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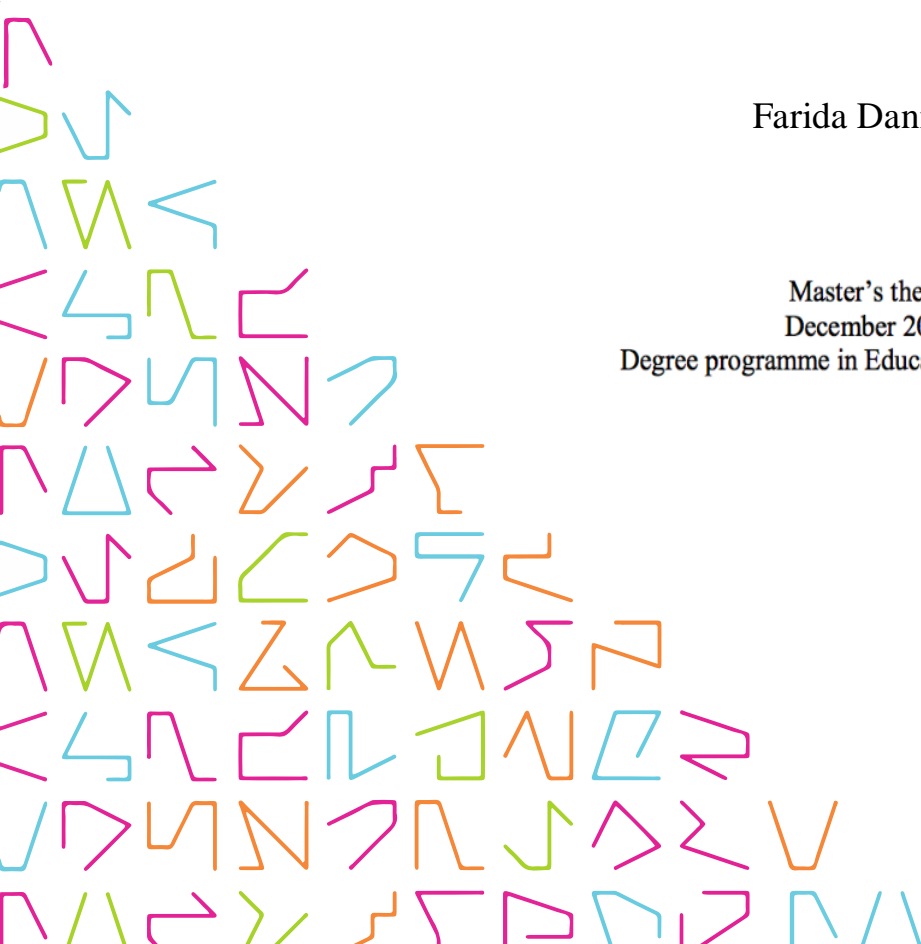# INVESTIGATING TEACHERS' PERSPECTIVES: STUDENTS' EXPERIENCES OF COLLABORATION, FEEDBACK AND REFLECTION USING AN EDUCATIONAL TECHNOLOGY TOOL

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ABSTRACT

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The past decade has seen rapid development of, and engagement with, new educational technologies. Literature suggests online educational technologies can contribute towards the construction of knowledge by increasing opportunities for collaboration, feedback and reflection. This thesis explores the experiences of three university lecturers from the Netherlands using the educational technology FeedbackFruits to promote online learning opportunities for collaboration, feedback and reflection amongst their students. Online and face-to-face semi-structured interviews were conducted to determine the lecturers' perceptions of student collaboration, feedback and reflection when using the FeedbackFruits tool. The benefits of the tool included increased time for students to reflect on their learning, and the provision of quality, in-depth peer feedback. Overall, this contributed to the application of higher-order thinking skills and deeper learning experiences of the students. The discussion then explores the ability of the FeedbackFruits tool to promote online collaboration, feedback and reflection amongst students. This thesis concludes that educational technology tools can be exploited by educators to achieve effective collaboration, feedback and reflection in order to enhance the learning experiences of their students. Specifically, educators blending online asynchronous and synchronous learning.

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1 INTRODUCTION

The increasing focus on formal education preparing students for life in our twenty-first century world emphasises the need for developing supportive curricula and teaching strategies at a global level (Voogt et al. 2013). Crucial twenty-first century learning skills include critical thinking, problem-solving, communication and collaboration (Partnership for 21st Century Learning, 2015). The importance of these key skills can be traced back to a collection of learning theories including connectivism, constructivism, experiential learning and transformative learning (Dewey, 1910; Kolb, 1984; Mezirow, 1991; Piaget, 1952; Siemens, 2005; Vygotsky, 1978). While these theories suggest collaboration, feedback and reflection are crucial in developing deeper learning, the extent to which they have been incorporated in today's formal education system remains unclear. Despite experts emphasising the ineffectiveness of transmission models of content delivery in developing the twenty-first century competencies and skills of students, traditional passive-learning methods stubbornly persist in today's classrooms (Scott, 2015).

The use of archaic pedagogy to foster the twenty-first century skills of students seems somewhat paradoxical. Traditional lecture-style learning and memorisation focuses on developing lower-order thinking skills, while the development of higher-order thinking skills is often neglected (Zohar & Dori, 2009). It is evident students require deeper learning in order to thrive in today's world (Partnership for 21st Century Learning, 2015). This suggests a need for transforming the pedagogy used in formal education to meet the modern learning needs of students.

Pedagogical approaches can be transformed through the effective use of appropriate tools and practices. One such example includes the educational technology, FeedbackFruits. It possesses multiple features offering its users opportunities for collaboration, feedback and reflection. The relationship between these activities, the development of higher-order thinking skills and deep learning are well documented in literature (Anderson & Krathwohl 2001; Bialik & Fadel, 2015; Lee & Choi, 2017). The effective use of FeedbackFruits can in turn, contribute towards the students' development of the twenty-first century skills of problem-solving, critical thinking, communication, collaboration, and self-management (Pellegrino & Hilton, 2012).

But do educators perceive the tool as advantageous? Are the stated benefits achieved in practice, and what drawbacks does the tool have? Specifically, this thesis looks to answer the question:

"What are the learning experiences of online collaboration, feedback and reflection amongst participants using an educational technology tool?"

This thesis focuses on the perceptions of educators on the experiences of collaboration, feedback and reflection amongst their university students using FeedbackFruits. This tool was chosen for this investigation given its multiple features, versatility and amenability to a range of educational outcomes. This dissertation seeks to clarify and broaden our comprehension on how FeedbackFruits can be used to promote opportunities for purposeful collaboration, feedback and reflection for deeper learning experiences of students. Finally, it is hoped the findings from this investigation will be transferable and will inform efforts to effectively use educational technologies to promote twenty-first century skills in education.

1.1. Background and study design

While methods of teaching have developed slowly over the past century, educational technology has evolved more rapidly (Collins & Halverson, 2010). The advancements made in technology present educators with opportunities and challenges. From the myriad of educational technologies that exist, which is the most suitable tool for both the educators and students in terms of pedagogical purpose and usability? The question of how to best use online educational technologies to develop skills of collaboration, feedback and reflection is largely overlooked (Semple, 2000). This thesis is an effort to shed light on this matter. It sets out to identify how online educational technologies, in particular, FeedbackFruits, promote opportunities for collaboration, feedback and reflection amongst students.

FeedbackFruits is a didactic plugin that offers a variety of tools that facilitate onsite, blended and online learning including: interactive video; interactive documents; interactive presentations; study material comprehension; interactive audio; peer feedback;

group member evaluation; skill feedback and assignment feedback. Educators using FeedbackFruits in three universities in the Netherlands were interviewed to discuss how the tool promoted opportunities for collaboration, feedback and reflection amongst their students. The interviews were carried out in the summer of 2018. This thesis aims to explore how opportunities for student collaboration, feedback and reflection can be improved when using educational technologies and expanded upon in the future. As a result, it is expected that from this, issues are identified and ways of addressing the challenges of promoting collaboration, feedback and reflection amongst students are shared. This information could be valuable to educators wishing to improve the depth of learning of their students and their twenty-first century skills and competencies using educational technologies.

1.2 Thesis Objectives, Purpose and Research Question

This thesis attempts to answer the following question: "What are the learning experiences of online collaboration, feedback and reflection amongst participants using an educational technology tool?" This question can be answered through addressing the following sub-questions:

1) How do educators understand collaboration, feedback and reflection?
2) What is the perceived impact of collaboration, feedback and reflection on the learning of participants?
3) What are the strengths and challenges of the educational technology features which promote collaboration, feedback and reflection?

