DIGITALEDUCATIONREVIEW

An exploration of agency enactment in e-portfolio learning co-design

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ABSTRACT

Although research has always related e-portfolios to self-regulated learning, recently agency, which includes individual, relational, and contextual domains, has also been highlighted. Likewise, agency has been explored in technological environments that support collaborative and co-design learning processes. This study, investigating the enactment of student agency within e-portfolio learning co-design with 68 secondary students in Hong Kong, focuses on how students perceive their agency within a co-design e-portfolio learning framework, which was coined as the Co-PIRS model in previous stages of research. With descriptive aims, a mixed research methodology was designed using quantitative and qualitative data collection instruments. Among the findings, it is argued that students report a greater awareness of agency, characterized by competence beliefs (individual domain) in the showcase phase of e-portfolios, peer learning (relational domain), and the opportunities to make choices (contextual domain) in the implementation phase. The study also reveals students' positive attitudes towards reflection, which suggests the suitability of structuring collaboration in the co-design approach. These insights serve as a foundation for implementing e-portfolio co-design frameworks to empower students' agency and provide educators with guidance in Secondary Education and beyond.

KEYWORDS: e-portfolio, agency, co-design, educational technology, secondary education

1 INTRODUCTION

Within the constantly evolving realm of educational technology, e-portfolios stand out as a pivotal instrument for facilitating reflective learning and showcasing student achievements. The literature robustly supports e-portfolios' role across educational strata, particularly in higher education, where they serve as a medium for students to document their learning progression, articulate their capabilities, and meditate on their learning journeys (Chang et al., 2018; Yang et al., 2015). The integration of e-portfolios into educational practices has been substantiated by research underscoring their benefits in enhancing students' learning, fostering self-reflection, and demonstrating learning achievements (Chang et al., 2018; Zhang & Tur, 2022).

This research derives from the fundamental significance that learner agency represents throughout contemporary discourse regarding education. Learner agency, which refers to the ability of learners to purposefully and constructively direct their learning journeys, plays an important role in the growth of competence and self-control (Ali et al., 2022). It demonstrates the active participation of learners in their educational pursuits by utilizing creative thinking and choice-making (Jääskelä et al., 2017). Learning environments that recognize and cultivate individual strengths and goals promote agency, which is vital for constructing a professional identity (Hempel-Jorgensen, 2015). The acknowledgement of the learner agency's critical role in fostering the growth of learner identities, encouragement of motivation, and influence on strategic behaviour is commonplace; its importance is emphasized in the context of learner-centred curriculum success (Chaaban et al., 2021; Rasulova, 2022).

Within the realm of e-portfolio learning, agency is manifested when students engage in creating and managing their own e-portfolios; this entails undertaking tasks such as making decisions, reflecting, and setting objectives (Zhang & Tur, 2023a). However, the emphasis goes beyond the ultimate product and encompasses the transformative learning experience inherent in the e-portfolio creation process. To this end, the Co-PIRS model, introduced by Zhang and Tur (2023b), pilot-validated by Zhang et al. (2024), represents a co-design framework for e-portfolio learning, encapsulating students and teachers' roles in the Planning, Implementation, Reflection and Revision, and Showcase phases (see details in the later section). This model aims to foster an ongoing process of learning, reflection, and improvement, thereby encouraging students to take a proactive position in their own learning, and challenging the roles by positioning the student as the central agent of decision-making.

This research investigates student agency enactment in the Co-PIRS e-portfolio learning framework and their perceptions of Co-PIRS-guided e-portfolio learning. The following research questions were made to achieve the objectives:

- RQ 1: How do students perceive their agency enactment during the e-portfolio learning co-design process in terms of the specific domains of agency?
- RQ 2: What are students' general perspectives on e-portfolio use following the e-portfolio learning co-design process?

To answer the research questions, the specific research objectives are twofold:

- To disentangle the multiple layers of learner agency at each phase of the e-portfolio co-design learning approach.

