initiated the sprints by contacting the **subject matter experts** and inviting them to volunteer to participate in the brainstorming sprints for the Grade 7 to 9 workbooks. The community coordinator also stayed in contact with the subject matter experts afterwards by sending invitations to the subject matter experts to improve their personal and professional development by attending seminars such as the *WordPress* blogging seminar offered as a community building activity.

Once again, Interviewee02 was the **content coordinator** for the Grade 7 to 9 workbooks. She was, therefore, responsible for all of the content-related aspects of the content collection process.

In addition to the 40 subject matter experts who participated in the brainstorming sprints, **four paid authors** were contracted to author content. Each paid author was responsible for one of the Natural Science strands in the South African school curriculum, namely Life and living, Matter and materials, Energy and change and Earth and beyond. These paid authors wrote the content within an office environment after the brainstorm sprint had been completed.

The **subject matter experts** were requested to participate in content reviews once the paid authors had completed the content for the strand for which they were responsible. Other subject matter expert volunteers were also invited to participate in the content review process.

### 4.4.3 Technology

Initially the content was captured in *Google Docs*, this was to aid the capture of the raw content that was identified during the brainstorming sprints. After the raw content had been captured in this manner, the content was refined and consolidated, thus reducing the volume of content.

Once the content had been sufficiently reduced, a computer programme *LaTeX*, was used to complete the technical editing of the workbooks. This computer programme allows for the advanced technical editing that is required to format mathematical and scientific formulae, and formats the final product as a PDF file for easy sharing (Kottwitz, 2011).

### 4.4.4 Computer Literacy

Computer Literacy did not impact the brainstorming sprints in the same way it impacted the Grade 4 to 6 workbooks, as only the four authors required the necessary computer skills and knowledge of Latex. Bearing in mind that as paid authors, they were selected according to their subject, computer and Latex knowledge. As the book review process was again conducted using *a.nnotate*, no advanced computer skills or knowledge was needed to use this computer programme.

## 4.5 Comparison between Case 1a and Case 1b

An agile approach was closely mimicked by both the authoring sprints and the brainstorming sprints. The timeframe for both Case 1a and Case 1b, however, is significantly shorter than the sprints used to develop software (Schwaber & Sutherland, 2016). A comparison between the online authoring and the brainstorming sprints is shown in Table 4.2.

**Table 4.2:** Comparison between the online authoring and the brainstorming sprints.

Criteria	Online authoring sprints	Brainstorming sprints
<b>Role-players</b>	Community coordinator Content coordinator Facilitator Subject matter experts	Community coordinator Content coordinator Facilitator Subject matter experts Paid content authors

Criteria	Online authoring sprints	Brainstorming sprints
<b>Authoring process</b>	<p>Forty volunteer authors.</p> <p>Author content online, in small groups, using <i>Google Docs</i>.</p> <p>All volunteers authored online and reviewed the content. Editors reviewed and finally approved the content.</p>	<p>Forty volunteer contributors.</p> <p>Brainstorm content in small groups, using <i>Google Docs</i>.</p> <p>All volunteers contributed to the brainstorming sprints.</p> <p>The content was reviewed by the subject matter experts who participated in the brainstorming sprints and other content experts who volunteered their time for this purpose.</p> <p>Editors reviewed and finally approved the content.</p>
<b>Technology</b>	<p>Google Docs</p> <p>a.nnotate</p> <p>LaTeX</p>	<p>Google Docs</p> <p>a.nnotate</p> <p>LaTeX</p>
<b>Computer literacy</b>	<p>There were varying levels of computer literacy among the subject matter experts.</p>	<p>Computer literacy of the subject matter experts did not impact the content collection process.</p> <p>Paid authors were hired according to their subject knowledge as well as their computer literacy level.</p>

It is important to take note of the fact that the subject matter experts and the interactions between them, were of great importance during the authoring process. This was demonstrated by the community coordinators' interactions with the subject

matter experts and the explicit nurturing of the communities that were built around the authoring sprints.

The minimum viable product in both Case 1a and Case 1b was not “working software” as explained in the Agile Manifesto (Beck et al., 2001) but was the workbooks produced through the authoring process implemented. The workbooks were an artefact which could be reviewed and published at short notice, as was the case during the 2010 teacher strike in South Africa (Interviewee01, 04 October 2016).

In approaching the creation of these workbooks in an agile manner, there was constant collaboration with the “*stakeholders*” as many of the subject matter experts were in fact teachers, one of the ultimate end users of the workbooks. After each sprint, the process was reviewed and improved. For example the move from online authoring during a sprint, to a sprint utilising brainstorming to collect the ideas and content from the contributors. These improvements indicated that change management was embraced.

In addition, other aspects of an agile approach were incorporated into the authoring processes of both Case 1a and Case 1b, namely time-boxing and self-organising groups. The use of computer applications, such as *Google Docs*, to capture the content, albeit by multiple or individual authors aided the process by capturing the content electronically and thus making it easier to work with the content. Over time, a number of technology changes were made to improve the process. Interviewee02 (04 October 2016) reflected on the technology changes that had occurred during sprints for other books authored and published by the publishing company, by mentioning:

The technology that we were trying to use wasn't playing along so that we actually were adjusting on the fly as we were going, every break we were chatting and then completely adjusting... We were going to use *Connexions* [a platform for sharing content in PDF format] and we end up using *Word documents*... [and then] re-imported [them into *Connexions*].

It is important to note that for the authoring of the Grade 4 to 9 workbooks *Connections* and *Word documents* were not used. Due to the difficulties encountered in previous sprints for other textbooks published by the publishers, as noted above, the publishing company decided during a sprint review to use *Google Docs* for any future sprints.

## **4.6 Case 2: Instructional design of an eLearning module for a South African university using an agile approach**

The module in question formed part of a diploma course offered by the South African university and was intended to be rolled out, in an online mode, in parallel with a face-to-face module of the same course.

### **4.6.1 Instructional design process**

An agile approach was chosen to manage the instructional design of the module. The weekly scrum meetings aided the communication among the group members. Interviewee03 (11 November 2016) commented on her decision to use an agile approach:

I have just found that [the agile approach] really helped keeping things moving. The whole communication aspect of agile of keeping everyone aware of what everyone else is doing, discussing problems as they happen, all within the span of a week, rather than having a project meeting closer to a milestone and things don't work.

The team leader's choice of an agile approach was reached collaboratively with stakeholders at the university. Additionally, it was important to know exactly on which aspect of the project each team member was working at any given time. It was decided that week-long sprints, with weekly virtual scrum meetings, the project would stay on track.

Interviewee03 (11 November 2016) felt that using a traditional project management approach, with milestones at certain points on a timeline, was not a good fit for the project as the milestones might have been too far into the future. Interviewee03 (11 November 2016) stated that she would probably have chosen an agile approach, even if the team was in the same location, as she felt the approach was valuable and a good approach to managing projects.

I probably would have chosen agile anyway because I think it's a good methodology, but I thought it even more important to have very short chunks of time because we were all remote [geographically dispersed].

Communication and change management are two important aspects of an agile approach. The eLearning module instructional designers were able to incorporate

these aspects into their weekly routine and were able to make changes as necessary. During the weekly scrums, each group member explained to the other group members what they had achieved since the last scrum meeting and what they still had to complete. The members of the group commented on any challenges they experienced in terms of the development process, or the use of technology. It is important to note, that in keeping with agile principles, a scrum meeting was not regarded as a planning meeting, but was used to inform the other team members regarding the status of the relevant tasks (Rubin, 2013).

Challenges encountered in this case, were that the university stakeholder, namely the project sponsor, and the contracted Instructional Designers did not appear to have a complete understanding of the nature of an agile approach. Interviewee03 (11 November 2016) commented that many of the aspects of the agile approach were carried out without the group fully understanding them.

An obvious disadvantage was we were remote and were not able to have daily scrums. It was difficult for them to buy into the agile process.

Interviewee03 (11 November 2016) mentioned that she would facilitate a training session for future projects on two specific aspects, one being the agile approach, and secondly on aspects of instructional design. Aspects of the process that Interviewee03 (11 November 2016) identified for additional training prior to future project iterations are highlighted in Table 4.3.

