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E-PORTFOLIO ALTERNATIVE ASSESSMENT STRATEGY ENHANCING HIGHER-ORDER THINKING SKILLS IN AN OPEN DISTANCE LEARNING ENVIRONMENT

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ABSTRACT

Alternative assessment in the 21st century illustrates the importance of assessment practices that promote higher-order thinking, allowing students to be innovative and create in their learning as active participants. The purpose of this paper was to explore e-portfolios as an alternative assessment strategy to enhance higher-order thinking skills (HOTS); drawing on the case of a South African open distance learning (ODL) university. Semi-structured interviews with six lecturers who were purposively selected were conducted to collect data for the qualitative phase of the study.The interviews were audio-recorded, transcribed, and analyzed for themes. For the quantitative phase, a cohort of Bachelor of Education (BEd) and Postgraduate Certificate in Education (PGCE) students (n=106) voluntarily completed an online questionnaire. For findings from the study revealed that e-portfolios can be effective tools used to ignite students' higher-order thinking skills through design and development. Furthermore, the active involvement of students in developing and designing their e-portfolios will refine their higher-order thinking skills by maintaining and keeping up with the innovative, authentic, and performance-based assessment that forces deep thinking.

Keywords: Authentic assessment; traditional assessment; performance-based assessment; e-portfolio.

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INTRODUCTION

Assessment is an important part of measuring the success of student learning. Mostly, students in higher education, particularly those at open distance learning (ODL) universities, have been assessed through traditional venue-based assessment practices (van Wyk, 2018; Oliver,2015). These practices can include paper-based portfolios and written examinations. For example, a formal assessment in the form of a two-three-hour examination paper cannot holistically assess a student's competence. Therefore, in the past decade universities started rethinking "new" alternative means of assessing students holistically.

As an ODL university, the institution under study introduced an alternative assessment approach as part of the assessment policy. Walvoord (2010, 2) defines assessment as "the systematic collection of information about student learning, using the time, knowledge, expertise, and resources available, to inform decisions that affect student learning." Therefore, assessment has to inform all learning acquired.

The constructivist approach to teaching and learning requires that lecturers change their teaching strategies, methods, and assessment practices. Globally, Education 4.0 compels educators to rethink disruptive pedagogies and innovative alternative assessment practices to prepare students for the challenges of the Fourth Industrial Revolution (4IR). The challenge is to create learning opportunities for students to be empowered with high-level cognitive skills, and to equip them with analytical, critical, and reflective ways, to ask questions. make informed decisions, solve problems and learn independently (Zoller & Pushkin 2007). Additionally, with the demand for lifelong learners and professionals who can compete globally, there is a need for assessment to be reviewed alternatively. This ultimately led to a shift in the assessment practices that determines students' learning achievement. Therefore, inquiry-based learning situated in real-world phenomena is vital for making changes to the traditional textbook-based memorization of facts, and passive and rote learning to exploration (Simonson, Smaldino & Zvacek, 2014).

William and Thompson (2017) posit that educational assessment should not simply measure what students have achieved. But it should also help students to acquire skills and competencies. In addition, Bloxham and Boyd (2007) support the latter view that assessment can reveal strengths and weaknesses and showcase skills and competencies the students acquired in the learning process. In line with this thinking, McLoughlin and Luca (2003) posit that it is vital to develop student skills in higher education; however, this is much more difficult in the ODL environment. Saba (2003) argues that one of the main characteristics that differentiate distance education from other forms of traditional education is the central focus on the students and their independence in the learning process. In this instance, distance education focuses on driving students to become self-directed learners, which may lead them to become life-long learners. This is not to say that traditional education cannot create self-directed learners. Given this,

Saba (2003) further argues whether distance learning successfully helps to develop autonomous and organized study skills and other higher-level cognitive skills and learning.

The ODL institution understudy is committed to producing lifelong learners. As a matter of urgency, the institution decided in its strategic planning for 2016-2030 to reconfigure and review its assessment strategies and practices to determine students' learning achievements. By so doing, the institution has introduced various alternative assessment strategies that can be used to determine student performance, including multiple-choice questions (MCQs), take-home examinations, open-book examinations, research projects, and e-portfolios. The lecturers can choose to use an e-portfolio as an alternative assessment tool for their respective courses or modules. The e-portfolio is a non-venue-based examination, which, on completion of the required evidence collected, is uploaded as a final production of a learning management system (LMS), students' learning management system portal, to be assessed (Barrett, 2010).

