Collaborative e-Portfolios Use in Higher Education During the COVID-19 Pandemic: A Co-Design Strategy

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Abstract: As the globe gradually entered the post-pandemic phase, electronic portfolio practises during the COVID-19 pandemic should be examined for future implementation. During the lockdown, electronic portfolio use was observed in higher education institutions by urging the provision of teaching and learning in a virtual mode. Under these conditions, the study analyses empirical e-portfolio practices and proposes a co-design model for effective e-portfolio implementation. This study is based on a systematic review, which included searching for and retrieving 221 papers from academic paper databases in English, Chinese, and Spanish; systematic screening using the Rayyan tool and the PRISMA model; and finally, extracting 12 publications, which were analysed by VOS Viewer and Nvivo, focusing on collaboration. The data collected allows for gathering several patterns of collaboration in e-portfolio practice. Based on the results obtained, a co-design strategy is suggested, which includes collaborative frameworks in e-portfolio implementation processes such as the community of inquiry (CoI) and community of practice (CoP). The co-design strategy provides the formulation of implementation recommendations related to collaborative e-portfolio. Conclusions reflect on utilising e-portfolios collaboratively in higher education settings by presenting a co-design strategy that is supported by the CoI and CoP frameworks.

Keywords: *Co-design, COVID-19, e-portfolio, higher education, systematic review.*

Introduction

Online learning is the most rapidly expanding field in education because they allow flexible access to educational opportunities to learners from varied backgrounds and geographical regions which are frequently unable to access higher education through traditional ways. Although online education is not a novel concept, the global COVID-19 pandemic has driven online learning into regular practice (Mudau & Modise, 2022). E-portfolios have attracted the attention of academics and educators as a widely utilised digital tool in online learning settings (Devarajoo, 2020; Domene-Martos et al., 2021; Rodriguez et al., 2022).

Educators at all levels use e-portfolios in their instructional practices to enhance teaching and learning, particularly in higher education settings. Many universities and colleges actively develop institution-wide e-portfolio programmes to document a student's college experience (Ismailov & Laurier, 2022; Mudau, 2022). Various researchers have characterised e-portfolios in different ways. A recent publication presented a synthesised description of an e-portfolio based on the available literature: An e-portfolio is an integrated electronic compilation of multimodal artefacts as learning evidence that can be utilised in teaching, learning, assessment, and showcasing; it depicts skill development by concentrating on the learning process, progress, and success; besides, it necessitates self-regulation, self-reflection, and self-evaluation (Zhang & Tur, 2022).

The COVID-19 pandemic struck the world and posed a challenge to the traditional face-to-face educational setting. Institutions had to transform to emergent virtual education, and students could not attend school regularly. Educational institutions such as schools, colleges, and universities have been clamouring for digital platforms to stay afloat in this uncertain time of an unprecedented pandemic and virtualise their academic activities while maintaining quality (Devarajoo, 2020). Furthermore, these situations and the related problems and hurdles influenced educators' material organisation, instructional approach, and online assessment. Simultaneously, it had a psychological influence on pupils and their performance and learning objectives, implying that it substantially impacted their cognitive and emotional processes (Rahiem, 2021; Rodriguez et al., 2022; Schiff et al., 2021). Because of these constraints, using digital technology

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tools such as e-portfolios to underline the benefits of virtual collaborative learning and cooperation has grown in popularity (Ismailov & Laurier, 2022).

The globe has now entered the post-COVID-19 era. As the world returns to normalcy following the worldwide pandemic, educational institutions throughout the world are examining alternative models for educational offerings (Zhang & Tur, 2022). At this point, it is critical to take what we have learned over the last three years and apply it with zeal, building new methods of operation while honouring the previous knowledge and practice. According to recent research, the experience of social distancing and remote learning may have long-term implications for future university programme designs (Beech & Anseel, 2020; Ismailov & Laurier, 2022). In light of this, this study was meant to perform a systematic review of empirical evidence on collaborative e-portfolio implementations conducted during the COVID-19 pandemic, with a particular focus on co-design processes. The article synthesises the findings and presents recommendations for e-portfolio users.

Literature Review

This section sheds light on the research's background and theoretical frameworks, which echo the theme: the collaborative co-design process in e-portfolio implementation during the COVID-19 pandemic.

Collaboration in e-Portfolio Practice

Collaboration in e-portfolios use can be interpreted under the lens of constructivism. Constructivism is a commonly used and accepted theory of cognition that asserts that knowledge is not passively acquired but actively constructed. It refers to approaches that acknowledge the importance of engaging and challenging learners' existing mental models to improve their understanding and performance (Saxton & Hill, 2014). Implementing e-portfolios typically entails a high level of learner autonomy and initiative, learner responsibility for their learning, and the opportunity to enhance their learning through collaboration with their learning peers and teacher. The emphasis on collaborative learning stems from the fact that it is viewed as an activity performed with the assistance of others outside of the individual approach. However, collaborative learning is not opposed to individual learning; instead, it is viewed as a supplement, and consequently, its applicability for the individual building of e-portfolios should be recognised (Tur & Urbina, 2016). In the context of Web 2.0, the influence of technology raises its potential even further since Web 2.0 expands the opportunities for collaboration, communication, and knowledge generation (Tur & Urbina, 2016).

COVID-19 Demands Collaboration in Educational Practice

The COVID-19 virus was discovered in 2019 and declared a worldwide pandemic by the World Health Organisation (WHO) in March 2020 (WHO, 2020). To prevent the spread of the virus, countries worldwide implemented severe measures such as total or partial lockdowns, social distance rules, etc. Society has been confronted by the global health crisis, which has directly impacted education provision: educational institutions were also forced to transform how they provide education; the stakeholders, including students, teachers, and other professionals, are experiencing unprecedented challenges. As a result, emergency remote education was implemented in various delivery formats to ensure educational continuation (Bozkurt & Sharma, 2020).

To confront the challenge of COVID-19-led Emergency Remote Education, collaborative practises during the pandemic and lockdown were regarded as an effective way. According to Bozkurt and Sharma (2020), the COVID-19 challenges necessitate collaboration, the establishment of supportive communities, the sharing of tools and expertise, and attention to various perspectives. Learners need care, compassion, and support; thus, it is essential to establish safe and collaborative environments where they may assist and support each other during the learning journey. Villatoro Moral and de-Benito Crosetti (2022) also have similar views; they claim that technology-enhanced settings make it easier for people to work together and are a key part of solving the educational problems caused by the COVID-19 pandemic. Through sharing, cooperating, regulating, organising, and interacting among educators and learners, students can develop their responsibility for learning and take charge of their own learning with teachers' and peers' assistance (Villatoro Moral & de-Benito Crosetti 2022). As Bozkurt and Sharma (2020) stated, supportive and collaborative communities are vital for educators and learners to cooperate and support each other during the pandemic. In this circumstance, some frameworks of collaborative learning community, such as the community of practice (CoP), community of inquiry (CoI), and co-design, should be mentioned.

Community of Practice (CoP)

Scholars in the field of higher education are focusing on the concept of CoP to adapt to the shifting educational environment caused by COVID-19 (Grunspan et al., 2021). CoP was mentioned by Lave and Wenger in their published book and has now expanded to various areas in educational research and practice. A CoP is a group of individuals who share similar concerns, are interested in or enthusiastic about what they are doing and learn how to do it better by frequently interacting (Wenger, 2010).

Wenger (2010) highlights three crucial elements of the CoP.

