Journal of University Teaching & Learning Practice

Volume 16 | Issue 3 Article 3

2019

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Recommended Citation

de Jager, T. (2019). Impact of ePortfolios on Science student-teachers' reflective metacognitive learning and the development of higher-order thinking skills. *Journal of University Teaching & Learning Practice, 16*(3). https://doi.org/10.53761/1.16.3.3

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Abstract

A concern in higher education is that most students do not acquire higher-order thinking skills, 'cannot think', are not engaged in reflective student-centred teaching and learning and do not always acquire technology skills. Numerous studies have indicated the importance of a digital learning environment that facilitates the acquisition of IT skills, reflective and critical thinking learning skills while creating an electronic portfolio. To establish the impact of portfolios on the reflective metacognitive learning and the development of higher-order thinking skills in student-teachers (n=167) in the field of science, qualitative and quantitative approaches were used to collect data. The results showed that for the majority of the participants (n=160) it was the first time that they had created an ePortfolio and engaged in reflective metacognitive learning experiences. The researcher was able to identify students' weaknesses and strengths, their interests and goals in life. Most of them regarded the learning process as time consuming, did not wish to share poor learning experiences with others, found it difficult to express their learning experiences in a second language and were unable to create an ePortfolio in an organised manner as they were not capable of metacognitive reflection. This paper is relevant for higher education lecturers in developing students to become independent learners by using an ePortfolio.

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Introduction

A concern in higher education is that the majority of students are not engaged in *reflective, metacognitive,* student-centred teaching and learning (Parkes, Dredger & Hicks 2013), and do not always acquire *technology skills* (Oliver 2011) or *higher-order thinking skills* (Collins 2014). Brookhart (2010) relates higher-order thinking skills to concepts such as problem-solving and critical thinking. Students should not only attain knowledge and skills, but should also be able to apply the knowledge and the critical-thinking and IT skills they have developed, to solve problems in real-life situations (Buyarski & Landis 2014).

Bransford and Stein (1984) write that problem-solving is the process during which acquired information, critical and creative thinking, communication and reflective learning and teaching skills are applied. Reflective teaching and learning can be defined as the process whereby students are guided and supported to critically analyse, compare and adjust their actions and practices to improve and develop their metacognition and critical-thinking skills (Hadley 2007). Smith and Yates (2011) add that metacognition is a skill that students develop to reflect on and monitor their learning strategies and activities to support successful learning. Various studies have indicated that a digital learning environment facilitates the acquisition of IT and reflective and critical thinking, and that these learning skills can be acquired by creating an electronic portfolio (ePortfolio) (Gerbic, Lewis & Amin 2011; Light, Chen & Ittleson 2012; O'Keeffe & Donnelly 2013).

The ePortfolio can be defined as a collection and exhibition of a student's experiences, work, efforts, progress and achievements over a period of time (Pelliccione, Dixon & Giddings 2005; Butler 2006) and includes digital artefacts, written reflections on both formal and informal learning experiences, collaborative assignments, community engagement, research activities and learning achievements (Light et al. 2012). Elaborating on this, Smith and Yates (2011) point out that an ePortfolio enables students to engage in metacognitive learning by reflecting back on learning experiences and the goals they have achieved. Barrett (2007) and Chang, Pao, Chou and Chen (2011) state that ePortfolios not only develop IT skills, but also help students to reach their goals, become independent learners, assess themselves, reinforce their learning skills and communicate with the world. Di Stefano, Gino, Pisano and Staats (2015) postulate that the process of compiling the ePortfolio also provides opportunities for students to develop skills that enable them to evaluate, synthesise, analyse, create and communicate. Light et al. (2012) highlight that students develop higher-order thinking skills by assessing their own progress and reviewing their skills development, and can compare, analyse and draw conclusions from the materials included in the ePortfolio. The portfolio can also be used to evaluate students' formative progress and to execute summative evaluation (Buyarski & Landis 2014). In addition, Miller and Morgaine (2009) maintain that the creation of ePortfolios is important in higher education, as it can support students' metacognitive learning and thinking. Metacognitive thinking occurs when students can monitor and reflect on their own learning activities and processes that contribute to successful learning (Akyol & Garrison 2011).

Various studies on ePortfolios show that the media content used by students and the creation and presentation of their online environment can present evidence of their metacognition and critical-thinking skills (Akyol & Garrison 2011; Miller & Morgaine 2009; Ottenhoff 2011). However, Bornman (2016) points out that in the South African context, educators are mostly unable or ill-prepared to integrate technology into their lessons, as opportunities are not always available for them to participate in professional development. This contributes to a learning barrier for students that

excludes them from reflective technology-assisted learning experiences and the development of the technology and higher-order skills that are applicable in the wider world (Alawdat 2013).

