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The Role of ePortfolios in Formative Assessment: A Systematic Literature Review

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Abstract

In educational settings, formative assessment is used to determine the status of students and foster their development. Task, process, and feedback serve as the basis of formative assessments. Typically, tasks are introduced to lessons to facilitate student feedback. Due to their technological potential, ePortfolios are often used to help with assigning tasks, managing processes, and getting feedback. It is necessary to incorporate the findings from environments where ePortfolios are used for formative assessment into the literature. A systematic literature review was employed for this purpose. Three researchers reviewed 33 studies utilizing content analysis. The Fleiss kappa was used to determine inter-rater reliability. Quantitative analysis was performed on the articles' dependent or related variables, environments, research method, implementation period, evaluators, ePortfolio type, activity format, evaluation instruments, education level, and course categories. Among the qualitative findings of the studies were the prominent concepts of the use of ePortfolios, as well as the themes and codes of advantages and challenges. The findings indicate that the integration of ePortfolios into the formative assessment process, despite its challenges, provides significant advantages. It is expected that the study's findings will be useful for researchers as well as practitioners who intend to use ePortfolios for formative assessment processes.

Keywords: ePortfolio, formative assessment, feedback, task, systematic literature review

Introduction

Assessment is a crucial component of education. Sometimes summative assessment is used to determine a student's grade, while sometimes formative assessment is used to support learning by disclosing the student's status in the learning process (Wiliam & Black, 1996; Bennet 2011; Van der Kleij, Vermeulen, Schildkamp, & Eggen, 2015; Box, 2019). Formative assessment can enlighten the learner, the teacher, and other educational stakeholders about the learner's developmental progress (Black & Wiliam, 1998; Chappuis & Stiggins, 2002; Black & Wiliam, 2010; Bennett, 2011; Fuller & Dawson, 2017). With the acquired information, gaps can be identified as the process continues (Dunn & Mulvenon, 2009) and student-specific feedback and guidance can be provided (Bennett, 2011). Rather than evaluating the student or the learning outcome, the purpose here is to provide information about the student's circumstance and to assist in improving the quality of the learning process (Stobart, 2008). However, formative assessment requires more time and effort from teachers and students to implement (Black & Wiliam, 2010). For instance, assigning tasks to students, determining the assessment tools/criteria for these tasks, providing information on the use of these tools, establishing a feedback approach (self-peer-tutor-mentor, etc.), and providing feedback on the tasks/products at specific intervals can result in a substantial amount of work.

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Technological advancements can contribute to this process and provide alternate solutions to the challenges encountered in both the administration of the formative assessment process and its constituent parts (such as sharing, feedback, etc.) (Irving, 2015). The ePortfolio approach, which enables both summative and formative assessment, is regarded as a key technology and paradigm for facilitating this challenging endeavor (Barrett, 2010; Vogel, 2018; Lam, 2022). ePortfolio systems facilitate the process of observing, monitoring, sharing, reflecting, and providing feedback on the learning processes and experiences of students (Barrett, 2006; Chang, Chou, & Liang, 2018). ePortfolio platforms also facilitate the creation, storage, and accessibility of formative assessment resources. Supporting the process of sharing these resources and providing feedback on development is another contribution (Fathi & Rahimi, 2022). ePortfolio systems also provide an opportunity to share and receive feedback with the creator of the artifacts for as long as desired (Bennett, 2011).

Despite numerous studies in the literature on the educational effects of the ePortfolio frequently used in formative assessment processes (Barrett, 2006; Nicolaidou, 2013; Ebil, Salleh, & Shahrill, 2020; Beckers, Dolmans, & Van Merrinboer, 2022), ePortfolio use in formative assessment processes has only been discovered in a systematic study (Burner, 2014). The focus of the related research was limited to foreign language writing skills. In light of this, there is a need for literature review works that will broaden the scope and obtain recent studies. Furthermore, it is hypothesized that this research, which will additionally examine the outcomes of experimental investigations on the topic, would provide valuable insights for scholars and professionals in relation to the utilization of portfolios within the formative assessment procedure.

Aim of the Study

This study examines quantitative analyses that employ formative assessment in an ePortfolio environment in terms of dependent or related variables, environments, research methodology, implementation period, evaluators, ePortfolio type, activity type, evaluation tools, education level, and courses. Furthermore, based on the results derived from the qualitative study of the ePortfolio applications utilized during the formative assessment procedure, the prominent concepts and challenges encountered were presented in the existing literature.