This paper explores the use of e-portfolio as an alternative assessment strategy to improve higher-order thinking skills (HOTS). To explore this, the main research question is: To what extent does e-Portfolio as an alternative assessment tool enhance students' HOTS in the ODL environment? To answer this main research question, the following specific research questions were asked:

1. How do students respond to the change of assessment instructions and questions into real tasks reflecting real situations?
2. How is the e-portfolio evidence provided by students developing higher-order thinking skills in the course?
3. How much do the assessment tasks designed by lecturers enhance students' higher-order thinking compared to the traditional assessment?

Literature review

Conceptualising an E-portfolio

Assessment is a learning activity that aims to build student thinking and scientific attitudes that encompasses critical thinking and problem-solving (Swartz & Perkins, 2016). Barrett (2010:6) defines the e-portfolio as "an electronic collection of evidence that shows your learning journey over time" intending to document student learning by providing evidence of their knowledge, competencies, and skills. Thus, students can systematically compile materials and documents created in the context of the course or module in line with learning objectives and progress and their reflective practices. Students should compile evidence of knowledge, skills, and values using an online learning management system (LMS) and the electronic portfolio (e-portfolio). As stated earlier, the e-portfolio was introduced by institutional management to move away from the traditional way of assessing students' work. One specific characteristic of the e-portfolio is based on the authentication of evidence

produced. Therefore, an e-portfolio is used because the assessment of students has to be authentic and performance-based in the design of assessment activities. The tasks should influence higher order thinking to effectively enhance students learning.. Thus, learning activities such as project-based learning and reflective journal can be used to build on the higher-order thinking levels to build on students' thinking and scientific attitudes. The learning activities planned and designed by lecturers should be aimed at instructing students to perform a variety of activities such as analyzing data, categorizing, creating categories, summarizing, evaluating, synthesizing, and predicting from discussion or practicum activities.

Higher-order thinking skills competence in designing and developing e-portfolio

"Higher-order thinking" is an umbrella term that incorporates multiple complex critical thinking and problem-solving skills (Brookhart, 2010) encompassing various forms of thinking such as critical, systemic, and creative thinking (Boddy, Watson, & Aubusson 2003; Resnick, 1987). Rodriguez (2013) concurs that e-portfolios have considerable advantages for students in developing transferable skills, specifically reflection, critical thinking, learner autonomy, professional development, and the ability to organize and self-regulate the learning process. Patton (2012) and Rofiah, Aminah, and Ekawati (2013) describe higher-order thinking as the ability to link, manipulate, and transform existing knowledge and experience to think critically and creatively when deciding and solving-problems in new situations, including logic and reasoning, analysis, evaluation, creation, problem-solving and retrival decision. In this regard, HOTS processes encompass the upper levels of Bloom’s Cognitive Taxonomy (Brookhart, 2010). HOTS is a thinking process that not only memorizes but also involves an in-depth understanding and critical thinking analysis process. Higher-order thinking is viewed as the strategy indicating the setting of meta-objectives, whereas critical, systemic, and creative thinking are regarded as the tactics used in the activities needed to achieve the proclaimed objectives. In each course learning activity, students are expected to showcase their competencies and skills acquired, like the development of higher-order thinking levels. In this regard, learning activities should be aimed at instructing students to perform a variety of tasks that enhance their HOTS, such as analyzing data, categorizing, creating categories, summarizing, and predicting from discussion or practicum activities. Consequently, students can showcase their competencies and skills acquired about the course content and objectives undertaken. Additionally, the portfolio can serve as an instrument of self-reflection, providing the students and lecturers with a retrospective view of personal learning successes as measured by the individual learning goals of students and outcomes of the course.

In higher-order thinking, critical thinking is categorized as convergent thinking, which leads to one point; creative thinking fits divergent thinking, which

disperses from one point (Johnson & Johnson, 2002). Concerning Bloom's taxonomy (Krathwohl, 2002), thinking skills are categorized into two groups: lower-order thinking, which includes comprehension, knowledge, and application, and higher-order thinking, which involves creativity, evaluation, and analysis. In explaining the three concepts of HOTS, several authors outlined them as analysis, evaluation, and creativity. The analysis is the ability of the individual to determine the parts of a problem and show the relationship between the sections, and see the causes of an event or give arguments that underpin a statement (Kou, Du, He & Ye, 2016). The analysis is an attempt to sort integrity into elements or parts to clear the hierarchy or composition. The process of analysis requires the identification of components and connections between parts; therefore, the output of this learning process represents higher-order thinking since it requires an understanding of the content and structure of the material studied (Musa, Mufti, Latif & Amin, 2011). One of the indicators for measuring higher-order thinking includes analytical skills, described by Asshaari, Othman, Bahaludin, Ismail, and Nopiah (2012) as one of the highest cognitive domains in the analytical ability (Branney & Priego-Hernández, 2018). Indicators for measuring analytical skills include focusing on key ideas and analyzing while conducting research skills such as analyzing data, categorizing, creating categories, summarising, and predicting from discussion or practicum simulation, seminars, demonstrations, and workshops activities come into play and can deepen student learning.