The primary objective of this thesis is to improve purposeful learning experiences when using online educational technologies. This thesis focuses on how the learning outcomes of students at the tertiary level of education can be improved using educational technologies. This is explored through an analysis of course facilitator interviews to identify how their students' learning experiences with an online educational technology correlate with higher-order thinking skills and deeper learning through the existence of opportunities for collaboration, feedback and reflection.

The main research findings are relevant for educators wishing to use online educational technologies effectively to develop the learning of their students. The findings can shed light on the strengths and implications of using educational technologies to promote opportunities for onsite and online collaboration, feedback and reflection amongst university students.

This thesis consists of seven chapters. Following the introduction, this dissertation focuses on the global context of the study in chapter two. Chapter three explores reflection, feedback and reflection and related learning theories. Chapter four presents the data collection and analysis methods research methods used. Chapter five provides key findings. Chapter six provides a discussion where the significance of the findings is interpreted and described, and possible implications of the research are explored. Finally, chapter seven provides a conclusion to the thesis.

2   GLOBAL CONTEXT

This chapter provides an overview of the context for this research. It introduces definitions for twenty-first century competencies and skills, and presents the suggested pedagogies to foster twenty-first century competencies and skills for deep learning.

2.1   Developing twenty-first century competencies and skills

We have observed a global focus on teaching for developing the twenty-first century competencies and skills of students due to economic, environmental, and social challenges (Boix-Mansilla & Jackson, 2013: Pellegrino & Hilton, 2012). A general agreement exists in literature that the fostering of twenty-first century skills and competencies in education are of importance as they can be effectively applied to everyday life, thus, assist students to thrive and meet their full potential in the modern world. The fostering of students' twenty-first century skills in mainstream education has become ubiquitous in global education rhetoric, however, a widespread definition for twenty-first century skills does not appear to exist (Steiner-Khamsi, 2014). The Asia Society (2013) broadly defines twenty-first century skills as:

1. **Cognitive (academic)** – mastery of core content as well as critical thinking and creativity.

2. **Intrapersonal (emotional/personal)** – Attitudes and behaviours that influence how students apply themselves, including having a growth mindset, learning how to learn, being motivated to succeed and showing grit in pursuing goals.

3. **Interpersonal (social)** – Competencies that students need to relate to other people, including communication, collaboration, leadership and global awareness.

Whereas, UNESCO (2016) refers to twenty-first century skills as 'transversal skills' which can be classified under the following five domains:

1. **Critical and innovative thinking:** creativity, entrepreneurship, resourcefulness, application skills, reflective thinking, reasoned decision making.

2. **Interpersonal skills:** communication skills, organizational skills, teamwork collaboration, sociability, collegiality, empathy, compassion.

3. **Intrapersonal skills:** self-discipline, ability to learn independently, flexibility and adaptability, self-awareness, perseverance, self-motivation, compassion, integrity, risk-taking, self-respect.

4. **Global citizenship:** awareness, tolerance, openness, responsibility, respect for diversity, ethical understanding, intercultural understanding, democratic participation, conflict resolution, respect for the environment, national identity, sense of belonging.

5. **Media and information literacy:** ability to locate and access information through ICT, media, libraries and archives, express and communicate ideas through ICT use media and ICT to participate in democratic processes, ability to analyse and evaluate media content.

Unifying aspects of these two definitions of twenty-first century skills include: problem-solving, critical thinking, communication, collaboration, and self-management (Pellegrino & Hilton, 2012). This dissertation will next focus on how educators can best foster these skills amongst their students.

2.2 Fostering twenty-first century skills: pedagogies for deep-learning

The importance of developing the skills of problem-solving, critical thinking, communication, collaboration and self-management is not new and can be traced back to educational taxonomies (Bloom, 1956; Anderson & Krathwohl 2001). Bloom's taxonomy provides a hierarchy of educational objectives ordered from remember (low-level application) to create (high-level application). Anderson and Krathwohl's (2001) taxonomy revised Bloom's where a second cumulative hierarchical dimension of

knowledge is added, ordered from the factual dimension (low-level application) to the metacognitive dimension (high-level application) (Table 1). Higher-order thinking skills involve cognitive activities beyond the lower-level application level of understanding according to Bloom's taxonomy (Bloom, 1956). Higher-order thinking skills are also strongly related to the development of metacognitive knowledge (Anderson & Krathwohl 2001; Bialik & Fadel, 2015). Literature widely shows students most effectively acquire new competencies when they develop strong metacognitive abilities (Scott, 2015). Furthermore, higher-order thinking is strongly correlated with deep learning (Lee & Choi, 2017). Deep learning can be described as situations where students are able to extract what was learned in one situation and apply it to new situations (Warburton, 2003; Pellegrino & Hilton, 2012). Anderson and Krathwohl's (2001) taxonomy omits Bloom's affective and psychomotor domains. Nevertheless, the revised Bloom's taxonomy is a valuable tool that can be used by educators to clarify intended cognitive outcomes (Pickard, 2007). As a result, it can be used as a guide to plan course activities, create assessment criteria such as rubrics and develop performance indicators.

Using the two-dimensional framework of knowledge and cognitive processes (Table 1), the majority of twenty-first century skills can be classified as involving higher-order thinking skills and thus engaging students in deep learning. Despite this, mainstream education has not widely incorporated these elements to best support learners in developing twenty-first century skills (Scott, 2015). It is clear the transmission style of learning is inefficient in fostering twenty-first century skills as memorisation and repetition occupy only the lower levels of the knowledge and cognitive processes. Literature widely supports the fact that metacognitive abilities can be developed through promoting opportunities of collaboration, feedback and reflection (Saavedra & Opfer, 2012; Sawyer, 2008; Scott, 2015).

TABLE 1. A two-dimensional framework: Knowledge and Cognitive Processes (Bloom 1956; Anderson & Krathwohl, 2001).

	The cognitive process dimension					
The knowledge dimension	**Remember**	**Understand**	**Apply**	**Analyse**	**Evaluate**	**Create**
Factual knowledge						
Conceptual knowledge						
Procedural knowledge						
Metacognit ive knowledge						

This chapter has explored the global context of twenty-first century competencies and skills, and the relationship between deeper learning experiences and the fostering of these skills. This chapter has shown that when students are presented with more opportunities to apply higher-order thinking skills, they are more likely to experience deeper learning. This in turn, contributes towards the fostering of the twenty-first century skills of students. The next section will explore reflection, collaboration and feedback and related learning theories.

3 THEORETICAL FRAME OF REFERENCE

This section provides an overview on the role of collaboration, feedback and reflection in learning and relevant learning theories. Learning and educational technologies are presented, together with the relationship between educational technology and deep learning. FeedbackFruits' features for collaboration, feedback and reflection are then explored.

3.1 Collaboration, Feedback and Reflection

3.1.1 Collaboration

Collaborative learning involves learners working together on a common goal, exchanging their opinions on a subject, and clarifying the meanings of concepts or jointly addressing a problem (Hron & Friedrich, 2003). Collaborative learning can occur at various levels from one-on-one or small-group interactions to whole school collaboration to interactions with other professionals outside of school (Darling-Hammond et al. 2017). Collaborative learning involves a shift from teacher-led learning to a cooperative environment where students working together as a group are responsible for each other's learning and their own (Scott, 2015). During the collaborative learning process, participants assimilate, process and synthesise ideas by building upon existing knowledge. This involves the higher-order thinking and metacognitive skills required for deep learning. There is a vast amount of literature promoting the role of collaborative learning in developing the critical thinking of participants (Gokhale, 1995; Laal & Ghodsi, 2012). This is turn, can enrich the knowledge of course participants. Collaborative learning is most successful when participants are actively engaged in the learning process (Mezirow, 1991).

Collaborative learning has its roots in constructivism where learning is actively constructed (Dewey 1910; Fosnot & Perry, 1996; Piaget, 1952, Vygotsky, 1978). Piaget's theory of cognitive constructivism suggests humans cannot be given information, which they immediately understand and use; instead they must construct their own knowledge

(Piaget, 1952). Vygotsky developed the theory of social constructivism, where learning is connected to its social context. Vygotsky's concept of the zone of proximal development suggests the level of learning an individual can achieve with adult guidance or in collaboration with more adept peers is greater than the level of learning an individual can achieve through independent problem-solving (1978). Collaborative learning enables each learning community to benefit from the prior knowledge of each participant to construct new relevant knowledge (Gary & Roberts, 2006). While constructivism has been considered as one of the most influential theories of learning, common criticism exists. Kirschner et al. (2010) suggest constructivist approaches can have negative outcomes when participants acquire misconceptions or incomplete or disorganised knowledge. Here it must be emphasised that flexibility in guidance within constructivism is crucial in making it highly adaptable to the diverse learners' needs to ensure that positive learning outcomes are achieved (Schmidt et al. 2007, cited in Hunt & Chalmers 2012). A second criticism argues that while constructivism states real education is achieved via experience, not all experience is correspondingly educational (Kumar, 2006). As a result, some experiences can be counter-productive to the depth of the learning experience. It can be highlighted, however, that constructivism as an approach to learning does not mean that students do not have to provide evidence for their claims (Hyslop-Margison & Strobel, 2008). Overall, collaboration in terms of constructivism can be considered as a diverse set of approaches, where flexibility exists simultaneously in how the learner is understood and how learning is created.

