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RESEARCH ARTICLE

The Use of e-Portfolios as a Teaching, Learning and Assessment Tool in Higher Education: Differing Opinions among Ghanaian Pre-Service Teachers and Nurses

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ABSTRACT

Lately, there has been an increased use of e-portfolios in tertiary institutions, and this tool has implications for students studying practical courses. However, very few studies have examined pre-service teachers' and nurses' perceptions towards the use of e-portfolios as a pedagogical tool. The purpose of this study was to examine pre-service teachers' and nurses' perceptions towards the use of e-portfolios in their training. To achieve this aim, 300 pre-service teachers and nurses were selected from a Ghanaian University and surveyed. The findings show that the majority of the respondents believe that the use of e-portfolios has a positive impact on their professional training. The study also revealed significant differences between pre-service teachers' and nurses' perceptions about the use of e-portfolios. The study further shows that, although there are challenging factors with the use of e-portfolios, the majority of the respondents prefer the use of e-portfolios as a teaching, learning, and assessment tool.

Keywords: Assessment, e-portfolios, learning, pre-service teachers.

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1. Introduction

Assessment methods are crucial in evaluating students' learning outcomes and promoting their academic growth in universities. With the advancement of technology, educational institutions have increasingly incorporated digital tools into their assessment practices. One such tool gaining popularity is the e-portfolio, which allows students to digitally compile and showcase their academic achievements, skills, and personal reflections.

In recent years, e-portfolios have gained significant attention as a viable assessment tool in higher education. The flexibility of e-portfolios allows students to showcase their skills, knowledge, and accomplishments through various multimedia formats, including text, images, videos, and audio recordings (Jahara *et al.*, 2023). This multimodal approach to assessment enables students to present a more comprehensive picture of their learning journey, going beyond traditional paper-based submissions.

One of the key advantages of e-portfolios is their accessibility. Unlike traditional assessments that may be limited to specific time frames or physical locations, e-portfolios can be accessed and reviewed anytime and anywhere with an internet connection (Lu, 2021). This flexibility empowers students to self-reflect, revise their work, and receive feedback from peers, instructors, and potential employers throughout their academic journey. Moreover, e-portfolios have the potential to capture and demonstrate a wide range of competencies beyond academic achievements alone. They can encompass skills such as critical thinking, problem-solving, teamwork, and communication, which are highly valued by employers (Keane, 2014). Through the curation and reflection process, students can articulate the development of these transferable skills and provide evidence of their growth over time.

Additionally, e-portfolios promote active and reflective learning. As students curate their work, they engage in a metacognitive process that involves evaluating their progress, identifying areas for improvement, and setting goals for future development (Lorenzo & Ittelson, 2005). This reflective practice enhances students' self-awareness and deepens their understanding of the connections between learning experiences.

Despite the numerous benefits of e-portfolios, their implementation has also associated challenges. Technical

issues, such as limited access to technology or inadequate training, can hinder students' ability to create and maintain e-portfolios effectively (Jahara *et al*., 2023). Moreover, the subjective nature of e-portfolio assessment may introduce variability in evaluation criteria and grading inconsistency, raising concerns about reliability (Lu, 2021). These challenges highlight the importance of understanding students' perceptions and experiences with e-portfolios as an assessment tool.

In addition to the benefits and challenges discussed, a growing body of research sheds light on students' perceptions of e-portfolios as an assessment tool. A study by Madden *et al*. (2019) investigated students' attitudes towards e-portfolios in a specific discipline, namely nursing. The findings demonstrated that students recognized the value of e-portfolios in demonstrating their clinical competence, fostering self-reflection, and promoting lifelong learning. Moreover, students appreciated the ability to showcase their professional development and achievements to potential employers, indicating the potential career benefits associated with e-portfolios. Further, Forsey *et al*. (2013) research examined students' perceptions of e-portfolios in terms of their impact on learning and engagement. The study revealed that e-portfolios encouraged students to be more actively engaged in learning and facilitated a deeper understanding of course materials. Students reported that the reflective nature of e-portfolios helped them connect theory and practice, enhancing their overall learning experience.

While these studies indicate positive perceptions of e-portfolios among students, it is important to acknowledge that individual preferences and experiences may vary. Some students may embrace the flexibility and self-directed nature of e-portfolios, while others may find the process overwhelming or time-consuming. For instance, Baris and Tosun (2013) found that e-portfolio usage enhanced academic achievement and that students who actively engaged with their e-portfolios, reflecting on their learning experiences and setting goals, demonstrated higher levels of academic success compared to those who did not use e-portfolios. This suggests that e-portfolios can serve as a tool for promoting self-regulated learning and improving student outcomes.

Additionally, e-portfolios can potentially support students' career readiness and transition into the workforce. As employers increasingly seek evidence of skills and competencies beyond academic qualifications, e-portfolios provide a comprehensive platform for students to showcase their experiences, projects, and achievements that align with desired employability skills (Todeschini & Sollberger, 2023). Through the documentation and reflection of their learning journey, students can develop a coherent narrative demonstrating their skills, strengths, and growth over time, enhancing their prospects in the job market.