Keeping in mind the numerous benefits of ePortfiolios, the researcher requested students to create their own as a formative assessment activity. The development of their IT and critical-thinking skills and their use of metacognition in learning was assessed based the following research questions:

> *In the reflective process of choosing and compiling from existing artefacts, how did the creation of an ePortfolio contribute to student-teachers' reflective metacognitive learning and the development of higher-order skills?*
>
> *What challenges did student-teachers experience in creating and uploading their ePortfolios on the internet?*

Background

Nearly two decades ago, Klenowski (1998) noted that the process of compiling a paper-based portfolio offered students an opportunity to develop their knowledge and understanding, their ability to analyse, synthesise and apply knowledge and their critical-thinking skills with the cooperation of other students and the educator. In the rapidly changing higher-education environment of the 21st century, the use of ePortfolios is advocated to help students to independently reflect, construct and continuously learn content knowledge (Collins 2014). Koraneekij and Khlaisang (2015) argue that ePortfolios could help students to critically think about and reflect on how they learn, and to employ technology skills in presenting their learning experiences and achievements. According to Jenson and Treuer (2014), an ePortfolio is valuable, as it can be used to document and manage deep and continuous student-centred learning over a lifetime.

A digital portfolio (ePortfolio) is seen as a method for evaluating the development of IT, communication, metacognition, critical thinking and creative skills (Koraneekij & Khlaisang 2015). By creating an ePortfolio, students develop technology skills that allow them to engage in depth with what was learned in a logical and sequential way (Collins 2014). In most cases, students are scaffolded, or mind maps are used to assist them in reflecting on what they have learned in an organised manner (O'Keeffe & Donnelly 2013). Since students have diverse learning styles, Songkram and Khlaisang (2013) suggest that lecturers should encourage them to present their knowledge both verbally and visuospatially. Songkram and Khlaisang (2013) propose that the construction of an ePortfolio should include multimedia experience and learning, which include artefacts such as journals, blogs and concept maps, to deepen students' metacognitive learning.

When compiling an ePortfolio, students require various skills to enable them to reflect on what they have learned. According to Kaplan, Silver, Lavaque-Manty and Meizlish (2013), students should be able to spatially organise, order and select the material that will give coherence to the ePortfolio, apply IT skills and create hyperlinks to previous experiences or that which was previously learned, which again contributes to the development of metacognitive skills. Since students in the classroom context do not naturally acquire reflective skills, they need to be supported and guided by the lecturer in developing them while creating their ePortfolios (Di Stefano et al. 2015). Reflective practice is described as a set of utensils that students use to critically analyse, organise and connect their experiences and practices with a view to self-improvement. Hadley (2007) conducted a study that enabled her to establish that the mentor and peer mentors could encourage students to reflect and more deeply and thoroughly when she created portfolio forums in which students felt comfortable

and willing to share their reflections on their work and experiences with their peers. By sharing their work with the class for feedback, they were able to achieve higher levels of reflection and self-confidence (Hadley 2007).

Research based on 11 empirical studies was conducted at a university in Pennsylvania (USA) between 2010 and 2012 to determine the advantages of using ePortfolios to assess English as a Second Language (ESL) students. The findings showed that ePortfolios motivated and enhanced ESL students' technology, writing, assessment and learning skills (Alawdat 2013). Tezci and Dikici (2006) found that students who compiled ePortfolios as part of an assessment process showed development of their writing and drawing skills, and their test performance scores improved in comparison with those of students who had not compiled ePortfolios of their academic progress.

Wozniak and Zagal (2013) used the ePortfolios of 30 students at DePaul University in Chicago to conduct a qualitative research study. The results indicated patterns between students' preferences regarding images, videos, navigation schema and embedded forms that reflected characteristics of metacognition. They are of the opinion that the ways students select media content and plan and organise their online learning environment provide evidence of their metacognition. A study conducted with higher-education students in Ireland to determine the effectiveness of ePortfolios as a learning tool showed that only 45% of the participants felt that ePortfolios were effective in assessing their learning, while 49% stated they enjoyed creating ePortfolios and 65% found it to be too time-consuming (O'Loghlen 2015). The study concluded that students need training and support in the construction of ePortfolios. Another study that involved first- and second-level language students at the Kapio'lani Community College (Hawaii) was conducted to analyse the students' reflective learning and determine whether the ePortfolio contributed to student-centred learning. The goal was to transform students into independent learners, but the study ultimately found that the students merely transferred their lecturer's way of teaching to the construction of their ePortfolios (Parkes et al. 2013). The reason might be that students were not familiar with learner-centered metacognitive learning. Nevertheless, various researchers are of the opinion that the construction of an ePortfolio could contribute to guided active and reflective student participation that can be assessed in an authentic manner by various methods, such as lecturer-formative, self- and peer assessment (Buyarski & Landis 2014; Parkes et al. 2013).