E-portfolio alternative assessment strategy

HOTS can be developed during the design of e-portfolios when students are given activities that require them to research a specific concept or topic. Higher-level thinking skills are exercised in authentic knowledge work, and participants continually raise the bar for accomplishments since they engage in complex problems and systems thinking (Scardamalia, Branfsford, Kozma & Quellmalz, 2012). In e-portfolio design and development, the student demonstrates higher-order thinking by comparing, organizing, critiquing, and structuring the relevant information and content. Evaluation is one of the activities where judgments are made regarding the value of an idea, creation, or method (Asshaari et al., 2012). This reasoning ability is necessary for thinking and concluding the form of knowledge. Creativity, as a HOTS component, creates quality evidence through planning, designing, and producing artifacts effectively in the e-portfolio. Using e-Portfolios encourages students to think deeply about the type and quality of evidence produced, which ultimately tap into their development of innovative and creative skills. Therefore, to improve the students' higher-order thinking skills, teaching, learning, and assessment activities should be designed to prioritize activities that allow students to perform a variety of activities that promote and stimulate creativity and involve decision-making and problem-solving. Higher-order thinking includes reading with understanding and identifying relevant and irrelevant material. The review of the literature should be up-to-date, comprehensive, and address the need for the manuscript

Theoretical framework

In their traditional view, learning portfolios help students to collect their assignments tasks, to present selected artefacts and showcase examples, and to reflect on their work and achievements. An e-portfolio is a dynamic Web space maintained and created by a learner, a group of learners, participants in a course or a whole community, which includes demonstrations, resources, accomplishments, articulated experiences, individual and collaborative creations, as well as peer feedback.

This paper is underpinned by self directed learning theory. According to Knowles, self-directed learning is ”a process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes” (Knowles, 1975) . By linking online learning to the principles of self-directed learning, Garrison viewed self-directed learning as both a personal attribute and a learning process (Garrison, 2000). In addition, his approach puts emphasis on learners’ use of resources, their motivation to learn, the learning strategies they follow and, particularly, on collaboration with other people within a given educational context, to reach their learning objectives (Knowles, 1975). Accordingto his model, self-directed learning includes three mutually interacting dimensions: self-management, self-monitoring, and motivation.

Self-directed learning theory is “a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes” (Knowles, 1975). In this regard, this study considers that e-portfolio learning refers to both, the product and the process of learning (Asshaari et al., 2012). As a product, an e-portfolio, provides a personal space where learners can collect their digital artefacts and creations that offer evidence of their experiences, achievements, and actual learning outcomes. On the other hand, as a process, it allows learners to move beyondwhat they have learned, to consider how they have learned and to understand many aspects of their learning and the connections among them, which are inherent to creative, constructive and collaborative processes.

However, it is critical to point out that the key factors to harness the full advantages of e-portfolios are a) learners’ reflection on individual and peer artefacts b) feedback provided by peers sharing common interests and learning goals, and c) collaboration among participants and collaborative creation of new artefacts. Therefore, through e-portfolios, we can create effective learning environments that help students to trace their own learning trajectories by providing multiple opportunities to demonstrate their outcomes. In addition, students are able to enhance their educational experiences through self-

directed reflection, which promotes meta-cognition, self-observation, self-evaluation and motivation.

METHODOLOGY

This paper employed a pragmatic approach, with an exploratory mixed-methods design conducted to obtain a holistic picture of the effect of e-portfolio as an alternative assessment strategy in the ODL context. In applying the mixed methods approach, the researchers were able to use various instruments and tools for data collection, sampling, and data analysis in a single study (Creswell, 2017).

Population and Sample

The research participants, as the target population, comprised six lecturers and 106 students drawn from various colleges currently using e-portfolio tools as an alternative assessment strategy, chosen because they have the experience of teaching and assessing students, using e-portfolios as the phenomenon under investigation. Qualitative data were first collected through semi-structured interviews and transcribed. This was followed by the collection of quantitative data that included the completion of an online questionnaire by students. The research participants were lecturers and students chosen because they had the knowledge and were involved in the phenomenon under investigation (Creswell, 2017) and for a specific purpose that is of interest to a specific study the e-portfolios (Booth, Colombo & Williams, 2008; Denzin & Lincoln, 2000). The following inclusion criteria assisted in the selection of participants: The six lecturers (n=6) had experience in teaching and assessing students, using an e-portfolio assessment strategy. The lecturers used e-portfolio in their respective modules. The lecturers prepared to participate in the interview processes, and follow-up interviews. Students (n=156) registered in the eportfolio modules were selected to take an online survey. The students and lecturers included in the study were informed about the research online via email and were provided an information sheet on the tasks and responsibilities of each participant and consent forms to be signed and returned. The researchers, as lecturers in the institution, made sure that they set aside their personal experiences not to influence the participant or their ideas or thoughts as they answered interview questions. To deal with this challenge, the researcher made it clear to the research participants that there was no pressure or obligation to participate in the research if they were not comfortable, even if they had agreed to participate, they could withdraw at any given time without reproach.