While e-portfolios offer the potential for enhancing student learning experiences and promoting reflective thinking, it is essential to examine how pre-service teachers perceive this assessment method, considering the practical component of teaching education. Understanding pre-service teachers' perspectives on using e-portfolios as an assessment tool is crucial to align assessment strategies with student needs and preferences. Furthermore, exploring pre-service teachers' perceptions of e-portfolio assessment will shed light on its effectiveness and identify potential benefits and drawbacks. This knowledge will enable educators and administrators to make informed decisions regarding integrating and improving e-portfolio assessment practices in universities. However, very little research has been conducted to explore pre-service teachers' viewpoints about using e-portfolios as assessment tools from a teacher education university in Ghana. This study aims to gain in-depth insights into pre-service teachers' perceptions of e-portfolio as an assessment tool and to determine the effectiveness of e-portfolio assessments specifically from pre-service teachers' viewpoint.

2. Literature Review and Theoretical Framework

This study was guided by three important theories that have been applied to educational research and other subject areas. These theories are constructivism, social cognitive theory, and self-regulated learning. Constructivism posits that learners are not passive recipients of knowledge but active participants in constructing their understanding of the world (Amineh & Asl, 2015). Learners engage in sense-making activities, integrating new information with prior knowledge and experiences. This process involves forming connections, building mental representations, and refining existing schemas. In the constructivist framework, learning is viewed as a dynamic process through social interaction. Collaborative learning environments are valued, as they provide opportunities for learners to engage in dialogue, share perspectives, and negotiate meaning with their peers (Li, 2021). Through such interactions, learners can collectively gain new insights, challenge their existing beliefs, and co-construct knowledge.

Constructivism also highlights the importance of hands-on experiences and authentic tasks in promoting meaningful learning. Learners benefit from actively exploring their environment, manipulating objects, and engaging in problem-solving activities. These active experiences allow learners to discover patterns, connect, and develop conceptual understanding (Costes-Onishi & Kwek, 2023). Moreover, constructivism recognizes the role of reflection in the learning process. Learners are encouraged to reflect on their experiences, evaluate their understanding, and adjust their mental models. Reflective thinking helps learners become aware of their thinking processes, identify misconceptions, and develop metacognitive skills (Jelena, 2019).

By embracing constructivist principles, educators can design instructional strategies that foster active engagement, collaboration, and reflection. This may include providing hands-on learning opportunities, facilitating discussions, promoting problem-based learning, and encouraging learners to construct meaning through inquiry and exploration.

Social Cognitive Theory, proposed by Bandura (1986), emphasizes the role of observational learning and self-regulation in learning (Mujahidah & Yusdiana, 2023). According to this theory, individuals learn through direct

experience and observing others and the outcomes of their behaviors. Central to Social Cognitive Theory is the concept of modeling, where individuals acquire new behaviors by observing and imitating others. Through observational learning, individuals can acquire knowledge, skills, attitudes, and values by observing the behaviors of models. Models can be real people, characters in media, or symbolic representations.

In addition to observational learning, Social Cognitive Theory highlights the importance of self-regulation. Self-regulated learning involves individuals actively monitoring and controlling their own learning processes. It encompasses goal setting, self-monitoring, self-evaluation, and self-reflection. Social Cognitive Theory posits that individuals can regulate their behavior by setting specific goals, developing strategies to achieve them, and monitoring their progress. Self-reflection plays a vital role in self-regulation, as individuals engage in metacognitive processes to evaluate their performance, identify improvement areas, and adjust their learning strategies.

Furthermore, Bandura emphasizes the concept of reciprocal determinism, which suggests that personal factors, behavior, and the environment interact and influence each other. Individuals are not passive recipients of environmental influences but actively shape their environments through their behavior and cognitive processes. As a result, individuals are influenced by their environment and can influence it.

By integrating Social Cognitive Theory into educational practices, educators can promote observational learning by providing opportunities for students to observe and model desired behaviors. They can also facilitate self-regulated learning by teaching students' effective goal-setting strategies, providing timely feedback, and encouraging reflection on their learning experiences.

Self-regulated learning is a dynamic and active process in which learners assume responsibility for their learning (Segaran & Hasim, 2021; Zimmerman, 2000). It involves a range of metacognitive, motivational, and behavioral strategies that learners employ to control and direct their learning activities. One key aspect of self-regulated learning is goal setting. Self-regulated learners set specific, measurable, attainable, relevant, and time-bound (SMART) goals for their learning. These goals provide a clear focus and direction, helping learners prioritize their efforts and efficiently use their time and resources (Segaran & Hasim, 2021).

Planning is another important component of self-regulated learning. Learners develop plans that outline the steps and strategies they will employ to achieve their goals. This includes selecting appropriate learning resources, organizing study materials, and scheduling sessions. Effective planning helps learners structure their learning activities and promotes efficient and effective learning (Ateş, 2023; Pintrich, 2004).

Monitoring plays a crucial role in self-regulated learning. Learners continually assess their progress toward their goals and evaluate the effectiveness of their learning strategies. They engage in self-reflection and self-assessment, examining their understanding, identifying strengths and weaknesses, and adjusting their learning approach (Segaran & Hasim, 2021).