- o Domain: People in a community share an area of interest, expertise, and commitment that sets them apart from others. This shared domain gives everyone a place to start, encourages them to get involved, helps them learn, and gives their activities value.

- o Community: Individuals talk to each other, try to solve problems, share information, and make new connections. Community as a concept generates the social fabric necessary for collective learning. A robust community stimulates interaction and encourages the sharing of ideas. Strong communities stimulate interaction and idea-sharing.

- o Practice: Community members are genuine practitioners in this sphere of interest and develop a shared repertoire of materials and ideas they incorporate into their work. The practice is the particular emphasis around which the community creates, distributes, and maintains its core of collective knowledge, while the domain represents the community's broad area of interest. In this sense, practising together to learn from one another, whether face-to-face or remotely in a small or big group, might be regarded as an additional foundation of CoP.

In the context of e-portfolio use, the CoP's goal is to give students and teachers a way to collaborate, interact, share best practices, and improve at using e-portfolios in the classroom or the institution.

Community of Inquiry (CoI)

Due to the COVID-19 pandemic, online learning has grown in popularity in higher education contexts, and the CoI has captured the interest of multiple scholars (Homer, 2022). Theoretical interests and innovations in online education have shifted from concerns about organisational and structural constraints to worries about transactional (teaching and learning) issues (Garrison, 2007). This paradigm shift results from advancements in communication technologies combined with an emphasis on collaborative-constructivist learning theories (Garrison, 2007). The CoI framework is a collaborative-constructivist process model that specifies the critical aspects of a successful online higher education learning experience; it is the process of creating a rich and meaningful (collaborative-constructivist) learning experience via the development of three presences: cognitive presence, social presence, and teaching presence (Garrison, 2007).

- o Social presence is the participants' capacity to connect with the learning community, interact meaningfully in a trustworthy setting, and create interpersonal relationships by projecting their different characteristics (Garrison, 2007). Social presence promotes a collaborative atmosphere for online learning (Castellanos-Reyes, 2020). Learners construct collaboration channels using the capabilities of the existing technology to facilitate effective learning (Garrison, 2007).

- o Cognitive presence refers to the extent to which students can generate and reinforce meaning via continuous thinking and discussion (Garrison, 2007). Cognitive presence emphasises that critical thinking is the purpose of all educational endeavours (Garrison, 2007). However, it is not always the case that critical thinking and collaboration occur naturally. A third component, teaching presence, is frequently required to enable and accept managerial functions (Castellanos-Reyes, 2020).

- o Teaching Presence is the design, facilitation, and direction of cognitive and social processes and includes peer collaboration in learning as a learning support (Garrison, 2007). In one-room pioneer schools, the teacher served this function (Garrison, 2007). When additional forms (such as online learning) were introduced, the teacher and the students were jointly responsible for administrative chores.

Grounded on the previous theory, Shea and Bidjerano (2010) introduced the "updated" CoI and introduced a new presence framework, the learner presence, which includes aspects such as "self-efficacy and other cognitive, behavioural, and motivational constructs supportive of online learner self-regulation (Shea & Bidjerano, 2010)." In higher education practice, it is crucial that learners are also present in an online learning environment, such as in the context of using e-portfolios, where the presence of the instructor (teaching presence) is essential (Modise, 2021). Active engagement, planning, strategic selection, and use of technological tools to facilitate learning, collaboration with others, self-assessment, and self-monitoring through reflective practice characterise the learners' presence (Modise, 2021).

Co-design in Collaborative Learning

Co-design occurs in educational practice when the educational participants, such as students and educators, cooperate in designing lesson elements and instructional strategies (Villatoro Moral & de-Benito Crosetti 2022). There are several co-design approaches and technologies, notwithstanding their commonalities (Mor et al., 2015). Co-design refers to the joint creation of knowledge and the development of technology designs that react to educational demands (Gros, 2019) and learning processes (Penuel, 2019). It relates to instructional design, constructivist philosophies, and connective concepts (Mor et al., 2015). Co-design practices are associated with participatory and collaborative mechanisms (Bovill, 2020; Gros, 2019).

Participatory and collaborative design constitute co-design pedagogical methodologies that begin with collective reflection and result in enhanced knowledge in both the participants and the artefacts generated (Villatoro Moral & de-Benito Crosetti 2022). Participatory co-design begins with cooperation among educational participants, progresses via discussion and agreement, and culminates in co-creation (Bovill, 2020). Various levels of engagement are formed within co-design because there are varying interactions between participants (between educators, between learning peers, between learner and educator, or between professionals) and varying levels of participation (Villatoro Moral & de-Benito Crosetti 2022). Recent research has revealed substantial benefits of co-design: it can enhance deeper learning among students and further give educators critical insights to plan curriculum and instruction more effectively (Gros, 2019).

CoP and CoI are related and interconnected theoretical frameworks that underlie community-based learning (Jan & Vlachopoulos, 2018). Co-design, which addresses collaboration and facilitates collective learning, encourages interaction among the learning community members within the CoI and CoP frameworks. Although the current literature does not directly discuss co-design in the context of e-portfolio implementation, we believe that, along with the CoI and CoP frameworks, co-design can be applied in the process of e-portfolio-based learning to promote the level of collaboration and further boost learning. Thus, we formed the overarching research inquiry in this study to guide the systematic review: How are the collaborative co-design strategies, inclusive of CoP and CoI paradigms, used in e-portfolio implementation during the COVID-19 pandemic?

Based on the overarching research inquiry, the following detailed research questions were raised:

o What are the bibliometric characteristics of the e-portfolio articles published during the pandemic and their main themes?

o How do the elements of CoP, CoI, and co-design manifest in collaborative e-portfolio practice during the pandemic?

o What implications can be made for a collaborative co-design e-portfolio strategy addressing CoP and CoI frameworks?

Methodology

Research Design

The systematic review methodology was adopted to address the research question mentioned above. Systematic reviews aim to synthesise the existing information in a certain field, summarising what is known about a specific issue based on the findings of multiple studies and providing suggestions for future study and practice (Moreno-Küstner et al., 2018). Multiple tools (Ryaan, VOSviewer, NVivo) were employed in the study for data collection and analysis.

Sample and Data Collection

The research adhered to Tawfik et al. (2019)'s model for a systematic review (see Figure 1). Inspired by the paradigm, the data collection was conducted in four phases:

Phase 1. Preliminary search and planning. At this stage, before commencing the formal systematic review procedure, this study did a preliminary search to identify related papers, check the validity of the research idea, and check if there were enough articles to execute the analysis. After the preliminary research, below-stated research steps were designed and carried out by two researchers.

Phase 2. Search strategy, criteria, and parameter establishment. During this phase, inclusion and exclusion criteria were developed to determine which publications would and would not be included in the final sample (see Table 1). This research aims to provide a comprehensive picture of secondary studies without the bias of English-only articles. As a result, review articles in three languages were sought: English, Chinese, and Spanish. It is noted that we acknowledge the benefits of including other languages; however, to ensure the quality of the review, only these three languages that the authors are fully proficient were chosen. Besides, the three languages cover the majority of the publications. Different forms of the following keywords were used in the three languages (Boolean operators "AND" and "OR" were used to split the keywords): "e-portfolio," "electronic portfolio," "digital portfolio," and "COVID-19." Based on these keywords, two researchers developed search strings in three languages cooperatively. Because different databases include academic publications in various languages, six academic databases encompassing these three languages were selected: Web of Science (WOS), Scopus, ERIC, Science Direct, Dialnet, and China Academic Journals Full-text Database (also known as CNKI). Considering the emphasis on e-portfolio usage in higher education during COVID-19, a publication date filter of publishing after 2020 and a higher education descriptor were used throughout the search.