**Table 4.3:** Comparison of initial iterations and future iterations

First Iteration	Future Iterations
Geographically distributed team.	Geographically distributed team.
Misunderstood process	Additional training on an agile approach at the beginning.
Different styles and instructional strategies.	Additional training at start on instructional design principles and styles.

#### 4.6.2 Role-players

Interviewee03 was contracted by a South African university to act as the **team leader** on an instructionally designed eLearning module development project. The team leader was based in Cape Town, while the two **instructional designers** for the course were both situated in Pretoria.

The **project sponsor** was a university employee who liaised with the team leader and the subject matter experts. It was vital for the project sponsor to also be on board with an agile approach as this person ultimately owned the project. Interviewee03 (11 November 2016) agreed and mentioned that the project sponsor should have had a complete understanding of the agile concepts, but that this was unfortunately not the case.

I didn't feel that the project sponsor at the university totally understood the agile concepts, and as such I don't think he bought into the process as one might expect a project sponsor in an agile project.

In this case, the **subject matter experts** were university lecturers. Interviewee03 (11 November 2016) commented that the group had no need to create the source documents used in the project as these were supplied by the subject matter experts. Interviewee03 (11 November 2016) commented on the role of the subject matter experts by mentioning:

The subject matter experts being the lecturers, would have produced the learning guides and so on, and in some cases along with that, textbooks. And we basically have taken that, put some instructional design on to it and turned that into e-learning courses.

This, in turn, led to the agile approach being used for the instructional design component of the eLearning module using the content supplied. This aspect is in contrast to Case 1a where the content was authored during the sprints and with Case 1b where the content topics were brainstormed during the sprints. For case 1b the content was later authored by a single author for each of the four Natural Science strands.



### 4.6.3 Technology

The choice of technology for the development of the instructionally designed module was the eLearning authoring software, *Articulate Storyline*. This application could be installed locally on the team's individual computers, meaning that the developers were not dependent on an internet-based application.

At the beginning of 2015 load shedding<sup>1</sup> was a daily certainty in South Africa. The use of an online development application such as *QuickLessons* was not a realistic choice, as a steady internet connection was necessary.

*Articulate Storyline* is expensive and due to this fact, is most often only available at universities or within corporate environments. The development group utilised the university's *Articulate Storyline* licence to develop the instructionally designed eLearning module.

In addition, *Articulate Storyline* had virtually no learning curve, as the interface and much of the functionality mimics *Microsoft PowerPoint*. There were other features, such as the ability to include *JavaScript*, which made it exceptionally versatile. Interviewee03 (11 November 2016) commented:

It [*Articulate Storyline*] has the look and feel of *Microsoft PowerPoint*. It's not a totally foreign interface for your average user who would be conversant with *Microsoft PowerPoint*. In future, knowing what I know now, without taking the price into consideration, I would still choose *Articulate Storyline*.

The group utilised *Dropbox* for file sharing and *Trello* for task management. There were some challenges regarding the use of *Dropbox* as not everyone in the group knew how to use *Dropbox* effectively (Interviewee03, 11 November 2016).

### 4.6.4 Computer Literacy

Within this case, there were fewer technology complications due to the high levels of computer literacy of the group members. Some challenges were, however, encountered when it came to sharing files on *Dropbox*, as some of the group members

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<sup>1</sup> Load shedding – is a uniquely South African concept whereby the electricity supply was cut to certain geographical areas at specific times of the day, causing rolling blackouts. This was done to reduce electricity consumption.

did not fully understand how to use this file sharing application effectively (Interviewee03, 11 November 2016).

#### 4.7 Discussion of insights gained during the study

Data from cases identified was analysed according to the conceptual framework identified in Chapter 2 (See Figure 2.2). The concepts identified in the conceptual framework thus framed the insights gained during this study. Table 4.4 shows how these concepts linked to coding the data.

**Table 4.4:** Conceptual framework with coding links

Concept	Coding link
Minimum viable product	Links to the overarching concept used for comparison of the two cases.
Individuals and the interactions between them	Links to communities of practice.
Stakeholder participation	Links to communities of practice.
Change management	Links to changes in the technology used and the agile approach in general.
Time-boxing	Links to the length of the sprints.
Self-organising groups	Links to communities of practice.
Face-to-face interactions	This concept was incorporated into the individuals and their interactions during the data analysis phase of the study.
Market outlets	This concept was incorporated into the concept of a minimum viable product during the data analysis phase. This minimum viable product in both Case 1 and Case 2 could be produced for either OER or a commercial market.
Technology	As technology played an important part in both Case 1 and Case 2, this concept was added during the data analysis phase of the study.

A comparison between the cases was conducted, data from both cases was analysed according to the conceptual framework identified in Chapter 2. The comparison of the cases is shown in Table 4.5.

**Table 4.5:** Comparison of two cases investigated

Categories	Case 1		Case 2
	Case 1a	Case 1b	
<b>Minimum viable product</b>	Print and online books distributed under a Creative Commons licence and as OERs. A similar approach was used to translate the workbooks into Afrikaans.	Print and online books distributed under a Creative Commons licence and as OERs. A similar approach was used to translate the workbooks into Afrikaans.	Proprietary instructionally designed university module for a diploma course, rolled out in tandem with a face-to-face course of the same content.
<b>Individuals and the interactions between them</b>	An active community of 40 subject matter experts or practicing teachers was fostered to author content. Facilitation of the sprints was important for training purposes and to foster interactions between the participating authors. Mini sprints of two to three hours with feedback, in the form of scrums at the start and finish of each sprint, were held.	An active community of 40 subject matter experts or practicing teachers were involved in brainstorming sprints. Facilitation of the sprints was important for training purposes and to foster interactions between the participating authors. Mini sprints of two to three hours with feedback, in the form of scrums at the start and finish of each sprint, were held.	A geographically dispersed workforce and client. Weekly scrums were held to keep the project on track and communicate the progress of the project to the group members.

Categories	Case 1		Case 2
	Case 1a	Case 1b	
		Four paid authors captured the content collected.	
<b>Client collaboration</b>	Collaborated with educators and the Department of Basic Education. Collaboration was evident in the small group discussions which took place to clarify concepts or when assistance with using the technology was required.	Collaborated with educators and the Department of Basic Education. Collaboration was evident in the small group discussions which took place to clarify concepts or when assistance with using the technology was required.	Collaborated with the university with regards to the content, the review process and the choice of software.
<b>Change</b>	Changes were made from the Connexions platform to Google docs.	Sprints evolved from online authoring sprints to brainstorming sprints.	Embraced change as and when it occurred.
<b>Time-boxing</b>	Mini sprints of two to three hours each over a period of 3 days a weekend. Each sprint started and ended with a face-to face scrum meeting.	Mini sprints of two to three hours each over a period of 3 days a weekend. Each sprint started and ended with a face-to-face scrum meeting.	Weekly sprints Daily scrum meetings were not possible but a Skype-based scrum meeting was held on a weekly basis.
<b>Self-organising teams</b>	Small groups of seven to ten individuals divided workload into chunks to complete a given	Small groups of seven to ten individuals brainstormed the content. These	The team leader and instructional designers worked as a self-organising team. Each

Categories	Case 1		Case 2
	Case 1a	Case 1b	
	task. These groups were self-organising whereby they decided amongst themselves which content each subject matter expert would author.	groups were self-organising in that they decided amongst themselves which aspects of the content was to be discussed.	member worked according to their strengths within this team.
<b>Technology</b>	Utilised <i>Google Docs</i> and <i>a.nnotate</i> applications for authoring and review of book respectively. LaTeX was used to typeset the content.	Utilised <i>Google Docs</i> and <i>a.nnotate</i> applications for authoring and review of book respectively. LaTeX was used to typeset the content by author.	Utilised <i>Articulate Storyline</i> to design and author eLearning for a module. Utilised <i>Dropbox</i> for file sharing and <i>Trello</i> for task management.

It is evident from the comparison in Table 4.5 that an agile approach is a versatile approach to author content collaboratively. As has been shown, an agile approach can be utilised to create printed books, electronic versions of books, eLearning modules and to translate any of these artefacts. Within an agile approach the outcome is important, not how one reaches the outcome. The technology used was not what was important. The use of a specific application was not critical to the process, the technology was simply the vehicle to reach the outcome.

