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Unfolding the Potential of E-Portfolios for Assessment of Metacognitive Skills in Higher Education

Sameer Gull Sher[*]
Aisha Mahmood[**]

Abstract

This qualitative research looks at how higher education students feel about using e-portfolios for metacognitive progress and assessment, specifically within the context of project-based learning (PBL). A total of seven participants from the higher education context were recruited for this research. To gather data, interviews were conducted in a semi-structured manner, as well as the thematic analysis employed to explore the interview transcripts, resulting in the identification of four key themes. The results show that e-portfolios have a important influence on the improvement of metacognitive abilities, offer a thorough assessment in comparison to other techniques, present certain difficulties and disadvantages, and are appreciated by learners in higher education. These observations add to the expanding body of research on e-portfolios and their role in supporting metacognitive development within the context of PBL. The implications of these results for educational practice and policy include the integration of e-portfolios to enhance student engagement, critical thinking, and self-regulation in PBL environments. Furthermore, this study suggests the need for larger-scale research to validate and expand upon these findings, as well as investigating the perspectives of educators and administrators. Overall, this research provides valuable insights into the advantages and potentiality of using e-portfolios for evaluating metacognition abilities in higher education, particularly in project-based learning.

Keywords: *E-portfolios, metacognitive assessment, monitoring, project-based learning, qualitative study*

[*] University of Education, Lahore, bsf1800190@ue.edu.pk
[**] University of Education, Lahore aisha.mahmood@ue.edu.pk

Introduction

Metacognition, or the capability to imitate on one's own learning and thinking procedures, is a crucial component of higher education. However, there is currently a knowledge deficit regarding how to effectively assess and develop metacognition skills in higher education. The usage of e-portfolios as metacognitive assessment tool has been gaining increasing attention in various educational contexts, particularly in project-based learning (Lukitasari et al., 2021). According to another study of Lukitasari, Handhika, and Murtafiah (2018), the use of e-portfolios in project-based learning can enhance higher order thinking skills, however, empirical research on its effectiveness in the context of higher education is lacking.

The study's purpose was to demonstrate the e-portfolios potential for assessing metacognition skills in higher education and to investigate how they can facilitate the growth of such abilities among learners in the context of project-based learning. What are students' opinions and experiences with using e-portfolios for metacognitive evaluation in project-based learning? The objective of this research was to learn more about how e-portfolios can help in the growth of metacognitive abilities in students of higher education. Research questions of the study; How do students see the usage of e-portfolios for metacognitive evaluation and development? In what ways do e-portfolios encourage the development of metacognition skills in higher education?

Some studies have investigated usage of e-portfolio for assessing metacognition skills in various educational contexts. For example, Bowman et al. (2016) investigated the usage of e-portfolio for supporting metacognition preparation during first-year project, while Lukitasari et al. (2021) investigated the usage of e-portfolios in PBL for developing students' metacognitive ability in science. Wozniak and Zagal (2013) examined the usage of e-portfolios in a community-based education program. However, there is a need for further empirical research to explore the effectiveness of e-portfolios in other educational settings and subject areas of higher education.

Literature Review

Bowman et al. (2016) investigated the usage of e-portfolios for supporting metacognitive exercise during 1st-year program of writing. Their study found; e-portfolios could be an effective tool for promoting metacognitive growth among students, as they provide opportunities for reflection and self-assessment. Lukitasari et al. (2021) investigated the usage of e-portfolios in PBL for developing the students' metacognitive

ability in science. Their study originate that e-portfolios could enhance students' metacognitive skills by providing a platform for self-reflection and self-evaluation. Wozniak and Zagal (2013) examined the usage of e-portfolios in a community-based education program and established that, e-portfolios offered evidence of metacognitive development beyond traditional text-based assessments. These studies suggest that electronic-portfolios have the probability to be an effective tool for assessing metacognitive skills in higher education. By providing opportunities for reflection and self-assessment, e-portfolios can help students develop their metacognitive abilities and become more self-directed learners. However, additional exploration is required for exploring the efficiency of e-portfolios in other educational settings and subject areas, such as Pakistani higher education.