3.1.2 Feedback

Carless defines feedback as "a dialogic process in which learners make sense of information from varied sources and use it to enhance the quality of their work or learning strategies" (2015). Feedback is a key component of the adult learning theory (Knowles, 1984; Darling-Hammond et al. 2017). Feedback is closely linked to reflection, where synchronous and asynchronous feedback can present opportunities for active participation, in-depth reflection and meaningful responses (Doherty, 1998). The receiving of feedback from individuals in a learning community is crucial in developing and fine-tuning knowledge (Daniel et al. 2013). Opportunities for feedback include

formative assessment, where gaps in learning can be identified (Scott, 2015). This can be supported through the use of rubrics and assessment criteria. The use of such assessment tools can prove challenging to some students and educators (Wolf & Stevens, 2007). This can be overcome through supporting participants to evaluate their own and their peers' learning. This process supports content mastery, develops students' metacognitive skills and thus provides a deeper learning experience (Saavedra & Opfer, 2012). A further challenge of the provision of feedback involves students giving shallow 'nice' feedback in discordance with the assessment criteria in order to avoid conflict with their peers (Daniel et al. 2013). This can be overcome through raising student motivation, where students believe they can successfully accomplish the task (Svinicki, 2001). Secondly, the provision of models of good feedback can be considered as one of the most effective ways of acquiring the skill of giving feedback (Bandura, 1986). In summary, feedback can be considered as an essential component of the learning process, however, guidance on giving feedback is required to ensure the learner benefits from such opportunities.

3.1.3   Reflection

"Reflective practice is the mindful consideration of one's actions, specifically one's professional actions and is a challenging, focused, and critical assessment of one's behaviour as a means towards developing one's craftsmanship."

(Osterman, 1990).

A significant amount of literature supports the importance of reflection in learning (see for example: Darling-Hammond et al. 2017; Dewey, 1910). Reflection plays a pivotal role in Kolb's theory of experiential learning (1984). Reflection is also a component of the transformative learning theory which has foundations in constructivism where adults problem-solve through critical self-reflection (Mezirow, 1991). Through self-reflection, adults can improve their understanding of themselves and their learning, thus transforming their perspectives. Various forms of reflection exist and can be considered of equal significance (Liimatainen et al. 2001). Engaging in reflection enables participants to refine their practice in their given context (Daniel, 2003). Regular

reflection thus enables participants to manage and enhance their knowledge, skills and practices. However, there is disagreement on the role of reflection in learning. Some argue reflection is not an essential component of the transformative practice (Clarke, James & Kelly, 1996; Morrison, 1995; cited in Moon 2004). Taylor (2007), however, highlights the complex nature of transformative learning where the depth of critical reflection is influenced by learning community relationships, the nature of the perspective transformation, and context. Reflection can be understood as an essential component of learning, existing in various forms where flexibility exists in how the learner recognises the task of critical reflection.

3.2   Learning and educational technologies: face-to-face, online and blended.

Traditional experiences of face-to-face learning have rapidly developed in the digital age. The use of online learning has been expanded to enhance or completely replace on-site classrooms. Online learning has presented new challenges in developing appropriate learning strategies and tools to support the learning needs of temporally and spatially separated communities (Gary & Roberts, 2006). The rapid developments in technology have impacted on the ways in which learning can be achieved. A variety of learning types exist including: face-to-face, blended and online. Each have their own advantages and disadvantages. Nevertheless, they provide learners with new opportunities to construct new knowledge (Taddei, 2009). This section discusses modes of learning and educational technologies for developing opportunities for collaboration, feedback and reflection.

Face-to-face learning involves on-site synchronous learning. The advantages of face-to-face learning include: the ability of students to raise live questions and interact with their peers on site (Casebourne, 2017). The main disadvantages associated with this form of learning are mainly financial with venue and staffing fees requiring consideration. Furthermore, only individuals living in close proximity to the venue can participate in the onsite learning experience (Casebourne, 2017).

Online learning is education that is made available through an internet connection. Due to this mode of delivery, online learning can be made accessible worldwide (Smart & Cappel, 2001). The benefits on online learning include: increased learner autonomy

where learners move at their own pace, the opportunity for learners to revisit content that is not immediately understood, and the use of online technologies to interact with the facilitator and course participants. Moreover, learning can take place in different temporal and geographic zones. The key disadvantage of online learning includes limited internet accessibility, particularly in developing countries (Gulati, 2008). Furthermore, online courses involve a lack of physical interaction with peers and, therefore, decreased development of interpersonal skills (Caplan, 2005). A lack of physical interaction also means that participants cannot benefit from the non-verbal communication of their peers and facilitators which can generate misunderstandings. Individuals can feel embarrassed or nervous during online video discussions which may impact on the depth of answers given (Hay-Gibson, 2009).

Blended learning involves both online and offline learning. The outcome of this is that the benefits of both online and face-to-face learning can be experienced (Gamage & Tanwar, 2017). In summary the benefits include: the opportunity for course participants to raise synchronous questions, students being able to initiate live discussions, development of interpersonal skills, greater learning autonomy, personalised learning experiences, increased methods of interacting with peers and facilitators, and the ability to participate in a course independent from the location of the learner. Blended learning does, however, have its disadvantages. The main disadvantages associated with blended learning include: reduced social interactions and communication which contributes towards increased student confusion due to the misinterpretation of information (Dougiamas & Taylor, 2003; Welker & Beredino, 2005).

In response to the evolution of online learning, Siemens (2005) proposed the twenty-first Century learning theory of connectivism. Connectivism involves the integration of principles explored by chaos, network, complexity and self-organisation theories. The learning process is not completely dependent on the individual. Learning can reside out of the participant and is focused on connecting specialised information sets. These connections advance the learning of the individual and are of greater importance than our current state of knowledge. Connectivism assumes the continual acquirement of information where there are clear distinctions between significant and insignificant information. This suggests online learning programmes should also adopt principles of connectivism where diverse opinions on a specialist subject are shared to develop the learning of the individual. There has been controversy, however, surrounding

connectivism as a learning theory. Kop and Hill (2008) suggest connectivism is merely a theoretical framework for understanding learning. Nevertheless, the theory of connectivism is relevant to online learning given it provides students with opportunities to extend their learning, cultural awareness, motivation and engagement through maximising interactions between learners irrespective of location (Clark, Veale & Watts, 2017).

The success of all forms of learning outlined above is dependent on the pedagogies, curriculum and technologies used to support learning. For effective online learning, Ring and Mathieux (2002) suggest it should be highly interactive and collaborative. This is as it enables students to participate in discussions where they can share and apply knowledge into their own context to solve problems.

The next section explores how educational technologies can be employed in all modes of learning to maximise purposeful, deep learning.

3.3 Educational technology and deep-learning

"Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources"

(Richey et al. 2008).

Educational technology is a term that can be broadly applied to a spectrum of technologies and methodologies that are influenced by stakeholders' behaviours and contextual factors (Pastor & Quirós, 2015). Educational technologies should not be considered as a separate entity where its sole use will transform education. Instead, it should be carefully integrated in the learning process together with the use of the appropriate curriculum and pedagogies (Davies, Fidler & Gorbis, 2011; Gamage & Tanwar, 2017; Scott, 2015). The purposeful use of new technologies online may also lead to increased opportunities for learner-driven forms of learning (Furlong & Davies, 2012).

Many different educational technologies currently exist which make it difficult for educators to select the most appropriate tool for the desired learning experience. Limited independent, peer-reviewed evidence exists on this topic for educators which contributes towards the slow movement in the adoption of such technologies in education (Gamage & Tanwar, 2017). Furthermore, the skills, attitudes, abilities and experience of teachers significantly impact on how technology can be and is used effectively in the classroom.

Gamage and Tanwar, (2017) call for improved teacher training in educational technologies, methodologies and increased opportunities to incorporate technology into the educational process. It is also crucial that educational technologies are used to develop higher-order thinking skills and deeper learning experiences. This in turn, contributes towards fostering the twenty-first century skills of the students. The question lies in how can educators best develop the higher-order thinking skills and deep learning of their students? This can be achieved through encouraging learning through participants belonging to an online community (Meyer, 2003; Siemens, 2005). Fostering participation amongst participants can lead to the co-creation of learning (Scott, 2015). It is essential that educational technologies are used so they engage learners and support the construction of new knowledge whilst working in collaboration with their peers. In this way, the knowledge of individuals can be radically transformed.