- To capture student perceptions of their e-portfolio learning following the e-portfolio learning co-design process, and their sentiments towards it.

By delving into the complexities of student agency in the e-portfolio co-design process, this research targets making a scholarly contribution and proffers practical implications for educators.

2 LITERATURE REVIEW

2.1 E-portfolio and its implementation in education

E-portfolios have gained popularity in educational settings as repositories of student work. They can be used for assessment, reflection, and exhibiting competencies (Amaya, 2013; Fuglík, 2013; López-Crespo et al., 2021). The electronic version of portfolios has replaced conventional paper-based portfolios, providing a more dynamic instrument corresponding to the digital competencies demanded in contemporary education (Xe et al., 2019). E-portfolios serve as archives for student work, enabling the documentation of learning progressions, from ongoing tasks to the final outcomes of a student's efforts. Learning evidence is highly multimodal and interconnected by using hypertext (Galván-Fernández et al., 2017). This process promotes reflective practice and the development of knowledge and skills (Razali et al., 2021).

The educational advantages of e-portfolios have been extensively acknowledged. The findings from these investigations have demonstrated that by moving the emphasis from a teacher-centred to a learner-centred approach, learning technologies, such as e-portfolios, have the potential to enhance instructional practices and empower learners (Boholano et al., 2022; Le, 2012). Moreover, integrating e-portfolios into educational practices facilitates reflective thinking and collaboration (Tur & Urbina, 2016), allowing learners to employ theoretical knowledge they have learned in real-world scenarios (Ayan & Seferoğlu, 2011).

The current body of literature indicates that e-portfolios are not just an educational technology tool but represent a transformative change in educational philosophy. By enabling a learner-centred approach and facilitating the integration of knowledge, e-portfolios contribute substantially to the enhancement of student learning (Ayan & Seferoğlu, 2011; Boholano et al., 2022; Fuglík, 2013; Le, 2012; López-Crespo et al., 2021), which has been highly claimed for self-regulated aims. The self-regulated learning model has been mostly contextualized in formal educational contexts and promotes students' skills for setting learning aims, planning the process, monitoring progress and self-assess achievements (Zimmerman, 2002). There are diverse models which slightly differ in the role that personal aspects like motivation play in the iterative self-regulated learning cycle (Panadero, 2017). However, although it has been a very relevant model for students' autonomy, this approach fails to grasp the sociomaterial aspects of learning, which are key in the agency background for learning (Eteläpelto et al., 2013; Jääskelä et al., 2017).

2.2 Agency and its sources

Agency, as defined by Bergström et al. (2014), is the inherent capacity of individuals or groups to act autonomously and make free choices. Understanding the sources of agency is crucial, as it underpins the ability of individuals to navigate and influence their own lives and environments. The literature on agency posits several dimensions that contribute to the development and exercise of this capacity, which mainly highlight the sociomaterial nature of agency (Charteris & Smardon, 2018), thus going beyond individual skills for self-regulation and including the social and material environment.

One salient dimension involves the subjective and objective sources of information that inform agency. Subjective agency is often described as internally driven, and rooted in personal beliefs, desires, and intentions. Objective agency, on the other hand, is influenced by external, factual information. The relationship between these two facets is complex, with some scholars suggesting subjective agency is contingent upon objective agency, while others believe they stem from distinct sources of information (Ma & Hommel, 2015).

Relational sources of agency form another dimension, characterized by social factors such as equal treatment, teacher and peer support, and trust (Jääskelä et al., 2017). These elements underscore the significance of interpersonal relationships and social networks in facilitating or constraining agency. The support and recognition from these social networks are essential for individuals to feel empowered to take action.

Agency is also conceptualized as a consensual relationship involving power dynamics, where one party has the power to impact the legal relations of another (Leow, 2019). This legalistic perspective highlights the formal structures and authorities that can either enable or restrict individual or collective agency. Furthermore, the interplay between an individual and their social context is a critical source of agency, suggesting that it is contextually situated (Hakanurmi et al., 2021). This perspective emphasizes that agency is not just a personal attribute but also a product of social interactions and the surrounding environment.