Data collection and Analysis

The semi-structured interview, consisting of open-ended questions, was used to allow the participants to express their thoughts. The researchers were able to probe for more clarity on the answers and respond to the situation with follow-up questions and additional questions, often allowing a new point of view to

emerge (Bryman, 2012). The interviews were recorded to provide a precise record of the data to allow the researchers to listen and check them several times, and for participants to verify their comments. The duration of the recording time ranged from 35 to 45 minutes. Two or three days were required to transcribe and review each interview before storing it on a CD and an electronic folder. Audacity software and a backup portable audio recorder were used for recording the interviews. The correct equipment used to record the interview allowed the researchers to be more focused during the interview. Audio recording "frees you from having to write everything down, so you can concentrate on the social interpersonal nature of the interview process and respond fully to the interviewee" (Simons, 2009:52). However, notes taken during the interview alerted the researcher to important issues that might need further elaboration, rather than cutting the participants off in the middle of their discussion. In addition, a reflexive journal was used to record information concerning events that occurred in the field and personal reflections about the study. After the transcription of interviews, follow-up interviews were conducted to confirm that the information transcribed was correct and that the context remained true. After completion of the interview sessions, the researcher transcribed the interviews into a Microsoft Word document using voice recognition software.

For the qualitative phase, the constant comparative method guided the data analysis, which was based on an inductive approach geared to identifying patterns and discovering theoretical properties in the data in a back-and-forth interplay with the data (Glaser & Strauss, 1967). The researchers constantly checked and rechecked the elemental codes and concepts. The researcher scrutinized and compared data with other data and with codes to organize ideas and pinpoint concepts that seemed to cluster together. The codes were clustered into substantive categories and the category codes were compared across interview transcripts. At the first stage of open coding, the researcher examined the data; compared it, and then grouped small units of meaning from the transcriptions and gave each a code. Although some units were similar or identical, the researcher still coded them separately, as outlined by Glaser and Strauss. In the second stage or axial coding, the data were put together again but grouped in new ways, making connections between categories. The third stage of selective coding entailed selecting the core category and relating it to other categories, ensuring a strong relationship between them. This stage also indicates categories that might need refinement through further data collection or during the next iteration of data collection. The core category was based on the use of e-portfolio as an alternative assessment, leading to the development of a framework that would guide lecturers in assessment. The broad categories under which all the themes for interviews were grouped: lecturers' experience in using the e-portfolio as an alternative assessment tool, development and enhancement of student learning in competency skills, particularly higher-order thinking skills (HOTS), e-portfolio issues, and challenges. The researchers

analyzed collected quantitative data through tables and translated the analyzed data into descriptive statistics to ensure relativity (Grant, Sen & Spring, 2013).

Validation of the Instrument

In the qualitative research phase of this article, trustworthiness was based on the four criteria, credibility, transferability, dependability, and confirmability (Lincoln & Guba, 2000), which are is essential in research. The data from semi-structured interviews and document analysis could be compared for triangulation, thus ensuring trustworthiness (Bryman, 2012).

Reliability of the Instrument

In this study, a self-designed questionnaire was completed by students. In light of this instrument, the researcher ensured that the instrument (online questionnaire) used in the data collection phase was appropriately and accurately designed and was piloted using twenty students not involved in the study for validity. Furthermore, the reliability of the study and internal consistency of the items was ensured by the Cronbach's alpha coefficient, while peer debriefing was used for standardization of the survey questionnaire Overall, the Cronbach's alpha coefficient was high ($\alpha > 0.81$). (Bryman, 2012).

RESULTS

The sections below provide the findings gathered from the interviews with lecturers and student responses on the online questionnaire. The findings from the qualitative data are reported first followed by quantitative findings, and are organized based on the research question: To what extent does the e-portfolio equip students with higher-order thinking in ODL institutions?

Qualitative findings

The following sub-themes emerged during the interviews with participants: Instructions of High-order Thinking Skills, Evidence of Developing Higher-order Thinking Skills, and Evidence of reflective practices.