3.4 FeedbackFruits features for Collaboration, Feedback and Reflection

Online educational tools can facilitate students' active construction of knowledge. Research suggests students connect knowledge more effectively with ongoing opportunities for collaborative, experiential and authentic learning (Teräs, 2018). A diverse range of educational technologies exist to maximise such experiences. An example includes the educational tool FeedbackFruits. FeedbackFruits was created to maximise student engagement throughout the learning process. All the tools contained within FeedbackFruits have built-in analytics to enable the instructors to monitor their students' progress online. Since FeedbackFruits' establishment in 2012, its use by universities has expanded throughout the Netherlands and internationally.

FeedbackFruits is a didactic plugin that offers a variety of tools that facilitate blended learning including: interactive video; interactive documents; interactive presentations; study material comprehension; interactive audio; peer feedback; group member evaluation; skill feedback and assignment feedback. The creators of FeedbackFruits claim that the tools promote collaboration, feedback and reflection in different ways. Table 2 explains in further detail the learning processes promoted by each technology and their pedagogical purposes.

TABLE 2. features of FeedbackFruits, their pedagogical purposes and the learning process promoted.

Learning process promoted	Feature/ technology	Pedagogical purpose
Collaboration, feedback and reflection	Interactive Video	Shares video content. Students can add video annotations. Can be used to engage students with the material before class with inline questions and discussions. The facilitator can also provide students with feedback using a video.
Collaboration, Feedback and Reflection	Interactive Documents	Shares documents. Students can add whole-class annotations. Can be used to engage students using inline questions and discussions.

Collaboration, Feedback and Reflection	Interactive Presentations	Shares presentations. Fosters interaction during lectures, where instructors can add questions (open or closed) to existing slides. Students can answer questions where their names are displayed or anonymously during live presentations.
Collaboration, Feedback and Reflection	Study Material Comprehension	Shares documents. Students can individually comment on documents and respond to specific questions through providing annotations.
Collaboration, Feedback and Reflection	Interactive Audio	Shares audio files. Inline questions can be provided to promote discussion amongst students.
Feedback and Reflection	Peer Feedback	Students provide peer reviews. The instructor specifies review criteria to guide students through the process. After the hand in deadline, each student is automatically assigned a peer's work to review. Both commentary and responses are displayed in the browser, without the need to download individual lessons. Students can revise their work before final submission. Students can

		write a self-reflection on the feedback received.
Feedback and Reflection	Group Member Evaluation	Students individually peer assess members of their group following a collaborative task. Students can write a self-reflection on the feedback received.
Feedback and Reflection	Skill Feedback	Instructors provide students with feedback on their skills. Students can write a self-reflection on the feedback received.
Feedback and Reflection	Assignment Feedback	Instructors provide students with inline feedback on their work. Students can write a self-reflection on the feedback received.

This chapter has shared definitions and related learning theories on collaboration, feedback and reflection. It has presented the advantages and disadvantages of face-to-face learning, online learning and blended learning. It discussed how education technologies can be used to promote deep-learning. Lastly, it provided an overview of the various features of the FeedbackFruits tool, their pedagogical purposes and the learning process promoted.

This chapter has found that deeper learning experiences occur when collaboration, feedback and reflection are effectively carried out. Each type of learning presents different advantages and disadvantages which can significantly impact on the depth of learning. Diversity in educational technologies exist which can promote opportunities for

collaboration, feedback and reflection. As a result, educators must select the appropriate tools carefully to ensure they transform the learning of the participants. The next section presents the data collection and analysis methods used in the study.

4   DATA COLLECTION AND ANALYSIS METHODS

Qualitative methods were used to collect data for this dissertation. Specifically, semi-structured interviews were used to enable a deeper understanding of participants' experiences with the tool and to responsively challenge and explore the diverse experiences of the interviewees using the FeedbackFruits tool in their professional environment. This in turn led to the identification of relationships between the educators' statements. This was crucial in gaining a deeper understanding on how this educational technology tool promoted opportunities for collaboration, feedback and reflection.

A fundamental criticism of qualitative research involves the implicit assumptions, interests and perspective of the researcher. A researcher's theoretical position, interests, and political perspective will affect, if not determine, the research question and the methodological approach (Diefenbach, 2008). In terms of data collection and analysis, my role and influence were acknowledged. In addition to the data collection methods, it is important to note that at the time of research, I was working as the educational scientist at FeedbackFruits. This gave me first-hand experience on how different university educators used FeedbackFruits to enhance the learning experiences of their students. This was advantageous as it provided me with an alternative source of information on how the tool was being used, what was working well and where further developments were required. As I was aware of these points, I was able to incorporate these aspects in the questions delivered during the semi-structured interviews to ensure the questions were contextually relevant. I am aware that my employment by FeedbackFruits could have created a conflict of interest, so it was agreed prior to the research being undertaken that I would be free to give an honest evaluation without fear of repercussions, and I was on a time-limited contract.

Through my initial conversations at FeedbackFruits it became clear educators were using the tool in different ways in academic institutions. As a result, the educators were experiencing a variety of issues with effectively using the tool to promote opportunities for collaboration, feedback and reflection.

As the educational scientist, I wished to understand what the learning experiences of online collaboration, feedback and reflection were amongst participants using an educational technology tool. This in turn, would provide further insight on what learning strategies worked for promoting opportunities for collaboration, feedback and reflection amongst student to determine how the use of the tool could bring about more purposeful, deeper learning.

The data was collected using semi-structured interviews with the participants. No fixed figure exists for the suggested number of interviewees for a qualitative research project. Samples sizes can range from 1-100 or more (Baker & Edwards, 2012). In this case, three Lecturers from three different Dutch Universities using FeedbackFruits were interviewed. The interviews were conducted over a three-month period during the summer of 2018. The interview questions encouraged the participants to discuss their students' experiences of collaboration, feedback and reflection when using FeedbackFruits to support learning experiences. It can be argued that the number of interviewees that participated in the study was too low to generate significant data. The three interviewees were selected as the uptake of educational technology tools in tertiary education is still limited. In addition, as FeedbackFruits is a new technology, there were only a small number of qualified users. I managed to speak to a good subset of this limited number. The educators worked at three different Dutch universities. Dutch universities were selected as they are representative of advanced research institutions globally. Given the universities that participated in the study volunteered, I am aware of the response bias. The interviews were carried out at the end of term. This gave the interviewees more time to reflect on and evaluate their use of the tool. Furthermore, the use of the tool was still fresh in their minds which lead to the sharing of detailed information.

All interview questions were open to limit leading the interviewees' responses and to encourage in-depth and detailed answers (Jacob & Furgerson, 2012). A criticism of this approach is that asking an individual to identify experiences from multiple perspectives can prove a challenging task given individual experiences (Stangor, 2014). Furthermore, an individual's perception is also influenced by their attitudes, beliefs, culture and values (Hofstede, 1998).

The aim of a semi-structured interview is to elicit a narrative from the interviewee (Edwards & Holland, 2013). The core features of the semi-structured interview used

involved a content approach where the topics of collaboration, feedback and reflection were covered in a fluid and flexible structure (See Table 3). This in turn, promoted the answering of the primary thesis question of "what are the learning experiences of online collaboration, feedback and reflection amongst participants using an educational technology tool?" Furthermore, the semi-structured interview enabled the production of a situational and contextual perspective of knowledge. This was achieved through the nature of the semi-structured interview questions delivered.

TABLE 3. A Table showing the questions used in the semi-structured interview to elicit information on each research question.

Research sub-question	Corresponding interview question number
How do educators understand collaboration, feedback and reflection?	1. Describe collaboration, feedback and reflection on your courses. 2. What might collaboration, feedback and reflection mean to your students?
What is the perceived impact of collaboration, feedback and reflection on the learning of participants?	8. How do students collaborate, provide feedback and reflect using FeedbackFruits? 9. What are the outcomes of using FeedbackFruits on your practice?
What are the strengths and challenges of the educational technology features which promote collaboration, feedback and reflection?	3. How do you use FeedbackFruits to promote opportunities for collaboration, feedback and reflection? 4. How might the use of Feedback fruits differ between students and lecturers? 5. How do the online opportunities for collaboration, feedback and reflection provided by FeedbackFruit differ to in class opportunities?

| | 6. Tell me about your experiences in using FeedbackFruits. |
| | 7. What features would you add to the FeedbackFruits tool to promote collaboration, feedback and reflection? |

Semi-structured interviews of participants were carried out either online or on-site. Two interviews were carried out in person. The third was carried via google hangouts. The benefits of carrying out face to face interviews is that it is a synchronous form of communication where the interviewer has the advantage of reading social cues. Furthermore, the interviewer and interviewee can directly respond to what the other says or does (Opdenakker, 2006). Videoconferencing offers the same advantages; however, participants may feel embarrassed or nervous to be on camera which may impact on the depth of answers provided during the interview (Hay-Gibson, 2009). The interviews were recorded and transcribed. The interviews were confidential in order to facilitate full and frank responses. The duration of the interviews ranged from 30 to 60 minutes. All data obtained during the interviews was stored at secure levels and not passed on to other individuals and organisations.