Self-regulated learners also employ various self-motivation strategies to maintain their engagement and persistence. They set intrinsic goals aligned with their personal interests and values, which contribute to their sense of autonomy and enjoyment of the learning process (Ryan & Deci, 2000, 2022). Additionally, they use self-reinforcement techniques, such as self-praise or rewards, to maintain motivation and positive self-evaluation.

Self-control is another essential component of self-regulated learning. It involves managing distractions, resisting impulses, and staying focused on learning. Self-regulated learners develop strategies to overcome procrastination, manage time effectively, and maintain a disciplined approach to their learning (Segaran & Hasim, 2021).

Educators can empower students to become independent and lifelong learners by fostering self-regulated learning. They can provide explicit instruction on goal setting, planning, monitoring, and self-reflection strategies. They can also create a supportive and structured learning environment that encourages students to take ownership of their learning and develop self-regulatory skills.

2.1. E-portfolios as an Assessment Tool in Universities

Traditional assessment methods, such as exams, essays, and presentations, have been widely employed in tertiary institutions to evaluate students' knowledge and understanding of the subject matter (Grieve *et al*., 2021). These methods often involve students demonstrating their knowledge through written responses or oral presentations within a limited timeframe. However, traditional assessment methods cannot capture students' holistic learning experiences and skills. They tend to emphasize rote memorization and regurgitation of information, which may not accurately reflect students' true understanding or ability to apply knowledge in real-world situations (Yasmin *et al*., 2023). These methods often focus on assessing declarative knowledge rather than higher-order thinking skills.

As an alternative assessment method, an e-portfolio allows for collecting and presenting diverse artifacts, including written work, multimedia projects, and reflections, which provide a more comprehensive view of students' learning outcomes (Barrett, 2010; Lu, 2021). E-portfolios enable students to showcase their knowledge, skills, and growth over time, demonstrating their ability to think critically, solve problems, and be creative. E-portfolios provide a platform for students to curate and present evidence of their learning journey, which goes beyond the limitations of traditional assessments. By including various artifacts, such as research papers, videos, presentations, and reflective essays, e-portfolios allow students to demonstrate their understanding of complex concepts and showcase their ability to apply knowledge in authentic contexts. Moreover, e-portfolios offer opportunities for students to engage in metacognitive processes by reflecting on their learning experiences, identifying areas of improvement, and setting goals for future learning (Bowman *et al*., 2016; De Jager, 2019). This reflective component of e-portfolios encourages students

to think critically about their learning and make connections between different areas of knowledge. In addition, e-portfolios align with authentic and formative assessment principles. Authentic assessment evaluates students' skills and knowledge in real-world contexts, mirroring the challenges they may encounter in their future careers or further studies (Carless, 2012; Schultz *et al*., 2022). E-portfolios allow students to showcase their abilities within authentic settings, offering a more meaningful and relevant assessment experience. Furthermore, e-portfolios support formative assessment practices by providing ongoing feedback and opportunities for revision and improvement (Pourdana & Tavassoli, 2022). Instructors can provide timely feedback on students' e-portfolios, fostering a continuous learning process and enabling students to track their progress over time. This formative feedback helps students identify their strengths and areas for development, enhancing their self-assessment skills and promoting a growth mindset.

2.2. Students' Perceptions of the Use of e-portfolios in Education

Students' perceptions of e-portfolios as an assessment tool are influenced by various factors, including prior experience, technological competence, and perceived usefulness. Students who have prior experience with e-portfolios may have a more positive attitude towards their use (Ciesielkiewicz, 2019). Students' attitudes, motivation, and engagement play a crucial role in their acceptance and adoption of e-portfolios. Positive attitudes towards e-portfolios and intrinsic motivation can enhance students' engagement and willingness to participate actively (Abdul Wahab, 2019). Instructor support, guidance, and feedback are essential in shaping students' perceptions and experiences with e-portfolios. Clear instructions, meaningful feedback, and opportunities for reflection and dialogue contribute to positive student experiences (Beaumont *et al*., 2011; Hui *et al*., 2023).

Age differences play a significant role in shaping students' perception of e-portfolio use. Older students, in particular, may exhibit varying levels of technological proficiency and prior experience with digital tools, which can impact their acceptance and comfort with e-portfolios (Ciesielkiewicz, 2019). The familiarity and confidence in using technology can influence their perception of the usability and benefits of e-portfolios. Furthermore, generational differences in learning preferences and expectations can contribute to variations in how different age groups perceive the use of e-portfolios (Jin *et al*., 2020). Older students may have different preferences in terms of learning styles, communication methods, and engagement with technology. These generational disparities can shape their perception of the advantages and challenges associated with e-portfolio implementation.