Background

Formative Assessment

According to a frequently cited definition, formative assessment is the organization of learning and teaching activities with feedback from teachers and/or students (Black & Wiliam, 2010; Asamoah, Shahrill, & Abdul Latif, 2022). Similarly, according to Ramsey and Duffy (2016), formative assessment is a process that supports instruction by providing both educators and learners with continuous and real-time feedback. Pachler, Daly, Mor, and Mellar (2010) assert that formative assessment is distinguished from summative assessment by the presence of feedback. On the positive effects of feedback on learning, there is an extensive body of research, despite the existence of a few controversial studies with contradictory findings (Wiliam, 2011; Lui & Andrade, 2022). The objective of the feedback should be to reduce the distance between the current and desired state of the learners (Andrade, 2010). All stakeholders in education, including teachers, students, parents, and mentors can provide feedback. Some information regarding the learning process is required for effective feedback and guidance (Schildkamp, Van der Kleij, F, Heitink, Kippers, & Veldkamp, 2020). According to Klenowski (2009), those required information can be gathered via assignments, tests, mini-examinations, dialogues, observations, and discussions. In addition to these, data obtained by individuals with tools such as structured criteria lists, guides, and rubrics (Kutlu, Doğan, & Karakaya, 2017) and data obtained automatically by computer systems (Karaoğlan Yılmaz, Yılmaz, & Öztürk, 2020) can be used to provide constructive feedback. Formative assessment differs from summative assessment in that it focuses on the learning process and the quality of this process rather than on the results (Stobart, 2008; Gezer,

Wang, Polly, Martin, Pugalee, & Lambert, 2021). The objective is to ensure that all stakeholders are aware of the process, rather than to evaluate it, and to provide educational environments with data so that enhancements can be made as needed.

ePortfolio

Portfolios are physical files in which the learning process is recorded systematically, including what students learn, their thinking, questioning, analyzing, and producing abilities, as well as their interactions with teachers and peers (Gibson, 2006; Stefani, Mason, & Pegler, 2007; Yancey, 2023). ePortfolios are electronic collections of every kind of data associated with the learning process (Barrett, 2010; Törmala, 2021). There are challenges with storing, accessing, and updating physical portfolios (Heath, 2005). In addition to overcoming these issues, ePortfolios provide additional advantages, such as the ability for instructors and peers to provide immediate feedback and the offering of rich multimedia content (Barrett, 2006). In addition, ePortfolios have been reported to improve research skills (Demir & Kutlu, 2016), writing performance (Nicolaidou, 2013), vocabulary learning (Sharifi, Soleimani, & Jafarigohar 2017), self-directed learning skills (Beckers et. al., 2022), and engagement and self efficacy (Mason, Pegler, & Weller, 2004; López-Crespo, Blanco-Gandía, Valdivia-Salas, Fidalgo, & Sánchez-Pérez, 2021).

The literature classifies ePortfolios in a variety of ways. Himpsl and Baumgartner (2009) identified three kinds of portfolios: reflection, development, and presentation, whereas the Global Learning Consortium (2005) listed six types: assessment, presentation, learning, personal development, multiple-owner, and working. While classified in different categories, ePortfolios frequently emphasize process, reflection, assessment, and development.

In the beginning, ePortfolios were stored on CDs and DVDs, but with the widespread use of the Internet and the development of Web 2.0 tools, they migrated to online environments. In addition, by adding ePortfolio components to learning management systems (Demir & Kutlu, 2016; Beckers et. al., 2022), existing blogs (Huang & Hung, 2010; Chang, Liang Tseng, & Tseng, 2014), Facebook (Kabilan, 2016), other social media platforms (Shepherd & Bolliger, 2011; López-Crespo et. al., 2021), or ePortfolio-specific platforms (Chuang, 2010; Garrett, 2011; Yang, Tai, & Lim , 2016; López-Crespo et. al., 2021) ePortfolio has been developed and its use has become widespread. Platforms such as Mahara and Elgg, which support all the expected ePortfolio features, are frequently used for this purpose (Balaban & Bubas, 2010; Mgarbi, Chkouri, & Tahiri, 2022). The use of various forms of ePortfolios may be favored depending on the educational or instructional purpose. This situation may also result in the selection of various assessment instruments. In the literature, it is frequently found that assessment types such as rubrics (Barbera, 2009; Chau & Cheng, 2010; Nicolaidou, 2013), checklists (Sánchez Gómez, Ostos, Solano, & Salado, 2013), questionnaires (Hung, 2012; Beckers et. al., 2022), content analysis (Huang & Hung 2010; Kabilan, 2016), and observation forms are frequently used in ePortfolios (Kutlu et. al., 2017). ePortfolios provide academic support for both assessment and the establishment of effective learning environments (Barrett, 2006; Chang & Kabilan, 2022). This support is enabled not only by a technological environment but also by its structure, which relies on the student-centered, active participation, and constructivist learning theories, encourages sharing, and facilitates the process of collaboration (Gülbahar, 2009).

ePortfolio for Formative Assessment

In the portfolio approach, not only the outcome or product but also the development and process that contribute to this improvement are significant (Barker, 2006; Kerr, 2007; Bennett, Knight, & Rowley, 2020; Beckers et. al., 2022). Similarly, formative assessment does not emphasize product or evaluation but rather focuses on process awareness and development (Nitko & Brookhart, 2014; Morris, Perry, & Wardle, 2021; Mashauri, 2023;). ePortfolio broadens the perspective of a particular final product, thereby contributing to the development of process-quality knowledge (Barrett, 2003). This is an essential component of both the educational setting and the formative assessment procedure. The

ePortfolio approach enables students to make connections between "what they have learned" and "how they have learned" while creating artifacts and recognizing their development (Hallam & Creagh, 2010; Blaschke & Marin, 2020).