There are numerous file sharing applications, *Dropbox* is but one of these. Where the technology was vital was when authoring online, in a shared document, *Google Docs* appears to be the most robust of the options available at the time, and was therefore utilised by Case 1.

The practitioners, known in this study as subject matter experts, all belonged to other communities of practice at their place of work, or may have belonged to a group of educators who met to set an examination paper. The practitioners arrived at the

authoring sprints with a certain competence and left with that competence having changed. They were then able to share their newfound competence with the other communities of practice to which they belonged. This, too, talks to crossing the boundaries of the various communities of practice to which the practitioners belonged, thus displaying knowledgeability (Kubiak et al., 2015). When subject matter experts transfer the knowledge they have gained from one community of practice to the members of another community of practice they are crossing boundaries and forming landscapes of practice. Table 4.6 displays the insights gained during this study categorised by the concepts previously identified.

**Table 4.6:** Insights gained from the data analysis

Categories	Insights gained
<p><b>Minimum viable product</b></p>	<ul style="list-style-type: none"> <li>• An agile approach can be utilised for many different types of artefacts (such as printed workbooks, electronic versions of the previously mentioned workbooks, eLearning modules or OER content). This insight is indicative that an agile approach is transferable to any type of minimum viable product and need not be limited to software development as the manifesto suggests.</li> <li>• A style sheet, or a blueprint, is a necessary tool for the consistency of text and formatting, and to minimise the amount of technical editing required before finalising the artefact.</li> <li>• A minimum viable product is a successful outcome of an agile approach. Can be made available to the project sponsor at short notice, for deployment.</li> </ul>
<p><b>Individuals and the interactions between them</b></p>	<ul style="list-style-type: none"> <li>• Community building is vital for the cohesion of the group during collaboration. Trust is fostered through community building, this in turn creates a safe space for sharing ideas.</li> <li>• Facilitation and additional training by a group facilitator assist in community building and with conflict resolution.</li> <li>• Face-to-face interactions are important to an agile approach as they assist with building trust among the group. This implies that if the group is geographically</li> </ul>

Categories	Insights gained
	<p>distributed, ways should be explored to facilitate face-to-face interaction, or at least simultaneous conversations, such as synchronised chat feeds.</p>
<p><b>Stakeholder participation</b></p>	<ul style="list-style-type: none"> <li>• Collaboration with all the stakeholders is fundamental during the process and is essential to keep everybody informed as to the progress of the project.</li> <li>• It is vital that all stakeholders fully understand, and buy into an agile approach and appreciate what is required of them.</li> <li>• Upfront training would lead to obtaining the full cooperation of all stakeholders.</li> </ul>
<p><b>Change management</b></p>	<ul style="list-style-type: none"> <li>• In keeping with an agile approach, change is inevitable and should be embraced. Change is to be expected in an agile approach and as such, stakeholders should be encouraged to accept the changes as they manifest.</li> <li>• Scrum meetings are a way to manage change and minimise discomfort within the group regarding change. Scrum meetings should be held at regular intervals to minimise any discomfort regarding change and the approach as a whole.</li> <li>• At times, facilitation and training around change management is needed when members of the group experience discomfort in this regard.</li> </ul>
<p><b>Time-boxing</b></p>	<ul style="list-style-type: none"> <li>• While time-boxing is an important aspect of an agile approach, the actual length of sprints can be adjusted to suit the needs of the project.</li> <li>• Regular scrum meetings must be held to answer the questions which have to do with time management and keeping the project on track: <ul style="list-style-type: none"> <li>• What has been achieved?</li> <li>• What still needs to be achieved?</li> <li>• What challenges / successes were encountered?</li> </ul> </li> </ul>

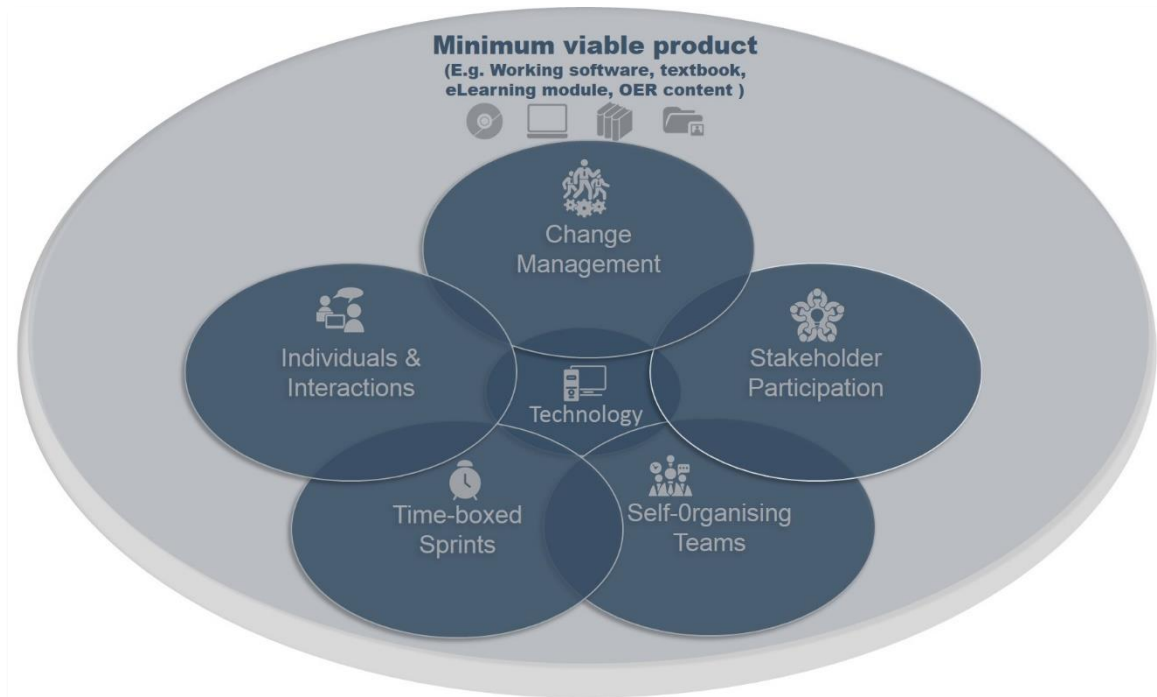
Categories	Insights gained
<b>Self-organising groups</b>	<ul style="list-style-type: none"> <li>• Work division within the groups should evolve through discussion and not be imposed by any stakeholder.</li> <li>• Depending on the project, a team leader may be identified as a liaison, between the group and stakeholders. However, within the group there should not be any hierarchy. This means that at any given instant any member of the group may assume the lead for a given task or discussion.</li> <li>• The optimal group size for collecting content by brainstorming or authoring online is between seven and ten individuals, however smaller groups are optimal when it comes to instructional design.</li> </ul>
<b>Technology used</b>	<ul style="list-style-type: none"> <li>• The use of software applications assists with the mechanisms of an agile approach, but need not necessarily be the end product. In order to work collaboratively a robust platform is necessary. Whichever platform is chosen should be able to cope with two or more people editing the same sentence of a shared document at the same time.</li> <li>• A rigorous means of file sharing, instant messaging, screen sharing, task management and a meeting / video conferencing application in a single application would benefit all instances of an agile approach.</li> </ul>

Often the “destination” is important, even though the route to the destination may be different for each person, or case. In the cases investigated as part of this study, a variety of authoring methods and technologies were highlighted, but in each of the cases an artefact that was of value to the community that it served, was produced.

The framework identified in Chapter 2 guided this study. This, in turn, led to the researcher being able to answer the questions relating to how an agile approach can assist in collaborative creating content, why community is valuable to the process and how technology could be used to assist in collaborative content authoring.



The agile approach in Education which emerged during this study was developed into a diagram (See Figure 4.2). The diagram could be used by future researchers to make sense of their data when studying agile approaches in education.



**Figure 4.2:** The agile approach in Education

The diagram shows the interaction between the concepts that are regarded essential when following an agile approach to authoring educational content rapidly and collaboratively. The over-arching concept is the minimum viable product, while the technology used, infiltrates into each of the remaining concepts, which, in turn, each overlaps with one another. The five concepts sandwiched between the minimum viable product and technology are individuals and the interactions between them, stakeholder participation, change management, time-boxing and self-organising teams.