e-Portfolios are an educational tool that can facilitate the integration of learning and promote the growth of metacognitive skills (Peet et al., 2011). Metacognition, which involves consciousness and control of own learning and thinking procedures, is a crucial skill for learners (Flavell, 1987; Schraw & Dennison, 1994). By reflecting on multiple artifacts within their e-portfolio, students can evaluate their knowledge over a period of time, their learning plans, and their strong point and flaws (Chen, 2009). According to Flavell (1987) and Schraw & Dennison (1994), When a person can monitor, assess, and adjust their own thought and learning processes, it is said to be engaging in metacognition. According to research, metacognition promotes greater knowledge transfer, greater comprehension, academic advancement, and personal achievement (Akyol & Garrison, 2011).

Higher education institutions aim to foster metacognitive skills and assess their attainment in students to prepare them for lifelong learning, creative thinking, and problem solving (AAC&U & National Leadership Council, 2007). e-portfolios are being widely used in higher education to achieve these goals, but creating assessment tools that can accommodate diverse manifestations of metacognition in learning remains a challenge. To overcome this challenge, e-portfolios need to focus on the method of learning, allowing learners to create connections to develop a contingent sense of them (Yancey, 2009). The end-of-course grades, GPA, and metacognitive awareness all show favourable correlations in higher education (Young & Fry, 2012). Additionally, according to Coutinho (2007), mastery objectives among undergraduate students are associated with better levels of metacognitive awareness and higher GPAs than performance goals.

Over time, metacognition may be additionally acquired (Lewis et al. 2014). Pedagogical methods and technologies have developed to support thoughtful reflection and visualisations of learning in order to encourage learners' cognitive and metacognitive growth, including the development of educational portfolios or learning portfolios. Previous research has indicated the presence of metacognition in e-portfolio development through the analysis of self-reports and reflective artefacts that are written in text (Dalal, 2012). Furthermore, researchers have also examined the use of new media elements within e-portfolios, such as photos, videos, and hyperlinks, as evidence of metacognition, like these might demonstrate how well students grasp how learning occurs, their place in larger contexts as learners, and their involvement in communities of learning (Wozniak & Zagal, 2013). However, various exercises that encourage it purposefully created this objective in notice, which limits their usefulness. There is no established set of standards by which this metacognitive behaviour may be finally evaluated, despite the fact that numerous instructors and educational scholars encourage learners reflecting about their education and create networks throughout time (Luther & Barnes, 2015). While some rubrics use "reflective statements" to assess metacognition in e-portfolios, there is little guidance on why these statements are important or how to write them well (Luther & Barnes, 2015). Therefore, it is important to classify and gather the best rehearses for coaching reflection series in the setting of e-portfolio development.

The idea that reflection on individual experience is essential for learning and knowledge creation has been present in education and learning thePry for a long time (Flavell, 1979). E-portfolios have been used in higher education for over a decade to support student learning and facilitate metacognitive thinking (Miller & Morgaine, 2009). Reflection by portfolios allows students to review their progress and also aids in retrieving knowledge and promoting higher-order rational abilities such as evaluating and drawing conclusions (Oosterbaan et al., 2010). "Folio thinking" refers to learning that integrates different experiences, enhances self-understanding, encourages responsibility, and helps develop an intellectual identity (Penny Light et al., 2012).

For e-portfolios to be successful, specific conditions must be present, such as a well organized portfolio setting, clear rules and hopes, and sufficient prior experiences for reflection (Driessen et al., 2005). Involvement of a coach or mentor is also essential in encouraging deep reflection (Driessen et al., 2005). The mentor provides encouragement, models reflection, helps set goals, and aids in creating learning plans (Pearson & Heywood, 2004). Learners are more expected to involve in reflection when encouraged by a mentor or peer mentor

(Pearson & Heywood, 2004). Encouraging students to project their work to the class for feedback can stimulate learning and encourage higher levels of reflection. Scaffolding of reflection activities over time and presenting reflection as an iterative process is another important technique (Qvortrup & Keiding, 2015). E-Portfolio platforms are currently used more often as a pedagogical tool and by a range of restraints that had not previously used portfolio tactics before the advent of the digital media. Only a small number of studies have explicitly examined the impact on educational results among e-portfolios and their conventional a paper-based counterparts, despite the fact that study on e-portfolios has mostly concentrated on their advantages and suitable circumstances for deployment. Driessen et al. (2005) found in one of these studies that electronic platforms offered benefits above paper-based portfolios, increasing student motivation and improving usability for mentors reviewing student portfolios. Furthermore, it was discovered that both paper-based and computer platforms produced work of equal quality from students.