Building on these dimensions, Jääskelä et al. (2017; 2023) propose a tripartite categorization of agency sources encompassing contextual, relational, and individual domains. The contextual domain acknowledges the influence of the wider social and cultural environment on agency, the relational domain focuses on social interactions and support systems, and the individual domain emphasizes personal capacities and resources. In this work, the description of dimensions and elements of learners' agency by Jääskelä et al. (2017, p. 2065-2066) is used to explore students' enactment of agency. The complete conceptualisation can be summarized in the following Figure 1:

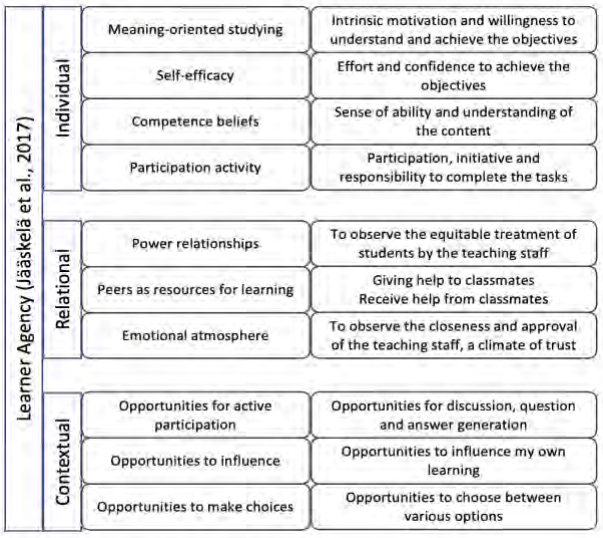

Figure. 1. Dimensions of Learner Agency (Jääskela et al., 2017, p. 2065-2066)

Agency enactment in e-portfolio learning

The role of learner agency in education, particularly within the framework of e-portfolio learning, is an area of growing interest and investigation. Ali et al. (2022) define learner agency as the capacity of learners to actively engage in their education through decision-making, problem-solving, creativity, collaboration, and self-regulation, asserting its fundamental importance in higher education. This active involvement is not only pivotal for knowledge construction but is also integral to competence development within a learner's field of study (Hempel-Jorgensen, 2015).

In the context of e-portfolio learning, agency is reflected in the intentional actions that learners take as they engage with the social experience of learning (Watling et al., 2021). E-portfolios create an environment that fosters participation and influence, enabling learners to recognize and apply their individual strengths, interests, and goals. This process supports the development of their identity both as learners and as future professional experts (Jääskelä et al., 2017). Professional agency, which is closely related to work-related learning, has been found to intertwine significantly with learning in professional settings (Hökkä et al., 2017). In these contexts, the enactment of agency is fundamental to the learning process, as it aids learners in navigating and adapting to their workplace environments.

The factors that support the development of agency in learning environments, such as independence, ownership, scaffolding, and reflection, have been recognized as crucial for students to exert more control over their learning (Crowhurst & Cornish, 2020). E-portfolios offer a platform that can facilitate these factors, allowing learners to take ownership of their learning journey, reflect on their progress, and receive scaffolding when necessary. Moreover, the interdependence between individual agency and the social affordances of learning environments highlights that learning involves both personal development and the interactions between the learner and the social context (Eteläpelto, 2017). E-portfolios, by their very nature, provide a unique confluence of personal and social affordances that can significantly enhance this relational interdependence.

Self-directed learning is another aspect closely related to the enactment of agency. Learners who are familiar with self-directed learning techniques and who are supported by an educational environment conducive to proper evaluation can implement self-directed learning more successfully (Hwang & Oh, 2021). Beckers et al. (2016) discuss self-directed learning as encompassing various goal-directed, self-controlled learning behaviors, which are essential for the expression of agency within learning contexts. As a tool widely used for self-directed learning, e-portfolio learning has the potential to stand as a potent medium for the enactment of agency. By affording learners a structured yet flexible space to curate and reflect upon their educational experiences, e-portfolios serve as a catalyst for the development of agency, promoting active and self-regulated learning that is aligned with personal and professional growth (Beckers et al., 2016; Zhang & Tur, 2023c, 2023b).