#### **4.8 Chapter summary**

The minimum viable product is the overarching concept, followed by the insights gained for five of the concepts: individuals and the interactions between them, stakeholder participation, change management, time-boxing and self-organising groups, all of equal importance. Finally, the insights related to technology are presented. As Figure 4.2 shows, technology infiltrates and is evident in all of the

preceding concepts. So technology can be considered as an important component for streamlining the agile approach for educational content.

The insights discussed in this chapter are summarised in Table 4.7.

**Table 4.7:** Summary of insights gained

Summary of insights gained
<p><b>Minimum viable product</b></p> <ul style="list-style-type: none"> <li>• A variety of products can be developed using an agile approach.</li> <li>• A scaffold, such as a style sheet or a blueprint, is of value to the process.</li> <li>• A minimum viable product is always available at any stage of the process, should the budget be withdrawn or there be a need to rapidly deploy the product.</li> </ul>
<p><b>Individuals and the interactions between them</b></p> <ul style="list-style-type: none"> <li>• Community building is important.</li> <li>• Facilitation assists the process.</li> <li>• Face-to-face interactions are a cost effective and efficient way to interact, but synchronous contact between authors can be facilitated through the use of modern technology.</li> </ul>
<p><b>Stakeholder participation</b></p> <ul style="list-style-type: none"> <li>• Stakeholders should fully understand and buy in to an agile approach right from the start of the project.</li> <li>• Training with regards to the agile approach, instructional design principles and the technologies used, is needed upfront.</li> <li>• Stakeholders need to be kept informed of progress and inevitable changes.</li> </ul>
<p><b>Change management</b></p> <ul style="list-style-type: none"> <li>• Change is to be expected.</li> <li>• Regular scrum meetings minimise discomfort due to change.</li> <li>• Facilitation regarding the acceptance of the inevitability of change is needed.</li> </ul>

## Summary of insights gained

### Time-boxing

- Time-boxing is an important aspect but the actual length of sprints can be adjusted to suit the needs of the project.
- Regular scrum meetings important to answer the questions which have to do with time management and keeping the project on track:
  - What has been achieved?
  - What still needs to be achieved?
  - What challenges or successes were encountered?

### Self-organising groups

- Self-organising groups evolve through discussion.
- Roles and topics should not be imposed upon the group by any stakeholder.
- Based on their individual strengths, any member of the group may assume the lead at a given time.
- The optimal group size for content collection through brainstorming and online authoring is between seven and ten individuals.
- Smaller groups are optimal for instructional design aspects of a project.

### Technology (Software applications)

- To work collaboratively a robust platform is necessary.
- A means of file sharing, instant messaging, screen sharing, task management and meeting / video conferencing should be in place.
- Application training may be required.

The study is summarised in Chapter 5 and recommendations are presented for further development of the agile approach in Education. Finally, recommendations are offered for practice and for further research.

**5 SUMMARY AND CONCLUSION**

- 5.1 • Introduction
- 5.2 • Summary
- 5.3 • Recommendations
- 5.4 • Conclusion

## **5.1 Introduction**

An agile approach is most often used in software development, however there are other areas where agile approaches are applied, such as in manufacturing and project management (Mathis, 2013). This study explored how an agile approach can facilitate rapid and collaborative content authoring in education and speaks, among others, to the *#Feesmustfall* campaign by South African students calling for free or cost effective higher education. Damsa and Ludvigsen (2012) state we should aim to understand the processes involved in collaboratively creating knowledge objects. This study therefore explored two cases that used agile approaches while collaboratively and rapidly authoring educational content. The agile approach that emerged out of the study offers a new perspective to authoring educational content collaboratively and rapidly.

This study was concerned with offering an agile approach to the rapid and collaborative authoring of educational content. In other words, the interest was in how using an agile approach can facilitate rapid and collaborative content authoring in Education. Firstly, how an agile approach can be structured to author content rapidly and collaboratively. Secondly, the study investigated why community building is valuable to the rapid and collaborative content authoring process before finally considering how technology could aid such content authoring.

## **5.2 Summary**

The background to this study lay in the researcher's involvement in the authoring of the workbooks for Grades 4 to 9 and discussed in this study as Case 1a and Case 1b. These workbooks were produced in record time to address an urgent need in the South African schooling system. The intriguing manner in which these workbooks were authored, led the researcher to investigate the agile authoring methodology used further.

The exploration of the authoring method was in an attempt to solve the problem posed by a number of uniquely South African contexts such as the 2011 teacher strike, 2012 textbook crisis (particularly in the Limpopo province) and the more recent 2015 and 2016 *#Feesmustfall* campaigns by South African students calling for free higher education.

The main research question was:

*How can an agile approach facilitate rapid and collaborative content authoring?*

The sub-questions used to explore the problem in depth were:

- How can an agile approach be structured to author content?
- Why is it valuable to create a community of practice to author content when using an agile approach?
- How can technology assist in content authoring using an agile approach?

The philosophical background to the study was that of interpretivist outlook. This philosophical background led to exploring the problem through a social constructivist lens and a qualitative methodology. The agile manifesto (Beck et al., 2001) formed the conceptual framework for the study. The agile manifesto, values and principles are displayed in Table 1.1.

The agile process was further investigated using the concepts derived from three of the agile principles namely time-boxing, self-organising groups and face-to-face interactions. The final concept investigated in terms of the conceptual framework was that of a minimum viable product. The purpose of the study was to explore two known cases to identify an agile approach that could be used by subject matter experts and communities of practice to author educational content rapidly and collaboratively.

Allen and Sites (Allen & Sites, 2012), Arimoto, Barroca and Barbosa (2015) and finally Torrance (Torrance, 2016) all used agile approaches in an educational context to create instructionally designed eLearning modules. Each of their approaches has a content collection aspect, but they name them differently and gather the content during different phases (Allen & Sites, 2012; Arimoto et al., 2015; Torrance, 2016). Arimoto, Barroca and Barbosa (2015) collect content during the development phase, which is the third phase of their agile approach. Allen and Sites (2012) and Torrance (2016) do content collection in the initial phase of their agile approaches and call the phase “the savvy start” and “analyse phase” respectively. None of these approaches, however, suggest a way to author the raw content. This current study offered an agile approach that subject matter experts could use to rapidly and collaboratively author raw content in an educational context (Case 1a & 1b).

Furthermore, the current study offered an agile approach to the educational constituency as a means to rapidly and collaboratively author educational content. The agile approach shown in Figure 4.2 depicts the interaction between the concepts of the emergent approach.

These concepts are the minimum viable product as the overarching concept when authoring content rapidly and collaboratively using an agile approach, individuals and the interactions between them, stakeholder participation and change management. Further concepts included in the approach included time-boxed sprints and self-organising groups. Finally, the technology used to support the approach, infiltrated into each of the preceding six concepts.

### **5.3 Recommendations**

Often individuals naturally gravitate towards approaches that are tried and tested. Within education, ADDIE appears to be that solution when it comes to content authoring (Allen & Sites, 2012). There are, however, a number of different approaches to authoring content for education and an agile approach could be implemented to offer solutions which other approaches may not be able to fulfil. One such example is to have a minimum viable product available to implement at short notice, such as the workbooks investigated in Case 1a and Case 1b. These books were reviewed and made available within ten days of the Department of Basic Education contacting the publishing company with this request (Interviewee01, 04 October 2014). In turn, the management of the development of the instructionally designed eLearning module was made easier through the use of an agile approach due to the use of short duration, week-long sprints (Rubin, 2013). The next three sections of this chapter discuss the recommendations in terms of the three sub-questions used for the study.

#### **5.3.1 How can an agile approach facilitate rapid and collaborative content authoring**

An agile approach could be utilised to develop any number of *minimum viable products* (Cockburn, 2007). This study interrogated two of these, namely workbooks published for the South African schooling system and the instructional design of an eLearning module developed for a South African university. In addition, this study indicated that an agile approach could be used in contexts other than software development, as

suggested in the Agile Manifesto (Beck et al., 2001). Evidence shows that the cases investigated in this study are good examples of the production of such *minimum viable products*.