Similar to this, van Wesel and Prop (2008) discovered no distinction among electronic versus paper-based portfolios in students' opinions of encouragement of self-reflection or the utility of the portfolio development process in general. But they did discover that pupils who produced e-portfolios received noticeably better ratings, potentially indicating a deeper level of reflection leading to improved performance. Smith et al. (2011) noted that the shift from paper to e-portfolios can be challenging for both students and instructors. Although the initial study compared paper and commercial e-portfolios, the researchers introduced the option of e-portfolios kept on flash drives. Despite some pupil preference for paper-based portfolios, the researchers chose to continue using flash drive portfolios because of ease of technology usage and need for clearer guidelines and resolution for portfolio use irrespective of platform. (Smith, 2011).

Within the framework of the current study, the usage of a qualitative exploratory design will permit for a broad exploration of the potential of e-portfolios for assessing metacognitive skills in Pakistani higher education. By collecting and analyzing qualitative data, such as interviews and observations, this study will provide insights into how e-portfolios are currently being used to assess metacognitive skills in Pakistani higher education and how they can facilitate the development of such skills among students.

Research Methodology

The study employed an exploratory research approach. The research

process involved conducting semi-structured interviews with seven MPhil female students from the University of Education (session 2022 to 2024) to explore their experiences with using e-portfolios for metacognitive assessment in higher education. Seven participants were recruited for this study, drawn from the population of female MPhil Education students at the Department of STEM Education, University of Education, Township, Lahore enrolled in the session of 2022 to 2024. The participants were predominantly female and their ages, socioeconomic backgrounds, and other demographic characteristics were not disclosed due to the need for confidentiality and anonymity in the study. The interview questions were developed based on a analysis of relevant works on e-portfolios and metacognitive assessment in higher education. The interviews were recorded, transcribed & analyzed thematically for identifying patterns and themes associated to the research questions. Prior to conducting the interviews, written permission was obtained from each participant and ethical issues were taken into account. Confidentiality and anonymity were maintained throughout the study.

Data Collection Method

Semi-structured interviews with participants were done utilizing an interview guide for the purpose of gathering data, adapted from the protocol used by Wozniak and Zagal (2013) in their study on the role of e-portfolios in a community-based learning program. The interview guide was established based on the research questions. The guide comprised of open-ended questions aimed at exploring the participants' experiences with e-portfolios for metacognitive assessment and development. Audio recordings and written notes were used during the interviews to ensure accurate capturing of the participants' responses.

Data Analysis

Transcribing was done on the interviews' audio recordings. The data were analyzed using thematic analysis, a widely recognized qualitative data analysis technique (Braun & Clarke, 2006). Thematic analysis includes identifying, coding, and analyzing patterns, themes, and categories inside the data to derive meaningful insights and understand the underlying participants' experiences and perspectives (Nowell et al., 2017).

To facilitate the data analysis process, the transcripts of the interviews were carefully reviewed and coded manually (Saldaña, 2013). The decision to conduct manual coding was also driven by the relatively small sample size and the specific research context. Manual coding allowed for

a more in-depth examination of the data and greater control over the analysis process. The researcher closely read through the transcriptions multiple times to gain familiarity with the data and identify initial codes and themes. Following an iterative process, the identified codes were organized into broader themes and sub-themes based on their relevance and significance to the research objectives and research questions.

Additionally, member checking was undertaken to verify that the interpretations are accurate. The themes were examined and findings were shared with the interviewees, allowing them to examine and offer remarks about the researcher's interpretations. This process helped ensure the alignment between the participants' perspectives and the researcher's interpretations, enhancing the trustworthiness of the analysis. The manual coding and thematic analysis approach allowed for a thorough and nuanced exploration of the data, capturing the richness of the participants' experiences and perspectives.