2.3. Challenges and Opportunities in the Use of e-portfolios

Implementing e-portfolios as an assessment tool presents several challenges. One of the primary challenges is the potential for technical issues. McKenna *et al*. (2017) and Picciano (2013) note that technical difficulties in using the e-portfolio platform can hinder its effective implementation. These challenges may include problems related to the platform's usability, compatibility, and user interface. Another challenge is the workload associated with e-portfolio implementation. McKenna *et al*. (2017) highlight the time required to curate and organize artifacts within the e-portfolio as a potential obstacle. This process demands substantial effort and commitment from both students and educators, which can be overwhelming. To overcome these challenges, various strategies have been suggested. Luera *et al*. (2016) propose providing technical support and training to students to enhance their proficiency in using the e-portfolio platform and address any technical difficulties they may encounter. Distributing the workload throughout the semester is another strategy recommended by Totter and Wyss (2019). This approach can help alleviate the burden of curating and organizing artifacts, making the process more manageable for students. Additionally, addressing resistance to change is crucial. Effective communication and highlighting the benefits of e-portfolios can help mitigate resistance and encourage their adoption (Luera *et al*., 2016). In terms of opportunities for future research and innovation, Syzdykova *et al*. (2021) suggest exploring the integration of emerging technologies in e-portfolio assessment methods. Incorporating features like artificial intelligence, virtual reality, or augmented reality can enhance the functionality and interactivity of e-portfolios, opening up new possibilities for assessment. Another opportunity lies in investigating the impact of e-portfolios on long-term learning outcomes. Mapundu and Musara (2019) emphasize the importance of studying how e-portfolios influence students' knowledge retention, skill development, and overall academic growth. Furthermore, examining the effectiveness of different feedback models within e-portfolio assessment methods is an area of research worth exploring (Syzdykova *et al*., 2021). Identifying effective approaches to providing feedback and promoting student reflection and improvement can enhance the value of e-portfolios as an assessment tool.

3. Method

This study employed the quantitative cross-sectional design to gather data at a single point in time, allowing for the examination of students' perceptions regarding e-portfolios as an assessment tool within a specific timeframe. This design enables the collection of numerical data, facilitating the quantitative analysis of variables and the generation of statistical findings. Through the cross-sectional survey, information will be obtained from participants representing various academic disciplines and year levels in different departments of the University.

3.1. Participants

Firstly, two departments, namely departments of nursing and teacher education in one of the universities in Ghana, were purposely selected for this study due to the practicum dimensions of their training. Secondly, a convenient sample of 300 pre-service teachers and nurses were selected from the two departments. Out of this number,

185 (62%) were selected from the teacher education department. In terms of gender, 58% were females. Also, the majority of the respondents (67%) were between the ages of 20 and 24. Further, 63, 82, and 155 of the respondents were in the second, third, and final years of their study, respectively.

3.2. Research Instrument

The primary research instrument for data collection was a questionnaire adapted from Wuetherick and Dickinson (2015). The questionnaire consisted of closed-ended questions structured on a Likert scale to capture participants' responses on a range of statements related to the use of e-portfolios. Prior to the data collection exercise, the adapted questionnaire was piloted in another department to help modify the items to suit the Ghanaian context. Cronbach's alpha coefficient was calculated at 0.928, which indicates high reliability with the Ghanaian sample.

3.3. Procedure

The data collection procedure started with obtaining ethics approval from the university's Humanities Ethics Committee, followed by consent from the respondents indicating their voluntary participation. Specifically, respondents' confidentiality and anonymity were ensured by not collecting any personally identifiable information. Also, respondents were informed about their rights to withdraw from the study at any point without facing any negative consequences. The survey questionnaire was distributed electronically to the selected participants using a secure online platform with clear instructions on how to complete the questionnaire and the timeframe. The data collection exercise took approximately 5 days.

The collected data was analyzed through both descriptive and inferential statistical techniques using SPSS V25. Descriptive statistics such as frequencies, %ages, means, and standard deviations were computed to summarize the participants' responses. Inferential statistics, including independent t-test and one-way ANOVA, were run to identify possible differences across various demographic characteristics of respondents and their perceptions of the use of e-portfolios in education.

4. Results

The first section of the results, as presented in Table I, deals with respondents' viewpoints about the potential benefits derived from the use of e-portfolios as a teaching tool. The results indicate that more than 50% of the respondents expressed positive sentiments toward most of the items, which shows that the respondents appreciate the value of e-portfolios to the teaching and learning process. 70% of respondents agreed that e-portfolios foster digital literacy and enhance technological skills. Further, statements such as "E-portfolios enable students to showcase their accomplishment and developmental journeys," "E-portfolios encourage students to take ownership of their learning," and "E-portfolios enhance students' motivation and sense accomplishment" were positively endorsed by 67%, 65%, and 64% of the respondents, respectively.

On the contrary, the results revealed that about 34% and 30% of the respondents remained neutral to the statements "e-portfolios foster collaboration and communication among students and teachers" and "e-portfolios encourage students to set goals and monitor their accomplishment." Also, some statements evoked discernible reservations among participants. Specifically, assertions such as "the use of e-portfolios improve students' critical thinking and reflection skills," "e-portfolios enable continuous feedback and assessment, allowing for timely intervention and support," and "e-portfolios support lifelong learning and professional development beyond the classroom" registered higher percentages of disagreements, at 29%, 24%, and 24% respectively.