Phase 3. Paper identification. After searching papers with the established criteria, 221 papers were identified: ERIC (n = 36), Web of Science (n = 83), Scopus (n = 8), Science Direct (n = 82), Dianet (n = 12), CNKI (n = 0). The searched papers were then retrieved and entered Rayyan, a collaborative platform for conducting systematic literature reviews (Ouzzani et al., 2016).

Phase 4. Paper screening and inclusion. For data screening and eligibility determination, the updated Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) reporting standards (Page et al., 2021) were used. Rayyan identified five duplicates, which were immediately removed; nine papers were deemed invalid. Rayyan's first screening of 207 articles was successful. Then, using the previously agreed-upon search criteria, two researchers screened titles and abstracts and assessed publications. It should be noted that further duplicates that Rayyan did not eliminate were still found at this point. 172 papers were eliminated during this process. 35 papers were searched for retrieval after the title and abstract screening procedure; however, 4 were not successfully recovered. Before completing them, the researchers downloaded the complete text of the 31 publications and assessed their suitability using the previously indicated criteria. 19 of these were eliminated, leaving 12 empirical papers finalized for the systematic review. It is noted that there were no articles authored in Chinese from the CNKI database among the 12 publications included in this research; 11 papers in English and 1 in Spanish were in the final list.
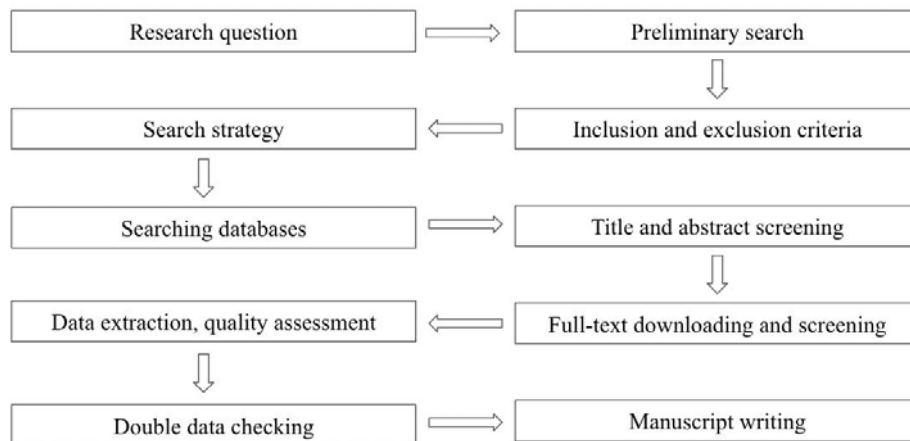

Figure 1. The Diagram of The Systematic Review

Table 1. Inclusion and Exclusion Criteria

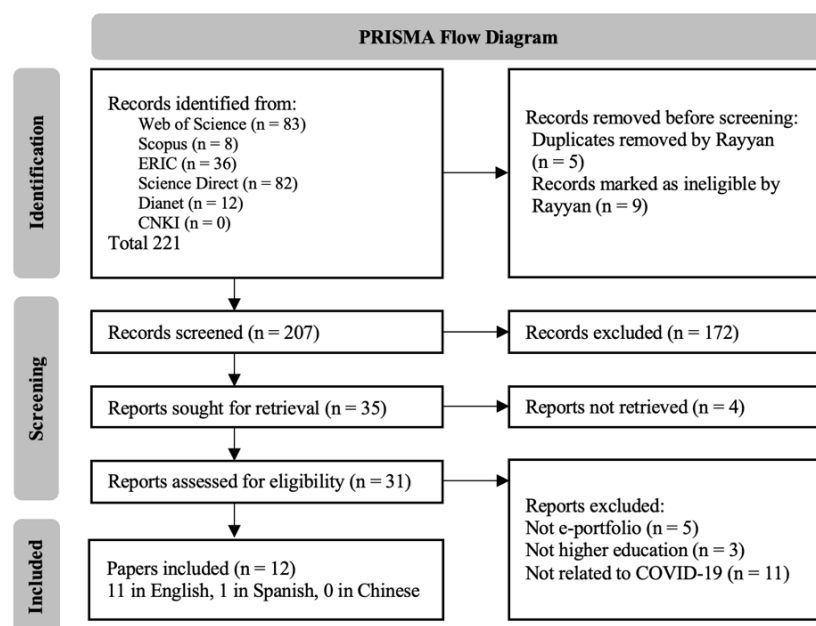| Inclusion Criteria	Exclusion Criteria
Published during 2020-2023	Published before 2020
Targeting Covid-19	Not mentioning the Covid-19 pandemic
Refer to e-portfolios use	Not directly related to e-portfolios
Empirical studies	Not empirical studies, such as reviews
In the area of education	Outside of the educational studies scope

Figure. 2. The PRISMA Flow Chart

Analyzing of Data

Content analysis, a research method to systematically code and categorize data (Hsieh & Shannon, 2005), is a widely used method in systematic reviews to systematically categorize and analyze qualitative data (Tsai et al., 2009). The content analysis technique was applied to all 12 selected publications, and the research questions stated before guided the analysis for the quality-of-study evaluation. To ensure the reliability of data analysis and improve the efficiency and efficacy of the analytic process, instead of manual analysis, computer-assisted qualitative data analysis software (CAQDAS) (Leech & Onwuegbuzie, 2011) was utilized. Besides, two researchers participated in the data analysis to improve the intercoder reliability. There is an increasing trend for researchers to use CAQDAS while conducting qualitative research or reviews since it offers platforms for "saving, indexing, sorting, and coding" as well as cross-team cooperation (Leech & Onwuegbuzie, 2011, p.71). In this study, the CAQDAS tools, VOSviewer and NVivo, were adopted in the data analysis process.

VOSviewer: VOSviewer was regarded as an effective tool for constructing and visualising bibliometric networks. It also has text mining features that may be utilised to generate and visualise co-occurrence networks of significant phrases collected from a collection of scientific literature (Van Eck & Waltman, 2014). The keyword co-occurrence was applied to obtain a general picture of the selected studies. The selections' titles and abstracts were analysed and visualised via VOSviewer.

NVivo: Among the several CAQDASs available, NVivo is one of the most extensively utilised in educational research (Leech & Onwuegbuzie, 2011). After deciding on the paper selections, NVivo, the CAQDAS tool, was employed as an analytical instrument to analyse further the chosen empirical studies guided by the predetermined research inquiries. This research adopted the Eight Step Pedagogy (N7+1) educational paradigm proposed by O'Neill et al. (2018) while using Nvivo. They addressed the significance of the literature review in scientific investigation and discussed the problems encountered when performing a literature review using traditional methods (O'Neill et al., 2018). In response to these obstacles, they suggested using NVivo to analyze the data in preparation for the next study phase. In addition, they suggested using the N7+1 framework (O'Neill et al., 2018) for NVivo implementation in literature reviews. The N7+1 processes involve establishing an NVivo project, importing and classifying the literature, and then categorizing and visualizing the information to generate review themes (O'Neill et al., 2018).

Findings/Results

Based on the previously mentioned research questions (RQ1 and RQ2), the results were categorised into two main parts: bibliometric findings including the underpinning themes, and the elements of CoI, CoP, and co-design that underpin collaborative e-portfolio practice in the context of collaborative e-portfolio practice in higher education during the COVID-19 pandemic. Based on the findings, the implications drawn from the reviewed papers (RQ3) are elaborated in the discussion section.