To gain a greater understanding on experiences of collaboration, feedback and reflection, carrying out interviews of students using this tool would have been considered a rich source of information. Given the research question focuses on how educators can best use educational technologies to promote opportunities for collaboration, feedback and reflection, it was thought best to focus on the educators' experiences to not overcomplicate the research process. The educators possessed the pedagogical knowledge and professional experience to provide rich data on exactly how the educational technology provided opportunities for collaboration, feedback and reflection. Furthermore, the researcher was unable to interview students due to resource constraints.

As this dissertation focuses on examining the experiences of three educators' perceptions of collaboration, feedback and reflection of students promoted by FeedbackFruits, a deductive thematic analysis was used. A deductive thematic analysis is a form of content analysis. Content analysis can be used to best increase sensitivity in understanding and interpreting observations about the experiences shared using the three key features of

deep learning (Armat et al. 2018). Marks and Yardley (2004) recommend the descriptive use of thematic analysis on a small sample size as it would be meaningless to assign numbers to a data set that is too small to meet the usual minimum requirements for statistical analysis. Furthermore, it would be misleading to quote frequencies of codes from populations where samples are not large enough to allow for reliable statistical generalisation.

Marshall and Rossman (1999) propose the following six stages of thematic analysis:

- organisation data
- generation of categories or themes
- coding of the data
- test emergent understandings of the data
- search for alternative explanations of the data
- write-up the data analysis

The deductive thematic analysis generally followed the stages as outlined above; however, as the thematic analysis was deductive, it began using the pre-existing categories (analysis matrix) (see Table 4 below) based on prior research on collaboration, feedback and reflection. The interviewees' answers from the semi-structured interview were initially classified to correspond to collaboration, feedback and reflection. To enable an in-depth understanding on the features the data obtained from all semi-structured interviews was combined to determine exactly how FeedbackFruits promoted opportunities for collaboration, feedback and reflection. An additional category for the challenges associated with each feature was added. Once this initial stage of processing the data had been completed, common patterns were identified. The patterns were labelled with codes. Distinctions were drawn between different aspects of the data by organising the data into a set of categories. Key statements from the interviews were classified, interpreted and added to the corresponding areas of the matrix. Each area of the matrix was then conceptualised into subcategories. In circumstances where some coded sections of the text were unable to be classified in the matrix, new categories were inductively created (Armat et al. 2018). As coding progressed, categories were refined by splitting, splicing and linking codes (Marks & Yardley, 2004). Once all data had been categorised, an analysis was carried out.

TABLE 4. Analysis matrix used for the deductive content analysis

Research themes	Interviewee 1	Interviewee 2	Interviewee 3
Collaboration			
Challenges to collaboration			
Feedback			
Challenges to feedback			
Reflection			
Challenges to reflection			

4.1 Reliability, validity and ethics

4.1.1 Reliability

Reliability can be defined as obtaining the same results if the study were replicated (Morse & Richards, 2002). In this study, as a single observer is a source of data, the impact of the observer's subjectivity is unknown (Babbie, 1986). Subjectivity is a key issue when carrying out research and can compromise the reliability of the research (Wilson, 2010). Furthermore, the formation of a content analysis coding scheme depends mainly on the researcher's judgment on how to code the lexical content of a coding category (Cariola, 2014). An example of this includes many words of the text being classified into much fewer content categories (Weber, 1990). If the lexical classification of the content analysis coding scheme is not reliable, this can generate results which are not valid (Cariola, 2014; Weber 1990). This in turn, would produce results of little significance.

A common criticism of all forms of content analysis is that they lack reliability in ensuring an acceptable scientific standard (Neundorf & Skalski, 2010). Limited claims can be made with qualitative studies as they mostly focus in depth on smaller samples. As a result, generalisation can be problematic (Bengtsson, 2016). While some issues may arise regarding the reliability of data when carrying out a thematic analysis, it can be argued that in this situation, a deductive thematic analysis was the most appropriate analysis method. It was thought optimal given the resource constraints and so the study could be replicated.

To ensure valid inferences were made from the text, the consistency of the classification procedure was assessed by another individual to ensure different people could code the same text in the same manner. As a result, this contributed towards the classification procedure generating variables that are valid. A variable can be considered valid to the extent it measures or represents what the investigator intends it to measure (Cariola, 2014; Weber 1990). Finally, new findings can be assessed against

literature to deduce whether or not they are reasonable and logical (Morse & Richards, 2002).

4.1.2 Validity

Validity is when the results truthfully reflect the phenomena studied (Morse & Richards, 2002). Specific measures that can be taken to secure the reliability of the results include: the appropriateness of the time scale for the study; the appropriateness of the methodology; the suitability of the sample studied (Chilisa & Kawulich, 2012). Given the nature of the study, the three-month time period taken to execute the interviews enabled the collection of substantial amounts of data. Secondly, the methodology used was most suitable for the sample size of three. Lastly, the sample consisted of experienced educators who had extensive experience in using the tool. It would have been beneficial to have interviewed individuals with various professional experience and with varying levels of experience with the tool as this would have provided more diverse perspectives on the opportunities and challenges of the tool in terms of opportunities for collaboration, reflection and feedback. While the issues reducing the reliability and validity of a study can never be completely eliminated, the researcher made all attempts to minimise them.

4.1.3 Ethical considerations

Lichtman (2012) defines ethical behaviour as "a set of moral principles, rules, or standards governing a person or profession." All participants were safeguarded against anything that may cause harm to them. All individuals participating in the research study were guaranteed privacy and anonymity. The information provided to the researcher during this investigation was treated in a confidential manner. Participants were informed of the nature of the study and the involvement of participants in the research project was voluntary. All participants were eligible to participate irrespective of age, gender, ethnicity, or disability. Individuals were free to decline participation. The researcher met the obligations and responsibilities of the General Data Protection Regulation (GDPR) (Summers, 2018).

4.2   ANALYSIS FRAMEWORK

The unit of analysis in this study was text based on three interviews. Audio recordings of the interviews were made. The interviews were transcribed using the audio transcription software trint. The accuracy of the transcriptions was then checked and corrected by the researcher. The text was read through multiple times to gain an accurate and deeper understanding of the text. The matrix provided in Table 3 was used to assist with the coding of text. The meaning units were condensed into a description close to the text (the manifest content) and into interpretations of the underlying meaning (latent content). The main themes included: collaboration, reflection and feedback. From the themes, further sub-themes were developed to identify the essence of the themes. These included: understanding expectations, deep learning experiences and higher order thinking of students, emotional response, learning environment, potential challenges and educators' needs.

In this analysis, understanding expectations and deep learning experiences and higher order thinking of students are overarching sub-themes that are rooted in the other themes. Figure 1 is a thematic map presenting the relationship between themes, subthemes and the research questions.
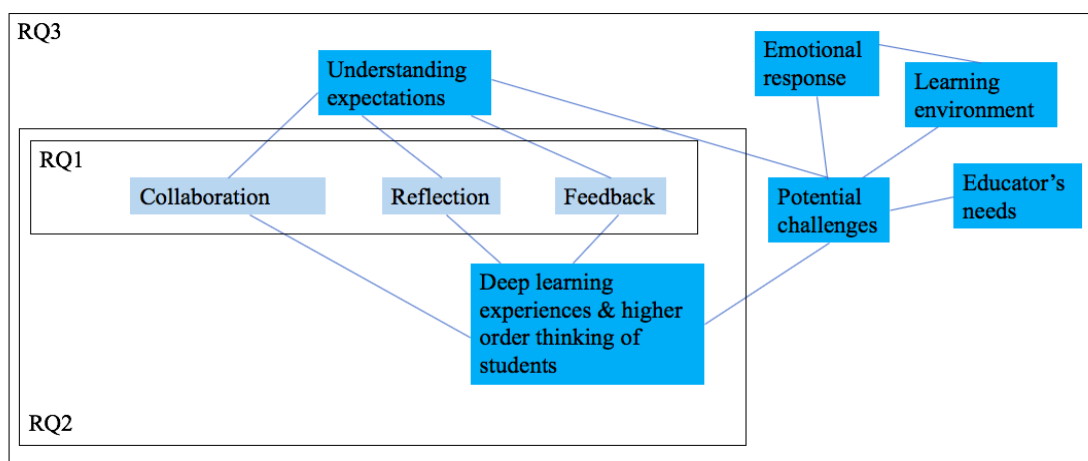

FIGURE 1. Thematic map

This figure presents how, from the preset categories identified (Table 3), the following themes and sub-themes emerged from the data. The themes of collaboration, reflection and feedback were acknowledged. From the data the following sub-themes were recognised:

1. Understanding expectations - students understanding their teachers' expectations and the assessment criteria.
2. Deep learning experiences and higher-order thinking of students- situations where students can extract what was learned in one situation and apply it to new situations; situations where higher-order thinking skills were applied.
3. Emotional response - how students interpret and emotionally respond to feedback.
4. Potential challenges- barriers in the promotion of opportunities for collaboration, feedback and reflection, particularly when using educational technologies.
5. Learning environment- various locations, contexts and cultures where individuals learn. e.g. face-to-face and online learning environments.
6. Educators' needs- the educators' requirements in order to effectively carry out their roles and responsibilities.