The second section of the results in Table II deals with the respondents' challenges of using e-portfolios as a teaching and learning tool. Out of the 300 respondents, a significant proportion (67%) agreed that limited access to technology and internet connectivity was the foremost challenge, hampering students' effective engagement with e-portfolios. Also, 54% of the respondents acknowledged the time-intensive nature of creating and maintaining e-portfolios, which could potentially overwhelm students as the next challenge. Further, the results reveal that 53% of the respondents concurred that there is absence of standardized assessment criteria for e-portfolios, making it difficult to ensure consistency and impartiality during evaluations, was a challenge. Close to half (49.8%) of the participants agreed that e-portfolios might impose an increased workload on educators due to the demands of assessing and providing feedback.

The third section of the results presented in Table III deals with the perceived benefits of using e-portfolios as an assessment tool. The results indicate that most respondents (72%) believed that e-portfolios provide a platform for them to demonstrate their creativity and innovation. Also, the benefits of e-portfolio assessment go beyond just creativity, as about 67% of the respondents expressed their belief that e-portfolio assessments help identify areas that need improvement and development. Similarly, approximately 67% of the respondents agreed that e-portfolio assessment provides a complete view of students' overall performance. This comprehensive viewpoint results from various artifacts, reflections, and achievements presenting a multi-dimensional perspective of a student's academic journey. Unlike traditional assessments focusing on specific elements, E-portfolios offer a broad window into students' intellectual development, encapsulating their academic accomplishments, personal growth, and progress over time.

The fourth section of the results, as depicted in Table IV, deals with the challenges of using e-portfolios as assessment methods. The results indicated that most of the respondents (63%) agreed that "technical problems or constraints with e-portfolio platforms impede the assessment procedure."

4.1. Tests of Mean Differences

A series of independent t-tests and One-way ANOVAs were performed to identify possible sources of differences

TABLE I: Perceived Benefits of Using e-Portfolios as a Teaching and Learning Tool

Statement	Agree	Neutral	Disagree	Mean	Std.
	No. (%)	No. (%)	No. (%)		
The use of e-portfolios enhances student engagement in the learning process.	158 (52.8)	42 (14.0)	99 (33.1)	3.11	1.366
The use of e-portfolios improves students' critical thinking and reflection skills.	148 (49.5)	66 (22.1)	85 (28.5)	3.21	1.090
E-portfolios foster collaboration and communication among students and teachers	149 (49.9)	101 (33.8)	49 (16.4)	3.36	1.015
E-Portfolios help students showcase their skills, achievements, and progress.	199 (66.5)	56 (18.7)	44 (15.2)	3.59	0.998
The use of e-portfolios promotes digital literacy and technology skills.	210 (70.3)	47 (15.7)	42 (14.1)	3.80	1.152
E-portfolios support lifelong learning and professional development beyond the classroom.	158 (52.8)	69 (23.1)	72 (24.1)	3.30	1.260
E-portfolios enable continuous feedback and assessment, allowing for timely intervention and support	164 (54.9)	62 (20.7)	73 (24.4)	3.41	1.081
E-portfolios encourage students to set goals and monitor their progress towards achieving them.	158 (52.8)	90 (30.1)	51 (17.1)	3.43	1.029
The use of e-portfolios encourages students to take ownership of their learning.	195 (65.2)	57 (19.1)	47 (15.7)	3.56	1.019
The use of e-portfolios enhances students' motivation and sense of accomplishment.	192 (64.2)	67 (22.4)	40 (13.3)	3.69	1.055

TABLE II: Challenges of Using e-portfolios as a Teaching and Learning Tool

Statement	Agree	Neutral	Disagree	Mean	Std.
	No. (%)	No. (%)	No. (%)		
The implementation of e-portfolios requires significant technical expertise and support.	126 (42.1)	77 (25.8)	96 (32.1)	3.04	1.165
E-portfolios often encounter compatibility issues with different devices and operating systems.	144 (48.1)	83 (27.8)	72 (24.1)	3.31	.980
E-portfolios can be time-consuming for students to create and maintain.	160 (53.5)	94 (31.4)	45 (15.0)	3.46	.942
E-portfolios may result in an increased workload for teachers in terms of assessing and providing feedback.	149 (49.8)	81 (27.1)	69 (22.6)	3.32	1.025
Limited access to technology and internet connectivity poses a challenge for students when using e-portfolios.	201 (67.2)	61 (24.4)	37 (12.4)	3.82	1.080
E-portfolios may encounter privacy and security concerns related to the storage and sharing of student data.	155 (51.8)	71 (23.7)	73 (24.4)	3.26	1.189
E-portfolios may not be suitable for all subjects and disciplines, limiting their applicability in certain educational contexts.	155 (51.8)	66 (22.1)	78 (26.0)	3.37	1.065
E-portfolios may not effectively capture certain types of learning outcomes or skills that are difficult to present digitally.	159 (53.2)	97 (32.4)	43 (14.4)	3.46	.924
Students may struggle to articulate and reflect on their learning experiences within the e-portfolio format.	157 (52.5)	95 (31.8)	47 (15.7)	3.42	.914
E-portfolios may lack standardized assessment criteria, making it challenging to ensure consistency and fairness in evaluation.	176 (53.2)	80 (26.8)	43 (14.4)	3.63	1.026

in terms of the respondents' viewpoints about using e-portfolios as teaching, learning, and assessment tools. Specifically, the factors for these analyses were gender, age, program of study, and level of study. The dependent variables were "benefits for teaching and learning (BTL)," "benefits for assessment (BAS)," "Challenges for teaching and learning (CTL)," and "challenges as an assessment tool (CAT)." However, the results only revealed significant differences among respondents regarding their program of study and year of study on the benefits of teaching, learning, and assessment benefits. Specifically, the result of the independent t-test was statistically significant for a program of study when it comes to using e-portfolios as a teaching and learning tool ($p = 0.006$). This suggests that respondents from the two departments (teacher education and nursing) differed significantly in how they viewed the benefits of e-portfolios for teaching and learning. A closer inspection of the mean differences indicated that respondents from the teacher education department expressed high agreement, thus scoring on the benefits for teaching and learning subscale. The results are displayed in Table V.