Another possible context that could be explored is to locally create content specifically focused on the needs of the Global South. The Global South has become tantamount to changeable progress, unconventional monetary systems, unsuccessful nations and countries burdened with bribery, poverty and conflict (Comaroff & Comaroff, 2012). Comaroff and Comaroff (2012) suggest the Global South as the accepted term when describing non-European post-colonial societies. In the light of this definition of the Global South, authoring content specifically for the Global South could alleviate social inequalities brought about through the lack of access to education, in these post-colonial societies. Within the context of the Global South, organisations such as the World Health Organisation could use an agile approach for authoring policy briefs and curriculum design.

Furthermore, when the *minimum viable product* is targeted for print delivery or digital delivery, the use of a scaffold would be valuable. Examples of such scaffolds are the style sheet (or a blueprint) and the concept maps used while authoring the workbooks investigated in Case 1a and Case 1b, as they ensured all of the groups worked to the agreed guidelines. Case 2, on the other hand, did not make use of a similar scaffold. The lack of a scaffold led to the instructional designers all using different styling. A scaffold is even more crucial for geographically dispersed groups to ensure consistent styling throughout the module. Included in the style sheet should be font size and font family for the various headings and any additional font styles. In addition, a colour palette should be included specifically for electronic content.

An agile approach values *stakeholder participation* (client collaboration) over documentation (Beck et al., 2001). This means that while contracts and other documentation are necessary, collaboration trumps such documentation. A crucial aspect of the agile approach is to find ways to enable collaboration and face-to-face interactions with all stakeholders including the development group (Beck et al., 2001). Buy-in and understanding of an agile approach by all stakeholders is a central aspect of agile approaches, as a lack of understanding of the approach could lead to a compromised minimum viable product at the end of a sprint. A compromised minimum viable product could be due to some stakeholders not meeting their commitments.



In addition, the actual choice of an agile approach should preferably be done collaboratively with all stakeholders. Such participation could, in turn, lead to greater buy-in from the stakeholders, as a collaborative decision making process could aid their understanding of the approach. Training should then be provided for stakeholders at the outset regarding what an agile approach entails. By providing training on agile approaches, the stakeholders could better understand the entire process and what is expected of them in an agile approach.

*Change management* should be embraced and be expected within an agile approach (Beck et al., 2001). Making use of an agile approach in education is a change in itself, as the approach is not well documented in the existing literature relating to content development in an educational context. Often change brings about innovation and innovative ideas that could be fostered through change. When choosing a specific agile approach to follow in the development of a minimum viable product, a prominent factor would be to ensure that the specific approach allows for the inevitable changes to the project, such as requests for changes to the project requirements. Facilitation and additional training regarding change management and the implementation of the approach would be necessary when making use of the approach in an educational setting.

Communication is central when implementing an agile approach (Mathis, 2013) and is used to maximise *change management*. Scrum meetings, which form the backbone of sprints in an agile approach, are a way to manage change and any discomfort that may be experienced due to change. These meetings are short (15 minutes maximum) and are often conducted standing up. The agenda of a scrum meeting is to keep the group informed regarding the project. These meetings should be held at regular intervals in order to minimise the discomfort experienced by group members regarding change and the approach as a whole.

It appears, from this study, that *time-boxing* is a fundamental principle of an agile approach. In addition, what is evident is that the actual length of the sprints can be adjusted to suit the needs of the project. *Time-boxing* contributes to keeping the project on track and keeping all stakeholders informed with regards the project's progress (Rubin, 2013). In addition, *time-boxing* supports the management of 'scope creep' as only agreed upon work is carried out within a specific sprint due to time constraints (Rubin, 2013). Any additional change requests received during a sprint should be held

over for future sprints and not be discussed at the current sprint scrum meetings. What does appear to be of importance is that, within a sprint, regular scrum meetings should be conducted to answer the following questions:

- What have you achieved?
- What still needs to be achieved?
- What successes or challenges did you encounter?

The answers to the three scrum questions speak to time management. These answers could be interpreted as all stakeholders being committed to the set deadlines, given that a great deal had been achieved within the sprint. Alternatively, the possibility exists that not all of the work set out for the sprint was completed, especially if challenges were encountered. If this is the case then those challenges should be addressed during the sprint review to find ways to address the challenges in future sprints. *Face-to-face interactions* (Beck et al., 2001), or the lack thereof, can hamper the success of a project utilising the agile approach. As such, creative ways should be explored to make *face-to-face interactions* possible, for example using Skype's video functionality, especially where the authors are geographically dispersed.

An agile approach appears to be a useful approach to authoring educational content. For it to become a formidable approach within an educational environment and an alternative to the more traditional approaches, such as ADDIE, any person or institution wishing to implement this approach would need to offer a considerable amount of training and facilitation to the group members before embarking on this journey.

### **5.3.2 Why is community building valuable to a rapid and collaborative content authoring process**

With regards to *individuals and the interactions between them*, facilitation should be considered where a group of like-minded individuals come together for the purpose of rapidly and collaboratively authoring educational content. Facilitation is valuable when those individuals do not form part of a well-established community of practice that meets regularly, in other words, where trust has already not been established through regular previous interactions. Trust is ensconced in the 12 principles of agile (Beck et al., 2001) through the agile principal of supporting, trusting and motivating those involved in a particular project (See Table 1.1). This principle talks to community building being significant in an agile approach and should be encouraged.

A community, such as the one nurtured during the authoring of the workbooks developed in Case 1a and Case 1b, fosters trust and enables participants to interact freely and openly. It would possibly be easier for an existing community of practice to implement an agile approach, than for a group of strangers. This could be attributed to the fact that trust may already exist within an established community of practice (Kubiak et al., 2015).

Communities of practice are most often self-organising. *Self-organising groups* often lead to group members working to their individual strengths, which in turn leads to members offering their best work (Beck et al., 2001). The division of work within the group should evolve through discussion and collaboration (Rubin, 2013). Within the group there should not be any hierarchy, meaning that at any given instant any member of the group may assume the lead depending on the strengths they have to offer. In keeping with the agile principle of building projects around motivated individuals, in an environment where support and trust exist, this study found that trust is vital when implementing an agile approach and more especially in self-organising groups.

Further research could take place in the form of investigating a community of practice that has implemented an agile approach to author educational content. One example could be investigating a community brainstorming their indigenous knowledge and how that knowledge could be preserved.

A community of practice could form around the development of the minimum viable product. Members of such a community of practice would also be members of a wider landscape of practice (Wenger-Trayner & Wenge-Trayner, 2015). Within landscapes of practice there appears to be a cross pollination of knowledge at the peripheries of the communities of practice that make up the landscapes of practice (Kubiak et al., 2015). Often innovation takes place at the edges of the communities within a landscape of practice.

The short-lived community of practice that formed around the workbooks authored in Case 1a and Case 1b is an example of how knowledge gained in such situations can be transferred from one community of practice to another, within an individual's landscape of practice. Members of the authoring group could use a similar approach to that of Case 1a and Case 1b within their own communities to develop content or assessments for a group of schools.

Possible scenarios for implementing the agile approach that emerged from this study could be that subject matter experts and communities of practice use the approach to author content rapidly and collaboratively in an educational context. For example, existing communities of practice, especially within a corporate context and consisting of like-minded colleagues and subject matter experts could use an agile approach to develop modules and training in order to improve productivity. Within the context of the South African educational system, a group of colleagues could come together to implement an agile approach to draw up a common district or provincial examination based on textbooks produced for the current version of the schooling syllabus, the Curriculum and Assessment Policy Statement (CAPS).

### **5.3.3 How can technology aid content authoring using an agile approach**

*Technology* aids an agile approach but needs not necessarily be the end product. This study considered technology as a vehicle to support the rapid and collaborative development of a minimum viable product using an agile approach. In order to work collaboratively a robust platform is required. Whichever platform is chosen, should be able to support the requirements of the minimum viable product and the context within which it is used.

Within this study, *Google Docs* appears to be a hardy platform to use as the platform can handle two or more participants working on the same document at the same time. There appears to be a need for an easy means to share files, use instant messaging and screen sharing, manage tasks, to meet face-to-face or via video conferencing and finally to aid the review process. This is of particular importance when the group is dispersed geographically. A solution incorporating all of these application needs could aid the implementation of an agile approach in education.

With regards to the specific applications chosen for a particular project, it cannot be assumed that all the participants participating in a project will have a similar level of computer literacy. A discrepancy with regards to computer literacy leads to the need for additional training on the chosen applications. Intuitive software is, therefore, central to the decisions regarding the use of specific software applications. Software applications which are intuitive by nature, are easier to implement.