This chapter has presented the data collection and analysis methods used, and outlined the reliability, validity and ethical considerations. Lastly, it discussed the analysis framework used in this study. The next section presents the finding of this study based on the analysis framework.

5 RESULTS

This section begins with a summary of the educators' perspectives on the features of FeedbackFruits, their pedagogical purposes, learning process(es) promoted, strengths and challenges (Table 5). This summary is followed by the detailed findings for the themes and subthemes outlined in the thematic map (Figure 1).

TABLE 5. A summary of the educators' perspective: advantages, challenges and recommendations in using FeedbackFruits to support opportunities for collaboration, reflection and feedback.

Learning process promoted	Feature/ Technology	Advantage(s)	Challenge(s)	Educators' recommendations
Collaboration feedback and reflection	Interactive Video	Increased time to reflect. Deeper reflection. Increased time to write meaningful feedback. Deeper level of learning than on-site instruction.	Student providing shallow feedback and reflections.	Educator provides scaffolding on how to write quality feedback and re-flections.

Collaboration feedback and reflection	Interactive Documents	Increases students' exposure to additional materials that cannot be accessed on site Increased time to reflect. Deeper reflection. Increased time to write meaningful feedback. Deeper level of learning than on-site instruction.	Student providing shallow feedback and reflections.	Educator provides scaffolding on how to write quality feedback and reflections.
Collaboration feedback and reflection	Study Material Comprehension	Increases students' exposure to additional materials that cannot be accessed on site Increased time to reflect. Deeper reflection.	Students not executing collaborative activities appropriately, sharing work instead.	Educator provides scaffolding on how to effectively complete the literature review task.

		Increased time to write meaningful feedback. Improved understanding of material due to group annotations. Deeper level of learning than on-site instruction.		
Feedback and reflection	Peer Feedback	Increased time to write meaningful feedback. Improved understanding of material due knowledge shared in peer feedback.	Student providing shallow feedback and reflections.	Educator provides scaffolding on how to write quality feedback and reflections.
Feedback and reflection	Group Member Evaluation	Increased time to write meaningful feedback. Improved understanding of material due knowledge	Student providing shallow feedback and reflections.	Educator provides scaffolding on how to write quality feedback and reflections.

		shared in peer feedback.		
Feedback and Reflection	Skill Feedback	Increased time to write meaningful feedback. Improved understanding of material due knowledge shared in educator's feedback.	Time consuming for educators to provide detailed feedback	-
Feedback and reflection	Assignment Feedback	Increased time to write meaningful feedback. Improved understanding of material due knowledge shared in educator's feedback.	Time consuming for educators to provide detailed feedback	-

RQ1: How do educators understand collaboration, feedback and reflection?

In this subsection, the results are presented for the educators' perspectives on the themes of collaboration, feedback and reflection. Furthermore, the findings on their perspectives on how their students might perceive activities for collaboration, reflection and feedback are shared.

Collaboration

The educators were clear and consistent on their definitions for effective collaboration. They agreed that effective collaborative involved the active construction of knowledge amongst group members. The following factors were found to be interrelated: effective collaboration, task complexity and depth of learning. When collaborative work involved a joint interpretation, a combined output, a clear goal and group members who worked to their strengths, educators felt the collaborative work was most efficiently executed. Furthermore, when positive relationships existed between the students and the educator, the educators believed effective collaboration took place.

There was a consensus that students' understandings of collaboration differed greatly to those of the educators.

> I think that we put students too much in a situation where they have to collaborate, where the process is much more about dividing the work instead of really learning with each other…what is hard to say is if they actually learn with each other from each other. (Educator 3).

They stated most students believed collaboration involved the division of tasks which was often incongruent with the active construction of knowledge in a social setting. This in turn, impacted on the quality of the work produced and made it difficult for the educator to determine the depth of the students' learning. The act of collaborative work was often met with low student motivation and engagement. They stated this was primarily due to

students being unclear of exactly what true collaborative work involved. A common theme in the educators' answers was that students were more focused on the end-product than the process of learning itself. As a result, the students were unaware of the learning benefits of collaborative work.

Feedback

All educators agreed effective feedback was an essential component for transforming the knowledge of students. It enabled students to determine how to furthermore develop their understanding on a given topic and improve the overall quality of their work. They suggested it developed the students' ability to take on different perspectives through receiving feedback from a peer, reflecting on their work and critically assessing its contents. The feedback could be received in various forms. The receiving of peer feedback was also regarded as a form of support in the learning environment. This in turn, contributed towards positive learning outcomes. The educators believed that through delaying the process of receiving feedback, students were able to reflect more deeply on the learning process. Furthermore, the provision of peer feedback, provided students with the opportunity to revisit and develop their work before it was submitted to the educator. As a result, the educators could provide more focused feedback of higher quality. Peer feedback therefore supplemented educator feedback and vice-versa.

Giving the students the opportunity to provide feedback empowered them to take ownership of the learning process, thus promoting their motivation and engagement. The educators found students valued feedback more when it was given by a peer rather than the teacher. However, this also depended on the quality of the feedback provided.

> Well it depends on, I think it depends on the feedback they receive. It also depends on the student. I think, if a student is an active learner, he knows the value of feedback either from a teacher or a peer. (Educator 1).

The issue of the giving of shallow feedback was highlighted as being a hindrance to the learning process. The educators stated that variation existed in the extent to which students valued feedback. Those who were unclear of how to give effective feedback

often had low motivation when feedback activities were set. They believed some students perceived feedback as the receiving of a grade rather than a process in the transformation of knowledge. Lastly, one educator highlighted how the way in which students interpret the feedback received also impacted on the depth of learning.

Reflection

All educators shared the opinion that reflection was a crucial stage in the learning process, which often took place closer to the final stage of the learning process.

> Well that is the end result I think in each learning process, each learning process ends with reflection. It ends with the reflection of the student. What have I done? What has it brought me? And what didn't it bring me? and how can I use that information to improve myself to get better and get better knowledge? I think it's about instant internal dialogue within the student itself. (Educator 1).

There was some general agreement that it played a central role in self-improvement. Reflection activities involved an internal dialogue where, students recognised the process in how they learn and how to improve the learning process. Another educator highlighted it was closely related to feedback and they must not be regarded as separate entities in the learning process. A positive correlation was highlighted between a positive learning environment and students' ability to reflect. They felt reflection improved the self-awareness of students and led to them becoming more empowered learners. The educators agreed that most students questioned the value of carrying out reflections as they were unsure of why they were doing it. This negatively impacted on student engagement and motivation. This could be overcome through guiding students on how to write quality reflections to furthermore develop the learning process. It was believed that students' perceptions of feedback were also influenced by the existence of a learning environment where students felt comfortable enough to share their opinions with their peers.

RQ2: What is the perceived impact of collaboration, feedback and reflection on the learning of participants?

The emerging theme that corresponded to this research question was deep learning experiences and higher-order thinking of students. This subsection will present the findings on this theme.

Deep learning experiences and higher-order thinking of students

There was consensus amongst the educators that when opportunities for collaboration, feedback and reflection were fully exploited, students applied their higher-order thinking skills and experienced deeper and more purposeful learning.

> What I experienced from the comprehension module is that [through collaboration, feedback and reflection]...they got a deeper insight into topics of the texts. So that was really important to me, that through the comprehension module it really had an effect on the learning results of the students. (Educator 1).

The educators described the outcomes of effective collaboration, feedback and reflection as being part of a whole learning process of self-transformation.