2.3 Co-design in e-portfolio learning and its connection to learning agency

Co-design is a collaborative approach involving the active participation of multiple stakeholders, such as students, teachers, and administrators, in designing and developing educational tools and resources (Ang, 2015), and recently, technological environments have been introduced in the process (De Benito et al., 2020; Negre-Bennassar et al., 2023). Students can develop greater confidence in their own capacities when power relations are distributed among peers for collaborative learning in co-design approaches (Breaden et al., 2023; Bovill et al., 2016).

The use of co-design in e-portfolios has been shown to be effective in various educational contexts. For instance, it has been employed to improve the academic writing performance of ESL students by providing appropriate feedback and addressing motivational challenges (Alshahrani & Windeatt, 2012). Additionally, e-portfolios have been utilized to organize, design, and assess students' learning processes, serving as a strategy to collate and record student and teacher experiences for reflection (Ghany & Alzouebi, 2019). Moreover, the development of e-portfolios for second language learners and graduate skills enhancement has been explored, highlighting the potential of co-design in addressing diverse educational needs (Ngui et al., 2019). Furthermore, the implementation of e-portfolio systems based on co-design principles has been found to increase reflection and awareness among teachers and students, emphasizing the value of involving stakeholders in the design process (Rossi et al., 2008).

Building on the existing literature that underscores the importance of learner agency in e-portfolio learning, the co-design approach offers a practical pathway to further empower students as active participants in their education. The collaborative nature of co-design inherently supports the development of agency, as it requires learners to engage in decision-making, problem-solving, and reflective practices that are central to their learning experiences (Ali et al., 2022; Jääskelä et al., 2017; Bovill et al., 2016).

Given this intersection between co-design e-portfolio learning and learner agency, as well as the scarcity of research in this area, there is a rationale for a study investigating the student agency's role in the e-portfolio co-design process. Such research could provide deeper insights into how students exercise the different

sources of agency during their e-portfolio co-design learning and how they perceive their learning in terms of its impacts on their learning outcomes and engagement. The study aims to fill this gap in the literature by adopting a mixed-method approach, quantitatively measuring the manifestations of agency in each phase of the Co-PIRS phases, and qualitatively exploring the students' perspectives on their learning experiences. The significance of this study lies in its potential to inform educational practices for enhancing learner agency through co-design, ultimately contributing to the optimization of e-portfolio implementation and the enrichment of learners' educational experiences.

3 THE STUDY

3.1 Participants

The participants of the study were 68 students from an international school in Hong Kong, who were all enrolled in Chinese language courses for the duration of an academic year. The demographic distribution of the group was multi-national, with students originally from Hong Kong, Korea, America, Singapore, and India. The age range of the students was 15 to 18 years, encompassing grades 10 through 12. Of these participants, the majority were male (n = 41), while 27 were female. Reflecting the elite status of the international school, all students came from middle-class or above socio-economic backgrounds, as indicated by the high tuition fees typical of such institutions. The introduction of the Co-PIRS model within their Chinese language learning was their first exposure to this form of learning and assessment tool. This model, which includes phases of Planning, Implementation, Reflection and Revision, and Showcase (Co-PIRS), was designed to foster student agency, enhance reflective practice, and support language learning.

In preparation for the study, ethical approval was sought from the school, ensuring adherence to the appropriate standards for educational research. Informed consent was duly obtained from all participants, and in the case of minors, parental consent was also secured. Throughout the research, strict confidentiality was upheld, and personal identifiers were omitted or anonymized when reporting the findings.