Learners can access ePortfolios from anywhere, at any time, using a variety of devices, including computers, tablets, and mobile phones. In addition, the inclusion of social media components in ePortfolio platforms makes them familiar to users and facilitates their use (Oh, Chan, & Kim, 2020). Students can use these platforms, which require few technical skills, to share their portfolios with whomever they want and receive as much feedback as they require (Heinrich, Bhattacharya, & Rayudu, 2007; Hegarty & Thompson, 2019). They can access the information in their shared ePortfolios whenever and with any devices they prefer. The core components of the formative assessment procedure are the mentioned sharing and feedback features (Black & William, 1998; Leighton, 2019). This process can be disrupted in non-digital or classroom settings due to factors that involve lack of time and access (Gamlem & Kari Smith, 2013). The ePortfolio approach can contribute to the perpetuation of the formative assessment process by offering numerous solutions to these challenges.

Method

In this study, a systematic literature review method was used. This method was chosen to acquire a structured and comprehensive synthesis of studies conducted on a particular topic according to specific criteria (Kitchenham, 2004). Systematic research is necessary because it enables researchers to disclose the similarity and diversity of studies on a topic and reveals the general trend to researchers who study or wish to study in the area of interest (Cohen, Manion, & Morrison, 2007).

Search Strategies and Sampling

The purpose of this study is to carry out a literature review on the use of ePortfolio environments for formative assessment. For this purpose, the following search was performed in the Web of Science database. This search was performed last on 15.10.2022.

"Electronic portfolio (Title) or e portfolio (Title) or e-portfolio (Title) and "formative assessment" (Topic) and Article (Document Types) and Education Educational Research or Education Scientific Disciplines (Web of Science Categories) and English (Languages)"

A total of 272 studies were identified at the end of the query. As there is so much research on the topic, it needs to set some criteria for the selection of publications (Heitink, Van der Kleij,Veldkamp, Schildkamp, & Kippers, 2016). For this reason, three researchers analyzed 17 articles via online sessions to create a consistent framework for reviewing the studies, and they defined the inclusion and exclusion criteria in Table 1. It was decided to exclude 187 studies whose full texts were inaccessible, not indexed in SSCI, reviews, model and system development, book chapters and proceedings. 85 studies remained to be reviewed after the studies that were excluded. The researchers reconsidered 10 papers collectively during a second online discussion on the themes to be used in the data analysis. In these reviews, the researchers decided to exclude 52 studies that did not use ePortfolios for formative assessment or did not provide information on how they used them. 33 studies were ready to be analyzed after this exclusion criteria was followed.

Table 1

Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Using ePortfolio for formative assessment process	Book chapters, reviews
Full text was accessible	model/system development and integration studies, proceedings
Indexed in SSCI	not provide information/details on how tasks and feedback are carried out in the ePortfolio assisted formative assessment process

Analysis, Validity, and Reliability

The data underwent content analysis. Content analysis is a systematic method that transforms texts into categories based on some criteria (Stemler, 2000). Before conducting a content analysis, three researchers analyzed ten studies in collaboration to identify potential themes.To ensure consistency between the codings, they then collaboratively reviewed the studies according to these themes. Next, the researchers independently reviewed nine studies chosen at random. To determine the agreement between researchers, the Fleiss kappa coefficient was calculated as 0.93. This indicates a very high level of agreement among the experts according to Landis and Koch (1977). Contradictory instances encountered by the researchers during the analyses were discussed, and the themes were finalized collaboratively during online sessions. All procedures were clarified in detail to ensure the external validity (Guba & Lincoln, 1982).