RQ3 What are the strengths and challenges of the educational technology features which promote collaboration, feedback and reflection?

This subsection initially explores the strengths of FeedbackFruits features increase students' exposure to opportunities for collaboration, feedback and reflection. This next section will explore the specific features highlighted by educators that enable such opportunities. Overall, no areas existed where the three educators strongly disagreed with one another.

Potential strengths of using educational technology to promote opportunities for collaboration, feedback and reflection

The educators provided both general and specific information on how the FeedbackFruits features impacted on opportunities for the overall learning experience.

Generally, they felt the tool promoted a more personalised learning experience for the students, where the students felt more empowered in the learning process through having greater autonomy. This in turn, positively impacted on the level of student engagement, collaboration, feedback and reflection. Another general strength of the tool was it assisted in the students' better understanding of learning tasks, which in turn correlated with successful learning experiences. The tool was found to augment in-person and online opportunities for collaboration, reflection and feedback. The tool was found to provide the educators with more information on the students' learning process.

> I could say that less students fail the course, I think in my case it's good because we're really targeting at developing their own level. (Educator 2).

It enabled them to identify where further clarification was required to facilitated deeper learning. The tool also enabled educators to quickly identify and communicate with students who disengaged from the learning process. Another educator stated that tool deepened his perspective on how his students learned and what they might require to

furthermore develop their learning. All educators highlighted how the asynchronous use of the tool was a strength as it gave the students more time to reflect on the learning process. Lastly, an advantage of the provision of online feedback was explored. An educator felt there were many online opportunities available for students and educators to provide students with feedback. This was regarded as a strength which promoted the learning process.

All educators stated they used a specific FeedbackFruits tool according to a specific learning outcome. For example, one educator highlighted how the group comprehension tool developed his students' ability in understanding complex literature through providing opportunities for collaborative discussion, thus enriching one another's learning experience. The educators' perspectives on the role features of the tools mentioned in the study played in learning are outlined in Table 5.

Potential challenges of using educational technology to promote opportunities for collaboration, feedback and reflection

Various themes and sub-themes were identified as potential challenges to promoting opportunities for collaboration, feedback and reflection when using the educational technology tool FeedbackFruits. These included: students understanding the expectations of the task set, educators' needs, learning environment and emotional response. This subsection will present the findings for each theme and sub-theme outlined.

Understanding expectations

A unifying challenge related to the promotion of opportunities of feedback, collaboration and reflection involved the students' understanding of the expectations of the set task. Students often lacked motivation in completing tasks involving feedback, reflection and collaboration because they did not understand their value to the learning process. Furthermore, the educators felt many students did not know how to effectively reflect, give feedback and collaborate. All educators believed this barrier could be overcome

through explaining how activities of feedback, collaboration and reflection could positively impact on their learning.

> [The feedback] quality depends on the students' knowledge of feedback criteria [success criteria]. (Educator 3).

In addition, the educators carefully scaffolded activities for feedback, collaboration and reflection prior to carrying them out. They believed this would develop the students' ability to effectively give feedback, collaborate and reflect. This would in turn contribute towards students applying their higher-order thinking skills and experiencing deeper learning.

Educators' needs

A common issue involved the lack of time for the educators to experiment and develop a variety of purposeful learning tasks with FeedbackFruits. It was also highlighted that providing students with detailed and effective feedback was a time-consuming task, therefore, using the feedback tool where educators provide students with personalised feedback to a large class might prove a challenging task which might be best avoided. The varying computer literacy and pedagogical knowledge of educators in tertiary institutions also presented a challenge. As a result, some of the educators' colleagues were less aware of how to use FeedbackFruits to promote opportunities for collaboration, feedback and reflection. This in turn contributed towards some resistance in educators fully embracing the tool in some tertiary education institutions.

An educator highlighted the importance of the features of the educational technology developing in the same direction as the educators wished the course to. The educators would find it problematic when the tool's features were incongruent with the educator's vision with the course.

> It's an interesting thing because FeedbackFruits is developing and you're developing your course. It's not always the same developments. Sometimes, in some ways, you are very close to each other but in a month later, it could be that

developments push a little bit outwards and then you have to really see how you can use it in your course and it keeps changing. (Educator 2).

However, one educator highlighted the willingness of FeedbackFruits to respond to the needs of the educators by being open to incorporating the educators' suggestions to improve the purposefulness of the tool.

Emotional response

An educator highlighted a challenge that greatly impacted on the extent to which opportunities of peer feedback contributed towards the learning of his students. This was due to the varying way in which students interpreted their peer's feedback. In some situations, the students' emotional response to the feedback may present a barrier to learning itself.

The downside is again, you as a facilitator can't control the interpretation. So, interpretation-wise it is more difficult for them to think what it's about. (Educator 2).

The educator suggested two ways of overcoming this barrier: enabling the students to choose the format in which they give peer feedback to one another, rather than only text, for example, the provision of video feedback. This form of feedback also provides non-verbal feedback so that the feedback is more clearly communicated to the receiver. One educator was in disagreement where he believed written feedback was the most detailed form of feedback, however, he stressed that the most appropriate forms of feedback varied according to the task set. The educators stated the importance of students begin able to give anonymous feedback as students would be more likely to give more genuine constructive insights. Educator 2 also believed the learning environment impacted on the way feedback was interpreted. This is explored in the following section.

Learning environment

All educators agreed a sense of community was crucial for the successful use of any asynchronous educational technology that promoted reflection, feedback and collaboration. They mentioned the importance in fostering a positive learning environment where all members of the learning community felt valued and safe. In such a learning environment, students had stronger bonds between their peers and their educators. As a result, they were more willing to be open and honest with their feedback. Furthermore, students were more motivated to develop, so more actively engaged in collaborative activities and reflected more deeply on their development and ways forward.

> Safety is a very important part of this. Safety and connection, I would say in contact with the students, creating the right atmosphere... I think that remains the first and main important way to be able to set the atmosphere to create a learning environment in which to inspire students to take up their own responsibility to develop, to put effort in there and teach. You get a sense of trustworthiness between you and the students. (Educator 2).

They felt that once this positive atmosphere had been established, students were more responsible for their own learning, and were more engaged in FeedbackFruit's learning opportunities for feedback, collaboration and reflection.

The next section will now discuss the main research findings, explore the limitations and present recommendations for the identified challenges.

6   DISCUSSION

The purpose of this thesis was to answer the following question: "What are the learning experiences of online collaboration, feedback and reflection amongst participants using an educational technology tool?" This question was answered through addressing the following sub-questions:

1. How do educators understand collaboration, feedback and reflection?
2. What is the perceived impact of collaboration, feedback and reflection on the learning of participants?
3. What are the strengths and challenges of the educational technology features which promote collaboration, feedback and reflection?

These questions were answered through the analysis of the text of semi-structured interviews of three educators using FeedbackFruits in their educational institutions. This section will now explore how the sub-questions were answered.

How do educators understand collaboration, feedback and reflection?

The interviews of the educators demonstrated a clear understanding of the terms collaboration, feedback and reflection. Their definitions provided strongly supported mainly constructivist approaches to learning as well as experiential learning and transformative learning (Dewey, 1910; Kolb, 1984; Mezirow, 1991; Piaget, 1952; Vygotsky, 1978). As a result, this was reflected in their examples of learning opportunities that promoted reflection, feedback and collaboration shared.

What is the perceived impact of collaboration, feedback and reflection on the learning of participants?

The interviews of the participants demonstrated their unique pedagogical knowledge and teaching techniques. This in turn impacted on the learning environment and students' opportunities for reflection, collaboration and feedback. Students often understood collaboration, feedback and reflection differently to their educators. The factors contributing towards this gulf in understanding are complex. This difference in perspectives of students directly impacted on the depth of their learning experiences.

Irrespective of the differences in pedagogical knowledge in the educator and student populations, it was clear that both educators and students had benefited from the use of FeedbackFruits in terms of the teaching and learning process. The findings support the learning theories explored where purposeful collaboration, feedback and reflection positively impacted on the construction of knowledge and the transformation of the self. A key finding was the impact of complex collaborative tasks, where the more complex the task the greater the level of collaborative work and construction of knowledge. This supports Vygotsky's ideas on the zone of proximal development (Vygotsky, 1978).

This suggests that deep learning experiences are often not synonymous with meeting the preferences of the students. Students may be apprehensive about completing complex tasks that involve the application of higher-order thinking skills as they may be out of their comfort zone as the task is unfamiliar to them. The negative outcome of this includes disengagement, low motivation and shallow learning experiences. What remains clear is that in these cases, such difficulties can be overcome through the educator clearly communicating the expectations of the task with the students and providing careful scaffolding (Bandura, 1986). The educators believed most students were able to define the terms reflection, feedback and collaboration but many were unable to explain why they are beneficial to the learning process and how to effectively carry out these activities. When delivering opportunities for collaboration, reflection and feedback in an educational setting it is crucial that a balanced is reached between task complexity and the offering of guidance on the task expectations. To fully accommodate to the needs of the students can be problematic as it hinders their ability to move from their comfort zones and transform themselves during the learning process (Teras, 2018).