The results of the one-way ANOVA with the level of study as the independent variable against the four dependent variables were also statistically significant regarding the benefits of teaching and learning and the benefits of an assessment tool. The result of the ANOVA is presented in Table VI, and a follow-up post hoc analysis is presented

TABLE III: Perceived Benefits of Using e-portfolios as an Assessment Tool

Statement	Agree	Neutral	Disagree	Mean	Std.
	No. (%)	No. (%)	No. (%)		
Using e-portfolios allows me to showcase my skills and accomplishments effectively.	159 (53.2)	72 (24.1)	68 (22.8)	3.27	1.227
E-portfolio assessment promotes a deeper understanding of the subject matter.	152 (50.8)	82 (27.4)	65 (21.7)	3.39	1.054
E-portfolios help me reflect on my learning progress and set future goals	173 (57.9)	102 (34.1)	24 (8.0)	3.63	0.885
The use of e-portfolios encourages me to take ownership of my learning.	201 (67.2)	76 (25.4)	22 (7.4)	3.74	0.883
E-portfolio assessment provides a comprehensive view of my overall performance.	200 (66.8)	78 (26.1)	21(7.0)	3.80	0.922
E-portfolios allow me to personalize and customize my learning experiences.	174 (58.2)	68 (22.7)	57 (19.1)	3.40	1.232
The use of e-portfolios enhances my digital literacy and technological skills.	194 (64.9)	49 (16.4)	56 (18.7)	3.62	1.112
E-portfolio assessment facilitates collaboration and feedback among peers and instructors.	174 (58.2)	93 (31.1)	32 (10.7)	3.59	0.945
E-portfolios provide a platform for me to demonstrate my creativity and innovation	214 (71.6)	58 (19.4)	27 (9.0)	3.74	0.916
E-portfolio assessment helps me identify areas for improvement and development.	200 (66.9)	66 (22.1)	33 (11.1)	3.75	1.009

TABLE IV: Challenges of Using e-portfolios as an Assessment Tool

Statement	Agree	Neutral	Disagree	Mean	Std.
	No. (%)	No. (%)	No. (%)		
The process of creating and maintaining an e-portfolio for assessment is time-consuming.	147 (49.1)	71 (23.7)	81 (27.0)	3.23	1.257
Integrating e-portfolios into the assessment process requires a high level of technical skills.	127 (42.5)	82 (27.4)	90 (30.1)	3.20	1.063
E-portfolio assessment lacks clear and consistent evaluation criteria.	125 (41.8)	116 (38.8)	58 (19.4)	3.29	0.972
The use of e-portfolios as assessment tools can be overwhelming and confusing.	172 (57.5)	85 (28.4)	42 (14.0)	3.52	0.984
E-portfolio assessment places additional stress and pressure on students.	159 (53.2)	85 (28.4)	55 (18.3)	3.47	1.063
E-portfolios often require significant effort to organize and present information effectively.	159 (43.2)	75 (25.1)	55 (21.7)	3.31	1.196
The assessment of e-portfolios does not provide timely and constructive feedback.	122 (40.8)	95 (31.8)	82 (27.5)	3.17	1.039
Students may face challenges in selecting and curating relevant evidence for their e-portfolios.	146 (48.9)	106 (35.5)	47 (15.7)	3.39	0.943
E-portfolio assessment may not align well with the specific learning outcomes of a course or program.	172 (57.6)	84 (28.1)	43 (14.3)	3.49	0.960
Technical issues or limitations with e-portfolio platforms hinder the assessment process.	188 (62.8)	81 (27.1)	30 (10.0)	3.72	0.997

in Table VII. The results show that for the benefits of e-portfolios in teaching and learning, there is a statistically significant difference between academic levels, with a p-value below 0.001. Similarly, the benefits of e-portfolios as an assessment tool also showed a significant difference between academic levels ($p = 0.001$).

The multiple comparisons, as displaced in Table VII, provide further analysis of the ANOVA results by pairwise comparisons between each academic level using the Tukey HSD test. For perceived benefits in teaching and learning, the test shows Level 400 students had significantly higher mean scores than Level 200 (mean difference = 3.58, $p = 0.006$) and Level 300 (mean difference = 3.89, $p = 0.001$). However, Levels 200 and 300 did not differ significantly from each other ($p = 0.969$). Similarly, for benefits in assessment, Level 400 students again showed significantly higher means versus Level 200 (mean difference = 2.97, $p = 0.007$) and Level 300 (mean difference = 2.82, $p = 0.005$).