Gallagher and Poklop (2014) conclude that ePortfolios should not be constructed only for assessment by lecturers, but also for all age groups that will read and view the portfolios on the internet. Students need to contextualise content and artefacts and allow for flexible feedback from a diverse peer population, which should include older generations.

Despite the advantages of ePortfolios, Downer, Fisher and Kirby (2018) point out the issues of confidentiality and privacy of vulnerable groups. They raise the concern that students are not always mindful that their personal information can be misused by a third party when uploading their ePortfolios online. Therefore, the participants of this study were informed of the possible risks involved when sharing personal information online and the implications of plagiarism.

Theoretical foundation

The process of creating an ePortfolio is based on several theories, and students are encouraged to use various strategies and methods to engage in experiential learning, reflect, monitor their cognitive processes (metacognition) and develop higher-order thinking skills when engaging in a digital

learning environment. The construction of an ePortfolio can be connected with Dewey's (1859-1952) social constructivism learning theory, which includes *social* (students interact and communicate with their peers, lecturer and others in compiling and presenting their ePortfolios on the internet), *artistic* (they use creative skills to construct an ePortfolio), *constructive* (they construct new digital knowledge by uploading videos and pictures based on prior experiences) and *expressive* (they use a language and artefacts to reflect on and present their learning experiences in an ePortfolio, with tutors, peers, mentors and others providing feedback on those reflections) aspects (Hickman 1990). Thus students construct knowledge through dialogue and interactions with others and reflect back on the comments and feedback received from those who reviewed their ePortfolios.

Kolb further asserts that learning occurs when knowledge is acquired though active experience (Kolb 1984). Kolb's experiential-learning theory illustrates a cyclical model of learning that consists of four stages: *concrete experience* (gathering evidence of previous learning experiences to compile a ePortfolio); *reflective observation* (students review their ePortfolios and reflect on, monitor and self-assess the progress they have made over a period of time); *abstract conceptualisation* (they construct and sequence a time-bound layout of learning experiences in the ePortfolio and develop critical-thinking and problem-solving skills); and *active experimentation* (students create and upload various artefacts and communicate with others in a language of understanding). Korthagen (1985) agrees with the authors discussed above, and asserts that the ideal processes involved in experiential learning are *action* and *reflection*. Thus, students take action in creating an ePortfolio and reflect back to establish possible weaknesses and strengths in what they have created and uploaded on their ePortfolios.

According to Flavell's (1979) theory, the creation of an ePortfolio offers opportunities to reflect on and apply metacognitive strategies, such as self-evaluation and monitoring of their own learning experiences, which enable students to *develop as independent learners* who can control their own learning; further, Baskin (2008) and Bass and Eynon (2017) postulate that the construction of an ePortfolio not only generates student-centred learning, but also documents students' learning in various stages. In reflecting, students learn more deeply and can learn how to improve their learning by making connections between various learning contexts (academic, the workplace and the community) (Entwistle & Karagiannopoulou 2014). Thus learning can take place beyond the lecture room.

Method

In this study, qualitative and quantitative approaches were followed to collect data. The participants in this research were two classes of Physical Sciences (n=67) and Life Science (n=100) student-teachers at a South African university (situated in a township) where the ESL learning barrier and poor socioeconomic conditions are generally encountered. Before the study was conducted, ethical clearance from the institution and informed consent from the participants was obtained.

Participants were asked to each create and upload an ePortfolio on a Google Site as an assessment activity during the last semester of their academic year. The purpose of the study was to establish the impact of ePortfolios on the reflective metacognitive learning and development of higher-order thinking skills in student-teachers in the field of science. The additional objectives of the study were to establish:

- whether student-teachers in the field of science acquired information technology (IT) skills; and.
- what challenges the participants had experienced in creating their ePortfolios.

Quantitative data collection and discussion

To ensure that all the students would be able to compile an ePortfolio, a diagnostic assessment was made to establish whether they had access to technology resources and whether they had developed the necessary technology skills. This was done by asking them to answer the questions below by selecting one of the following levels: "To a limited extent"; "Not at all"; or "I had full access to the internet".

Question 1: Do you have internet access to enable you to create and upload your ePortfolio?

