Promote Learning Survival Skills Through Technology Integration in Course Design

Mari van Wyk, University of Pretoria, South Africa*
Kimera Moodley, University Pretoria, South Africa

ABSTRACT

In an integrated, dynamic, and ever-changing world, it is imperative that students are able to transition between jobs irrespective of qualifications. Studies show that graduates are inadequately prepared for the working world. In an attempt to address this need, a postgraduate certificate course was redesigned to follow a constructionist approach integrated with mobile technology. Data were collected from two learning designers and 29 students, forming a qualitative study. An evaluation of the activities and learning survival skills in the course was done using the technology integration matrix (TIM). The results indicated that technology was integrated on various levels, and students achieved a multitude of skills, making them more confident in their use of technology. Feelings of anxiety, incompetence, and resistance were transformed to resilience, motivation, and comfort. The art to address graduate preparedness for work lies in effective course design and a constructionist forward-thinking approach to learning.

KEYWORDS

21st Century Skills, Constructionism, Course Design, Learning Survival Skills, Mobile Technology, Technology Integration, Technology Integration Matrix, Technology Use

INTRODUCTION

The term "survival skills" refers to techniques and methods that are used to sustain living in a natural environment. "Learning survival skills" are the skills needed to sustain effective and efficient learning in an environment that is conducive to learning. Wagner (2008a) describes learning survival skills as 21st century skills that are crucial for successful graduates to survive in the job market today. The intertwined relationship between learning survival skills and 21st century skills is demonstrated when comparing the several educational frameworks (for example: P21 Framework, Tony Wagner's Seven Survival Skills, EnGauge Framework from Metiri/NCREL) that were designed over the last decade and realizing that both survival skills and 21st century skills are developed within these frameworks (Dede, 2010; Hanover Research, 2011; Metri Group, 2003; Wagner, 2008a). The value of learning survival skills elucidated by Wagner (2008a) and Crockett et al. (2011) reveals that students leaving school in the current era will require teaching and learning to be designed in such a way that this skill development is embedded in activities and they gain authentic experiences. A crucial part of this skill development stems from the integration of technology into learning experiences.

*Corresponding Author

The exponential growth of technology development demands radical learning survival skill development sustainability to create life-long learning with technology integration (Wagner, 2008a). Technology integration in course design needs to be viewed panoramically taking into consideration the design approaches, the facilitation strategies and the student response or experience (Davies & West, 2014). This article focuses on the use of mobile technology on various levels by the learning designer, facilitator, and student, while the shared goal is to enhance learning survival skills in a constructionist approach. The constructionist approach, based on the work of Papert (1980), views learning as a process of discovering, building knowledge, and creating real-world objects based on what is already known. With this approach, students are not only engaged with real-world situations and tasks, but also learn by doing (Cocciolo, 2011; Paramaxi et al, 2013; Papert, 1980; Sirisopon & Sopeerak, 2013).

The integration of technology in course design, influences the course design and the student experience in a course. Technology plays a prominent role in education and is used in various ways (Waddell, 2015). It can be utilized for communication, distributing information, and creating artifacts to host eLearning programs, to name but a few (Frezzo, 2017; Raja & Nagasubramani, 2018). Subsequently, technology is seen as a tool that can be used to develop the sought-after learning survival skills that our students lack (Frezzo, 2017). 21st century students need skills that include the popular 4Cs for education (collaboration, communication, creativity, critical thinking) as well as the use of ICT for learning, self-regulation, innovation and solving real-world problems (Bray, & Tangney, 2016; C21 Canadians for 21st Century Learning & Innovation, 2012; Stauffer, 2020). The conglomeration of these skills constitutes learning survival skills.

BACKGROUND TO THE STUDY

The course examined in this study was part of a Postgraduate Certificate in Higher Education and was designed based on constructionist principles (Papert, 1980). Instruction was minimised and students had to explore technology, learn how the technology works, determine how it can be applied in their context, do the activities and present what they developed in the process to their peers. This process was repeated throughout the course for the majority of the activities. At the end the students needed to create a website (for their current teaching practice) and add all these artefacts (for example, interactive video, infographic, interactive PowerPoint, YouTube video, eBook, quizzes) to the website as a showcase of what they had learned and built throughout the course. Therefore, the activities were planned by the learning designers in such a way that they gradually progressed from easier activities to activities where more advanced functionalities of technology were used.

For example, they began with making an animation video and publishing it on YouTube. In a later activity, sourcing a YouTube video and adding interactions to the video. In the next week, creating a PowerPoint presentation, adding interactions (similar to those they did in the interactive video) to the PowerPoint and then lastly using the hyperlinks that they used in the interactive presentation to create a PowerPoint game. In each case the students built on what they already learned in the previous activity. At no point did the facilitator teach the students how to do the activities, they needed to rely on their own skills, resources provided and self-explored and peer collaboration. Since this was a course about eLearning, the nature of the activities relied heavily on the implementation of technology. Based on the informal feedback we received from students, they learned a great deal during this module and that made us curious to investigate how technology integration influenced learning and skills development. To address the research question "How does technology integration in course design promote learning survival skills?" we asked the students to complete a survey. From the survey results we wanted to know how technology integration relates to a technology integration framework (TIM) and what learning survival skills were developed, without asking students "what skills did you develop?"

LITERATURE

Higher Education is confronted with the dilemma of preparing students for the world of work (Mungal & Cloete, 2016). However, two decades into the 21st century we still read blog posts (Stauffer, 2020; Wabisabi learning, 2020), articles (Rayna & Striukova, 2020; Valtonen et al., 2021) and books (Stanley, 2018; Yang, Huang & Spector, 2019) on how to promote 21st century skills. Employment is currently so volatile (Tran, 2018), that educators cannot foresee what the future will look like, nor what skills the graduates will need (Bell, 2016; Suleman, 2016). In addition, technology plays a pivotal role in tertiary students' lives (Heltai, 2016) and thus it is worthwhile to pay attention to the role integration of technology plays in course design.

Learning Survival Skills

Conventional teaching models are currently being transformed to accommodate the demands and dynamic needs of the workplace. This transformation promotes the sustainability of 21st century education (Bell, 2016). This brings about a change in focus for 21st century education to develop skills that will allow students to become productive citizens (Wagner, 2008a). Although many frameworks and lists exist that mention 21st century skills and learning skills, this study will focus on the seven learning survival skills coined by Wagner (2008b). Wager asked various presidents of companies "What skills are you looking for when hiring young people?" Based on their answers, Wagner (2008b) came to the conclusion that the following skills are not negotiable and young people need to have them to survive in the world of work.