Bibliometric Information and Main Themes of the Chosen Papers

Before tapping into the research questions, the study first collected and classified the bibliometric information of the selected empirical studies (see Table 2). The chosen papers represent a diverse range of countries across Africa, Europe, the Americas, and Asia, including South Africa, the United States, Spain, Japan, Chile, the United Arab Emirates, and Malaysia. All articles fit into higher education settings and were published in the past three years (2020, 2021, 2022). In terms of the educational contexts and research focus, most chosen papers investigated stakeholders (students and/or lecturers') perceptions in virtual classes, including virtual emergency education due to the spread of the COVID-19 pandemic and the emerging presence of Open Distance eLearning (ODeL). Some papers tapped into e-portfolio utilisation in clinical practice, including teaching practicum and other supervised professional on-the-job training. The majority of studies (n = 11, 92%) employed qualitative methods such as interviews (focus group interviews, semi-structured interviews), surveys, and content analysis, whereas a single study employed a mixed-methods approach consisting of descriptive statistics and factor analysis. In addition, most selected publications (n = 9, 75%) conducted exploratory-descriptive research; one entirely descriptive paper presented a Learning Management System (LMS) e-portfolio Building System, and the other two investigated specific scenarios (case study). In terms of the publisher, most selections (n = 10, 83%) were papers published in various journals; one was from a chapter of a book: Teaching, technology, and teacher education during the COVID-19 pandemic: Stories from the field, and another one was from a Conference Proceedings.

Table 2. Selected Articles: Bibliometric Information

Author/ Date	Country	Context	Focus	Type	Method	Publisher
Devarajoo (2020)	Malaysia	Emergency virtual education	Student and lecturer experiences	Case study	Qualitative: interview	International Journal of Social Science and Human Research
Hendrith et al. (2020)	United States	Preservice teacher practicum	Students' perceptions	Exploratory-descriptive	Qualitative: survey	Association for the Advancement of Computing in Education (AACE)
Abuzaid et al. (2021)	UAE	Practicum	Student's experiences and challenges	Exploratory-descriptive	Qualitative: survey, focus group	International Journal of Current Research and Review
Domene-Martos et al. (2021)	Spain	Teacher training	Advantages and disadvantages of using a e-portfolio	Exploratory-descriptive	Qualitative: content analysis	International Journal of Environmental Research and Public Health
Ismailov and Laurier (2022)	Japan	Emergency virtual education	Virtual team processes	Exploratory-descriptive	Qualitative: content analysis	E-Learning and Digital Media
Miyoshi et al. (2021)	Japan	LMS e-portfolio Building System	Self-regulated learning	Descriptive	Qualitative description	Yonago Acta Medica
Modise (2021)	South Africa	Open Distance eLearning (ODeL)	Students' perceptions	Exploratory-descriptive	Qualitative: survey	Journal of Learning for Development
Mudau (2022)	South Africa	Open Distance eLearning (ODeL)	Functionality of e-portfolio as alternative assessment	Exploratory-descriptive	Qualitative: interviews	International Journal of Educational Methodology
Tucker et al. (2021)	United States	Engineering design course: onsite VS online	Engaging learning experience: mini projects and e-portfolios	Exploratory-descriptive	Mix-method: descriptive statistics and factor analysis	ASEE Annual Conference and Exposition, Conference Proceedings
Mudau and Modise (2022)	South Africa	Open Distance eLearning (ODeL)	Student engagement	Exploratory-descriptive	Qualitative: semi-structured interviews	Journal of Information Technology Education: Research
Rodriguez et al. (2022)	Chile	Emergency virtual education	Students' perceptions	Exploratory-descriptive	Quantitative: survey	Frontiers in Psychology
Viscarret et al. (2022)	Spain	Practicum supervision	The usefulness of e-portfolio as a learning tool for the practicum supervision	Case study	Qualitative: content analysis	Research in Education and Learning Innovation Archives (REALIA)

After retrieving the target papers, a keyword co-occurrence based on the title and abstracts of the selections was conducted via VOSviewer (See Figure 3). As depicted, the chosen papers centralised e-portfolios application from lecturer and students' perspectives during the COVID-19 pandemic. Multiple areas were explored within the overarching theme of e-portfolio use in higher education: student engagement, lifelong learning, learner autonomy, users' perceptions, e-portfolio tools, technical support, and practitioners' implementation.
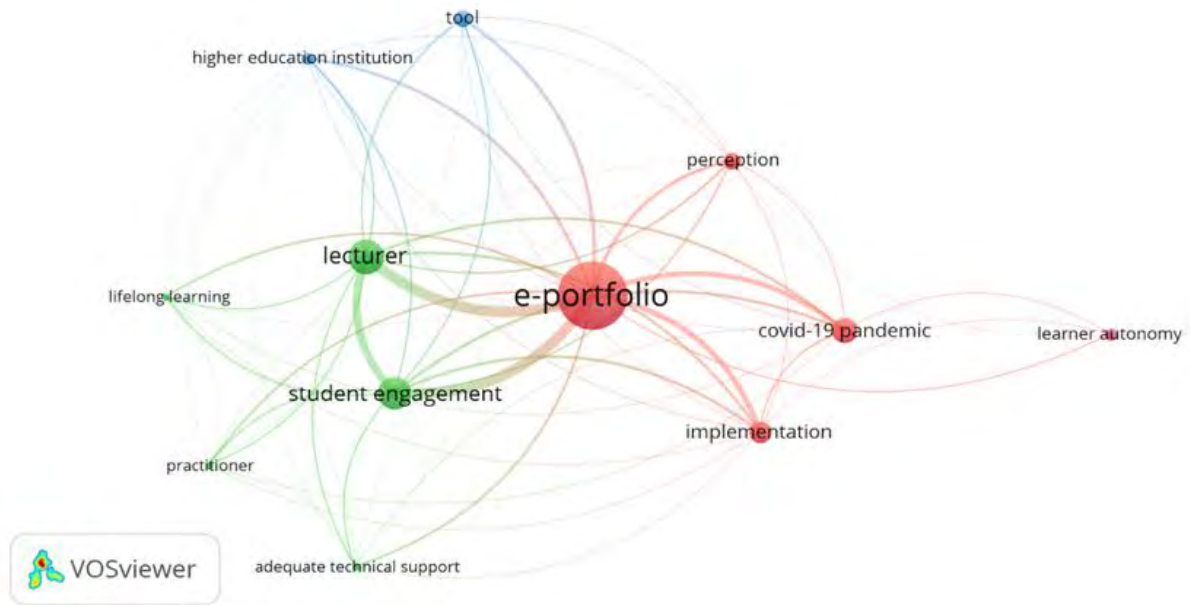
Figure 3. VOSviewer Keyword Co-Occurrence

VOSviewer Keyword Co-occurrence of the titles and abstracts offers a general view of the selected papers. In order to investigate the underpinning themes of the papers, Nvivo was employed to code the selections and analyse the underpinning themes. It is noted that similar themes in different research papers were synthesised into the same category, and synthesised themes identified in various papers were presented with a hierarchy chart (see Figure 4). Most reviewed empirical studies (n = 11, 92%) were contextualised in the context of virtual emergency learning due to the COVID-19 pandemic or Open Distance eLearning (ODeL); some research (n = 3, 25%) specifically focused on e-portfolio use in practicum (teaching and other clinical practice); two studies specifically investigated e-portfolio use associated with Learning Management System (LMS). Various aspects of e-portfolio practice were also found; almost half of the papers (n = 5, 42%) utilised e-portfolio as an assessment tool in various ways. Both formative and summative assessments were related; they were related to formal/informal learning and the visualisation of learning outcomes (n = 4, 33%). Remarkably, one study introduced self-directed mini-projects as a type of formative assessment to engage learners. Learners' engagement was broadly discussed in the chosen articles; some papers directly discussed student engagement, and some papers elaborated on self-regulated learning (SRL) and self-directed learning (SDL) (n = 3, 25%). Notably, collaborative learning was broadly discussed in the reviewed studies; some (n = 3, 25%) specifically focused on virtual teams or learning communities.