3.2 The learning design

The learning design of the study was structured around the Co-PIRS model, as outlined by Zhang and Tur (2023c, 2023b). This model served as the foundation for the e-portfolio-based co-design learning experience of the students, offering a structured approach for collaborative e-portfolio development, particularly in the context of remote learning necessitated by the COVID-19 pandemic. Their Co-PIRS model—Planning, Implementation, Reflection and Revision, and Showcase—details the roles and responsibilities of stakeholders throughout the e-portfolio lifecycle, promoting a systematic and community-oriented approach to e-portfolio integration (Zhang & Tur, 2023b).

The Co-PIRS model is characterized by several phases: Planning, Implementation, Reflection and Revision, and Showcase (see Figure 2) in which teachers and students play key roles as learning co-designers.

- Planning: At the outset, students engaged in a collaborative process to establish their learning objectives. This involved discussions with peers and the teacher to ensure that the goals set were both challenging and achievable. Students then crafted their learning plans, which served as a roadmap for their educational journey throughout the course.
- Implementation: During the implementation phase, students actively participated in creating multimodal learning artifacts. These artifacts included a range of representations of their learning, such as projects, tasks, and formative assessments. This approach recognized the multifaceted nature of learning and allowed students to document their progress using various forms and media. Students were encouraged to provide peer feedback, fostering a collaborative learning environment. In addition to peer feedback, teachers also provided learning materials that might support collaborative learning and peer feedback.
- Reflection and Revision: This feedback on the students' e-portfolio implementation aims to guide students to reflect on their strengths (glow) and areas for improvement (grow). Through reflection, students critically assessed their learning, identified gaps, and further improved. This reflective practice was not just an ad-hoc activity but a structured part of their learning, requiring them to write short reflections regularly. It is noted that the qualitative data collected in the study is the final reflection of their e-portfolio use, conducted at the end of the experiment, not the ongoing reflection of their learning.
- Showcase: The culmination of the Co-PIRS model was the showcase phase. At the end of each semester, students presented their e-portfolios, which included their learning artifacts and reflections. This summative presentation allowed students to demonstrate their learning journey over the semester and celebrate their achievements.

This design aimed to promote a setting where student agency was at the forefront, allowing the students to take charge of their learning process while receiving structured guidance and feedback from their peers and the teacher.

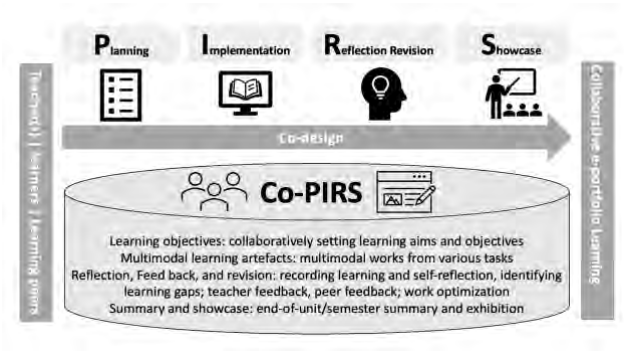

Figure. 2. The Co-PIRS model

4 METHODOLOGY

With the aim of exploring and understanding students' perceptions, a mixed-methods approach was designed, including techniques to collect quantitative and qualitative data. Regarding the former, an electronic survey based on a Likert scale was delivered, which had been developed ad hoc in previous stages of the research (Zhang & Tur, 2023a). It is based on the agency framework by Jääskelä et al. (2017, 2023), and includes each element defined in the three domains in each e-portfolio stage. The participants were asked to