The multiple comparisons provide more insights by pinpointing Level 400 as the stage where students perceive greater benefits compared to earlier levels. This highlights the importance of managing student expectations and providing sufficient support in the early years while continually enhancing e-portfolio practice to add value for senior students.

TABLE V: Independent Sample T-Test for Differences in Terms of Programme of Study

Variable		Levene's test for equality of variances		t-test for equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
Benefits (T&L)	Equal variances assumed	0.079	0.779	2.792	297	0.006
	Equal variances not assumed			2.819	246.890	0.005
Challenges (T&L)	Equal variances assumed	0.011	0.918	1.652	297	0.100
	Equal variances not assumed			1.671	248.459	0.096
Benefits (Assessment)	Equal variances assumed	0.033	0.856	1.329	297	0.185
	Equal variances not assumed			1.337	244.185	0.182
Challenge (Assessment)	Equal variances assumed	2.899	0.090	0.134	297	0.894
	Equal variances not assumed			0.138	263.463	0.890
Individual characteristics	Equal variances assumed	0.352	0.553	1.451	297	0.148
	Equal variances not assumed			1.454	241.315	0.147

TABLE VI: One-Way ANOVA for Levels of Study

Variable		Sum of squares	df	Mean square	F	Sig.
Benefits (T&L)	Between groups	1056.081	2	528.041	8.748	<0.001
	Within groups	17866.427	296	60.360		
	Total	18922.508	298			
Challenges (T&L)	Between groups	126.375	2	63.187	1.688	0.187
	Within groups	11079.411	296	37.430		
	Total	11205.786	298			
Benefits (Assessment)	Between groups	621.461	2	310.730	7.271	0.001
	Within groups	12649.201	296	42.734		
	Total	13270.662	298			
Challenge (Assessment)	Between groups	128.191	2	64.096	1.500	0.225
	Within groups	12650.953	296	42.740		
	Total	12779.144	298			

TABLE VII: Post Hoc Test of Tukey HSD for Comparing Levels of Study

Dependent variable	(I) Level	(J) Level	Mean difference (I–J)	Std. Error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Benefits (Teaching)	200	300	0.31185	1.30161	0.969	−2.7542	3.3779
		400	−3.57792*	1.16191	0.006	−6.3149	−0.8410
	300	200	−0.31185	1.30161	0.969	−3.3779	2.7542
		400	−3.88977*	1.06209	0.001	−6.3916	−1.3879
	400	200	3.57792*	1.16191	0.006	0.8410	6.3149
		300	3.88977*	1.06209	0.001	1.3879	6.3916
Benefits (Assessment)	200	300	−0.14712	1.09520	0.990	−2.7269	2.4327
		400	−2.96609*	0.97765	0.007	−5.2690	−0.6632
	300	200	0.14712	1.09520	0.990	−2.4327	2.7269
		400	−2.81897*	0.89366	0.005	−4.9241	−0.7139
	400	200	2.96609*	0.97765	0.007	0.6632	5.2690
		300	2.81897*	0.89366	0.005	0.7139	4.9241

Note: *$p < 0.05$.

5. Discussion

This study reinforces and builds upon the existing views about the benefits of integrating e-portfolios into education. Many researchers and experts have discussed how using e-portfolios in education can be advantageous, and this study adds to these discussions. It was found in this study that a significant number of pre-service teachers and nurses also share the viewpoint that e-portfolios can enhance their skills in using technology, such as computers and the internet. This aligns seamlessly with

what experts have been asserting: in today's world, having proficient technological skills is paramount for various tasks and endeavors (Poláková *et al*., 2023). Thus, this study lends substantial credence to the notion that e-portfolios are a valuable tool for augmenting technological proficiency. Furthermore, the findings shed light on the perception among pre-service teachers and nurses that e-portfolios offer a platform for them to showcase their academic accomplishments and personal growth. This perception closely corresponds to the well-established idea that reflecting on one's progress is essential to the learning journey (Lu, 2021). In addition, this study brings into focus the idea that e-portfolios can act as catalysts for enhancing collaborative learning and communication among students. This finding aligns with the current trend of harnessing technology to facilitate interactions within the educational realm (Dennen, 2007; Garrison & Kanuka, 2017). The findings further showcase how e-portfolios can foster a more proactive and participatory learning environment, resonating harmoniously with modern pedagogical methodologies that accentuate engagement and interactivity.

It was also found that e-portfolios can be like a spark that ignites creativity and fresh ideas in students (Mei, 2022). This connects with the idea that digital tools can help students express their thoughts in various ways (Mandasari & Aminatun, 2020), which gives strong evidence that e-portfolios can be a space where students can let their creative thinking and innovative ideas shine. Moreover, it was also revealed that e-portfolios can help students look at their work and find ways to improve it (Kabilan *et al*., 2010; Zimmerman, 2000).