Figure 4. Underpinning Themes of The Papers

Types of collaboration: CoP, CoI and co-design intertwined e-portfolio practice

The core of the study is collaboration in e-portfolio implementation, leveraged by CoI, CoP, and co-design. Four types of collaboration were determined (see Figure 5) from the retrieved publications: student-student collaboration (n = 7, 58%), student-teacher collaboration (n = 6, 50%), community collaboration (n = 6, 50%), and collaboration with other professionals (n = 1, 8%). Notably, community collaboration emphasizes cooperation within the community of learners, including various forms of collaboration, such as student-student and student-teacher collaboration.

For student-student collaboration, three main types were identified: peer evaluation (including peer review and feedback), cooperative e-portfolio making, and peer assistance through social interaction. Rodriguez et al. (2022) emphasised the significance of student-student collaboration, especially for implementing the new evaluation system, the e-portfolio-based assessment. They included co-evaluation, allowing students to reflect on and incorporate the ideas of their classmates responsible for constructing the projects. It was revealed that pupils appreciated peer input substantially. Rodriguez et al. (2022) advocated the collaborative development of knowledge through exchanging resources and reflections among peers as another layer of student-student cooperation. Likewise, in the study conducted by Abuzaid et al. (2021), students valued their engagement with peers since they were able to communicate their opinions and get feedback; interaction with classmates increases student learning and productivity. Modise (2021) also observed the learners' favourable opinions of peer-to-peer collaboration: almost 70% of the students reported that they experienced some of the most helpful assistance and support from their classmates. When confronted with several assignments, particularly group-based assignments and projects, the majority of students recalled forming WhatsApp groups. They communicated outside the university's LMS and Mahara e-portfolio platform by establishing conversations on other, more accessible social media platforms that allowed them to access and collaborate at any time (Modise, 2021). In Viscarret et al. (2022)'s context, student-student collaboration in e-portfolio construction enhanced the quality of students' cooperative practicum work, particularly in the field of social intervention. To facilitate social learning among peers, Mudau and Modise (2022) outlined their course design as follows: pupils ought to have more than two peers from the virtual classroom, not only to allow access to their personal learning e-portfolio environment (PLEEs) but also to empower peer review and peer assessment. Ismailov and Laurier (2022) also discussed peer social interaction in the context of e-portfolio use. He claimed that cooperative learning among students might occur in many online environments incorporating learning communities, wikis, blogs, discussion prompts, and other virtual taskwork, where students are allocated to groups to share their experiences or engage in the course content together (Ismailov & Laurier, 2022).

When it comes to teacher-student collaboration, the following aspects of collaboration were recognised: ongoing assessment and feedback; continuous guidance and support; facilitating the e-portfolio use process, including co-design. Miyoshi et al. (2021) employed an e-portfolio to create a student's self-promotional e-portfolio with tutors and other instructors for feedback. Each student shares their self-promotional showcase with their tutors for comments and other purposes under the collaborating area (Miyoshi et al., 2021). Rodriguez et al. (2022) also acknowledged instructors' continuous feedback for e-portfolios that enable collaborative learning. Tutors would offer comments and feedback during a workshop and complete summative assessments at the end. Additionally, the instructors organised and developed self- and peer-assessment rubrics for the evaluation (Rodriguez et al., 2022). They emphasised that the lecturers' input should be timely and constructive, and the student greatly valued the lecturers' ongoing assessment, feedback, and support (Abuzaid et al., 2021; Rodriguez et al., 2022). Guidance and facilitation constitute an additional layer of student-teacher cooperation in the e-portfolio development process. It was stated that the student-teacher interaction should be taken into account (Rodriguez et al., 2022). To do this, a teacher and a student must be ready to engage in the learning process and the usage of the e-portfolio in a teaching and learning environment supported by active approaches and various evaluation tools (Rodriguez et al., 2022). The papers also provided examples of co-design, such as providing students with templates, examples, and rubrics (Miyoshi et al., 2021; Viscarret et al., 2022), actively participating in their e-portfolio creation process through feedback, facilitating their engagement (Viscarret et al., 2022), and mediating learners' reflection (Rodriguez et al., 2022). In the context of COVID-19 caused emergency virtual education, Ferdig et al. (2020) emphasised the teacher-student collaboration in dealing with the change, including ongoing support for students, whole faculty collaboration to facilitate students' teamwork, and creating the content for the e-portfolios (co-design).

Collaboration within the entire learning community is also extensively discussed in the reviewed papers. In the selected papers, the most common types of community-wide collaboration were found to be the CoI and virtual teams. A CoI in education is a group of persons participating in intentional critical dialogue and reflection to develop personal meaning and reinforce mutual understanding (Modise, 2021). The CoI framework is a collaborative-constructivist process model that outlines the important features of a successful online higher education learning experience. It is based on the educational philosophy of John Dewey and social constructivism (Garrison, 2007). CoI is the process of establishing a rich and meaningful (collaborative-constructivist) learning experience by fostering three interdependent elements (which will be discussed in-depth in the discussion section): cognitive presence, social presence, and instructional presence (Castellanos-Reyes, 2020). Apart from the three presences, Modise (2021) cited Shea and Bidjerano's (2010) work on adding a new presence framework, the learner presence. It includes self-efficacy and other cognitive, behavioural, and