Results

The thematic analysis from interview transcriptions shown several key themes related to the participants' experiences and perceptions of using e-portfolios for metacognitive assessment. These themes shed light on the potential of e-portfolios on the growth of metacognition skills, their comparison to other assessment methods, encountered challenges or drawbacks, and the overall value of e-portfolios in assessing and developing metacognitive skills.

Theme	Code	Category	Examples
Experience and Perception of e-portfolios	Challenges	Difficulties in understanding	Difficulty in understanding the e-portfolio software
Experience and Perception of e-portfolios	Challenges	Time constraints	Limited time to complete the e-portfolio project
Impact on Metacognitive Skills Development	Impact	Reflection	Reflecting on strengths and weaknesses during the e-portfolio development
Impact on Metacognitive Skills Development	Impact	Awareness of strengths/weaknesses	Becoming aware of previously unknown skills during the e-portfolio process
Impact on Metacognitive Skills Development	Impact	Development of planning skills	Enhancing planning skills through the e-portfolio development

Theme	Code	Category	Examples
Impact on Metacognitive Skills Development	Impact	Development of monitoring skills	Improving monitoring skills while working on the e-portfolio
Impact on Metacognitive Skills Development	Impact	Development of evaluation skills	Enhancing evaluation skills during the e-portfolio development
Comparison with Other Assessment Methods	Comparison	Superiority over questionnaires	E-portfolios providing a more comprehensive assessment compared to questionnaires
Comparison with Other Assessment Methods	Comparison	Superiority over presentations	E-portfolios offering a more comprehensive assessment compared to traditional presentations
Challenges and Difficulties in Using e-portfolios	Challenges	Difficulties in understanding	Initial difficulties in understanding the e-portfolio software
Challenges and Difficulties in Using e-portfolios	Challenges	Learning through the process	Overcoming challenges and learning through the e-portfolio development
Use of Metacognitive Strategies	Metacognitive Strategies	Self-reflection	Engaging in self-reflection during the e-portfolio development
Use of Metacognitive Strategies	Metacognitive Strategies	Conscious of thinking and learning processes	Becoming conscious of thinking and learning processes during the e-portfolio development
Presentation of Evidence and Project Work	Presentation	Showcase project work	Including project work in various media formats (video, audio, pictures, flowcharts)
Presentation of Evidence and Project Work	Presentation	Showcase evidence	Providing evidence of project work in the e-portfolio
Satisfaction with the e-portfolio Process	Satisfaction	Positive experience	Expressing satisfaction with the organized and efficient e-portfolio process
Suggestions for Improvement	Improvement	Increase time limit	Suggesting an increase in the time limit for completing e-portfolio projects

Identified Themes

1. Experience and Perception of e-portfolios: The participants initially faced challenges in understanding the e-portfolio software but gradually became more comfortable and interested in the development process. They perceived e-portfolios as an organized and efficient way of presenting their work, providing a comprehensive representation of their accomplishments.
2. Impact on Metacognitive Skills Development: The usage of e-portfolios benefited the participants' acquisition of metacognitive abilities. They experienced self-reflection and became more aware of their strengths, weaknesses, and learning processes. The e-portfolio process also enhanced their planning, monitoring, and evaluation skills.
3. Comparison with Other Assessment Methods: Participants found e-portfolios superior to other assessment methods, such as closed-ended questionnaires or presentations. E-portfolios allowed them to present their work in multiple formats with evidence, enabling a more comprehensive assessment of their metacognitive skills.
2. Challenges and Difficulties in Using e-portfolios: The participants initially encountered difficulties in understanding the e-portfolio software, but they overcame these challenges and learned through the process. Time constraints during e-portfolio development were also acknowledged as a drawback.
3. Use of Metacognitive Strategies: The participants identified and applied metacognitive strategies during the e-portfolio development process. They discovered previously unknown skills and became more conscious of their thinking and learning processes.
4. Presentation of Evidence and Project Work: E-portfolios provided a platform for participants to showcase their project work and evidence in various media formats, including video, audio, pictures, and flowcharts. This comprehensive presentation allowed for a deeper understanding of their work and facilitated reflection on instructional media.
5. Satisfaction with the e-portfolio Process: Overall, the participants expressed satisfaction with the e-portfolio process. They appreciated the organization and backup capabilities of e-portfolios, which contributed to a positive experience.
6. Suggestions for Improvement: The participants suggested increasing the time limit for completing e-portfolio projects to aid in the further development of metacognitive abilities.