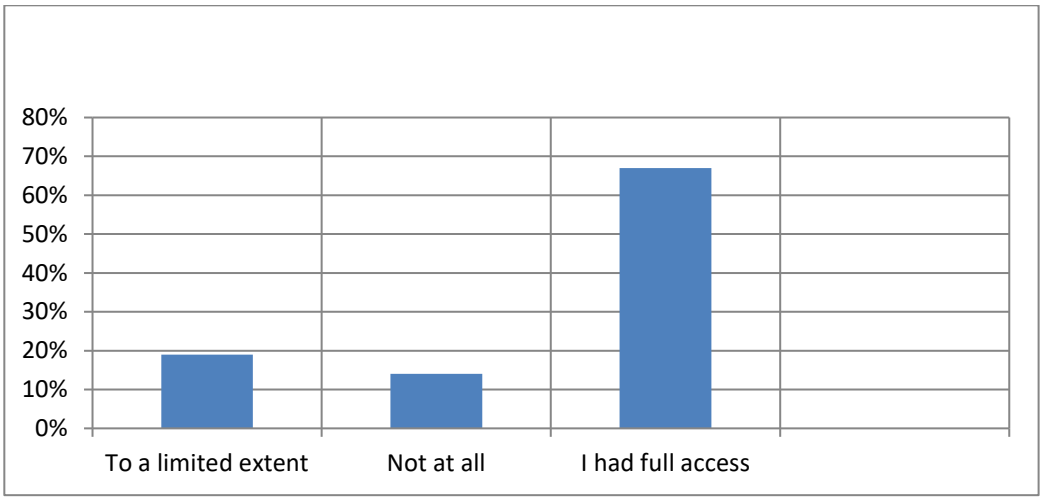

Figure 1. Internet access for creating and uploading an ePortfolio

Despite the participants' poor socioeconomic status, 67% had full access to the internet, while 19% had limited access and 14% had no access. A comparison of the responses to the second question to those to the first reveals a contradiction, since despite the fact that 14% indicated that they had no internet access, the responses show that only 2% (Figure 2) were never interactive on social media and 10% were active only once a week, while the majority (51%) indicated that they were active on the internet every hour of the day, and 38% accessed the internet once a day. Thus only 2% had no access to, or were not active on, the internet. The results of the survey indicated that student-teachers did have sufficient internet access to upload their ePortfolios on Google sites.

Question 2: How often do you use social media? (Facebook, Twitter and others)

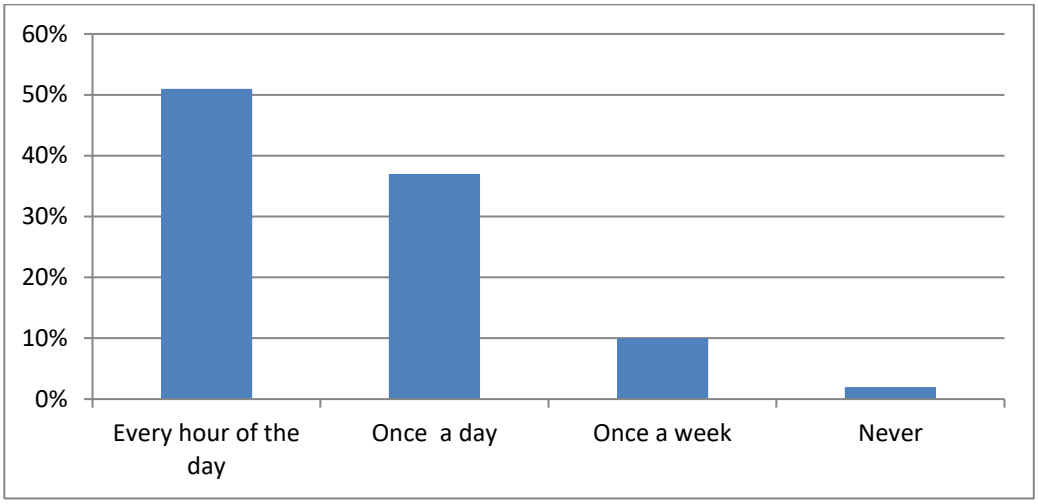

Figure 2. Frequency of social media use by student-teachers

With regard to their technology skills, 69% of the participants indicated that they had never before uploaded documents, while 31% believed that they would be able to upload documents, as they had done it before.

Question 3: Is this the first time that you will upload a document on the internet?