1. Critical thinking and Problem solving.
2. Collaboration and Leadership
3. Agility and Adaptability
4. Initiative and Entrepreneurialism
5. Effective Oral and Written Communication
6. Accessing and Analysing Information
7. Curiosity and Imagination (including creativity - Wagner, 2008b)

Although this list of learning survival skills might not include all the possible skills, it gives a good representation of what are seen as prominent skills that students and graduates cannot be without. This list of skills will be used to indicate the learning survival skills in the analysis (e.g., as integrated into Figure 3) and is also visible in Appendix A.

Even though there is rapid development of technology, increased access to decent technological devices, advanced and easy access to the Internet and existing popularity amongst students to use desired channels such as YouTube (Heltai, 2016; Humphrey, 2016), there is still a challenge for educational institutions to incorporate educational technology as part of their teaching and learning strategies. Although not developed for education, the omnipresence and ambiguous nature of mobile devices gives course designers the opportunity to incorporate mobile technology in such a way to facilitate effective online learning (Raja & Nagasubramani, 2018). Within the South African context, where socio-economic factors such as poverty, load shedding and the impact of COVID-19 are rife (Sekyere et al., 2020), teachers continue to enhance their skills and the skills of their students by developing content that promotes the active use of educational technology.

The teacher's task is to develop skills, incorporate technology, expose students to higher order thinking and ensure that they learn the content that they are supposed to know. Bell (2016) emphasizes that teachers need to include skills that challenge students' ways of thinking (creative, critical, decision making, problem-solving and learning), their ways of working (communication and collaboration) and tools that they work with such as ICT tools and information literacy tools. A possible way to

allow students to learn and develop learning survival skills is through the integration of technology in course design.

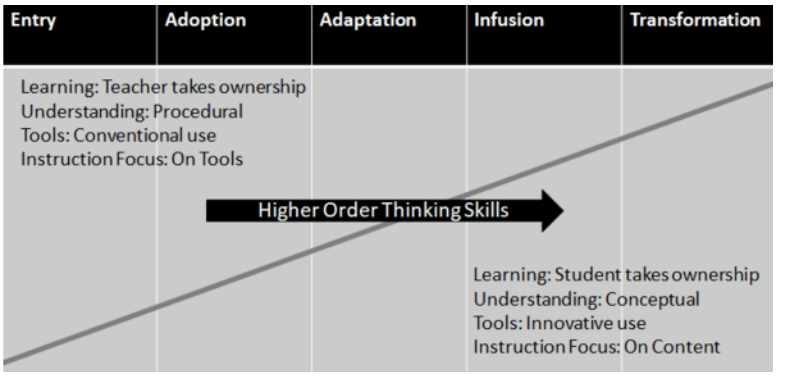
Technology Integration Models

There are a variety of theories, models and frameworks that can be used to explain technology integration. One theory that is linked to the integration of technology is connectivism. Connectivism, as propagated by Siemens (2005), is the connections and flow of information that creates knowledge rather than internal individual activities. Learning then becomes the ability to connect to nodes of information sources. A well-known technology integration model is the Substitution, Augmentation, Modification, Redefinition (SAMR) model, which focuses on the enhancement of teaching with technology and the transformation of technology (Puentedura, 2014). The model provides a framework to identify and evaluate technology-based activities and improve integration of these emerging technologies into everyday teaching (Hilton, 2015). It is used to develop, design and infuse digital technology. Another example is the well-known Technology, Pedagogy, Content Knowledge (TPACK) model, which describes the intersections of Technological knowledge, Pedagogical knowledge and Content knowledge in an attempt to capture the nature of technology integration (Koehler & Mishra, 2007). Defined by Gür and Karamete (2015, p. 779) as "a systemic approach to joining technical expertise in teaching with pedagogical content knowledge". When integrating technology, TPACK focuses on how to use digital devices such as computers, tablets, mobile phones, and the relevant software.

In this study, the researchers choose to focus on the Technology Integration Matrix, also known as TIM. TIM describes the optimization of technology integration for deep learning (McVeigh-Murphy, 2019) and describes both the learning and the technology in detail, while adding the aspect of learning survival skills development. In TIM, the 5 levels of technology integration relate with the 5 characteristics of meaningful learning, creating a 5 x 5 matrix resulting in 25 cells, where each cell describes a characteristic of that level (Harmes et al., 2016). TIM specifically focuses on pedagogy and the pedagogical approach that you use for technology integration. However, it is not specific to hardware or specific lessons, but examples can be integrated in the matrix (Welsh, 2013). The matrix can further be divided (diagonally) with the upper triangle relating more to a teacher controlled or teacher centered learning and the bottom triangle relating more to student centered learning (Figure 1). Therefore, indicating a continuum ranging from teacher centered to student centered learning. In addition, there is a shift from procedural understanding to conceptual understanding, which results in a transference to higher order thinking (Welsh, 2013).

As soon as educators start talking about higher order thinking, they would like to know how TIM compares with Bloom's revised taxonomy (Anderson et al., 2001). Although it is possible to map the two, Bloom's revised taxonomy refers to thinking skills while TIM refers to how to use technology,

Figure 1. Level of technology integration



which also involves lower and higher order thinking while using technology (Winkelman, 2020). In TIM, lower order skills relate to when students use technology at the entry level, and they tend to use it as it was designed for, while in the latter levels, it is used in a more innovative way which includes higher order thinking skills. These levels of technology integration are illustrated in Figure 1.

METHODOLOGY

A qualitative case study design within the interpretivist paradigm was followed. This focused on the single case of course design by understanding how the different role players impact on the successful integration of technology. The sample consisted of 29 students and four learning designers. Applying constructionist principles to the learning design, four learning designers (who also filled the roles of curriculum developers, instructional designers and facilitators) created a course for a Postgraduate Certificate in Higher Education. This course was aimed at promoting computing and eLearning knowledge and skills to students in any education, training and development occupation. Purposeful sampling was used to ensure that data received would provide a holistic view of course design (Palinkas et al., 2015).

Data was collected using a focus group discussion (via Google Meet) with two of the four learning designers (not the researchers) based on their intention of why and how they developed the various activities (Breen, 2006), an electronic survey, completed by the participants, to evaluate if the course design did in fact promote the skills intended (Cohen et al., 2007) and by evaluating the course activities against the TIM to ensure variety in technology level integration. Subsequently, the list of activities was analysed and learning survival skills, as mentioned in the literature review (numbered 1 - 7), were linked to each activity. These were either skills identified by the learning designers or mentioned by the students (see Appendix A). The focus group discussion covered the thinking behind the design of the course in terms of group work, peer assessment, technology use, and the promotion of learning survival skills. The course activities were evaluated against the TIM to compare the levels of technology integration across the various activities and ensure variety in terms of matrix levels in the activities. The survey addressed various aspects of student experience in terms of individual and group work activities and the best practices of teaching and learning approaches. To ensure anonymity, pseudonyms are used. The two learning designers will be referred to as [LD1] and [LD2] while the students will be referred to as [P], ranging from [P1] to [P29].