Findings

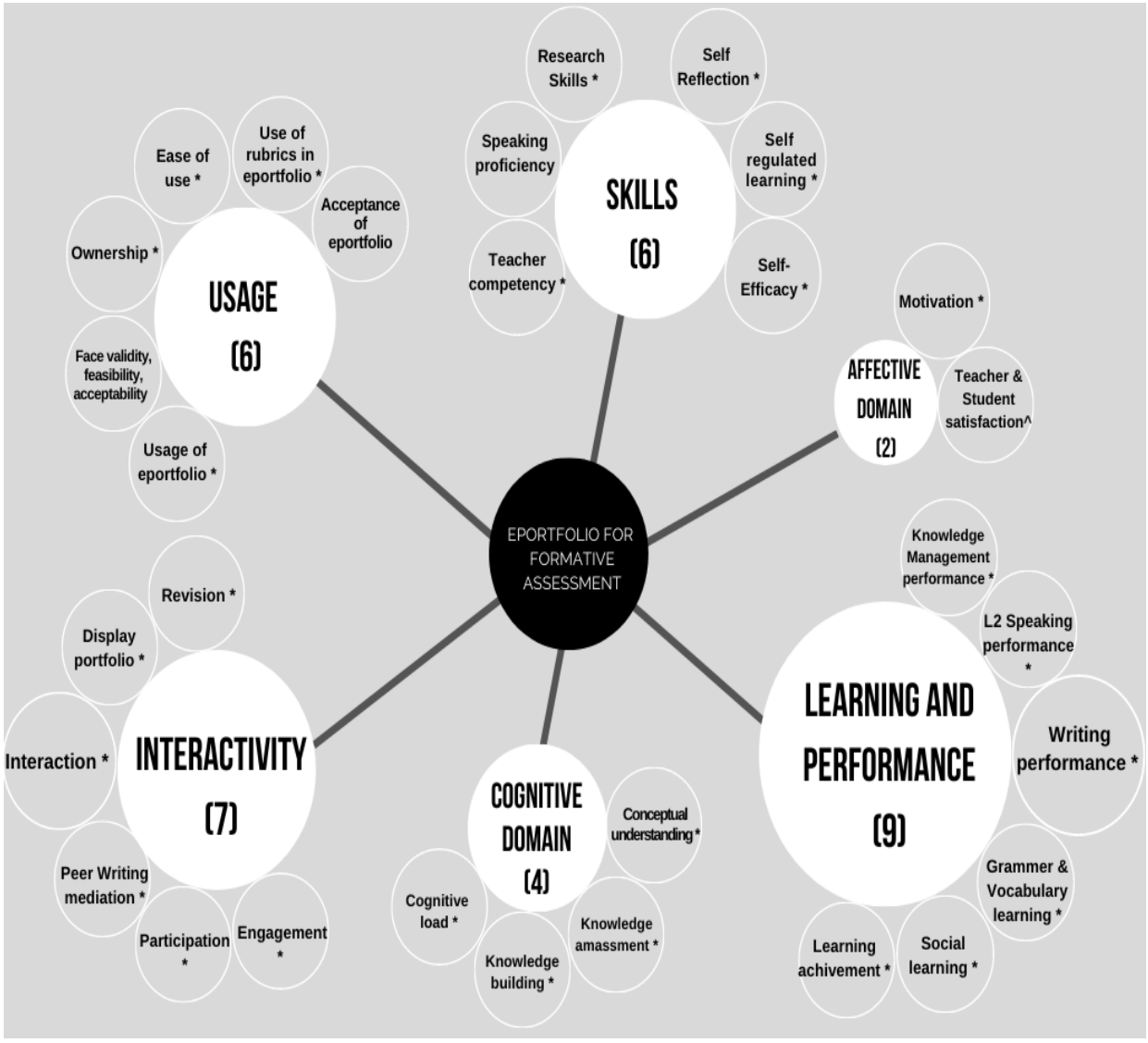
The included studies were analyzed according to the following topics. These are dependent or related variables, environments, research method, implementation period, evaluators, ePortfolio type, activity format, evaluation instruments, education level and courses, prominent concepts, advantages, and challenges.

Dependent or Related Variables

The themes and codes that emerged from the dependent or related variables obtained from the quantitative analyses were created by taking into account only the studies that collected data with valid and reliable measurement instruments, and statistical analyses were conducted on these data. The themes are skills, learning and performance, cognitive domain, interactivity, usage and affective domain. It is observed that the codes related to these themes represent a diverse spectrum, and that a remarkably high proportion of significant results have been obtained in the context of these analyzed variables (Figure 1). Themes indicate that more study has been conducted specifically on the topic of learning performance. Additionally, a similar amount of studies have been conducted on the topics of skills, interactivity, and usage. Writing performance (8.8%) and interaction (5.88%) are the most prominent categories.

Figure 1

Dependent or related variables



**studies with significant results, ^ increase but not significant*

Environments

The environments/platforms utilized in the studies were analyzed and classified into four categories: social media/network, developed by researcher or organization, learning management system, and others. The social media/network topped the list among the environment theme to the analyzed studies (f=16), approximately 48%. Ten categories are included in the social media / network as Blog, Mahara, e pass, Elgg, Edmodo, PebblePad, Facebook, Google Sites, Google Groups, QQ. Following the social media / network, the most frequent theme is developed by researchers or organizations. It corresponds to a total of 28.57% (f=8). Learning Management System and other themes are included in two studies. The environment could not be determined in five studies. In addition, in 15.2% of the studies (f=5), the development platforms were not specified.