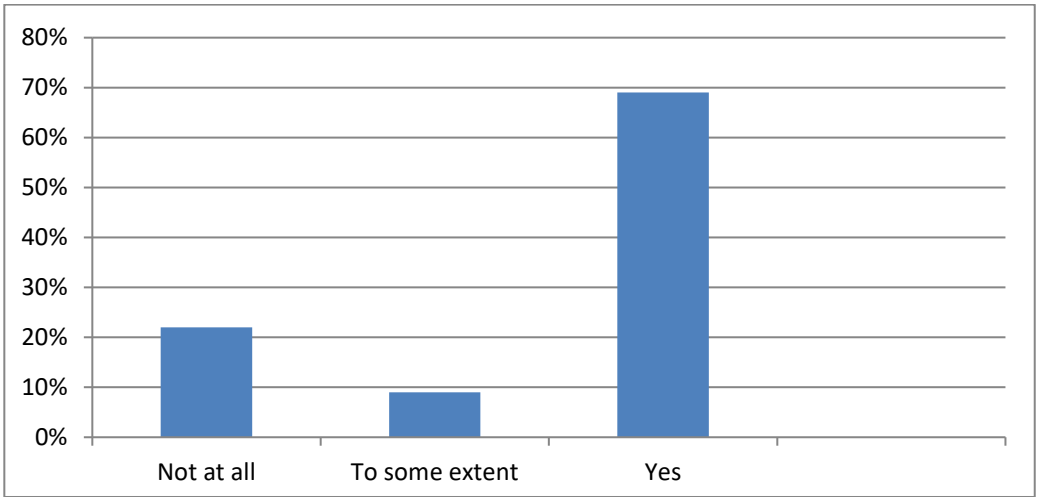

Figure 3. Experience in uploading documents on the internet

Mentors were appointed to assist the 69% of students who were not familiar with creating ePortfolios and uploading them on Google sites.

A list of applicable assessment criteria (Table 1), which could serve as a guideline for assembling ePortfolios, had been compiled based on the findings of previous research studies (Barahal 2008; Bass & Eynon 2009; Kaplan et al. 2013; Wozniak & Zagal 2015), and was provided to the participants before they started assembling their own ePortfolios.

The assessment criteria focused on metacognitive learning, creativity, the development of higher-order cognitive and communication skills, written reflections on learning experiences, the application of ethics, the quality of artefacts in combination with written reflections on their learning experiences, teaching practice and academic careers and the ability to upload documents on Google sites in the form of ePortfolios. Once they had uploaded their ePortfolios on the internet, participants were engaged in reflective teaching and had to complete a self-assessment rubric for their own portfolios, after which the link had to be sent to two of their peers for evaluation. According to Hadley (2007) and Smith and Yates (2011), the feedback received from peers and students' own reviews of the portfolios of other students provide opportunities for reflection. The reflection process is intended to guide and support them to critically evaluate, analyse, compare and adjust their actions and practices to improve and develop metacognition and critical-thinking skills. Self- and peer assessment provide opportunities for students to compare their output and make final changes before submitting their ePortfolios to the lecturer for assessment.

A rubric was used to assess participants' ePortfolios according to the assessment criteria provided in Table 1. The progress levels varied from "Not at all" (mark = 0) to "To a limited extent" (mark = 1), "Average" (marks = 2) and "To a great extent" (marks = 3). The total assessment mark was 60, which was converted to a percentage.

Once the lecturer had assessed the ePortfolios of all the participants, the results were summarised.

Table 1. Summary of assessment results according to the rubric

Assessment criteria	**Not at all (0)**	**To a limited extent (1)**	**Average (2)**	**To a great extent (3)**
Creative skills.	N=17	N=20	N=98	N=32
Content was organised in topics and sub-headings and supported with written reflections and artefacts.	N=12	N=17	N=42	N=96
Colours, tone, font and design tools were used.	N=24	N=34	N=96	N=13
Reasoning, investigating, observing, comparing and connectivity skills are evident in the portfolio.	N=24	N=32	N=91	N=20
Progressive reflections on academic performance are displayed.	N=40	N=46	N=42	N=39
Critical thinking reflections are evident in the ePortfolio.	N=69	N=58	N=35	N=5
Sufficient technology and communication skills are evident in the ePortfolio.	N=08	N=11	N=103	N=45
Ethical standards were upheld and no form of plagiarism was detected.	N=15	N=17	N=37	N=98
Written reflections indicate possible metacognitive learning.	N=12	N=16	N=43	N=96
Interpersonal and affective skills are reflected	N=46	N=58	N=40	N=23
Total				**30x2=60**