Data Analysis

Data was therefore inductively (student survey, activity list and skills identified) and deductively (focus group) analysed to confirm if the intended skills to be developed by the course design and teacher perceptions were actually achieved by the students. The focus group questions were designed around the research question. Learning designers responded to questions about the design of the module, the promotion of learning survival skills and the integration of technology. These responses of the two learning designers were grouped into the three themes where we looked for commonalities or differences.

While the research question that governs the study refers to technology integration, course design, and learning survival skills, the researchers focused on the data analysis around those themes. The survey was initially designed as an electronic course evaluation questionnaire published in the learning management system and completed by the students directly after completion. Therefore, some of the questions did not relate to the purpose of this study. Responses to questions that focus on the course design, the use of technology, group activities, peer support and exposure to tools and mobile devices were grouped together and quotes were highlighted. These themes were logically organised and presented as the findings of the study.

The researchers examined the list of activities that the students had to do and then matched it with the characteristics of meaningful learning environments and levels of technology integration of TIM. If it matched, then the activity was plotted in the corresponding cell.

The seven learning survival skills (Wagner, 2008b) (numbered 1 - 7) were linked to each one of the activities when a student referred to any of these skills while giving weekly feedback or responded to the questions in the survey. The researchers, in their capacity of both researchers and learning designers, looked at each of the activities and, based on their opinion, plotted skills next to the activities.

FINDINGS AND DISCUSSION

The findings of the focus group discussion with the two learning designers highlighted several aspects that were considered in the design of the course. The learning designers highlighted the benefits of group work. They explained that group work provided students with diverse perspectives where they could learn from one another and support and motivate each other. This would in turn create a learning community where they felt safe to discuss their challenges and plan and work together. Surprisingly, both learning designers also mentioned the aspect of creating a comfortable, safe learning environment for students to work together. This aligns well with the characteristics listed in the TIM and the intention of developing learning survival skills.

The learning designer's idea behind including peer assessment was to stimulate students to critically review each other's work and judge the quality of the resource created. In doing so, they evaluate and engage at a deeper level, identify flaws, provide constructive feedback by making informed judgements and grow together. They felt that "*peer assessment, it's kind of stimulating for the students what they'll have in the world of work*." [LD1] These authentic learning experiences would equip them with the learning survival skills to cope with similar situations.

Integrating technology into this course has been a well thought through exercise for the learning designers. They describe the value of producing an artefact, presenting something, working towards a final product, to be truly student-centred and engaging, which are all characteristics of constructionism as mentioned earlier by Papert and Harel (1991) and Resnick (1998). [LD2] mentioned that the use of a variety of technology tools is more than just the use of technology. She explains that "*you critically think about the technology that you add… you have to analyze what what is, what is available from this tool, and then you have to put your thoughts … in it*". She continues and adds that the module was designed that students

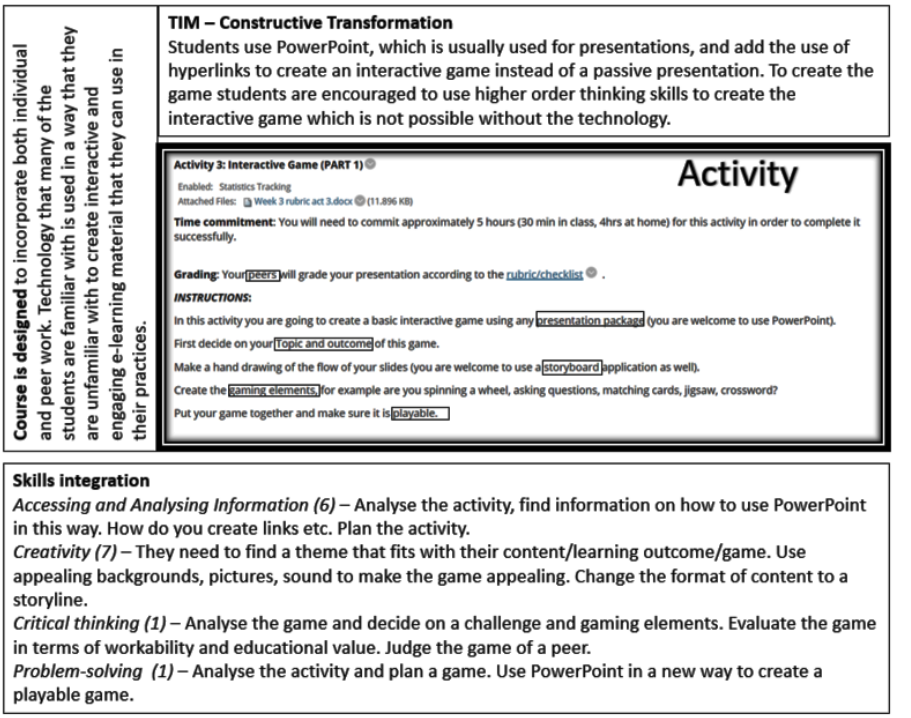
"have to work together on certain artefacts, they are actually developing their collaboration skills because they have to. They have to negotiate, about whose idea they are going to use and how they're going to incorporate it. They have to communicate effectively, and they have to think critically and creatively to be able to do the assignments as we've structured it".

She [LD1] agrees and further discusses that

"there are other skills, such as life skills, social skills and taking initiative and flexibility, which definitely, I think emerged in the course. It wasn't necessarily planned, but our students certainly had to navigate their way around being a bit more flexible, working in groups, sometimes taking the leadership role and other times knowing when to stand back and motivating each other. And then also in terms of literacy skills, students definitely developed like information media and technology skills due to the content that we covered in the course."

Below is an example of how an activity is designed and how it relates to the technology integration matrix as well as the learning survival skills involved (Figure 2).