Theme 1: Instructions of Higher-Order Thinking Skills (HOTS)

During the interview, the participants revealed that the use of e-portfolios compelled them to change the assessment instructions and questions into authentic tasks mirroring real-life situations. They further alluded that with an e-portfolio, learning takes place throughout the process of designing and developing e-portfolios. This learning includes the development of higher-order thinking whereby students are required to solve problems through analysis, synthesis, and evaluation. Unlike traditional assessment of venue-based examinations that focus on memorization of content knowledge, there is an

improvement in student learning through the e-portfolio. During the interviews, several participants pointed out that the learning activities required the students to sharpen their way of answering questions and developing their deep thinking since they have to become critical thinkers and apply their minds.

> *Through the use of an e-Portfolio, I set tasks that make the [students] think deeply [ly], do some research through the internet, especially when they are working on project creativity is expected. Although students [do] need more time throughout the duration to be exposed to more activities (*Participant GM03*).*

The pedagogical rationale is that in this digital age, learning cannot only be theory-based but should also be practical through authentic assessments. Therefore, knowledge and skills are acquired and learned through practice and guidance to develop real expertise. Interviews with the participants revealed that by developing tasks requiring higher-order thinking, students have improved in applying their minds, deep thinking, and in solving problems because they can analyze, create knowledge and evaluate when developing e-portfolios throughout their learningpress.

Theme 2: Evidence of developing higher-order thinking skills

The e-portfolio development process consists of purpose, content, and process whereby students provide evidence of learning interaction through selecting artifacts and consequent reflections on the choice and reason for inclusion. At the end of the study period, students will have developed a portfolio, an e-portfolio showcasing their experiences, skills, competencies, and achievements to serve as the summative assessment. During the interviews, the lecturers confirmed the following:

Sub-theme 2:1 Evidence of creativity through effective planning, designing and producing for their e-portfolios

Creativity in designing an e-portfolio plays a key role inshowcasing competencies; hence, authentic assessments are key to enhancing HOTS. During the interview, the participants revealed that they used to design assessment tasks based on the content of the module. However, the use of e-portfolio compelled them to change the assessment tools, strategies, and approach into authentic tasks mirroring real-life situations. One of the participants confirmed the following:

> *I used to set examination papers for my module as a summative assessment, but I never got to assess my students holistically since using a portfolio, students can display learning. (*Participant MM04*)*

Consequently, improvement is seen in their learning since performance-based assessment tasks are used in the e-portfolio, unlike traditional assessment

through learning activities that focus on memorizing content knowledge. During interviews, several participants pointed out that the assessment tasks and activities required students to sharpen their way of answering questions and developing better reporting of their findings.

> *Through the use of an E-portfolio, I will set tasks that make the [students] think deeply [ly], do some research through the internet, especially when they are working on project creativity is expected. Although students [do] need more time throughout the duration to be exposed to more activities (*Participant PK06*)*

The participants highlighted that they develop assessment tasks that require students to analyze, synthesize and construct knowledge, and evaluate their work.

> *As I assess, I identify higher-level thinking where students can analyze, evaluate, and show creativity* (Participant NP05).

The participant below is one of the few who pointed out the importance of developing HOTS in teaching and learning. This is done through creative assessment tasks, which require students to systematically work through the task and demonstrate their creativity, innovation, and higher-order thinking. Through e-portfolio teaching, students design and plan projects to improve their higher-level thinking abilities. By designing the project, students continue to conduct a literature review to collect project information. Analytical activities are conducted through discussion among students. One of the teachers said this,

> *In preparing the schedule of activities, students must plan every stage of the project very well (*Participant MM01*).*

The pedagogical rationale is that in this digital age, learning cannot only be theory-based but should also be practical through authentic assessments. Knowledge, skills, and values are acquired and learned through practice and guidance to develop real expertise. Interviews with the participants revealed that student HOTS have improved by developing tasks requiring higher-order thinking, which ensures deep learning in how to solve problems by analyzing, creating knowledge, and evaluating in developing e-portfolio throughout their learning progress.

Sub-theme 2.2 Evidence of enhancement of critical thinking

Since the practice of teaching and learning uses assessment to demonstrate learning, assessment tasks must encourage students to think deeply. The participants indicated that they provide assessment activities to develop critical thinking skills, which include comprehension, application, analysis, synthesis, and evaluation. Assessment tasks are designed to require students to think about relevant connections when designing quality evidence for their e-portfolio, selecting the best artifacts, and analyzing and conducting evaluations during the development of the e-portfolio. A significant number of participants confirmed that e-portfolio-use learning enhances critical thinking skills.