The assessment results showed that the majority of the participants did not engage in any form of plagiarism (n=98). A few (n=15) copied all their artefacts from the internet and inserted them in their ePortfolios; 17 copied between three and five, and 37 inserted one or two artefacts from the internet. The reason for this could be that the lecturer had cautioned them not to include artefacts unless permission had been obtained to use them. The majority of the participants (n=96) reflected

on their learning experiences in an organised manner and used creative designs and pictures to support their reflections. However, 12 participants were not able to create ePortfolios in an organised manner and were not able to reflect metacognitive learning. Thus the objectives of the portfolio to present evidence of students' metacognition learning and critical-thinking skills were not always achieved, as some students seemed to lack these learning skills. This finding accords with the study of Parkes et al. (2013), who established that the students in their study were not familiar with learner-centred metacognitive learning, as they merely transmitted their lecturers' manner of teaching.

It was encouraging to find that the majority of the participants (n=103 "Average" and n=45 "To a great extent") demonstrated sufficient technology and communication skills in their ePortfolios. Although nearly 50% (n=42 "Average" and 39 "To a great extent") of the participants showed progressive reflections on their academic performance, 40 students did not. During the study it became evident that students did not always know how to use the software tools to design and create. Only 13 participants could effectively use the various design tools in the creation of their ePortfolios, and 24 could not use them at all.

A large number of students obtained low scores for their ability to demonstrate critical-thinking skills in their ePortfolios (n=9 "Not at all"); 35 "Average"; and five "To a great extent"). It was surprising to find that where students engaged in community projects (n=40 "Average" and n=23 "To a great extent"), this was reflected in their interpersonal and affective skills.

Ninety-one of the portfolios displayed "Average" ability for reasoning, investigating, observing, comparing and connectivity skills, and 98 showed "Average" creativity, design and organising of portfolio according to topics and subtopics.

Feedback based on the lecturer's assessments provided valuable information for the participants and enabled them to reflect on and adjust their ePortfolios according to the lecturer's recommendations. In turn, the lecturer gained more perspective on students' needs, strengths, interests and goals in life.

Qualitative data collection and discussion

To enable the lecturer to reflect on the strengths and weaknesses of the assessment activity, allow students to reflect back on the process of metacognitive learning while creating an ePortfolio and understand why not all the participants achieved high assessment scores, the following open-ended questions were posed to all participants:

1. *In reflecting back, how did the creation of an ePortfolio contribute to your learning?*
2. *What were your main challenges in creating the ePortfolio and uploading it on the internet?*
3. *What did you dislike most about creating an ePortfolio and uploading it on the internet?*
4. *Which skills did you develop while creating an ePortfolio?*

The responses of the ESL participants were grouped in themes to highlight the most frequent comments.

Question 1: In reflecting back, how did the creation of an ePortfolio contribute to your learning?

Table 2. Frequent responses to question 1

Themes	**Participants' responses**
Reflection on goals achieved	

Students could reflect on the goals they had achieved in their academic careers.	N=52
Students enjoyed viewing their ePortfolios to determine their shortcomings and expressed a desire to improve their learning.	N=45
Identified negative and positive learning experiences	
It was a new experience.	N=160
The process focused on negative and positive aspects of their learning, which most of them enjoyed.	N=58
Reflection, affection, emotion and social context	
The process provided them with an opportunity to write about their emotions.	N=39
The process let them reflect on who they were.	N=78
The process let them reflect on how they had developed during their school careers and in the social context in which they had grown up.	N=101
To set goals in life	
Some students felt that an ePortfolio enabled them to set goals for themselves.	N=36
The ePortfolios illustrated what they had achieved in their lives over a period of time.	N=98

Fifty-two participants indicated that they could reflect on the goals they had achieved in their academic careers. Altogether, 45 students indicated that they enjoyed viewing their ePortfolio to determine their shortcomings and expressed a desire to improve their learning. It was also noted that when students assessed themselves, they could reflect back on their learning experiences and the goals they had achieved. Thus when creating an ePortfolio they could become independent learners who could assess themselves and determine whether they have achieved their goals.

For most of the students (n=160) it was the first time they had created an ePortfolio as a learning experience. They indicated that the ePortfolio allowed them to focus on negative and positive aspects of their learning (n=58), which most of them enjoyed. It can be concluded that the ePortfolio enabled students to appreciate their personal development when reflecting back on their learning experiences and the goals they had achieved.

As mentioned earlier, the participants came from diverse cultures and poor socioeconomic conditions, and encountered the ESL learning barrier. Therefore, the ePortfolio provided them (n=39) with an opportunity to write about their emotions, and to reflect on who they were (n=78) and how they had developed during their school careers and in the social context in which they grew up (n=101).