Figure 2. Example of an activity and its relations to technology and learning survival skills integration

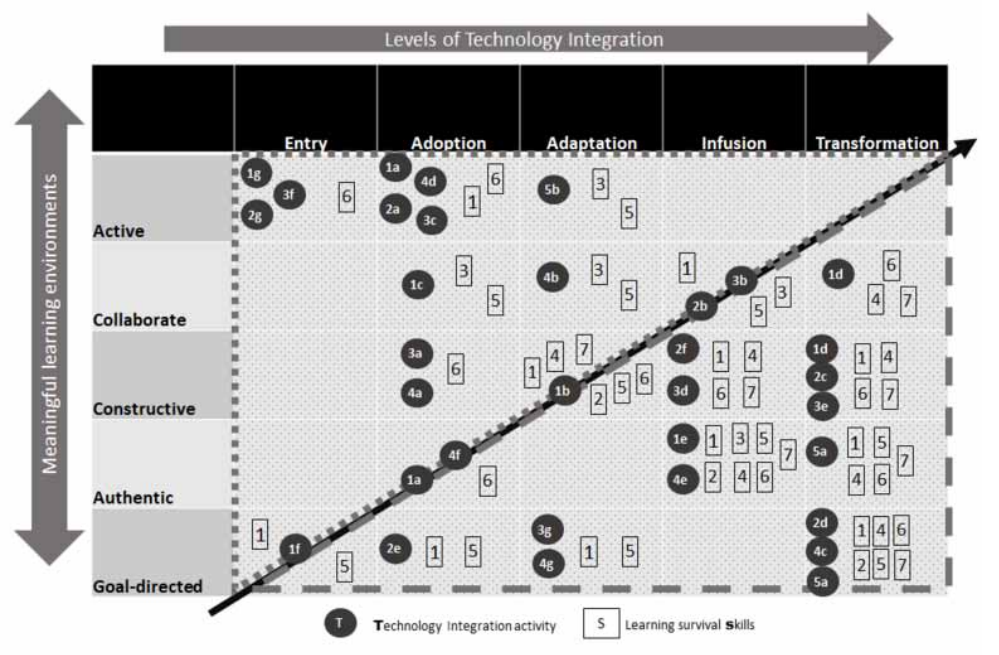


LD1 claims that this occurred because of the content and the constructionist approach. Several researchers claim to have found similar learning survival skills to be valuable (Bray, & Tangney, 2016; C21 Canadians for 21st Century Learning & Innovation, 2012; Stauffer, 2020).

In order to analyse course design it was important to examine each activity and plot the activities on the TIM. This would indicate the levels of technology integration that were achieved, the characteristics of the learning environment and also an indication of the amount of higher order thinking skills. By analysing the activities, the researchers were then able to identify the intended learning survival skills that they hoped to achieve and then use the student reflections and learning designer reflections to unpack whether the intended skills and actual skills achieved showed some similarity.

Appendix A reflects the activities that were designed. Even though the course ran for 14 weeks, the course was designed to reflect the 4 face-to-face sessions to give students sufficient time to complete the online and face-to-face activities. Week 5 was used to demonstrate and assess the final assignment. Each activity (T) was numbered *nx*, where *n* is the number of the week, and the *x* the number of the activity. For example, *1g* would mean week 1, activity g. A summary of the evaluation of the activities using the TIM is given in Figure 3. The activities were classified according to the level of technology integration and its meaningful learning environment and plotted on the matrix. For example, activity 1g, 2g and 3f were all on the entry level of technology integration and in the active learning environment. These three activities were all reading activities. Students use the tool (learning management system) to access the reading material. In another example 3g and 4g were on the adaptation level of technology integration and in the goal-directed learning environment. These activities are both blog reflection activities. Students use the blog function of the learning management system independently to reflect on their weekly activities and plan how the use of technology can help them in their own workplace as an instructional designer (Appendix A).

Figure 3. Summary of the learning activities plotted on TIM



After the researchers had plotted the level of integration of the activities on the technology integration matrix, it was clear that there was a balance of lower order and higher order thinking activities. Focusing on the levels there are more activities towards the end (transformation) than on the entry level. This is most suitable for this course since it is designed at a higher NQF level (7). As this course aims to develop the eLearning skills of the students, a high emphasis is placed on the use of apps, technology, and mobile devices to create eLearning material and an eLearning environment. This technology-rich course challenged students to use a variety of technology and the learning designers stayed away from using technology that was used in previous courses. Therefore, the idea is not to entirely move away from entry level but to scaffold the technology integration in the learning activities away from using it the conventional way, which is mostly dependent on the facilitator, towards using the technology in innovative ways, independent from the facilitator. This technology scaffolding process is evident in the design of the activities and the intended learning survival skills to be achieved.

Each level of the learning activities is equally represented except for the authentic level, which is an indication that although the researchers thought the students were applying it in their natural working environment, it might be that they were applying it mostly in their natural learning environment. This is an aspect that the learning designers can pay more attention to. One example will be to ask them in their reflection to indicate how they could implement what they have learned in their working environment or to design their activity based on content that relates to their work context. The researchers are not surprised that "active", "collaborative" and "constructive" featured strongly. The high representation of collaborative activities indicated the "group work" nature of the course. Students had to explore new technologies and apps and many times found support in their peers.

The researchers were not only interested in the technology integration, but also what learning survival skills (as mentioned by Wagner, 2008b) featured in the student feedback. These skills were isolated from the student survey responses and then plotted next to the related activities, it was clear that skills that relate to basic accessing and analysing information (6), communication (5), critical

thinking (1) and adaptability (3) were mostly linked to the activities that lie towards the more teacher-controlled environment as well as lower order thinking activities.

Although the researchers do not claim that complex activities = variety of skills, in this study it seems as if activities towards higher order thinking, transformation and meaningful learning environments create fertile ground for the integration of skills, consciously or unconsciously. All the skills on our list featured repeatedly in the higher order thinking activities except agility and adaptability (3) and leadership (2). Agility and adaptability (3) refer to the ability to adapt to changing work, using a variety of tools and skills, while leadership plays an important role in influencing teamwork in the volatile work environment (Hanover research, 2011). Although the skills don't have a presence, there is more than enough evidence that, when doing these activities, the participants practiced a variety of skills and constantly adapt to each new activity that they do over the course of the module. Both agility and adaptability (3) and leadership (2) fall under the skills called life and career (employability) skills (Hanover research, 2011). A possible reason why these skills don't feature prominently might be that the participants and the learning designers' mindset was more towards the "learning" than the real-life or work environment. Irrespective of not involving all the skills, the plotting of the technology and the skills on the TIM highlighted the integrated nature of skills during more complex activities.

Student responses showed extensive appreciation for the course design, group activities, support from their peers, exposure to new technology and mobile apps. Without directly asking them, they indicated in their reflections how learning survival skills were developed through this constructionist approach. They further mentioned that they now have the confidence to explore e-learning tools independently to sustain their learning survival skills.

With regards to the course design, students had an overwhelmingly positive experience, indicating that although it was challenging [P16], they appreciate how it was designed [P4], especially the scaffolding of learning [P23]. The manner in which the course was designed instigated creativity [P12], allowed for self-regulated learning [P24], built their skills [P23] and allowed them to have fun [P10]. They enjoyed the course [P20] and learned a lot [P3]. However, a few students did experience the course design as daunting because of the high number of activities [P17], steep learning curve and time limitations [P15]. The constructionist nature of the course was new to them and although some adapted quickly, some felt that they needed to be taught [P5].