The teachers echoed this idea, as they felt that providing minimal guidance on collaboration, feedback and reflection often resulted in poorly executed work which in turn had a negative impact on the overall learning process. Most teachers overcame this

by initially providing students with models of effective collaboration, feedback and reflection. This led to students valuing collaboration, feedback and reflection, thus promoted engagement and depth of the learning experience.

This dissertation highlights the importance of clearly communicating the expectations of the task with students and providing them with adequate scaffolding so that they can purposefully reflect, collaborate and provide feedback.

The learning environment greatly impacts on the level of collaborative learning, feedback and reflection. In situations where the learning environment is particularly hostile, students are less likely to engage in collaborative work and provide genuine feedback for reflections. A positive learning environment where a strong learning community is developed contributes greatly towards deeper learning. This is supported by theories of constructivism and connectivism (Dewey, 1910; Piaget, 1952; Siemens, 2007; Vygotsky, 1978).

In summary, it is of importance for educators to share their expertise for promoting collaboration, feedback and reflection with their colleagues. This is particularly useful where educational institutions have educators with varying experience and exposure to various educational technologies. Furthermore, the sharing of techniques on effectively scaffolding, providing feedback and reflection would benefit the educators as they would be more knowledgeable as to how to promote deeper learning amongst their students. The multiple opportunities that FeedbackFruits presents for learning may be overwhelming to educators. One option may be that, when educators are provided with the tool, they require more information on how it could be effectively used in the classroom during professional development sessions.

What are the strengths and challenges of the educational technology features which promote collaboration, feedback and reflection?

Reflecting on the interviews carried out for this study, it is clear there is not one particular tool or rigid formulaic process to lead to the effective construction of learning through

collaboration, feedback and reflection. Instead, flexibility should exist to allow educators to effectively design their tasks to meet the diverse learning needs of their students.

Challenges and Recommendations

This research enabled the identification of various challenges of promoting opportunities for collaboration, reflection and feedback, particularly concerning FeedbackFruits. The recommendations made by the educators to improve FeedbackFruits are presented in Table 4. The researcher acknowledged the educators' suggestions and furthermore developed them. The challenges and the respective recommendations suggested by the researcher have been summarised in Table 5. Research has shown the provision of standard comments related to specific elements of a set task for the use of educators can be time saving (Nicol & Milligan, 2006). A comment bank could be incorporated in the teacher and peer feedback tool to significantly assist in the provision of relevant feedback.

Another feature that could positively impact on how the students interpret peer-feedback could be to introduce an editor to the feedback tool where emoticons, fonts, colours and layouts can be used. This has been found to provide text with a 'body language', thus enhancing the content conveyed in the feedback and furthermore contributing towards collaborative critical reflection (Dougiamas & Taylor, 2003). In addition, Dougiamas and Taylor (2003) found that peer-ratings allowing participants to rate comments using a scale of showing mostly connected knowing to mostly separate knowing also developed participants' abilities to collaboratively critically reflect. This feature would particularly be of value to the peer feedback tool. Lastly, the use of pre-task modelling videos for tasks for collaboration, reflection and feedback could also be embedded in the FeedbackFruits platform to develop students' understanding on the importance of the tasks to the learning process and how to effectively carry out these tasks. Pre-task modelling using videos have been shown to positively impact on the learning process (Bandura 1986; Kim & McDonough, 2011).

TABLE 5. The challenges and corresponding recommendations in using educational technologies to support opportunities for collaboration, reflection and feedback.

Tool(s)	Learning process promoted	Challenge	Recommendation(s)
Skill Feedback Assignment Feedback	Feedback	Time consuming for educators to provide detailed feedback	Introduce a comment bank with relevant terms for educators to use when providing feedback.
Group Member Evaluation Peer Feedback	Feedback	Miscommunication and interpretation of feedback.	The ability to given feedback in multiple formats, incorporating non-verbal feedback A library of emoticons and an editor (allowing fonts, colours, layout) to enhance opportunities for adding rich 'body language' to reflections.

Interactive Video Interactive Documents Interactive Presentations Group Member Evaluation Peer Feedback	Feedback Reflection	Student providing shallow feedback and reflections.	Online models of feedback and reflections given and an explanation of how it can deepen the learning process. Introduce a comment bank with relevant terms for students to use when providing feedback. Tools for peer-rating were added to feedback area, allowing students to rate each form of feedback given using a scale ranging between shows mostly connected knowing and mostly separate knowing.
Study Material Comprehension	Collaboration	Students not executing collaborative activities appropriately, sharing work instead.	Online explanation on the educational theories supporting collaborative work.

6.1 Evaluation and limitations

During the times of the interviews, I was involved in the educational development of FeedbackFruits learning activities and interacted with educators who already had used the tool in their courses. This is a clear limitation as my research position may have impacted on the information shared by the interview participants. All participants in this study were keen academics who were motivated by the idea of introducing new pedagogies and technologies to the classroom to benefit the learning of their students. The comments shared here by the educators cannot be regarded as representative for an average tertiary educator population.

To improve the reliability of this study, more than one person would have been consulted to review the coding. Furthermore, a larger sample size would have been used that is more representative of the FeedbackFruits educator community as this would provide more information for the analysis. Three male educators working in the Netherlands were interviewed for this study. A further development would be to interview more educators using FeedbackFruits at an international level to gauge the extent to which culture impacted on opportunities for collaboration, feedback and reflection. All had substantial teaching experience and exposure to the FeedbackFruits tool. Furthermore, this study could have been carried out throughout the year to gain a more realistic view on how the tool was being used to promote opportunities for collaboration, feedback and reflection. Statistical data reviewing the usability of the FeedbackFruits tools would also enrich this study and might identify areas for further development. Lastly, gaining the opportunity to interview the student population of FeedbackFruits users would be valuable in determining whether or not their perspectives of the collaboration, feedback and reflection were in alignment with the educators' claims. This would also further assist in determining what might contribute towards the gulf in students' understanding of how to effectively collaborate, feedback and reflect. This could be achieved through the combined use of quantitative data (e.g. surveys) to support the qualitative data collected to gain a clearer picture on their perspectives and the learning situation.

During the investigation, it was noted that the strengths and challenges of all FeedbackFruits tools features had not been explored. Furthermore, at the time of research, FeedbackFruits had just introduced live, interactive presentations and was developing a feature for anonymity. An area to explore in future would be to see how all the current and new features impacted on the depth of collaboration, feedback, and reflection amongst students.

Despite the limitation shared here, this dissertation has presented educators' perceptions on the experiences of their students of collaboration, reflection and feedback. Furthermore, it has shed light on the strengths and challenges of the FeedbackFruits tool in promoting opportunities for collaboration, reflection and feedback. The information obtained from this study is valid and reliable as it is transferable and relevant to other educators working in similar contexts.

No significant ethical issues arose from the carrying out of this investigation.

7   CONCLUSION

Literature suggests that deep learning experiences where higher-order thinking skills are applied involve the promotion of opportunities for effective collaboration, feedback and reflection. While this relationship has been well appreciated, there is a need for educators to gain further information on how these opportunities can be best promoted, particularly when educational technologies are concerned. The effective use of educational technologies to maximise opportunities for collaboration, reflection and feedback is important as it is crucial in developing the twenty-first century competencies and skills of students. This study has provided some examples of how opportunities for collaboration, reflection and feedback can be promoted with the use of educational technologies.

In this dissertation, educators' perspectives on students' experiences of using an educational tool have been analysed. This was made possible through the support of semi-structured interviews. This research has shown the various learning outcomes of collaborative work, feedback and reflection. It has highlighted the interacting factors that contribute towards the effective execution of collaboration, feedback and reflection. The suggested approaches outlined for promoting opportunities for collaboration, feedback and reflection are all constructivist approaches. It also has presented the challenges which include the educators' expectations, the students' response and the learning environment. The greatest challenge reported involved students being unclear on the educators' expectations for the carrying out of tasks involving feedback, reflect and collaboration. As a result, such tasks were often met by students with low motivation and thus student disengagement. This barrier can be overcome through the provision of effective scaffolding. These results can be used to furthermore develop the FeedbackFruits tool to maximise opportunities for feedback, collaboration and reflection. Lastly, educators using educational technologies can use the findings presented in this study to promote deeper learning experiences amongst their students and foster their twenty-first century competencies and skills.

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