Furthermore, it was found that using an e-portfolio as an assessment tool can give a big picture of how well students are doing. This supports the findings that e-portfolios can gather many different pieces of student work to show a full view of their learning journey (Lam, 2022; Tosh *et al*., 2005). It is evident that e-portfolios are more than just a collection of work–they can give a complete picture of how students grow, both in their academic skills and as individuals. This research proves the positive effects of using e-portfolios for assessment. By showing that e-portfolios can spark creativity, aid in self-improvement, and offer a full view of student progress, this study contributes to understanding how valuable e-portfolios can be in education.

The study found a significant difference between pre-service teachers' and nurses' perceptions of e-portfolios as a teaching, learning, and assessment tool. This finding aligns well with previous studies investigating the use of e-portfolios in education. Firstly, prior research has highlighted that integrating and adopting e-portfolios varies across different academic disciplines (Holt *et al*., 2016; Reese & Levy, 2009). Secondly, studies have also emphasized the presence and importance of contextual factors within specific programs and institutions that can shape learners' engagement with e-portfolios (Ring & Ramirez, 2012; Wuetherick & Dickinson, 2015). The differences among pre-service teachers and nurses can be linked to the uniqueness of their professional training programs and the likely influence of contextual elements within each college's unique curriculum requirements and educational approaches. Thirdly, longitudinal investigations reveal that effective assimilation of e-portfolios tends to occur gradually over time as students and instructors become more adept through accumulated experience (Eynon *et al*., 2014; Rhodes, 2011). This implies that the lack of perceptual differences in other dimensions could suggest that the use of e-portfolios in the professional training programs of the pre-service teachers and nurses within the university may still be in the early stages of this evolutionary e-portfolio adoption process.

A possible explanation for the significant difference found in the benefits of using e-portfolios in teaching and learning across the two fields of study could be variation in the extent of e-portfolio use across the two academic programs and curricula. If e-portfolios are more extensively integrated into courses and activities in one program compared to the other, it can shape students' perspectives on the usefulness of this tool. Alternatively, the lack of significant differences in other dimensions could mean that students across the two professional fields share common views regarding the challenges of using e-portfolios and how individual factors impact engagement with e-portfolios. This suggests that student perceptions of these aspects are not necessarily dependent on their academic discipline. The findings could also indicate that while students may perceive the pedagogical value of e-portfolios somewhat differently based on their fields of study, their views on the practical matters of usage, assessment, and individual differences are largely similar despite coming from different professional fields. The implications are that integrating e-portfolios needs to consider disciplinary contexts, while challenges and individual factors may require more general and cross-disciplinary strategies.

The study also revealed differences in the perceived benefits of using e-portfolios as teaching, learning, and assessment tools across levels of study. This supports the findings that effective adoption of new technologies in education tends to follow a gradual, phased process as end-users become more experienced over time (Dintoe, 2018; Sherer & Shea, 2011). The developmental differences seen in this study mirror this understanding, with perceptions of e-portfolio utility growing steadily across academic levels as students gain greater expertise. Further, the developmental changes as students advance through their academic careers have been found to impact attitudes toward technology (Caruso & Salaway, 2008; Jones & Shao, 2011). Thus, the finding that students in higher levels of study perceived more benefits of using e-portfolios in education correlates with the notion that higher levels are associated with greater competence and comfort in using e-portfolios.

The findings of this study also highlighted challenges related to the use of e-portfolios in the professional training of pre-service teachers and nurses in their respective colleges within the university and align well with the growing disparity or unequal access to technology and the internet that is already talked about (Mavuru *et al*., 2022; Mossberger *et al*., 2003; Santos, 2020). Similarly, it was found that creating and keeping up with e-portfolios can take much time. This echoes other studies showing

that using technology in education can sometimes feel overwhelming for students and teachers (Baran & Correia, 2014; Fernández-Batanero *et al*., 2021). Moreover, this study points out that there are no set rules for evaluating e-portfolios, similar to previous research about assessing digital work (Ko & Rossen, 2017; Lu, 2021). This offers evidence to support the idea that clear and consistent guidelines for evaluating e-portfolios are needed. This research contributes to improving educational practices by providing evidence and making the case for fair and reliable assessment methods when using e-portfolios.

6. Conclusion

Following the findings and discussions of this study, it can be concluded that most pre-service teachers and nurses believe that using e-portfolios as teaching and assessment tools positively impacts pact on professional training. The study also found differences in perceptions about using e-portfolios in education between pre-service teachers and nurses. Further, the study also identified differences in perceptions across levels of study, with higher expressing favorable viewpoints about the use of e-portfolios in education. The study further shows that, although there are challenging factors with the use of e-portfolios, the majority of the respondents prefer the use of e-portfolios as a teaching, learning, and assessment tool.

7. Recommendations

The following recommendations are therefore proposed:

- The Ministry of Education (MOE) should integrate e-portfolio tasks into the curriculum strategically, ensuring they complement existing coursework rather than adding extra burden.
- Educators should implement a phased approach to e-portfolio development, allowing students to build and refine their portfolios over time.
- There is a need to align e-portfolio assignments with course objectives, encouraging students to reflect on their learning journey and connect it to broader academic goals.
- Educators should provide examples of exemplary e-portfolios that align with different levels of achievement to illustrate expectations.
- Educators should develop clear and detailed assessment rubrics that outline expectations for content, organization, reflection, and other relevant criteria.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

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