*…the topic, they have to deduct the information and use it in the sense that they will be able to answer that particular activity in the portfolio. So critical thinking, problem-solving, it is instilled. (*Participant PK06*)*

Item	Strongly disagree	Disagree	Agree	Strongly agree	Mean	Standard Deviation
Q1. I can create quality evidence (through effective planning, designing, and producing) for my e-Portfolio	0%	0%	41.18%	52.94%	3.64	0.23
Q2 I can **evaluate** the quality of evidence (through checking, critiquing, judging, and reviewing my activities) for my e-portfolio	0%	0%	44.06%	59.94%	3.74	0.32
Q3 I can analyze the quality of evidence produced (by comparing, organizing, critiquing, and structuring) my e-Portfolio	0%	0%	53.82 %	46.18%	3.67	0.30
Q4 I can apply knowledge and skills when developing evidence (by carrying out criteria expected) for my e-Portfolio.	0%	0%	40.06%	59.94%	3.81	0.391
Q.5 I can clearly understand (by comparing, interpreting, summarizing, and explaining) the evidence produced in my e-Portfolio.	0%	0%	58.25%	41.18%	3.64	0.44
Q6 I can remember	0%	0%	71.47%	28.53%	2.47	0.35

(by recognizing, listing, identifying, describing, and finding) quality evidence for my e-Portfolio.	

Students are given tasks which necessitate applying thinking, answering questions, and demonstrating learning. This could include understanding and explaining ideas and concepts,applying the information in a new situation, drawing connections among ideas, justifying a position or making decisions based on evidence or producing original work with new knowledge. As a result, an e-portfolio strengthens the components of thinking; develops skills, and promotes self-motivation through interaction and meaningful learning, raising self-awareness, and conducting self-assessment.

Sub-theme 3 Evidence of reflective practices

Writing up the reflective journal required that students reflect on what they had learned in the module, which included reflecting on the process and outcomes of their learning in a specific period. The reflective practices guided and informed the students to reflect on their learning process. This was informed by the learning objectives and learning content. The reflective practices help students take control of their learning, decide on which facts to use for reflection, and report on what they have learned in the module, and what still needs to be learned. The participants indicated the following:

> *Each learning activity students were expected to write up a reflective journal…(*Participant MM01*)*

One of the lecturers indicated that his students reflect on the learning at the end of the course:

> *My students give an overall reflection on the learning journey of the semester when in their portfolios…. (*Participant GM03*)*

Ultimately, when students complete their modules, they can showcase HOTS through their e-portfolio. The students, therefore, remain informed on their learning progress.

Quantitative results

To gather information on students' level of agreement concerning how the e-portfolio enhances their higher-order thinking skills compared to traditional assessments**,** the students were asked to complete an online questionnaire.. Table 1 below presents student perceptions.

Table 1: Student Perceptions of how e-Portfolio enhances higher-order thinking skills (HOTS)

Table 1 shows that respondents strongly agree that they are capable of creating (52.94%), evaluating (52.94%), and applying (52.94%) higher-order thinking skills (HOTS) when designing and producing evidence for the e-portfolio. It can be deduced that in the development of the e-portfolio, as an alternative assessment, students perceived that their higher-order thinking skills were enhanced.

DISCUSSION OF FINDINGS

The 21st century with its evolving world requires that students be equipped with the necessary competency skills required to achieve academically. This article emphasizes HOTS as skills needed in the 21st-century in the ODL environment. It is evident from the findings of this research that HOTS allow students to build their knowledge capacity to achieve their academic goals (Lukitasari, Handhika & Murtafiah, 2017, Shahraki & Barghi, 2017). Given the latter, the researchers contend that students can develop skills and competencies through authentic assessments that are performance-based. In addition, the use of the e-portfolio alternative assessment approach exposes students to competency skills throughout the learning process because they compile and share evidence (Nkhoma, Nkhoma, & Tu, 2018). Van Wyk (2017a) supports the notion that the competency skills students acquire in the development of e-portfolios assist them in developing confidence and personalizing their learning.

The evidence produced by students in their e-portfolios confirmed that HOTS empowered them with the ability to create, analyze, evaluate, and synthesize their artifacts. The researchers are of the view that students apply deep thinking to complete assessment tasks by putting together evidence that meets the requirements of HOTS. In addition, the study's findings revealed that the Tutorial Letters 101 and evidence produced in e-portfolios demonstrated that assessment activities are authentic, performance-based, and develop students professionally through a real-life situation. In addition, Bloom’s revised taxonomy, which specifies lower-order thinking that includes comprehension, knowledge, and application, and higher-order thinking including evaluation, creativity, and analysis, have been used in the development of the assessment tasks (Rofiah, Aminah and Ekawati, 2013).