Table 2

Environments

Theme	Environment/platform	f	%
Social Media / Network	Blog (Blogger, Wretch, wordpress based weblog	5	15.2
	Mahara	3	9.1
	e-pass	1	3.0
	Elgg	1	3.0
	Edmodo	1	3.0
	PebblePad	1	3.0
	Facebook	1	3.0
	Google Sites	1	3.0
	Google Groups	1	3.0
	QQ	1	3.0
Developed by researcher or organization	Private system	8	24.2
Learning Management System	BlackBoard	1	3.0
	Angel LMS	1	3.0
Other	PDA	1	3.0
	Microsoft Office OneNote Class Notebook	1	3.0
Unspecified	-	5	15.2
Total		33	100

Research Methods

When the research methods are examined, it is seen that mixed methods are the most common (f= 16, 48.5%). In addition, the studies also contain quantitative (f=9, 27.3%) and qualitative (f=8, 24.2%) methods.

Table 3

Research Methods

Method	f	%
Mixed	16	45.8

Table 3

Research Methods (Continued)

Quantitative	9	27.3
Qualitative	8	24.2
Total	33	100

Implementation Period

The implementation periods of the studies are classified under 3 themes (Table 4). Analyzing the article's implementation periods reveals that most implementations lasted one semester (f=20, 60.6%). Seven studies (21.2) were implemented for two semesters. The implementation periods of the 6 studies (18.2%) varied between 6 and 9 weeks.

Table 4

Implementation Period

Week/Semester	**f**	**%**
1 semester (14 weeks)	20	60.6
2 semesters	7	21.2
6-9 weeks	6	18.2
Total	33	100

Evaluators

The majority of studies used a combination of self, peer, and teacher evaluation (45.5%) (Table 5). There were six studies (18.2%) in which both the student and the teacher became co-evaluators. The teacher was the single evaluator in three (9.1%), and the peer was the single evaluator in two studies (6.1%). Also, peers and teachers were in the evaluator role together in three studies. There is only one study in which both the self and a peer served as the evaluator, and there is only one study that utilizes systems as an evaluator.

Table 5

Evaluators

Theme	**f**	**%**
Self-peer-teacher	15	45.5
Self-teacher	6	18.2
Teacher	3	9.1

Table 5

Evaluators (Continued)

Theme	f	%
Peer-teacher	3	9.1
Peer	2	6.1
Self-peer-teacher-mentor	1	3.0
Self-teacher-system	1	3.0
Self-peer-teacher-parent	1	3.0
Self-peer	1	3.0
Self	-	-
Total	33	100

Also, only three studies examined the relationship between evaluators. Two of them analyzed the relationship between self-teacher, and one analyzed the relationship between self-peer-teacher.

ePortfolio Type

The distribution of ePortfolio types in studies is represented in Table 6. The most frequent type of portfolio is development (process) with 16 studies (48.5%). The assessment portfolio is the following type of portfolio that is also quite widespread (f=8, 24.2%). In addition, both types of development and assessment portfolios were used in 5 studies (15.2%). Even though they are rare, some studies also used the showcase (f=2, 6.1%) and reflective (f=2, 6.1%) types of ePortfolio.

Table 6

ePortfolio type

Type	f	%
Development (Process)	16	48.5
Assessment	8	24.2
Development + assessment	5	15.2
Showcase	2	6.1
Reflective	2	6.1
Total	33	100

Activity Format

The majority of studies (f=13, 39.4%) employ a task and reflection combination, the most common activity type (Table 7). The studies that use tasks (f=9, 27.3%) are in second rank. Reflection was used as the activity format in four studies (12.1%). In addition, there are two studies that applied [task+discussion] and [task+project+discussion+reflection+presentation] activity types. Also, [Task+reflection+discussion], [Task+group project+reflection] and [Task+group project+reflection+presentation] activity types were each used in a seperate study.

Table 7

Activity Format

Format	f	%
Task + reflection	13	39.4
Task	9	27.3
Reflection	4	12.1
Task + discussion	2	6.1
Task + project + discussion + reflection + presentation	2	6.1
Task + reflection + discussion	1	3.0
Task + group project + reflection	1	3.0
Task + group project + reflection + presentation	1	3.0
Total	33	100

Assessment Tools

It is understood that mainly (f=12, 32.4%) rubrics are used as assessment tools (Table 8). Quizzes are the second most frequently employed assessment tool (f=4, 10.8%). In a small number of studies, survey (f=2, 5.4%), criteria list (f=2, 5.4%), rubric and survey (f=2, 5.4%), and content analysis (f=2, 5.4%) were preferred. It is surprising that 29.7% (f=11) of studies did not explain how electronic portfolios were evaluated. Standardized language testing and system-assessed tests were used in only one of them (f=1, 2.7%).