Furthermore, computer literate individuals could offer their assistance to groups that may not have the same level of computer literacy when capturing content digitally.

Assistance such as this would be of particular relevance where the gatekeepers of the knowledge may not have the necessary literacy, or computer literacy skills to capture the content digitally.

#### **5.3.4 Recommendations for further development of the agile approach in Education**

The agile approach in education that emerged from the current study can be expanded or refined through future research. The approach was a useful lens through which to explore the two cases studied. The approach is offered for future comparative studies on agile approaches within an educational context. The approach could be examined in conjunction with existing agile approaches to instructional design (discussed in Chapter 2), to see if it could add to their successful use.

#### **5.3.5 Recommendations for further research**

The two cases explored in this study have implemented approaches that are similar to the agile approach, as it is used in the development of software applications, to author content for educational contexts. This study set out to explore how an agile approach could assist in rapid and collaborative content authoring in Education. The study was limited to two cases within the South African context and, as such, it was not possible to establish if there are other cases in the Global South that involve the authoring of content in a similar way to fulfil a local need.

Within the South African context, workbooks investigated in this study in Case 1a and Case 1b, are both distributed as open educational resources. The workbooks were produced under a 'share alike' Creative Commons licence as is recommended by the Paris Open Education Declaration (UNESCO, 2016). This leads to recommending further research on the use of an agile approach to create open content for countries in the Global South.

In the insights gained from this study there appear to be a number of software applications that could fulfil the need to manage the processes involved with authoring content using an agile approach. These existing applications, are used in an eclectic mix to manage the agile approach. The development of a single open source technology platform to manage an agile approach could be researched. Such a platform should include safe and secure file sharing, screen sharing, instant messaging, task management and meeting or video conferencing capabilities.

## **5.4 Conclusion**

Evidence gained during the current study pointed to value of the agile approach in education, which emerged from the study. The agile approach in education could add to the body of knowledge and could be useful for the rapid and collaborative authoring of educational content. Furthermore, the agile approach in education could be of value to the fields of knowledge creation and instructional design.

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**ADENDA**

- Addendum A
- Addendum B
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## Addendum A

New and confusing terminology used throughout this study.

General terms	
Term	Definition
<b>Book review</b>	This is an online process used by Case 1 to verify and review the content in the books they publish. They use a software application named <i>a.nnotate</i> to carry out this process. Reviewers are able to comment and annotate content but are not able to change the content.
<b>Brainstorm</b>	A spontaneous group discussion to produce ideas and ways of solving problems (“Dictionary,” 2017).
<b>Global South</b>	Comaroff and Comaroff (2012) postulate that the “Global South” has become shorthand for the world of non-European, postcolonial peoples. They continue to explain that it is “ <i>synonymous with uncertain development, unorthodox economies, failed states, and nations fraught with corruption, poverty, and strife, it is that half of the world about which the Global North spins theories</i> ” (Comaroff & Comaroff, 2012).
<b>Instructional design</b>	<i>“Instruction is planned with the purpose of supporting the processes of learning. The intention is to arrange external events to support the process of learning (Gagne et al., 2005). “Instructional design is based on the principles of human learning especially the conditions under which learning occurs. Instructional designers consider principles associated with social-cultural aspects of learning and how they affect the selection of educational outcomes and the design of learning activities” (Gagne et al., 2005).</i>
<b>Open education resources</b>	<i>“Open Education Resources (OER) are teaching, learning, and research resources that reside in the public domain or are released under an intellectual property license that permits their</i>

	<i>free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge</i> (“Open education resources,” 2016)
Terms relating to the role-players	
Term	Definition
<b>Book reviewer</b>	Volunteer who is a subject matter expert who gives of their time to verify and review content of the workbooks produced for the South African schooling system.
<b>Community coordinator</b>	Case 1 employee who is responsible for all aspects of the authoring sprints related to the people attending the sprint.
<b>Communities of practice</b>	A set of relations among persons, activity, and world, overtime and in relation with other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge. It does imply participation in an activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their communities (Lave & Wenger, 1991).
<b>Content coordinator</b>	Case 1 employee who is responsible for the textbook, at authoring sprints this person is responsible for all aspects related to the content.
<b>Instructional designer</b>	Person contracted by the team lead to assist with developing the instructionally designed eLearning module.
<b>Facilitator</b>	Person contracted by Case 1 to facilitate the authoring sprints, including offering training with regards to group dynamics and how SMEs should respond to comments by other SMEs.
<b>Paid author</b>	Person contracted or employed by Case 1 to author a section of a textbook from the data captured during brainstorming sprints.

<b>Project sponsor</b>	University employee responsible for the instructionally designed eLearning module at the university, responsible for the review and acceptance of the minimum viable product.
<b>Team lead</b>	Person contracted to lead the development team for the instructionally designed eLearning module.
<b>Subject matter experts</b>	In the context of this study these are volunteers who participated in both the authoring sprints and brainstorming sprints. The group comprised mainly practicing educators and some university lecturers for the Case 1 project.  For Case 2, the instructionally designed eLearning module, subject matter experts were the university lecturers responsible for each of the eight sections within the module.
<b>Terms related to technology</b>	
<b>Term</b>	<b>Definition</b>
<b>a.nnotate</b>	<i>A.nnotate</i> is used online by thousands of individuals and groups who need to store or share comments on documents, web pages or images. Standalone servers are in use in universities, SMEs, blue chip companies and the public sector. <i>A.nnotate</i> technology is increasingly chosen by developers to add annotation capabilities to their own high-value web applications thanks to its flexible licensing, ease of use, and outstanding technical support (“A.nnotate,” 2016).
<b>Articulate Storyline 2</b>	<i>Articulate Storyline 2</i> is a rapid eLearning development application that enables the user to develop interactive and engaging eLearning products. The interface is similar to that of <i>Microsoft PowerPoint</i> .
<b>Dropbox</b>	<i>Dropbox</i> is a cloud-based storage and file sharing application. Files are uploaded to <i>Dropbox</i> via the internet and then are shared with group members through links or by giving the group members access to a shared folder.

<b>Google Docs</b>	<i>Google Docs</i> is a robust Web 2.0 collaborative application suite that incorporates document spreadsheet and presentation applications allowing collaboration and commenting in real time. More than one person is able to work on a specific file at any given time.
<b>LaTeX</b>	This computer programme allows for the advanced technical editing that is required to format mathematical and scientific formulae, and formats the final product as a PDF file for easy sharing (Kottwitz, 2011)
<b>Microsoft PowerPoint</b>	<i>Microsoft PowerPoint</i> is one of the MS Office suite of applications and mostly used to design, develop and present presentations. It can be utilised to develop interactive eLearning.
<b>Trello</b>	Trello is a task management application giving a visual overview of what is being worked on and who is working on it. It uses the agile approach, Kanban, which was developed by Toyota as a system to keep production levels high and maintain flexibility. It is best represented as a whiteboard filled with post-it notes. Each post-it represents different tasks involved in the project (Gray, 2015).

## Addendum B

### Dissertation overview

<b>Title</b>	An agile approach to rapidly and collaboratively author content within an educational context
<b>Purpose</b>	The aim of research is to explore an alternative means to author content in education that is both rapid and collaborative.
<b>Research Question</b>	How can an agile approach assist rapid and collaborative content authoring in education?
<b>Research Design</b>	Qualitative
<b>Philosophical underpinnings</b>	
<b>Paradigm</b>	Interpretivist view
<b>Ontology</b>	Social constructivism
<b>Epistemology</b>	Multiple realities exist. Researcher close to research. Research strategy – Multiple case study. Data collection – Individual and group semi-structured interviews and researcher reflection. Data analysis – Data coded according to conceptual framework and analysed in a research matrix.
<b>Axiology</b>	Research biases are acknowledged. Interview insights and multiple sources of data are used to minimise bias. Member checking of the initial interview transcripts.