The classes were interesting. The structure of the course is well designed. Every assignment and task assists you in completing the final exam which is good. [P5]

Researchers have reached consensus that graduates have good ICT skills (Anyim, 2018; Suleman, 2016) and that was evident in the student reflections. Most of them were comfortable using computers [P4] and the learning management system of the university [P29], but the exposure to the variety of free applications available on the Internet frightened and overwhelmed them [P9]. Students heavily leaned on one another and claimed that they are in this boat together and together they figured out how the technology worked [P24]. Not only were they each other's support but they also motivated each other to use technology in a variety of ways creating an effective community of practice for sustainability of learning survival skills.

The tools that I have discovered in this course have changed my approach. Every tool has challenged my thinking and I can incorporate these tools into my own classes for clear educational benefit, rather than for the sake of technology alone. [P28]

The students appreciated the variety of tools [P3] and acknowledged that it stimulates interaction, engagement, excitement [P13] and creativity [P29]. Although students know the technology, a small group of the students struggled [P8] and expressed frustration in trying to figure out how the

technology worked [P15], while others complained about the large number of technologies and apps that they need to use [P17]. Even though some struggled, they kept on trying to turn their frustration into empowerment [P10].

While the course was about eLearning for Computers, many of the applications were designed for mobile devices. Applications such as social media tools, student response systems, mobile LMS, apps are designed to be used on mobile devices. The content was also chunked in such a way that it can be absorbed over shorter time periods which give our part time students the benefit of working in bursts of time. Students experienced the benefits of working with mobile devices when they claim that they can learn any time of the day [P24] wherever they are [P3] with information always at hand [P26].

The students' attitude towards the use of the course also changed. As they experienced the technology, the group work, the constructionism and personal growth they became comfortable in using new technology. They appreciate technology more [P5], are much more aware of the benefits [P6] and indicate that they have changed their teaching style to incorporate technology [P7]. They are inspired [P19] and realise that they can do a lot of things by themselves [P16].

The students appreciated the involvement of their peers in their learning experience. They were fascinated by how well they learned from one another [P1]. They supported, helped and shared their knowledge, frustration and experience and in doing so created a learning environment conducive for learning [P6], [P12].

I honestly do not think I could have made it without them. [P9]

Working with their peers in this course let the students realise the importance of a learning community [P1]. Motivation [P7], positive attitude [P14], encouragement [P14], enthusiasm [P16], support [P8] all form part of their learning experience. This supportive environment and constructive feedback created a positive learning experience for the students.

In this study, learning survival skills were not mentioned in either the instructions in the activities nor the survey, but the participants did recognise that these survival skills are embedded in their activities and mentioned that the course design did promote these skills.

…beauty of hindsight is available to us now, as we review the design of the course it is structured to help develop the skill (although scary). [P23]

The participants focused on essential learning survival skills surfaced when the participants gave feedback about the course design. For example [P13] and [P20] commented:

I found it (design) very useful and interactive. It opened up my creative side and challenged me to be more present and focused. I enjoyed it. [P13]
… it helped me to think critically and solve problems on my own. [P20]

Although the participants mentioned many of the listed learning survival skills, the learning designers also agreed that subconsciously, they embed the learning survival skills in the design of the activities. For example, various activities were designed in such a way where students need to access and analyse information and compare applications to determine whether it is fit for the purpose. While this course leaned heavily on peer work, leadership and initiative played a crucial role in the success of the peer activities. Learner designers also deliberately try to embed reflective practices where students had to reflect weekly on what their learning experiences were during the week. A complete list of the skills that was used and linked to the activities by either the participants or the learning designer can be seen in Appendix A.

Based on the results from the focus group discussion with the learning designers, the evaluation of the activities against the TIM and the student reflections it was evident that the intended knowledge and skills by the learning designers were achieved by the students. It is important to note how well the activities were aligned to the TIM and how the design of the activities was structured within constructionism. The learning environments created using technology promoted the development of learning survival skills almost organically with little focus on actually trying to develop those skills. Additional skills that are required in the workplace today were also developed and scaffolded learning further to enhance and transform the learning experience. The students' responses suggest acknowledgement and appreciation for the challenging aspects that the course offered as they became aware of the value in the experience that it gave them. This aligns well to the works of Bell (2016) who highlights the importance of sustaining 21st century education. Other learning survival skills were visible in the nature of communication between the students. The netiquette, respect for different opinions, subtle humour and Ubuntu[1] practiced in the discussion forums demonstrate an understanding of cultural awareness within different contexts.

CONCLUSION

In addressing the research question the researchers realized that the perspectives of the learning designer, evaluation of the course design and student responses collectively give a holistic understanding of the effectiveness of course design. In this study a constructionist course design, with a strong emphasis on peer activities, peer support and peer motivation, coupled with unconventional use of technology and higher order thinking, unknowingly initiated learning survival skills development. Due to course design, students admit that learning survival skills such as creative thinking, collaboration, communication, and critical thinking, were developed. These skills were scaffolded throughout learning activities that are developed around authentic learning environments, student centred approaches and deep experiential learning that caters for creating, designing, developing or producing tangible artefacts that have contextual relevance. Thus, technology integration promotes learning survival skills through effective course design. The conventional use of technology disappears when technology is used to instigate higher-order thinking, reaching outcomes that will not be possible without technology.

This study highlights the resilience of learning survival skills development which is the persistent willingness, flexibility and adaptability to continue developing the necessary skills as technology improves and develops, maintaining skill development to remain at the forefront at the workplace. The limitations to this study can be related to the content of the course lending itself to this approach and active use of technology integration. Additionally, the strong qualitative nature of the study and the number of participants makes it impossible to generalise the findings, however, they will be useful to learning designers in a similar environment to the one depicted in this study. It is recommended that similar studies be done with different content to explore how constructionism and the effective use of mobile technology integration can be used to enhance and transform learning experiences and course design.

This research received no specific grant from any funding agency in the public, commercial, or nonprofit sectors.

FUNDING AGENCY

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

C21 Canadians for 21st Century Learning & Innovation. (2012). *A guide for facilitating 21st Century learning*. http://c21canada.org/a-guide-for-facilitating-21st-century-learning/

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Academic Press.

Anyim, W. O. (2018). Assessment of ICT Literacy Skills of Digital Library Users and Staff in Salem University Lokoja, Kogi. *Library Philosophy and Practice* (e-journal), 1801.