Some of the students (n=36) felt that an ePortfolio not only enabled them to set goals for themselves, but also illustrated what they (n=98) had achieved in their lives over a period of time, which could be useful when they applied for a job.

Question 2: What were your main challenges in creating the ePortfolio and uploading it on the internet?

Table 3. Frequent responses to question 2

Themes	**Participants' responses**

No technology devices and data	
The participants did not always have access to computers.	N=104
The institution's computers were generally occupied when they wanted to work.	N=69
Limited or no internet access at home	
Students did not have sufficient money to pay for the data needed to upload their ePortfolios.	N=148
Students had limited internet access and the network was sometimes unreliable and very slow.	N=133

The participants indicated that they did not always have access to computers (n=104) and that the institution's computers were generally occupied when they wanted to work (n=69). Students from poor communities did not have sufficient money to pay for the data needed to upload their ePortfolios (n= 148). They also had only limited internet access and the network was sometimes unreliable and very slow (n=133).

Question 3: What did you dislike most in creating your ePortfolio and uploading it on the internet?

Table 4. Frequent responses to question 3

Themes	**Participants' responses**
The process was time-consuming.	N=87
Students lacked technology skills.	N=103
Students found it difficult to upload pictures and documents on the internet.	N=88
Students could not create links to internet-based resources.	N=103
Students were reluctant to share their private lives on the internet.	N=26
Students enjoyed creating the ePortfolio.	N=88
Students did not enjoy creating the ePortfolio.	N=79

The majority (n=87) indicated that the creation of an ePortfolio is time-consuming. Responses showed that 103 students lacked the necessary technology skills when they started creating their ePortfolios, 88 found it difficult to upload pictures and documents and 130 were not familiar with how to create links to internet-based resources.

Although participants' consent to uploading their ePortfolios on the internet was obtained, 26 students indicated that they were reluctant to share their private lives on the internet, as they feared that others might see their weaknesses or who they really were. The reasons for this might have been that they lived in poor communities and did not always want to share information about their schools or communities on the internet for fear of negative judgements by others.

It was surprising to find that although the majority of the participants (n=88) enjoyed creating their ePortfolios, 79 did not enjoy it. The fact that they did not enjoy the activity could most probably be ascribed to the challenges they experienced during the process.

Question 4: Which skills did you develop while creating an ePortfolio?

Table 5. Frequent responses to question 4

Themes	**Participants' responses**
Technology skills	N=162
Time management skills	N=4
Creative and reflective skills	N=75
Collaboration skills	N=43
Reflection and metacognition skills	
Students could think back, plan, write, apply IT skills.	N=78
Students could their learning experiences with others via their ePortfolios.	N=66
Students developed writing and communication skills.	N=112
Students showcased their community-engagement projects, which reflected affective and caring skills.	N=62

The majority of participants (n=162) indicated that they had developed technology skills while creating their ePortfolios, and four reflected that they had to develop time-management skills to complete their portfolios within the time constraints.

In their responses, 75 participants gave some indication of having developed creative and reflective skills while creating their ePortfolios. These responses confirmed Koraneekij and Khlaisang's (2015) finding that students develop IT, communication, metacognition, critical-thinking and creative skills while creating ePortfolios. Some students (n=43) also showed that they needed to work collaboratively and share their portfolios with others. The results showed that 78 participants could think back, plan, write and apply IT skills, and that 66 of them enjoyed sharing their learning experiences with others via their ePortfolios.

The compiling of ePortfolios played a role in improving ESL student-teachers' writing and communication skills (n=112), as they had to reflect and write about their learning experiences.

Many students (n=62) showcased their community-engagement projects, which were part of their academic course assessment activities and reflected affective and caring skills. Considering that very little research on this topic has so far been done in South Africa, the study was, to a great extent, exploratory in nature, and diverse reflections contributed to the formulation of the conclusion and recommendations.

Findings

Since the end of apartheid in 1994 many policy documents followed to make higher education more inclusive for all students. Despite the implementation of innovative policies, the integration of technology was not addressed until the National Plan on Higher Education (Department of Education 2001), which emphasised the importance of information and communications technologies in higher education. This was followed by the White Paper on e-Education in 2003, which set out a policy framework to ensure technology access for all students in South African institutions (Department of Education 2003). However, the results of the current study suggest that many students still do not have full access to technology devices and the internet. The reason could be that most of the participants in this study represented diverse cultures, encountered the ESL learning barrier and came from poor socioeconomic communities.