motivational characteristics that facilitate self-regulation in online learners (Shea & Bidjerano, 2010). Contextually dependent components of learner presence include foresight and preparation, monitoring, and strategy (Modise, 2021). Virtual teamwork is built on a multiphase and sequential contact between team members collaborating to achieve a specific objective and produce a shared output. In other words, virtual teams function as multitasking units that coordinate goal-directed taskwork by performing numerous activities concurrently and sequentially, which, in work by Ismailov and Laurier (2022), inspires the e-portfolio design as CoP.
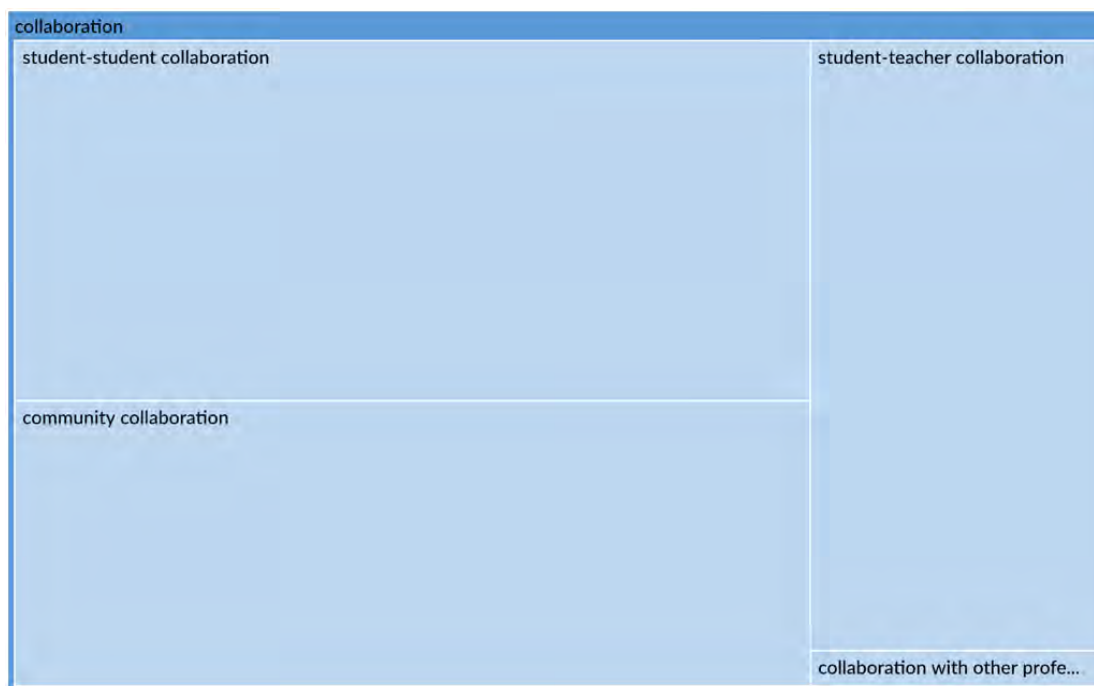

Figure 5. Types of Collaboration

Discussion

Even though e-portfolio use is commonly regarded as an individual and self-regulated learning approach, collaboration in the implementation process is essential. In fact, they regarded collaboration as one of the most fundamental processes in e-portfolio construction (Tur & Urbina, 2016). Effective collaboration in e-portfolio practice can maximise its advantages, facilitate teaching and learning, and optimise students' knowledge construction (Zhang & Tur, 2022). Inadequate collaboration can cause many challenges in e-portfolio implementation. Previous studies have identified multiple non-negligible concerns in educational e-portfolio implementation: technical difficulties, learners' unfamiliarity, a lack of common knowledge of how to use e-portfolios effectively, etc. (Abuzaid et al., 2021; Modise, 2021; Mudau & Modise, 2022; Viscarret et al., 2022; Zhang & Tur, 2022). These concerns stem from insufficient guidance and support from teachers and learning peers. A higher level of collaboration in the process of using e-portfolios is the key to addressing these challenges. The collaborative processes of e-portfolio use can be enhanced from the perspective of collaborative frameworks such as such as CoI, as collected in the literature review, and also CoP and the co-design approach. The results obtained in this study allow us to offer a systematic approach to collaboration that can be organised into a model that integrates related approaches that might contribute to improving the level and efficiency of collaborative e-portfolio processes for learning. It is noted that the proposed model is comprehensive and complex, involving various types of collaboration, different types of 'presences', and the incorporation of CoI, CoP, and co-design. While this comprehensiveness could be seen as a strength, it might also make the model challenging to implement in practice. Detailed guidance on how the model might be practically applied are also discussed in this section.

The collaborative process of e-portfolios implementation contains four main types: teacher-student (Abuzaid et al., 2021; Miyoshi et al., 2021; Modise, 2021; Mudau & Modise, 2022; Rodriguez et al., 2022; Viscarret et al., 2022;), student-student (Abuzaid et al., 2021; Ismailov & Laurier, 2022; Modise, 2021; Mudau & Modise, 2022; Rodriguez et al., 2022; Viscarret et al., 2022), with other professionals (Miyoshi et al., 2021), and whole community collaboration (Abuzaid et al., 2021; Ismailov & Laurier, 2022; Modise, 2021; Mudau & Modise, 2022). We argue that learning community collaboration, comprised of the two main protocols of CoI and virtual teams, encompasses all other kinds of collaboration. According to Hertel et al. (2005)'s description of virtual teams, the features of virtual teams fall within the CoP framework. Thus, virtual teamwork is regarded as a type of online CoP in this study. As a result, CoI and CoP are utilised in the discussion to address the community-based e-portfolio collaboration.

Based on the description of the CoP provided in the previous background section, an e-portfolio CoP is proposed: a group of e-portfolio participants who are interested in implementing e-portfolios and are heavily involved in the collaborative

process through cooperation and interaction. The objective of the e-portfolio CoP is to provide learners and educators with a means to cooperate, engage, exchange best practices, and improve their use of e-portfolios, further benefiting teaching and learning. There are three crucial elements of the CoP: domain, community, and practice (Wenger, 2010). In the context of the e-portfolio CoP, the three key factors can be interpreted in the following ways:

o Domain: the areas of shared interest in collaborative e-portfolio implementation to facilitate teaching and learning.

o Community: e-portfolio participants and their collaborative relationships build throughout the journeys of e-portfolio practices

o Practice: the ways that e-portfolios are employed collaboratively; the tools or systems that enable collaboration and facilitate the use of e-portfolios.

The common domain, e-portfolio use, serves as the starting point. All e-portfolio implementation participants should be included (teachers and students, even professionals in some cases), and teachers or professionals should nurture learners' interest through training and supervision. Once the domain is established, the next step is to develop an interactive community that promotes intellectual exchange and interaction. In the e-portfolio-based learning community, brainstorming, peer review, and peer assistance are highly valued, and collective and shared knowledge is the norm. The practice of e-portfolio CoP is deemed highly collaborative use of e-portfolios; community members construct their shared collections of learning evidence in collaboration.

Apart from CoP, CoI is also broadly discussed in the reviewed papers as a community-level collaboration structure. CoI for e-portfolio practice focus on the process of creating a rich and meaningful (collaborative-constructivist) learning experience through utilising e-portfolios among the community, which includes teachers and students, sometimes professionals or experts. On the basis of the cognitive, social, and instructional presences (Garrison, 2007) as well as the updated learner presence (Shea & Bidjerano, 2010), the e-portfolio CoI presences can be defined as follows:

o Social presence refers to e-portfolio participants' capability to interact with the whole e-portfolio learning community, communicate meaningfully, and form interpersonal connections to cooperate more effectively.

o Cognitive presence entails the ability of e-portfolio users to develop and sustain knowledge via ongoing thinking and collaborative discussion during the e-portfolio practice. This requires the e-portfolio practitioners to actively reflect and think critically on their own and their peer's work.

o Teaching presence is the creation, development, and guidance of cognitive and social processes throughout the implementation of e-portfolios by the teacher. It included not just the teachers' feedback, evaluation, and ongoing support but also teacher-facilitated peer collaboration, including peer feedback and peer assistance throughout the e-portfolio use journey.

o Learner presence consists of self-efficacy and other cognitive, behavioural, and motivational characteristics that facilitate students' self-regulation while using e-portfolios. It involves active participation, planning, the strategic selection of learning evidence, using appropriate technological tools to create e-portfolios, cooperation with others, self-evaluation, and self-reflection.

In the community collaboration of e-portfolio implementation, all four presences should be integrated. These four presences are interconnected and should all be considered to strengthen and facilitate the e-portfolio practice collaboration in the learning community.