Table 8

Assessment tools

Tools	f	%
Rubric	12	32.4
Quiz	4	10.8
Criteria list	2	5.4
Content analysis	2	5.4

Table 8

Assessment tools (Continued)

Tools	**f**	**%**
Survey	2	5.4
Rubric + Survey	2	5.4
Standardized language testing	1	2.7
Student reactions (System)	1	2.7
Unspecified	11	29.7
Total	37	100

Education Levels and Courses

Analysis reveals that ePortfolios are used for formative assessment at various educational levels and in a variety of course settings, including undergraduate, K-12, and graduate programs (Table 9). Undergraduate is the most preferred level of education (f =21, 58.3%). The number of studies conducted at K-12 is 8 (22.2%). In seven studies (19.4%), the education level is graduate or postgraduate. Despite the fact that the majority of studies are conducted in language education (f=13, 39.4%) and educational sciences (f=9, 27.3%), it is evident that they are conducted in numerous other fields, such as information and communication technology (ICT) and medical.

Table 9

Education levels and Courses

Education Levels	**Courses**	**f**	**%**
Undergraduate	Language Education	8	22.2
	Educational Science	7	19.4
	Medical Education	2	5.6
	ICT	2	5.6
	Technical and Vocational Education	2	5.6
Sub-Total		21	58.3

Table 9

Education levels and Courses (Continued)

Education Levels	Courses	f	%
K12	Language Education	4	11.1
	Science	2	5.6
	Research Skills	1	2.8
	ICT	1	2.8
Sub-Total		8	22.2
Graduate and Post- Graduate	Medical Education	2	5.6
	Educational Science	2	5.6
	Analysis on Game Industry	1	2.8
	Language Education	1	2.8
	Science	1	2.8
Sub-Total		7	19.4
Total		36	100

Prominent Concepts in Qualitative Analyses

The concept of feedback (f = 9) is most prevalent in the qualitative results of the studies reviewed. At the end of the qualitative analyses, self-assessment (f=6) emerged as a prominent concept. The studies also emphasize that if ePortfolio environments are designed by considering real learning tasks, a community of practice and interaction, they can make positive contributions in components such as confidence, ownership, self-improvement, peer assessment, attitude, professional development, social learning, motivation, new experience, content knowledge/content enrichment, monitoring of progress, peer support, teacher assessment, and reflection.

Figure 2

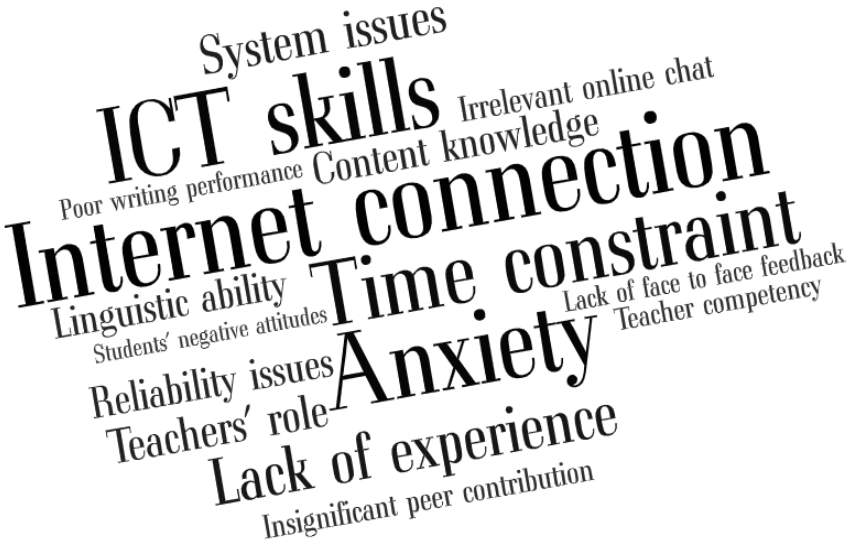
Prominent concepts

Challenges

In the qualitative findings of the studies, the challenges associated with the use of electronic portfolios in formative assessment processes were also examined. Internet connection was the most common difficulty encountered by the users (f=5), followed by anxiety caused by users following each other's work (f=4), the need to have ICT skills (f=4), time constraints (f=3), lack of experience, and system problems (f=2).

Figure 3

Challenges



Conclusions and Discussions

It is expected that studies addressing crucial educational variables, such as perception, attitude, motivation, and satisfaction, will contribute to the body of knowledge. In addition, there have been studies conducted on a variety of important variables in the field of education. This result indicates that ePortfolios are perceived as environments for managing formative assessment in the context of various variables. Remarkably, there has been a limited number of studies have been conducted in the affective domain. Considering the significance of the affective dimension in education (Vankúš, 2021; Pierre & Oughton, 2007), it is anticipated that further studies in the subject will fill this gap in the literature.