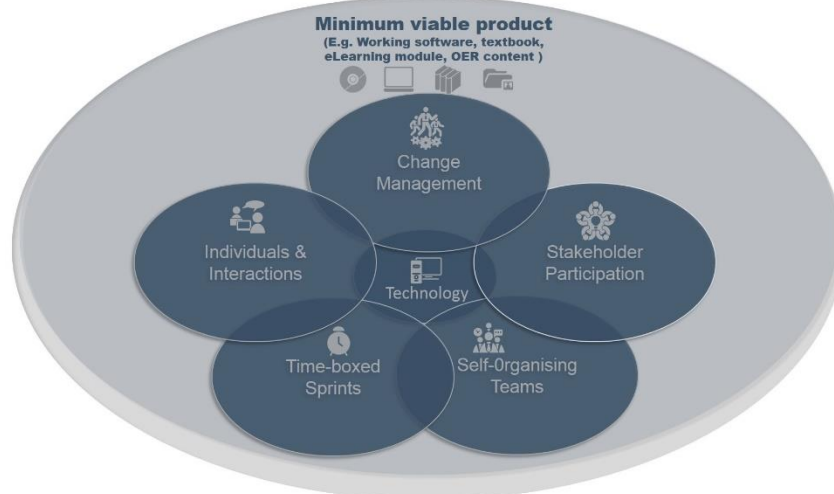


<b>Research Lens</b>	<p>Agile manifesto.</p> <p>Conceptual framework identified in Chapter 2.</p> <pre> graph LR     A["<b>Agile approach</b> Four Values of Agile ↓ 12 Principles Of Agile"] --&gt; B["<b>Agile process</b> Book sprints Time boxed sprints Self-organising groups Face-to Face interactions"]     B --&gt; C["<b>Minimum viable product</b> Software Book Module Video Presentation Lecture notes"]     C --&gt; D["<b>Market outlets</b> OERs or Commercial"] </pre>
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<b>Objective 1</b>	Explore an agile framework
<b>Sub-question</b>	<i>How could an agile framework be structured to author content?</i>
<b>Literature review</b>	<p>ADDIE (Gagne et al., 2005; Shinall, 2010).</p> <p>Waterfall method (Allen &amp; Sites, 2012; Cockburn, 2007; Rubin, 2013; Shinall, 2010).</p> <p>Agile manifesto (Beck et al., 2001; Cockburn, 2007; Mathis, 2013; Rubin, 2013).</p> <p>Agile in education (Allen &amp; Sites, 2012; Arimoto et al., 2015; Torrance, 2016).</p> <p>Book sprints (Hyde, n.d.).</p> <p>Time-boxed sprints (Beck et al., 2001; Mathis, 2013; Rubin, 2013; Schwaber &amp; Sutherland, 2016).</p> <p>Self-organising groups (Beck et al., 2001; Mathis, 2013; Rubin, 2013).</p> <p>Face-to-face interactions (Beck et al., 2001; Cockburn, 2007).</p> <p>Minumum viable product (Rubin, 2013).</p>

	<p>OER(Cape Town Open Education Declaration, 2007; “Open education resources,” 2016; UNESCO, 2016; Wiley et al., 2012).</p> <p>Commercial publishing (“About us,” 2017; Du Toit &amp; Links, 2017).</p>
<b>Methods</b>	<p>Case study</p> <p>Interviews</p> <ul style="list-style-type: none"> <li>• Individual</li> <li>• Group</li> <li>• Researcher observations and reflection</li> </ul>
<b>Insights</b>	<p>A variety of products can be developed using an agile approach.</p> <p>A scaffold, such as a style sheet, is an important aid.</p> <p>A minimum viable product is always available for deployment at short notice.</p> <p>Stakeholders should fully understand and buy in to an agile approach.</p> <p>Stakeholders stay informed.</p> <p>Training needed.</p> <p>Face-to-face interactions are preferable.</p> <p>Change is to be expected.</p> <p>Regular scrum meetings minimise discomfort due to change.</p> <p>Facilitation regarding change is needed.</p> <p>Time-boxing is an important aspect - actual length of sprints can be adjusted to suit the needs of the project</p> <p>Of importance is that regular scrum meetings are held to answer the questions:</p> <ul style="list-style-type: none"> <li>• What have you achieved?</li> <li>• What still needs to be achieved?</li> <li>• What challenges / successes did you encounter?</li> </ul>

	<p>Self-organising groups evolve through discussion and should not be imposed by any stakeholder.</p> <p>Any member of the group may assume the lead at a given time.</p> <p>Optimal group size is between seven and ten individuals for content authoring and collection sprints. Smaller groups are optimal for the instructional design aspects of the content.</p>
<b>Recommendations</b>	<p>Agile approaches in education can be used to develop a number of artefacts e.g. textbooks, eLearning modules and OER. Within the Global South context, organisations e.g. World Health Organisation could use an agile approach to develop policy briefs and for curriculum design.</p> <p>Provide a scaffold (blueprint), especially for print and digital content so everybody works to the agreed guidelines particularly for geographically dispersed groups.</p> <p>The scaffold should include font family and size for heading and body text, any additional font styles and a comprehensive colour palette.</p> <p>Facilitation aids the process in terms of an agile approach and change management, particularly in an educational setting where agile approaches are a foreign concept. Scrum meetings help to minimise the discomfort experienced due to change and the implementation of an agile approach.</p> <p>Time boxing is important for managing time and “scope creep”.</p>



The agile approach in education that emerged from this study could be expanded and refined through comparative study that could examine existing agile approaches to instructional design. Studies such as these could investigate how the agile approach in education could add to the successful use of existing agile approaches to instructional design.

<b>Objective 2</b>	Explore communities of practice
<b>Sub-question</b>	<i>Why is it valuable to create a community of practice to author content?</i>
<b>Literature review</b>	<p>Communities of practice (Farnsworth et al., 2016; Lave &amp; Wenger, 1991; Wenger-Trayner &amp; Wenger-Trayner, 2015; Wenger et al., 2002; Wenger &amp; Snyder, 2000).</p> <p>Landscapes of practice (Kubiak et al., 2015; Wenger-Trayner &amp; Wenger-Trayner, 2015).</p> <p>Face-to-face interactions (Beck et al., 2001; Cockburn, 2007).</p>
<b>Methods</b>	<p>Case study.</p> <p>Interviews</p> <ul style="list-style-type: none"> <li>• Individual</li> <li>• Group</li> <li>• Researcher observations and reflection.</li> </ul>

<b>Objective 2</b>	Explore communities of practice
<b>Insights</b>	<p>Community building is valuable when implementing an agile approach.</p> <p>Facilitation assists the process.</p>
<b>Recommendations</b>	<p>Facilitation is useful, particularly where the community involved in the agile approach is not a well-established community of practices. Facilitation builds trust amongst the group.</p> <p>Communities of practice could use an agile approach to develop common assessments for a group of schools, a district or province.</p> <p>Within a corporate environment, a community of practice could use an agile approach to develop modules to improve their productivity.</p> <p>Further research could be conducted into existing communities of practices who wish to implement an agile approach to e.g. capturing and preserving their indigenous knowledge.</p>

<b>Objective 3</b>	Explore how technology aids an agile approach
<b>Sub-question</b>	<i>How can technology assist in content authoring?</i>
<b>Literature review</b>	<p>ADDIE (Gagne et al., 2005; Shinall, 2010).</p> <p>Waterfall method (Allen &amp; Sites, 2012; Cockburn, 2007; Rubin, 2013; Shinall, 2010).</p> <p>Agile manifesto (Beck et al., 2001; Cockburn, 2007; Mathis, 2013; Rubin, 2013).</p> <p>Previous research (Cartmill, 2013; Petrides &amp; Jimes, 2008).</p> <p>OER(Cape Town Open Education Declaration, 2007; “Open education resources,” 2016; UNESCO, 2016; Wiley et al., 2012).</p> <p>Agile manifesto (Beck et al., 2001; Cockburn, 2007; Mathis, 2013; Rubin, 2013).</p>

<b>Objective 3</b>	Explore how technology aids an agile approach
<b>Methods</b>	<p>Case study.</p> <p>Interviews</p> <ul style="list-style-type: none"> <li>• Individual</li> <li>• Group</li> </ul> <p>Researcher observations and reflection.</p>
<b>Findings</b>	<p>To work collaboratively a robust platform is necessary.</p> <p>A means of file sharing, instant messaging, screen sharing, task management and meeting / video conferencing should be in place.</p> <p>Application training may be required.</p>
<b>Recommendations</b>	<p>A comprehensive, single Open Source platform could be developed to manage an agile approach within an educational setting. The platform should include a safe and secure file sharing system, a screen sharing capability, instant messaging, a means of task management and a meeting or video conferencing capability.</p>

## **Addendum C**

Example participant email and Informed consent leaflet

Good day [first\_name]

The purpose of this mail is to invite you to participate in a research project I am conducting  
**Rapid content creation by communities of practice in an online environment using an agile approach**

Your participation in the project will involve reflecting on your experiences while participating in the content creation sprints, held for content creation for [REDACTED] workbooks.