Based on the findings from the retrieved papers and the theories of CoP and CoI, the collaborative e-portfolio use paradigm is proposed and created (see Figure 8). In this modal, all e-portfolio participants are seen as a learning community involving student-student collaboration, student-teacher collaboration, and collaboration with other faculty members or experts when necessary. In the collaboration process, the CoP and CoI frameworks in the e-portfolio use context are adopted. The e-portfolio community members should be both practitioners and inquirers in the CoP of e-portfolio-empowered learning, enabling the four types of presence in CoI: social, teaching, learner, and cognitive (Shea & Bidjerano, 2010).

Among the four presences, the majority of the synthesised recommendations from the reviewed studies on e-portfolio implementation fall under the category of teaching presence: Teachers should promote cooperation; enable and facilitate students' reflection, particularly self-reflection, through prompts; provide guidance and ongoing support to students; motivate learners by encouraging them and addressing positive aspects; engage students through various platforms (such as social media sites and discussion forums); use examples and templates with detailed descriptions to scaffold; establish clear guidelines and rubrics and carefully communicate them to students; allow students autonomy and flexibility in their use of e-portfolios by enabling them to take ownership and choose the e-portfolio platforms they want to use (Abuzaid et al., 2021; Ismailov & Laurier, 2022; Miyoshi et al., 2021; Modise, 2021; Mudau & Modise, 2022; Rodriguez et al., 2022; Viscarret et al., 2022).

In real-life practice, to tackle the formerly mentioned challenges in e-portfolio implementation and optimise e-portfolio learning, educators should first be aware of and foster the different types of collaboration in e-portfolio implementation. Learners and other learning community members should be explicitly informed about the domain, practice, and community of their CoP, and teachers should promote their sense of belonging through ongoing reminders and facilitation. Simultaneously, educators can incorporate the four presences of CoI to design the learning activities of their learning community, ensuring all presences are well-addressed. For example, teachers offer continuous guidance, support, assessments, and constructive feedback while using e-portfolio; encourage students to work in pairs or groups to interact, support each other, and offer peer feedback in their e-portfolio tasks; utilise various tools and materials to promote students' self-reflection and critical thinking, such as process journals through e-portfolio with various prompts; and encourage students to regulate, evaluate, and reflect on their own e-portfolio learning through giving detailed guidelines, checklists, and rubrics.
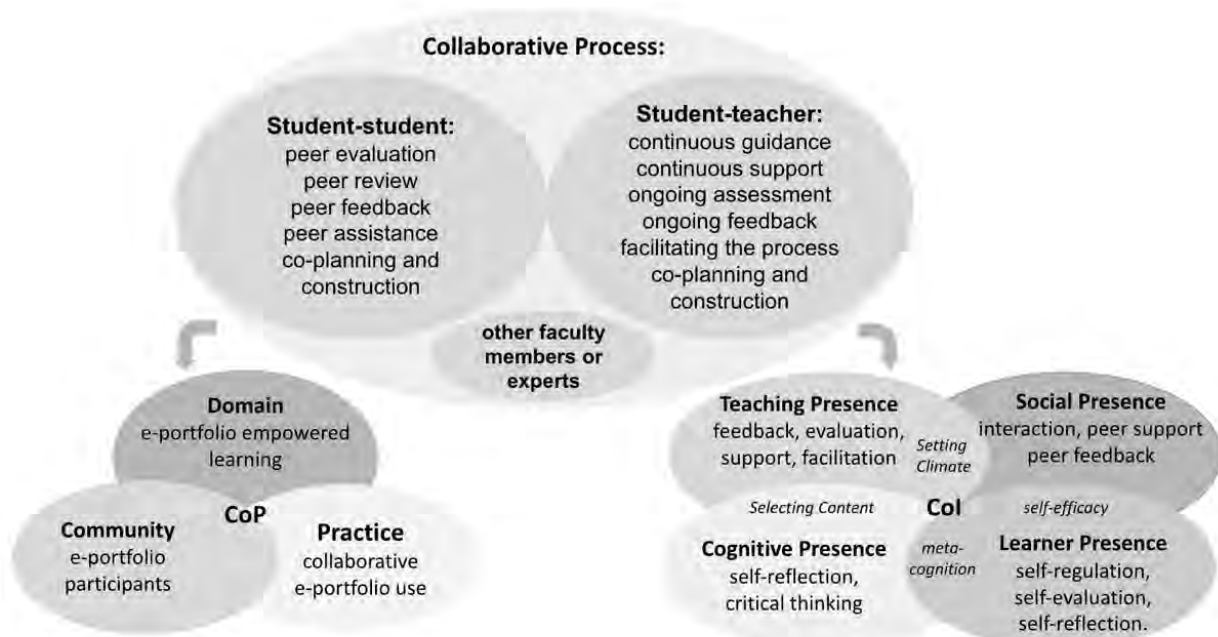

Figure. 6. collaborative process in e-portfolio implementation

The CoI and CoP frameworks provided theoretical guidance for developing and operating collaborative e-portfolio communities. The whole e-portfolio implementation process should be conducted collaboratively; in this sense, a co-design approach can be adopted. The co-design approach should be employed throughout the entirety of the e-portfolio-based learning journey, including documentation, reflection, assessment, and presentation.

The data collected in the review underpins the co-design model that systematises the collaboration process by adding the layers of CoI and CoP. Previous studies have touched on co-design: they looked at how students might act as participant designers in creating and implementing an e-portfolio and found that they can participate in three ways, as designers, models for ideas and examples, and peer reviewers (Gordon, 2017). Building on co-design proposals in the existing literature (Villatoro Moral & de-Benito Crosetti 2022) and the stages of e-portfolio implementation identified in the reviewed publications (Ismailov & Laurier, 2022; Miyoshi et al., 2021; Rodriguez et al., 2022; Viscarret et al., 2022), a collaborative e-portfolio implementation co-design process is proposed (see Figure 7). It is noted that, even though collaboration with other faculty members or experts may also exist in some cases, the student and teacher are the two key participants; thus, only these two participants were included in the proposed co-design process.

The e-portfolio processes (planning, implementation, reflection and revision, and showcase) in which teachers and students collaborate result in learning co-design. During the planning stage, teachers should support the selection of the appropriate e-portfolio and ensure technical assistance to ensure that all students have a thorough understanding of the procedure. In the initial step, teachers provide guidance, and negotiate and ensures agreement rubrics, resources, and examples or templates, and students collect proof of learning collaboratively based on teachers' direction. Teachers and students will participate in the continuing evaluation process via formative assessment, summative assessment, and peer review. After being evaluated, there should be an opportunity for collaborative feedback from teachers, learning peers, or even other faculty members and experts to facilitate additional reflection and revision. After developing optimised and integrated e-portfolio components, there will be a showcase, which may involve co-presenting. It is noted that collaboration and interaction should be managed during the learning journey; the e-portfolio co-design process is not a single loop but an ongoing procedure. In addition, the e-portfolio co-design model implies that e-portfolio-enabled