Since developing a new platform is costly, time-consuming, and labor-intensive, the consensus generally leans towards favoring existing systems for the majority of ePortfolio environments. However, there are only a few studies conducted using open-source and free platforms developed specifically for this purpose, such as Mahara and Elgg. This could be due to unfamiliarity with these platforms, the time-consuming process of setting up and modifying these environments, or the need for knowledge, skills, and time to maintain them. The positive results of the usability and satisfaction analysis of the studies (Garrett, 2011; McLeod & Vasinda, 2009) indicate the reasons behind the preference for these environments. Another possible explanation is that researchers choose their existing or familiar systems and are unwilling to learn new ones. Investigating the reasons for the limited utilization of these free environments explicitly designed for ePortfolios could contribute to their wider adoption.

Another result reveals that a majority of the analyzed studies employ mixed methods. In the social sciences, it is recommended to diversify analysis by combining quantitative and qualitative insights and opinions (Creswell, 2012). The results of analyzing different kinds of data can be used to enrich the literature.

The effective implementation of formative assessment through ePortfolio depends on users' ability to adapt to the process (Hallam & Creagh, 2010). Considering the related tasks, measurement and feedback systems, and the process of becoming familiar with a platform, it is obvious that this will take time. It is clear that the analyzed studies complied with the required period of time. Segaran and Hasim (2021), in their meta-analysis study on ePortfolio and self-regulated learning, found similar findings regarding the utmost duration of the implementation.

In six studies, both the student and the teacher took part as co-evaluators. This finding is significant in demonstrating that stakeholders are involved in the formative assessment and feedback mechanism. Since feedback and evaluation in ePortfolio environments require continuity, using alternative evaluators may be useful. There is only a single study that utilizes systems as an evaluator. This type of use may help to reduce the duties of teachers. It needs to be determined whether this is due to a lack of trust in student evaluations or other factors. Self and peer assessment and feedback may reduce a teacher's workload, especially in cases where the teacher may find it difficult to monitor the process, such as in massive online courses or large classes. Considering the developments in software, it is surprising to discover only a single study in which a computer system serves as the evaluator. The use of an automated system may reduce the workload of teachers. By integrating technologies like artificial intelligence, data mining, adaptive hypermedia, and intervention systems into educational platforms, evaluation and feedback performance can be enhanced. Although the positive effects of involving parents in educational settings are known (Hoover-Dempsey & Sandler, 1995), there is only one study in which parents were involved (Meyer, Abrami, Wade, Aslan, & Deault, 2010). When compared to the graduate and undergraduate levels, it makes sense for K–12 parents to participate in the evaluation process. In light of the fact that 22% of the reviewed studies were at the K–12 level, it would be useful to investigate the reasons why parents participated in only one study's evaluation process. Analyzing the relationships between evaluators in ePortfolios used for formative assessment can contribute to the literature on evaluator compliance and objectivity.

It is an expected finding that the developmental portfolio was frequently chosen as the ePortfolio type because, in studies using formative assessment, portfolio types that focus on the process are mostly preferred. Our research includes only those studies that implement the formative assessment in terms of both keywords and scope. The use of assessment ePortfolio is also quite widespread. Studies that focus

on development aim to collect data about the process and provide appropriate feedback (Tillema, 2001) and guidance (Chetcuti, Buhagiar, & Cardona, 2011). Although not common, some studies also used the showcase type of ePortfolio. Despite the fact that showcase portfolios are product-oriented, process-oriented practices were also observed in these studies by selecting the best of the products developed during the process to create showcase portfolios.

Regarding the activity format, a small proportion of studies employ all activity categories including task, group and individual project, reflection, discussion, and presentation. This may be due to the fact that as the types of activities increase, so does the effort required by students to execute these activities and by teachers to manage them. Despite the fact that these numerous types of activities provide students with richer experiences and a multifaceted view of the studied context, they increase the workload for teachers and students. In addition, there are a lot of studies that use interactions such as group projects or group discussions. This preference is understandable, especially in educational settings designed in accordance with social, constructivist, and connectivist theories (Andrade et. al., 2023; Bryant & Bates, 2015; Zhang, Olfman, Ractham, & Firpo, 2009). ePortfolio environments support educational environments by providing discussion forums, interactive whiteboards, synchronous and asynchronous tools for such group activities. It is thought that the main purpose of selecting these activities is to trigger the feedback process, which is an important part of formative assessment. Asking for reflections on the tasks leads to two products that can be given feedback. One of these feedback is related to the students' products, while the other is related to their reflections. Both feedbacks can be used to support the development of students during the formative assessment process (Wade, Abrami, & Sclater, 2005).

According to examined research, the majority of assessment tools are rubrics which frequently used instruments to measure development based on graded criteria (Contreras-Higuera, Martínez-Olmo, Rubio-Hurtado, & Vilà-Baños, (2016). Rubrics are also preferred for providing and analyzing self-peer-teacher assessments, as well as examining their relationships (De Grez, Valcke, & Roozen, 2012; Barbera, 2009). The personal and structured nature of the rubrics can enhance the objectivity of the feedback. In a small number of studies, a criteria list and content analysis were chosen. It is surprising that some studies did not explain how electronic portfolios were evaluated. Another assessment strategy is to use tests at regular intervals to determine the status of students or to support their learning. In particular, the fact that multiple-choice tests can be evaluated easily by the system will increase the speed with which students receive feedback and reduce the teacher's workload.