Bell, D. V. J. (2016). Twenty-first Century Education: Transformative Education for Sustainability and Responsible Citizenship. *Journal of Teacher Education for Sustainability*, *18*(1), 48–56. doi:10.1515/jtes-2016-0004

Bray, A., & Tangney, B. (2016). Enhancing student engagement through the affordances of mobile technology: A 21st century learning perspective on Realistic Mathematics Education. *Mathematics Education Research Journal*, *28*(1), 173–197. doi:10.1007/s13394-015-0158-7

Breen, R. L. (2006). A Practical Guide to Focus-Group Research. *Journal of Geography in Higher Education*, *30*(3), 463–475. doi:10.1080/03098260600927575

Cocciolo, A. (2011). Situating student learning in rich contexts: A constructionist approach to digital archives education. *Evidence Based Library and Information Practice*, *6*(3), 4–15. doi:10.18438/B8DP6N

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education*. Routledge. doi:10.4324/9780203029053

Crockett, L., Jukes, I., & Churches, A. (2011). *Literacy is not enough. 21st Century fluencies for the digital age*. Corwin.

Davies, R. S., & West, R. E. (2014). Technology integration in schools. In *Handbook of research on educational communications and technology* (4th ed., pp. 841–853). Springer New York. doi:10.1007/978-1-4614-3185-5_68

Dede, C. (2010). Comparing frameworks for 21st century skills. *21st century skills: Rethinking how students learn, 20*, 51-76.

Frezzo, D. (2017). *The role of technology in the education of the future*. https://www.weforum.org/agenda/2017/05/science-of-learning/

Gür, H., & Karamete, A. (2015). A short review of TPACK for teacher education. *Educational Research Review*, *10*(7), 777–789. doi:10.5897/ERR2014.1982

Hanover research. (2011). *A crosswalk of 21st century skills*. https://www.montgomeryschoolsmd.org/uploadedFiles/about/strategicplan/21stCenturySkills.pdf

Harmes, J. C., Welsh, J. L., & Winkelman, R. J. (2016). A framework for defining and evaluating technology integration in the instruction of real-world skills. In S. Ferrara, Y. Rosen, & M. Tager (Eds.), Handbook of research on technology tools for real-world skill development (pp. 137-162). IGI Global.

Heltai, G. (2016). *What Millennials' Youtube Usage Tells Us About the Future of Video Viewership.* Comscore. https://www.comscore.com/Insights/Blog/What-Millennials-YouTube-Usage-Tells-Us-about-the-Future-of-Video-Viewership

Hilton, J. T. (2015). A case study of the application of SAMR and TPACK for reflection on technology integration into two social studies classrooms. *Social Studies*, *107*(2), 68–73. doi:10.1080/00377996.2015.1124376

Humphrey, M. (2016). *Survey: Social Video Is Changing Marketing, And Millennials Know How.* Forbes. www.forbes.com/sites/michaelhumphrey/2016/05/26/survey-social-video-is-changing-marketing-but-millennials-know-how/#772f1a7d3e58

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology & Teacher Education*, *9*(1), 60–70.

Kynigos, C. (2015). *Constructionism: Theory of Learning or Theory of Design*? .10.1007/978-3-319-17187-6_24

McVeigh-Murphy, A. (2019). *What we learned from analysing tech integration models*. https://equip.learning.com/tech-integration-models

Metiri Group & NCREL. (2003). *EnGauge 21st century skills: Literacy in the digital age*. NCREL.

Mungal, A., & Cloete, M. (2016). Preparing underprepared students for Higher Education and beyond: The Development and Implementation of an Integrated project. *Accounting Education*, *25*(3), 203–222. doi:10.1080/09639284.2016.1157760

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health*, *42*(5), 533–544. doi:10.1007/s10488-013-0528-y PMID:24193818

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. Basic Books, Inc.

Papert, S., & Harel, I. (1991). Situating constructionism. *Constructionism*, *36*, 1–11.

Parmaxi, A., Zaphiris, P., Michailidou, E., Papadima-Sophocleous, S., & Ioannou, A. (2013). Introducing new perspectives in the use of social technologies in learning: Social constructionism. LNCS, 8118, 554–570.

Puentedura, R. R. (2014). *The SAMR ladder: Questions and transitions*. http://www.hippasus.com/rrpweblog/archives/2013/10/26/SAMRLadder_Questions.pdf

Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, *3*(1), S33–S35. doi:10.21839/jaar.2018.v3iS1.165

Rayna, T., & Striukova, L. (2020). Fostering skills for the 21st century: The role of Fab labs and makerspaces. *Technological Forecasting and Social Change*, *2020*, 120391.

Resnick, M. (1998). Technologies for lifelong kindergarten. *Educational Technology Research and Development*, *46*(4), 43–55. doi:10.1007/BF02299672

Sekyere, E., Bohler-Muller, N., Hongoro, C., & Makoae, M. (2020). *The Impact of COVID-19 in South Africa*. https://reliefweb.int/sites/reliefweb.int/files/resources/The%20Impact%20of%20COVID-19%20in%20South%20Africa_0.pdf

Siemens, G. (2005). *Connectivism: A learning theory for the Digital Age*. http://www.itdl.org/Journal/Jan_05/article01.htm

Sirisopon, N., & Sopeerak, S. (2013). Web-based instruction model under constructionism for critical thinking development. *Procedia: Social and Behavioral Sciences*, *103*, 1309–1318. doi:10.1016/j.sbspro.2013.10.461

Stanley, T. (2018). *Authentic learning: Real-world experiences that build 21st century skills*. Profrock Press.

Stauffer, B. (2020). *What are 21st century skills*. https://bit.ly/3hp5gKn

Suleman, F. (2016). Employability skills of higher education graduates: Little consensus on a much-discussed subject. *Procedia: Social and Behavioral Sciences*, *228*, 169–174. doi:10.1016/j.sbspro.2016.07.025

Tran, L. H. N. (2018). Game of blames: Higher education stakeholders' perceptions of causes of Vietnamese graduates' skills gap. *International Journal of Educational Development*, *62*, 302–312. doi:10.1016/j.ijedudev.2018.07.005

Valtonen, T., Hoang, N., Sointu, E., Näykki, P., Virtanen, A., Pöysä-Tarhonen, J., Häkkinen, P., Järvelä, S., Mäkitalo, K., & Kukkonen, J. (2021). How pre-service teachers perceive their 21st-century skills and dispositions: A longitudinal perspective. *Computers in Human Behavior*, *116*, 106643. doi:10.1016/j.chb.2020.106643

Wabisabi learning. (2020). *The critical 21st century skills every student needs and why?* https://wabisabilearning.com/blogs/literacy-numeracy/skills-every-student-needs

Waddell, J. (2015). *The role of technology in the educational process*. https://education.msu.edu/green-and-write/2015/the-role-of-technology-in-the-educational-process/

Wagner, T. (2008a). *The Global achievement gap. Why Even Our Best Schools Don't Teach the New Survival Skills Our Children Need-And What We Can Do About It*. Basic books.