Attached is a Research information leaflet and an Informed consent form. If, after having read the leaflet, you are willing to participate in the research project, please sign the informed consent page and return it to me, by **Friday 26 August 2016**, at [info@dcrawford.co.za](mailto:info@dcrawford.co.za)

Once I have received your informed consent, I will contact you to set up an interview with you. Thank you for taking the time to consider participating in this research project. I look forward to your participation.

Kind regards

Dawn Crawford : Ms

(Researcher)



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## INFORMATION LEAFLET AND INFORMED CONSENT

### PROJECT TITLE:

**Rapid content creation by communities of practice in an online environment using an agile approach**

Note: Title of the study changed after this leaflet was used.

**Primary investigator:** Ms D. Crawford (Faculty of Education: Mathematics, Science and Technology, University of Pretoria)

**Study leader:** Prof L. van Ryneveld (Faculty of Education: Mathematics, Science and Technology, University of Pretoria)

Dear Research participant,

You are invited to participate in a research study that forms part of my formal M Ed: Computer Integrated Education studies. This information leaflet will help you to decide if you would like to participate in the study. Before you agree to participate, you should fully understand what is involved in the study. You should not agree to participate unless you are completely satisfied with all aspects of the study.

### WHAT IS THE STUDY ALL ABOUT?

This project reflects on the process involved in creating content collaboratively by communities of practice in an online environment, making use of agile approach. The reflection will explore the process followed by authors while creating content collaboratively in communities of practice.

This reflection could possibly lead to the formulation of guiding principles for the process. The



guiding principles could include a process that could be followed to create content in a similar manner.

### **WHAT WILL YOU BE REQUIRED TO DO IN THE STUDY?**

- 1) You will be required to complete an open-ended questionnaire administered via Survey Monkey,
- 2) The time taken to complete the questionnaire is dependent on the richness of your responses to the open-ended questions. Should any of your responses require further clarification, it may be necessary for the researcher to conduct an interview with you. Such an interview would be conducted either face-to-face, telephonically or online.
- 3) The questionnaire can be completed on your own computer or smart phone, in a space of your choice.
- 4) Agree to the researcher using content from your blog, website, video channel, video log (vlog) in the study. The researcher will contact you via email to inform you which content will be used.
- 5) You will require access to the internet to complete the questionnaire.
- 6) You should not incur any additional costs, apart from your internet data costs. If the researcher needs to interview you, she will contact via email to set up the time, mode of interview (face-to-face, telephonic or online) and if necessary the venue for such an interview.

If you decide to participate in the study, you will be required to do the following:

- Sign this informed consent form;
- Enter your responses in the spaces provided on the open-ended, online questionnaire (you will be provided with a link to access the questionnaire);
- Agree to a follow up interview should this be necessary,
- Agree to the researcher using content published on your blog, website, video channel and/or video log (vlog) in the study.

## **WHAT ARE THE POTENTIAL BENEFITS THAT MAY COME FROM THE STUDY?**

The benefits of participating in this study are:

- Your participation will make a contribution to the body of knowledge regarding authoring content rapidly by communities of practice in an online environment using an agile approach;
- The researcher will share the final report with you to aid the validity of the study;
- Participation in the study could lead to the discovery of guiding principles to author content. These possible guiding principles could be used by other communities of practice to author content in different contexts;
- The possible guiding principles could be used to create localised content.

## **WILL YOU RECEIVE ANY FINANCIAL COMPENSATION OR INCENTIVE FOR PARTICIPATING IN THE STUDY?**

Please note that you **will not** be paid to participate in the study.

## **WHAT ARE YOUR RIGHTS AS A PARTICIPANT IN THIS STUDY?**

Your participation in this study is entirely voluntary, meaning that you may decide if you wish to take part or not. You have the right to withdraw at any stage without any penalty or future disadvantage whatsoever. You won't even have to provide the reason/s for your decision.

## **HOW WILL CONFIDENTIALITY AND ANONYMITY BE ENSURED IN THE STUDY?**

All information obtained during the course of this study is strictly confidential. All the data that you provide during the study will be handled confidentially. This means that access to your data will be strictly limited to the researcher, the supervisors of the study and the designated examiners (appointed by University of Pretoria). All the data sheets that have been collected will be stored in a secure place for three years, after which they will be destroyed and not shared with any other person without your permission.

In the light of this study being about open content creation and openness, you may request the researcher to waive confidentiality and offer you attribution for your contribution to the study.

### **IS THE RESEARCHER QUALIFIED TO CARRY OUT THE STUDY?**

The researcher is a M Ed student at the Faculty of Education: Mathematics, Science and Technology, University of Pretoria and received special training to do the research.

### **HAS THE STUDY RECEIVED ETHICAL APPROVAL?**

Yes. The researcher has presented the research proposal and received approval from the Faculty of Education to conduct this study and the Faculty Research Ethics Committee of the Faculty of Education, University of Pretoria has approved the formal study proposal. All parts of the study will be conducted according to internationally accepted ethical principles.

### **WHO CAN YOU CONTACT FOR ADDITIONAL INFORMATION REGARDING THE STUDY?**

The primary investigator, Ms D. Crawford, can be contacted during office hours on her cellular phone at 082 783 0566. The study leader, Prof L van Ryneveld, can be contacted during office hours at Tel (012) 460-5770, or via email at Linda.VanRyneveld@up.ac.za.

### **DECLARATION: CONFLICT OF INTEREST**

There is no conflict of interest as the researcher will include her perceptions of participating in authoring sprints in the research study.

### **A FINAL WORD**

Your co-operation and participation in the study will be greatly appreciated. Please sign the informed consent below if you agree to participate in the study, return the signed informed consent form to: info@dcrawford.co.za.





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## INFORMED CONSENT

I, hereby, confirm that I have been adequately informed by the researcher about the nature, conduct, benefits and risks of the study. I have also received, read and understood the above written information. I am aware that the results of the study, including personal details will be anonymously processed into a research report, unless I expressly request attribution for my participation in the study. I understand that my participation is voluntary and that I may, at any stage, without prejudice, withdraw my consent and participation in the study. I was offered sufficient opportunity to ask questions and of my own free will, declare myself prepared to participate in the study.

(*Tick the box*) I, hereby, request the researcher to waive confidentiality and offer attribution for my contribution to the study.

Research participant's name: \_\_\_\_\_ (Please print)

Research participant's signature: \_\_\_\_\_

Date: \_\_\_\_\_

Researcher's name: Dawn Crawford \_\_\_\_\_ (Please print)

Researcher's signature: \_\_\_\_\_

Date: \_\_\_\_\_

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## **Addendum D**

Example of interview schedule used for this study.



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### **Management interview schedule**

**Rapid content creation by communities of practice in an online environment using an agile approach**

1. What was your role in the content creation sprints?
2. How did you become involved in the content creation sprints?
3. What is the importance of a community of practice to the process of content creation sprints?
4. How do you maintain the community of practice that contributes to content creation sprints?

5. Briefly discuss the process followed from the inception of a book until the book / module is considered "done". Discuss in terms of initial planning, content sprints, feedback loops and final review.
  
6. Has the process evolved with each sprint? If yes, explain how the process was adapted?
  
  
  
  
  
  
  
  
  
  
7. Would you do anything differently in future content sprints?
  
  
  
  
  
  
  
  
  
  
8. Which phase do you consider most important to the process utilised, i.e. planning, content creation sprints or reflecting on the process. Explain why you say this.
  
  
  
  
  
  
  
  
  
  
9. Please include any additional information you deem important but has not been covered in the preceding questions.

Thank you for your time.

## **Addendum E**

Example of the concept maps used as a scaffold in Case 1a and Case 1b.

See the CD Rom filed on the back cover.