The qualitative findings of the study revealed that, unlike the traditional assessment of non-venue-based examination, the e-portfolio assessment has broadened assessment because the students were no longer assessed on content knowledge only, but were also required to deal with real-life situations based on the curriculum and relevant industry requirements. The lecturers started implementing alternative assessment activities to enhance deep learning (Shahraki and Barghi, 2017). As a result, learning process knowledge, skills, and values expanded, depending on the criteria and learning objectives set in the assessment tasks. It is worth highlighting that in comparison to the use of traditional assessment, there is improvement in assessment with the use of e-

portfolios Consequently, the findings highlight that, unlike the traditional assessment, students involved in e-portfolio assessment have shown improvement in their learning through evidence they acquired in the learning process. Although theassessment of the 21st-century competence skills is still in its infancy stage through the use of e-portfolio, lecturers have confirmed that their students are better equipped with knowledge, skills, and values, specifically HOTS skills.

Furthermore,the quantitative phase of the study pointed out positive results from students' responses regarding how e-portfolio enhances their HOTS. The findings confirmed that students could analyze, create and evaluate quality evidence for their e-portfolios.. Higher-order thinking skills provided students with the ability to link, manipulate and transform existing knowledge and experience to think critically and creatively when deciding and solving problems in new situations (including logic and reasoning, analysis, evaluation, creation, problem-solving, and retrieval decision-making (Rofiah, Aminah and Ekawati, 2013; Patton, 2012). Shahraki and Barghi (2017) support the fact that e-portfolio use enhances the components of thinking, skills, knowledge, and self-motivation through developing interaction and promoting meaningful learning, raising self-awareness, and conducting more self-assessments. Various scholars concur that e-portfolios have considerable advantages for students in developing transferable skills, mainly reflection, critical thinking, learner autonomy, professional development, and the ability to organize and self-regulate the learning process (Asshaari et al., 2012; van Wyk, 2017b; Shahraki and Barghi, 2017).

CONCLUSION and IMPLICATIONS

This study has shown that e-portfolio is an effective alternative assessment tool that ignites students ' higher thinking skills. Even though it must be noted thatthe alternative assessment approach is not used fully at the open distance learning university since some modules still prefer traditional assessment.

E-portfolio affords students more exposure to practical and theory practices. The reflective practices in their e-portfolios tell them about their learning progress to keep up with the innovative, authentic, and performance-based assessment that forces students to think deeply creatively when designing tasks.

Overall, it is the responsibility of the lecturers, as course developers, to support the students' development of higher-order thinking skills such as analysis, evaluation. To achieve this, aspects of critical thinking must be considered when developing learning activities, and reflective practices that will improve the development of cognitive skills must be constantly encouraged. For students to further improve their deep thinking, teachers must plan a variety of learning activities and tasks that expose students to the development of HOTS. These activities and tasks must meet and reflect genuine assessment in real-life application contexts. Constructive feedback, both formative and summative, must be integral. Furthermore, lecturers and students should form learning

communities, using social media platforms such as Facebook, WhatsApp, WeChat, and Twitter to share ideas, collaborate, and communicate best practices in developing authentic e-portfolio evidence. In addition, constant monitoring of students ' work through constructive feedback and appreciation for their efforts will motivate the lecturer to engage in learning e-portfolio construction in a more meaningful way. Finally, the policy must be revised to include a clause for technology and data access for all students. This will enhance their higher-order cognitive skills through reflective practices.

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REFERENCES

Asshaari, I., Othman, H., Bahaludin, H., Ismail, N. A., & Nopiah, Z. M. (2012). Appraisal on Bloom's separation in final examination question of engineering mathematics courses using Rasch measurement model. Procedia-Social and Behavioral Sciences, 60, 172-178.

Barrett, H. (2010). Balancing the two faces of ePortfolios. Educação, Formação & Tecnologias-ISSN 1646-933X, 3(1), 6-14.

Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). Taxonomy of Educational Objectives: Handbook I Cognitive Domain. *New York, New York: David McKay Company*, 144-45.

Bloxham, S., & Boyd, P. (2007). *Developing Effective Assessment In Higher Education: A Practical Guide: A Practical Guide*. McGraw-Hill Education (UK).

Boddy, N., Watson, K., & Aubusson, P. (2003). A trial of the five Es: A referent model for constructivist teaching and learning. *Research in Science Education*, *33*(1), 27-42.

Branney, J., & Priego-Hernández, J. (2018). A mixed-methods evaluation of team-based learning for applied pathophysiology in undergraduate nursing education. *Nurse Education Today*, *61*, 127-133.