learning may be scaffolded via smaller e-portfolio-based projects (Rodriguez et al., 2022), ultimately leading to a final project. This suggests that the e-portfolio co-design paradigm can also be associated with project-based learning (PBL).
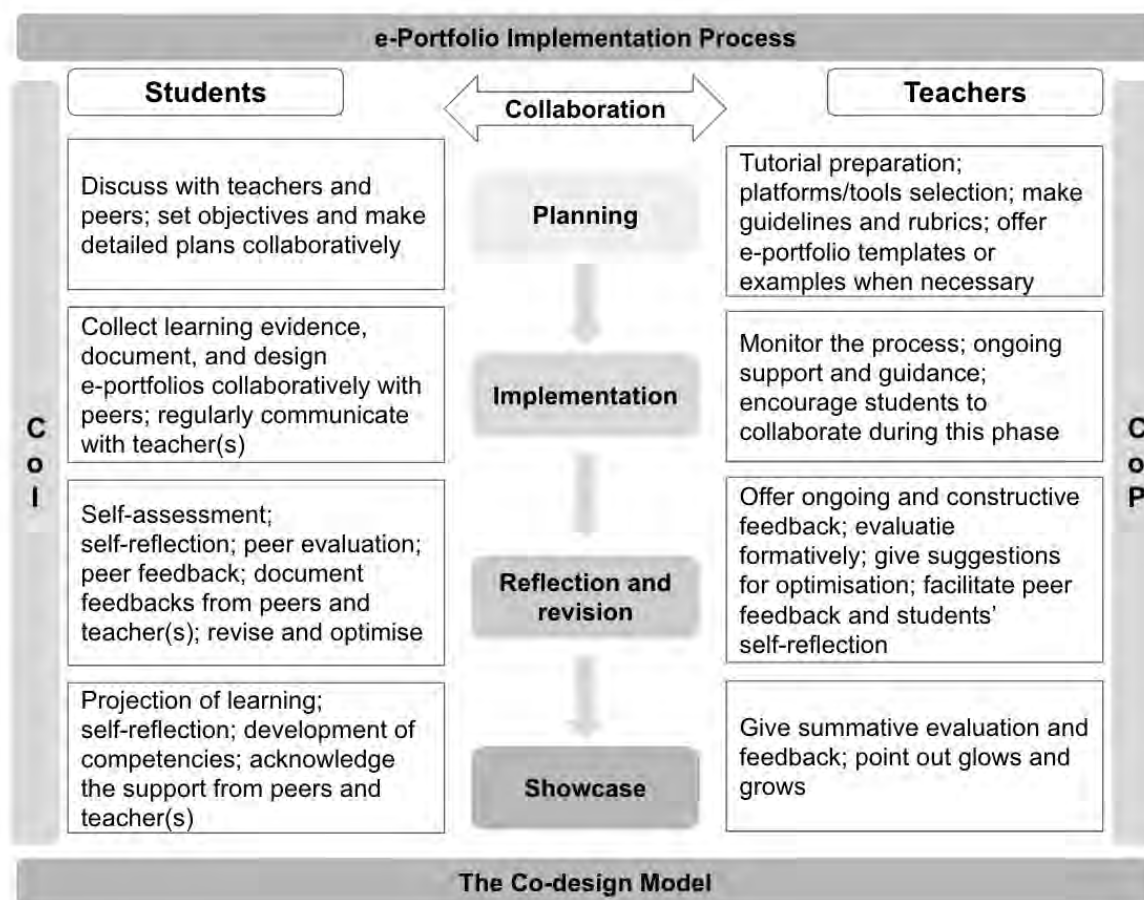

Figure 7. Co-Design E-Portfolio Implementation Process

Conclusion

To conclude, the study acknowledged the value of empirical studies carried out over the previous three years pertaining to the usage of e-portfolios during the COVID-19 pandemic and analysed them. Even though reviewed articles explored collaboration in the usage of e-portfolios, the discussion or introduction of particular collaboration designs or models has yet to be defined. The collaborative e-portfolio implementation model and procedure were revealed to be a research gap. This study focuses on the collaboration process and aims to promote collaborative learning and engagement in the context of e-portfolio implementation. Based on the existing literature, we proposed a paradigm for community-based collaborative e-portfolio co-design practice, including the concepts of e-portfolio-centric CoI and CoP. The e-portfolio implementation co-design process phases are planning, implementation, reflection and revision, and showcase, which include collaborative collection, peer assessment, community support (students, teachers, and other faculty or experts), feedback, reflection, and presentation. Future empirical work can be undertaken to validate the e-portfolio implementation paradigm and process. In addition, as suggested by recent research, the field of collaborative e-portfolio tools and platforms should be developed (Zhang & Tur, 2022). It is necessary to build new e-portfolio systems with collaborative capabilities and to do further research in this field. In summary, the study builds on previous work on e-portfolio practice during the COVID-19 pandemic and inspires further practice by bringing up a framework and model for collaborative e-portfolio use for enhanced teaching and learning in higher education environments.

Recommendations

The recommended co-design model's relevance and efficacy may vary according to the different educational settings, with varying support and resources available. Thus, it should be adaptive and customized to unique settings to accommodate these variances. Besides, the model's execution necessitates learners' and educators' engagement and buy-in. It is crucial for the model's effectiveness to encourage active participation, interaction, and collaboration among all e-portfolio stakeholders.

Even though tailored co-design strategies for different institutions are necessary, some general recommendations can be made for institutions to consider while designing their collaborative e-portfolio learning. Based on the findings of this systematic review, the recommendations for effective e-portfolio use in higher education contexts are as follows:

Adopt the co-design e-portfolio approach: Due to the significance of collaboration in implementing e-portfolios, higher education institutions should employ the suggested co-design strategy that involves the participation of both teachers and students. This strategy will enable a higher level of collaboration and further increase the effectiveness of e-portfolio use.

Incorporate the collaborative frameworks with CoI and CoP elements: Higher education institutions should consider incorporating concepts such as the CoI and CoP to promote collaboration in e-portfolio implementation. These frameworks offer a structured approach to collaboration and can help ensure that all e-portfolio participants work towards the same objectives.

Provide adequate guidance and support: This training should include guidance and support on using e-portfolios, such as technical skills workshops, templates, rubrics, and introducing best practices for collaborative and effective e-portfolio use.

Track and monitor the collaborative e-portfolio implementation: Tracking and monitoring the whole implementation process ensures the level of collaboration is reached and the learning needs of students are met. The teachers can do regular check-in, formative evaluations, and ongoing feedback; the students can continuously reflect on and review their e-portfolios.

By employing the co-design strategy, integrating collaborative frameworks, delivering adequate training and support, and keeping track of and assessing e-portfolio use, higher education organisations can facilitate participants' collaboration in the e-portfolio use process and further effectively implement e-portfolios. Institutions seeking to implement e-portfolios in a post-pandemic world may consider these recommendations an initial guide. Researchers could further investigate the e-portfolio use in higher education, particularly the pedagogical designs and models during implementation.

Apart from recommendations for higher education institutions, the study also suggests future research to investigate the effectiveness of the proposed co-design strategy. Besides, this study focuses on the co-design strategy in the higher education discipline; future studies could explore the collaborative use or co-design strategy of e-portfolios in different disciplines.

Limitations

This study attempted to analyse empirical studies comprehensively without limiting itself to English-only publications, potentially eliminating cultural bias. Thus, review articles in English, Chinese, and Spanish were explored (the final selection comprises one Spanish paper and eleven English papers; no Chinese paper fully matches the predetermined criteria), and publications from diverse backgrounds were included. However, since this study aimed to examine the collaborative e-portfolio practises during the COVID-19 pandemic, only research addressing the pandemic and collaboration is included. The specific focus led to limited selections for the systematic review. Due to the inclusion criteria of research addressing both the pandemic and collaboration, the relatively small amount of reviewed papers may limit the study's scope and application, further restricting the findings' generalizability.

Ethics Statements

The study does not involve any human subjects

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Conflict of Interest

The authors declare no competing interests.

Authorship Contribution Statement

Zhang: Conceptualisation, design, investigation, analysis, writing. Tur: Conceptualisation, editing/reviewing, supervision.

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