These interpretations highlight the value of e-portfolios for assessing and developing metacognitive skills in higher education. The findings emphasize the importance of providing adequate training and support to overcome initial challenges and maximize the benefits of e-portfolios. Educators, policymakers, and institutions can leverage e-portfolios to enhance students' engagement, critical thinking, and self-regulation by incorporating them into educational programs.

Discussion

The results of this study offer insightful information on the experiences of using e-portfolios for metacognitive evaluation. The thematic analysis revealed several important elements that were revealed in the transcripts of the interviews, shedding light on the impact of e-portfolios on metacognitive skills, their comparison with other assessment methods, challenges and drawbacks encountered during e-portfolio usage, and the overall value of e-portfolios in assessing and developing metacognitive skills (Nowell, 2017; Bowman, 2016; Lukitasari, 2021; Wozniak & Zagal, 2013).

Consistent with previous research highlighting the benefits of e-portfolios in promoting metacognitive skills (Lukitasari et al., 2021), the participants in this study emphasized that e-portfolios provided them with opportunities to present their work in a detailed and comprehensive manner. The incorporation of various forms of evidence, such as videos, audios, pictures, and flowcharts, facilitated a multifaceted representation of their accomplishments, leading to deeper reflection on their learning and thinking processes. This, in turn, resulted in an increased awareness of their own metacognitive abilities.

In comparison to other assessment methods, the participants acknowledged the unique advantages of e-portfolios in showcasing their understanding and accomplishments (Bowman et al., 2016). Unlike closed-ended questions or limited response options, e-portfolios allowed for diverse modes of expression, enabling a more comprehensive assessment of metacognitive skills. The accessibility of e-portfolios through online platforms also facilitated sharing and collaboration, expanding the potential audience and promoting a sense of ownership over their work (Lukitasari et al., 2021).

While the participants highlighted the benefits of e-portfolios, they also acknowledged some challenges and drawbacks. The initial unfamiliarity with e-portfolio development software posed a barrier, but with time and practice, they gained confidence in using the tools. Additionally, the integration of audio and video components presented a

learning curve as participants had to develop new skills in recording and editing (Nowell et al., 2017). These challenges underscore the importance of providing adequate training and support to learners and educators to maximize the benefits of e-portfolios.

The implications of these findings for educators, policymakers, and stakeholders are significant. E-portfolios can be integrated into educational programs as a means to assess and develop students' metacognitive skills. By facilitating self-reflection, evidencebased education, and comprehensive representation of knowledge and skills, e-portfolios have the potential to enhance students' engagement, critical thinking, and self-regulation. Educators can leverage e-portfolios to have understanding of students' learning and tailor instruction accordingly. Policymakers and educational institutions can support the implementation of e-portfolios by providing necessary resources, training, and infrastructure.

It's crucial to recognize the limits of this study, though. Only seven pePple comprised the sample, limiting the applicability of the findings to a broader population. Additionally, the study concentrated on a particular setting, and the results may vary in different educational settings or disciplines. Future research should involve larger and more diverse samples to validate and expand upon these findings. Longitudinal studies could explore the long-term impact of e-portfolios on metacognitive skills and academic achievement. Additionally, gathering insights from educators, administrators, and other stakeholders would provide a deeper understanding of the advantages, difficulties, and perspectives related to implementing e-portfolios in higher education.

Conclusion

This qualitative research study enhances our understanding of students' experiences in a project-based learning program and their use of e-portfolios for assessment of metacognitive skills and its development in higher education. The findings carry significant implications for educational practice, policy, and understanding, offering valuable insights for educators, policymakers, and stakeholders in education. The research highlights positive impact of e-portfolios on the development of metacognitive skills, their advantages over traditional assessment methods, and the importance of providing adequate training and support. It is necessary to do further study to fully examine the potentiality of e-portfolios, examine their effectiveness in different educational contexts, and guide future research and practice in this area.

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