Brookhart, S. M. (2010). *How to assess higher-order thinking skills in your classroom*. ASCD.

Bryman, A. (2012). Sampling in qualitative research. *Social research methods*, *4*, 415-429.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

Denzin, N. K. (2012). Triangulation 2.0. *Journal of mixed methods research*, *6*(2), 80-88.

Glaser, B. G., & Strauss, A. L. (2017). *Discovery of grounded theory: Strategies for qualitative research*. Routledge.

Grant, M. J., Sen, B., & Spring, H. (Eds.). (2013). *Research, evaluation, and audit: Key steps in demonstrating your value*. Facet Publishing.

Kou, F., Du, J., He, Y., & Ye, L. (2016). Social network search based on semantic analysis and learning. *CAAI transactions on intelligence technology*, *1*(4), 293-302.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice*, *41*(4), 212-218.

Lukitasari, M., Handhika, J., & Murtafiah, W. (2018, March). Higher-order thinking skills: using e-portfolio in project-based learning. In *Journal of Physics: Conference Series* (Vol. 983, No. 1, p. 012047).

Mazlan, K. S., Sui, L. K. M., & Jano, Z. (2015). Designing an e-portfolio conceptual framework to enhance written communication skills among undergraduate students. *Asian Social Science*, *11*(17), 35.

McLoughlin, C. E., & Luca, J. (2003). Can reflective and executive control skills be fostered online?. Mne." In Interact, Integrate, Impact: Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education, pp. 7-10.

Musa, F., Mufti, N., Latiff, R. A., & Amin, M. M. (2012). Project-based learning (PjBL): inculcating soft skills in the 21st-century workplace. *Procedia-Social and Behavioral Sciences*, *59*, 565-573.

Nkhoma, C., Nkhoma, M., & Tu, K. L. (2018). Authentic assessment design in accounting courses: A literature review. *Issues in Informing Science and Information Technology*, *15*(1), 157-190.

Scardamalia, M., Bransford, J., Kozma, B., & Quellmalz, E. (2012). New assessments and environments for knowledge building. In *Assessment and teaching of 21st-century skills* (pp. 231-300). Springer, Dordrecht.

Swart, O. (2015, October). Alternative Assessments: The journey from venue-based examinations to take-home and online timed assessments. In *International Conference on Mobile and Contextual Learning* (pp. 378-390). Springer, Cham.

Patton, A. (2012). *Work that matters The teacher's guide to project-based learning*. Paul Hamlyn Foundation.

Rodrigues, R. (2013). El desarrollo de la práctica reflexiva sobre el quehacer docente, apoyada en el uso de un portafolio digital, en el marco de un programa de formación para académicos de la Universidad Centroamericana de Nicaragua.

Resnick, L. B., & Science National Research Council (US). Committee on Research in Mathematics. (1987). Education and learning to think.

Rofiah, E., Aminah, N. S., & Ekawati, E. Y. (2013). Penyusunan Instrumen tes kemampuan berpikir tingkat tinggi fisika pada siswa SMP. *Jurnal pendidikan fisika*, *1*(2).

Saba, F. (2003). Distance Education Theory, Methodology, and Epistemology: Pragmatic Paradigm. *Handbook of distance education*. 3-20.

Shahraki, A., & Barghi, M. N. (2017) "Studying The Effect Of Using E-Portfolio On Critical Thinking Skills: Case Of University Students."

Simons, H. (2009). *Case study research in practice*. SAGE publications.

Simonson, M., Zvacek, S. M., & Smaldino, S. (2019). *Teaching and Learning at a Distance: Foundations of Distance Education 7th Edition*. IAP.

Swartz, R. J., & Perkins, D. N. (2016). *Teaching thinking: Issues and approaches*. Routledge.

Van Wyk, M. M. (2017a). Exploring student teachers' views on e-portfolios as an empowering tool to enhance self-directed learning in an online teacher education course. *Australian Journal of Teacher Education*, *42*(6), 1 http://ro.ecu.edu.au/ajte/vol42/iss6/1

Van Wyk, M.M., (2017b), An E-portfolio as empowering tool to enhance students' self-directed learning in a teacher education course: A case of a South African university South African Journal of Higher Education, 31(3) 268–285, DIO: 10.208535/31-834

Walvoord, B. E. (2010). *Assessment Clear and simple: A practical guide for institutions, departments, and general education*. John Wiley & Sons.

Zoller, U., & Pushkin, D. (2007). Matching Higher-Order Cognitive Skills (HOCS) promotion goals with problem-based laboratory practice in a freshman organic chemistry course. *Chemistry Education Research and Practice*, *8*(2), 153-171.