Another predictable finding is that formative assessment through ePortfolio environments are applicable to all levels and branches of the educational system (Sweet,1993). It is understandable that alternative tools, such as portfolios, reflections, and so on, are increasingly used to measure higher-level outcomes, particularly at the graduate and postgraduate levels. Given that ePortfolios facilitate reflection in numerous ways (Slepcevic-Zach & Stock, 2018), their prevalence at this level of education is not surprising. In addition, there are numerous opinions in the literature regarding the use of alternative assessment and evaluation tools, such as ePortfolios, at the K-12 level (Gülbahar, 2009; Meyer, Abrami, Wade, & Scherzer, 2011; Mitchell, Campbell, Somerville, Cardell, & Williams, 2021). Surprisingly, only a few of the studies were conducted in grades K-12. The fact that the number of research at the undergraduate level is higher than that of the graduate level can be explained by the number of students at these levels, but considering the number of schools and students at the K-12, it is confusing that the number of studies at this level. According to Barrett (2010), many ePortfolio applications are conducted at the undergraduate level. It is common knowledge that university-based academicians conduct the vast majority of academic research. It is believed that the prevalence of undergraduate-level research is due to the researchers' use of a convenient sampling method. Although the main concentration of study at each educational level is in the fields of language education and educational sciences, there are also studies in some other disciplines as well. ePortfolios are used extensively for reflection and process monitoring in language education and educational sciences. The lack of research in the social sciences and career development, where ePortfolios are commonly utilized, is notable. Thus, the use of ePortfolios for formative assessment in these disciplines can contribute to the literature.

The notion of feedback is predominantly observed in the qualitative findings of the studies examined. For students' success in the learning process, quality support and mentoring are essential, and feedback is an integral component of this (Peacock, Scott, Murray, & Morss, 2012). Peer feedback, for example, has been reported to reduce the need for teacher support in online environments (Shepherd & Bolliger, 2011). In a similar vein, Gardner and Aleksejuniene (2008) assert that formative feedback reduces the workload of both teachers and students and increases the possibility of producing high-quality assignments and outputs. It is apparent that user opinions reflect the benefits of feedback used in ePortfolio environments.

As a result of the content analysis, it is revealed that other prominent concepts are self-assessment and self-reflection. Providing users with a chance to evaluate themselves and to follow and monitor their processes is shown as the benefit of ePortfolio environments that support these concepts (Ebil et. al., 2020). ePortfolio environments facilitate self-assessment of self-directed learning skills (Beckers et. al., 2022). In addition, these environments also provide users with the opportunity for self-reflection (Wang & Jeffrey, 2017). The studies also emphasize that if ePortfolio environments are designed by considering real learning tasks, community of practice, and interaction, they can make positive contributions in components such as confidence, ownership, self-improvement, peer assessment, attitude, professional development, social learning, motivation, new experience, content knowledge/content enrichment, monitoring of progress, peer support, teacher assessment, and reflection. In addition, it becomes apparent that ICT skills and anxiety levels must be taken into account for the useful administration of these environments.

Studies identified slow Internet connections, lack of Internet access, installation problems, and system maintenance as major obstacles (Fathi & Rahimi, 2022; Hung, 2012). It is remarkable that these problems persist today. To avoid these issues, it is recommended to carefully organize the tasks/authorisations, the construction of the technical infrastructure, and the system's sustainability before starting the ePortfolio applications. Basic ICT skills are one of the competencies that must be considered for a successful ePortfolio process. Hung (2012) states that although technology plays an important role in the portfolio development process, it can create frustration for some users.Wang and Jeffrey (2017) state that users with low ICT skills show negative attitudes towards ePortfolio. Therefore, it would be beneficial to provide support in the form of fundamental ICT skills in order to reduce user anxiety and facilitate their participation in these processes. According to Kabilan and Khan (2012), despite the fact that students find the use of ePortfolios beneficial, they experience time constraints as a result of their responsibilities. It demonstrates that in the weeks that follow, students adopt negative attitudes, such as rephrasing the same comment, repeating what others say, and paraphrasing. Consequently, workload and time management are essential factors to consider in these environments (Stefani et. al., 2007).

Despite some challenges, it is clear that the use of ePortfolios in formative assessment provides a very high rate of positive results. Therefore, it can be assumed that their use in educational environments will be beneficial. Adapting techniques such as AI-supported feedback and evaluation to these settings can enhance the ePortfolio's support for formative assessment by shortening the response time and reducing the teacher's workload.

Declarations

Conflict of Interest: No potential conflict of interest was reported by the author.

Ethical Approval: Secondary data were used in this study. Therefore, ethical approval is not required.

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* indicates the study included in systematic literature review.

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