The ePortfolio provided them with an opportunity to write about their emotions and the social context in which they had grown up, and to reflect on who they were and how they had progressed during their schooling career. Despite poor socioeconomic status, the majority stated that they interacted on social media at least once a week, which indicated that they had full access to the internet. Only two participants were not active on, or did not have access to, the internet. From the survey it could be concluded that student-teachers did have sufficient internet access to upload their ePortfolios on Google Sites, although some complained that they did not have sufficient data allowances.

For most participants (n=160), it was the first time that they had been asked to create an ePortfolio and engage in reflective metacognitive learning experiences. The ePortfolio designs and pictures (n=96) were creative and well organised, and reflected metacognitive learning. Only 12 participants could not achieve metacognitive learning, as they could not create well-organised ePortfolios. Another constraint was that some of the students were unable to creatively design their ePortfolios, as they were not familiar with the software tools. Only 13 participants could effectively apply the various design tools while creating their ePortfolios, while 24 were not at all able to do so. For the majority (69%), this was the first time they had been required to upload a document on the internet, while 31% had uploaded documents before and were confident that it would not pose any problems. Mentors were appointed to assist students who needed help with creating and uploading their ePortfolios.

Concerning the ethical problems related to the uploading of personal information and copyright-protected artefacts, students were informed beforehand about the risks of private information online and warned not to engage in plagiarism, as they would be penalised for that in the assessment. Only 15 students ignored this warning and copied all their artefacts from the internet. The rest mostly used their original photos and designs.

Collins (2014), Parkes et al. (2013) and Oliver (2011) express concern about the fact that students *cannot reflect*, do not always acquire *higher-order thinking skills* and do not acquire sufficient *technology skills*. The findings of this study confirm those of the researchers discussed above, as 69 of the participants showed no evidence of critical-thinking skills in their ePortfolios, 35 showed "Average" reflection and only five indicated that they had reflected "To a great extent". However, 52 of the participants could reflect on the goals they had achieved in their academic careers and enjoyed the creative side of their portfolios. This might contribute to the students becoming independent learners, as they could establish whether they had reached their set goals (Chang et al. 2011). Ninety-one of the ePortfolios displayed an "Average" ability to reason, investigate, observe, compare and connect, while 98 showed "Average" creativity and ability to design and organise their portfolios into topics and subtopics.

The students' responses to the question regarding the advantages of creating an ePortfolio included the following: it helped students to reflect critically and set themselves goals; it illustrated what they had achieved over a period of time, which could be useful when they applied for work; it developed their time-management, IT and independent-learning skills; and it allowed them to work collaboratively, share their portfolios with others and showcase the community-engagement projects in which they had been involved and which demonstrated affective and caring skills. The majority of the participants indicated that they had developed creative and reflective skills while creating their ePortfolios. These responses aligned with Koraneekij and Khlaisang's (2015) findings that students develop IT, communication, metacognition, critical-thinking and creative skills while creating ePortfolios.

Participants' reflections on the creation and uploading of the ePortfolio were important for understanding these assessment results. Although they conceded that compiling an ePortfolio offered advantages, the participants did point out various disadvantages, which included that the process was time-consuming; its successful completion required a certain level of technology skills; it was difficult to upload pictures and documents and to create links from the internet; and they did not want to share their private lives on the internet, as they feared rejection when their actual poor circumstances were revealed.

Conclusion

The creation of an ePortfolio could contribute to independent learning, as students can reflect on and assess their own learning and the goals they have achieved. These reflections contribute to their appreciation of their personal development and help them to detect their strengths and weaknesses. While most indicated that the learning process was time-consuming and that they were not familiar with the software program tools, many also pointed out that they enjoyed learning during the process of reflecting back, planning, writing, applying IT skills and sharing their learning experiences with others via their ePortfolios.

Studies (Brookhart 2010; Buyarski & Landis 2014; Collins 2014) assert that students need higher-order thinking skills, such as reflection, recall, retention of knowledge and critical thinking, to solve the problems they may encounter. However, in this study low scores were indicated for students' ability to demonstrate critical-thinking reflections in their ePortfolios. Moreover, students were not always able to reflect their learning experiences in an organised manner.

Future work

The study showed that not all students could engage in metacognive, learning as they were not used to the learning strategy. The lecturer can practice metacognitive learning in min-lessons where students can reflect on their learning and the skills they have developed.

It is recommended that for lecturers to successfully request students to create ePortfolios, they need to conduct a diagnostic assessment of the class to establish whether students have access to computers and the internet (which are essential for such an assignment), are willing to share their personal learning experiences on the internet and can express their reflections in a second language. Mentors should also be available to help students who need assistance, as many of them may have no experience in reflecting on their learning experiences, uploading documents and creating links to internet-based resources.

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