Wagner, T. (2008b). Rigor Redefined. *Educational Leadership*, *66*(2), 20–24.

Welsh, J. L. (Presenter). (2013, Aug 17). *Technology integration matrix (TIM) and TIM tools introduction* [Video]. https://www.youtube.com/watch?v=zyN9l5LK5uM

Williams, H. S. (2018). *What is the spirit of Ubuntu? How can we have it in our lives?* https://www.globalcitizen.org/en/content/ubuntu-south-africa-together-nelson-mandela/

Winkelman, R. (2020). *Bloom's Cognitive Taxonomy and the Technology integration matrix*. https://fcit.usf.edu/matrix/blooms-cognitive-taxonomy-and-the-technology-integration-matrix/

Yang, J., Huang, R., & Spector, J. M. (2019). *Educational Technology: A Primer for the 21st Century skills*. Springer.

ENDNOTE

[1] Ubuntu refers to humanity towards others and togetherness, "I am because we are" (Williams, 2018).

APPENDIX A

Table 1 reflects the student activities, the TIM levels it was assigned to and the skills that were used and linked to the activities. These skills were either indicated by the learning designers, or *self-reported by the student*s. The number in brackets are from the seven learning survival skills (Wagner, 2008b) used to plot the skills next to the related activities.

Table 1: Weekly activities, TIM levels assigned and skills linked to the activities.

Week	Activity	TIM level	**Skills practiced based on the** nature **of the activity and the** *self-reported* **information from the students.**
1a	Baseline Test	The baseline test was used on the active learning adoption level where students were actively using technology but for conventional methods. Given the nature of the test the questions did not allow for further exploration as this activity was designed to assess the pre-existing knowledge of the students.	Accessing and Analyzing information (6)
1b	Social media apps for teaching and learning	In this activity students had to use a social media app and create a learning activity for their students to complete using as many features as possible and creating an environment for collaboration. This gave them the choice to use the tool at constructive learning adoption, adaption, infusion or transformation level. Whilst some students used the social media apps for mere creation of activities others transformed their learning activities by including other resources that could be accessed via the social media apps and this made the activity unattainable without the use of technology.	Accessing and Analyzing information (6) *Curiosity and imagination (7) [P13, P29]* *Problem solving (1) [P18]* *Written communication (5) [P8]* *Collaboration/Teamwork (2) [P10]* Leadership (2) Initiative (4)
1c	Demonstration of social media apps for teaching and learning	This activity formed the second part of the previous activity. In this part of the activity students were able to share their learning activity with their peers. This was done at a level of collaborative learning adoption, adaption, infusion or transformation. Even though the characteristics of the learning environment stayed the same, the level of technology integration was dependent largely on the level of design in the first part of the activity. This meant that if a student's level of technology was at adaptation in Part 1 (Constructive) then their level of technology for Part 2 (Collaborative) was also adaption.	*Oral communication (5) [P8]* *Adaptability (3) [P1, P9]*
1d	Animated videos	This activity was a combination of constructive learning transformation and collaborative learning transformation. Students were required to create an animated video, giving them the freedom to explore on their own and create an artefact that would not be possible without technology use, then use that artefact to communicate information through a collaborative process that used other resources.	Accessing and analysing information (6) Imagination (7) Initiative (4) *Curiosity and imagination (7) [P13, P29]*
1e	Learning theories infographics, test and memorandum	For this activity students were expected to work on an authentic learning infusion level. They were expected to research learning theories, create an infographic to demonstrate their understanding, create a test for their learning theory and provide a memorandum to this test. The aim of the activity was to give students a meaningful activity that they could make the link to their context.	*Critical thinking (1) [P18]* Accessing and analysing information (6) *Collaboration (2) [P24, P26]* *Adaptability (3) [P1, P9]* *Written and oral communication (5) [P8]* *Collaboration/Teamwork (2)[P10]* Leadership (2) Initiative (4)

Table continued on next page.

Table 1 continued

Week	Activity	TIM level	Skills practiced based on the nature of the activity and the *self-reported* information from the students.
1f	Blog - Reflection	The reflection blog was designed to allow students to reflect on their experiences of using technology and on the knowledge and skills they acquired from each activity. This was a goal-directed learning entry level activity since students were given guided questions with little room to discuss further. The aim was to achieve specific information.	*Written communication (5) [P8]* Reflective and *critical* thinking (1)
1g	Reading list	The reading material in preparation for the next week is on the active learning entry level. The students are reading to prepare for the next week's topics, but they are not actively searching for more information	Access information (6)
2a	Learning theories test	The learning theories test was designed to test the knowledge and understanding that students achieved from the previous week. The test was structured so that it fell in the active learning adoption level where students were actively using technology but for conventional methods. Students did not have the opportunity to explore beyond the tools used in the test.	Access information (6)
2b	Demonstration of infographics, test and memorandum	This activity formed the second part of an activity in week 1. In this activity students had the opportunity to share their activity with their peers at a collaborative learning infusion level. They had the opportunity to demonstrate how they make use of regular tools in their contexts.	*Oral communication (5) [P8]* *Critical thinking (1) [P18]*
2c	Interactive video	This activity was at the constructive learning transformation level. Students took pre-existing videos and added interactives into the video to make it more engaging. The aim of the activity was to demonstrate how an existing tool can be transformed to add interaction. This required students to use their prior knowledge and apply it to the activity to develop a better, more creative artefact.	Accessing and Analyzing information (6) Leadership (2) Problem-solving (1)
2d	Student response system, mindmap and presentation	Even though this was an individual activity, the focus was to design a learning activity that would require students/participants to actively participate and interact with content. This activity was on the goal-directed learning transformation level because the idea of sharing while designing was needed. This meant that students need to think out of the box and ponder on methods of how they perceive their students would respond to tools and resources selected.	Accessing and Analyzing information (6) *Curiosity and imagination (7) [P13, P29]* *Problem-solving (1)[P18]*
2e	Blog - Reflection	This was a goal-directed learning adoption level activity since students used conventional tools to portray their experience and the knowledge and skills that were learned. Guiding questions were again given with the option of elaborating using examples.	*Written communication (5) [P8]* Reflective and *critical* thinking (1)
2f	Preparation for Website assessment	This was part of constructive learning infusion where students had choice and could use their knowledge to build a website. The aim of this activity was to let the creative juices within the student to start flowing and allow room for self-discovery and exploration.	Accessing and Analyzing information (6)
2g	Reading list	The reading material in preparation for the next week is on the active learning entry level. The students are reading to prepare for the next week's topics, but they are not actively searching for more information.	Accessing and Analyzing information (6)
3a	Test on LMS - Quiz (there was a reading in previous week)	The Week 3 knowledge test was used on the constructive learning adoption level where students engaged actively with the learning tools and connected with new information to supplement their prior knowledge. Although they are actively seeking for the answers to the questions they are using the tool in the conventional way to build their knowledge.	Accessing and Analyzing information (6)
3b	Demonstration of interactive video, mindmap and presentation	This activity is the second part of the interactive video activity in week 2. In this part of the activity students were able to share their learning activity with their peers while being assessed. This was done at a level of collaborative learning infusion. The facilitator has provided the learning context while the students could choose which tool they are using.	*Critical thinking (1) [P18]* *Oral communication (5) [P8]* *Adaptability (3) [P1, P9]*

Table continued on next page.

Table 1 continued

Week	Activity	TIM level	Skills practiced based on the nature of the activity and the *self-reported* information from the students.
3c	Rubric Interactive video Assessment of Demo	The rubric tool was used in the active learning adoption level way where the normal functions were used to mark and enter marks (app). The facilitator created the rubric and the mark app, while students use it independently.	*Critical thinking (1) [P18]*
3d	PowerPoint - Interactive presentation	For this activity students work on the constructive learning infusion level. Students were given the learning context and the tool to create an interactive PowerPoint presentation. How they use the tool was entirely up to them. They had to explore the functions of the tool and they had the choice of how to use it.	Accessing and Analyzing information (6) *Curiosity and imagination (7)* Initiative *(4)* *Critical thinking (1) [P18]* *Problem-solving (1) [P18]*
3e	PowerPoint - Interactive game	In this activity the students were challenged to create a game, using PowerPoint. Therefore they had to work on a constructive learning transformation level. They need to use PowerPoint in a completely different way from what they usually do to build this new game, functioning on a creative, higher order level combining PowerPoint functions with logical sequencing.	Accessing and Analyzing information (6) Initiative *(4)* *Curiosity and imagination (7) [P13, P29]* *Critical thinking (1) [P18]* *Problem-solving (1) [P18]*
3f	Mobile learning - Reading	The reading material in preparation for the next week is on the active learning entry level. The students are reading to prepare for the next week's topics, but they are not actively searching for more information.	Accessing and Analyzing information (6)
3g	Blog - Reflection	For the reflections students were expected to work on the goal-directed learning adaptation level. The reflection blog was created and the students used it to reflect on what they have learned and discovered during the week and connect it with how it can benefit / help them.	*Written communication (5) [P8]* Reflective and *critical* thinking (1)
4a	Test on LMS - Quiz (there was a reading in previous week)	The Week 4 knowledge test was used on the constructive learning adoption level where students engaged actively with the learning tools and connected with new information to supplement their prior knowledge. Although they are actively seeking for the answers to the questions they are using the tool in the conventional way to build their knowledge.	Accessing and Analyzing information (6)
4b	Demonstration of interactive game	This activity forms the second part of the PowerPoint game from the previous week. This activity encouraged collaborative learning adaptation. The students demonstrated and played their games in their groups while it was being assessed. The facilitator encourages the students to explore more tools.	*Oral communication (5) [P8]* *Adaptability (3) [P1, P9]*
4c	Mobile LMS App - create classroom	In this activity the students need to create a virtual mobile classroom. They need to choose the technology, create the classroom and activities and test it by enrolling students. This activity allows the student choice, creativity, planning and evaluating their progress. Therefore this activity was on the goal-directed learning transformation level.	Accessing and Analyzing information (6) *Curiosity and imagination (7) [P13, P29]* *Written communication (5) [P8]* *Collaboration (2) [P24, P26]* Initiative (4)
4d	Rubric LMS - Assessment of Demo	The rubric tool was used in the active learning adoption level where the normal functions were used to mark and enter marks (app). The facilitator created the rubric and the mark app, while students use it independently.	*Critical thinking (1)[P18]*
4e	Mobile app builder - create app	In this activity students need to create a mobile app. They had to create an app that can be used in their environment (educational or social). This activity was at the level of authentic learning infusion.	Accessing and Analyzing information (6) *Curiosity and imagination (7) [P13, P29]* Initiative *(4)* *Collaboration (2) [P24, P26]*
4f	e-Book - Reading	Although this was only a reading activity, the students had to read this with their final assessment in mind. The information needs to be used and adapted and implemented later when they develop their own open educational resource. Therefore this reading was on an authentic learning adoption level.	Accessing and Analyzing information (6)

Table continued on next page.

Table 1 continued

Week	Activity	TIM level	Skills practiced based on the nature of the activity and the *self-reported* information from the students.
4g	Blog - Reflection	For the reflections, students were expected to work on the goal-directed learning adaptation level. Students need to reflect on what they have learned and discovered during the week and connect it with how it can benefit / help them in the future in their own workplace as an instructional designer.	*Written communication (5) [P8]* Reflective and *critical* thinking (1)
5a	Website (Final assessment)	The final activity worked on the goal-directed and authentic learning transformation. Students need to independently select tools, and develop open source educational material that can be used in their real-world environment. They need to present it as a website with a variety of tools used. The facilitator encourages creative use of the tools to develop higher order thinking.	Accessing and Analyzing information (6) Initiative (4) *Curiosity and imagination (7) [P13, P29]* *Critical thinking (1) [P18]* *Problem-solving (1) [P18]* *Written communication (5) [P8]*
5b	Website presentation	This activity encouraged active learning adaptation. The students need to demonstrate their website and answer questions while being assessed by the facilitator.	Oral communication (5) *Agility and adaptability (3) [P1, P9]*

Mari van Wyk is a senior learning designer at Comprehensive Online Education Services at the University of Pretoria. She holds a PhD in Computer Integrated Education. She is responsible for instructional design, research and curriculum development. Mari is an alumnus of the University of Stellenbosch, Tshwane University of Technology and the University of Pretoria. Her area of expertise is blended learning, mobile learning, e-Learning, and teaching with technology.

Kimera Moodley is a Senior Learning Designer at Comprehensive Online Education Services and a Lecturer in the Faculty of Education at the University of Pretoria. She holds a PhD in Computer Integrated Education and specialises in the field of Educational Technology. She has experience in face-to-face, online, and blended modes of facilitation. She offers support on accreditation processes, instructional design, curriculum development and online facilitation to Subject Matter Experts.