choose which element was mostly enacted in the different phases. For example, during planning e-portfolio tasks, were they engaged (individual elements)? Did they discuss with classmates (relational elements) or did they have opportunities to choose their own learning aims or their preferred tools to document learning (contextual elements)? Students had to choose one element that they believed would be enacted the most per phase. Data collection for the study was conducted at the international school where the participants were enrolled. This process took place after the students had been using e-portfolios for a full academic year and were well-acquainted with the Co-PIRS process. The survey was completed during a self-study period at the end of the term. In the latter, post-survey, students were prompted to reflect on their e-portfolio experience, with the option to write on paper or use a Google Form. This reflective task was designed to elicit insights into the students' perspectives on their e-portfolio process, capturing their subjective experiences and the perceived impact of the Co-PIRS model on their learning journey. The main prompt is "Reflect on your experience of using e-portfolios in this semester, and comment on your experience. In your reflection, please consider how your e-portfolio learning experience promoted the following feelings and activities." Following this, there are some prompts to elicit students' perceptions of their agency enactment in different domains. Participation was entirely anonymous and voluntary, and students were asked to confirm their consent and willingness. Before initiating the survey and the self-reflective writing exercise, students were provided with a consent form detailing the study's purpose.

4.1 Data Analysis

The design of the mixed methods is parallel and complementary, in which data collection processes are independent, come from diverse instruments and are integrated into the data analysis. In this sense, in the stage of data analysis, the work was primarily quantitative since qualitative data was integrated to understand students' perceptions in greater depth (Creswell et al., 2003; Hesse-Biber, 2010; Jorrín et al., 2021). The study employed a mixed-methods approach for data analysis, utilizing both qualitative and quantitative analytical tools to interpret the collected data.

4.1.1. Quantitative Data Analysis

The study's quantitative data, derived from the survey, were analysed using descriptive statistics in Microsoft Excel. After collecting responses through Google Forms, data was exported to an Excel spreadsheet, which facilitated the organization and analysis of the data, providing a more nuanced overview of students' views on their agency enactment within the Co-PIRS model's e-portfolio learning framework.

4.1.2. Qualitative Data Analysis

For the qualitative component—specifically, the analysis of students' written reflections—two software tools were employed: Voyant and NVivo 14.

- Voyant Analysis: Firstly, Voyant was used to scrutinize the written reflections to identify patterns, themes, and key terms. This web-based text analysis tool, recognized for its ease of use and comprehensive features (Hetenyi & Lengyel, 2019), provided preliminary quantitative insight into the corpus of reflections through frequency counts and word clouds. Neha and Kim (2023) highlight its capabilities in offering visual representations of data, which facilitated the identification of prominent concepts within the students' reflections.
- NVivo 14 Analysis: Subsequently, the study utilized NVivo 14 to conduct a more nuanced analysis. This involved coding the sentiments expressed in the reflections and employing these codes to delve into the students' perspectives regarding their e-portfolio co-design learning experience. NVivo's robust system for managing and coding data (Younas et al., 2023) enabled the researchers to systematically engage in thematic analysis, where nodes representing various themes were created and the data were categorized accordingly (Watson & Bullard, 2022).

5 RESULTS

5.1 Students' agency enactment through the e-portfolio learning co-design

The analysis of questionnaire responses concerning the Co-PIRS process reveals distinct patterns in the enactment of student agency across different phases—Planning, Implementation, Reflection & Revision, and Showcase. The study explored agency in three domains: individual, relational, and contextual (see Figure 3,4,5).

5.1.1. Individual Domain Agency

In the individual domain of agency, competence beliefs were most prominently enacted in the Showcase phase with 33 references, followed by Reflection & Revision (17 references), Implementation (13 references), and Planning (5 references).

Meaning-oriented learning showed a different pattern, with the highest enactment reported during the Planning phase with 21 references. The subsequent phases, including Implementation, Reflection & Revision, and Showcase, presented a relatively uniform distribution with 16 references each, indicating a consistent engagement with their learning throughout the Co-PIRS-framed e-portfolio learning process.

Participation activity was most frequently reported during the Implementation phase with 32 references, which was significantly higher than in Reflection & Revision (18 references), Planning (14 references), and the least during Showcase (4 references), suggesting that students are most actively engaged with learning tasks during the Implementation phase.

Self-efficacy was reported to be highest during the Reflection & Revision phase with 19 references, followed by Showcase (25 references), Implementation (15 references), and Planning (9 references). This indicates that students gain confidence as they reflect on and revise their work, which may contribute to a stronger sense of self-efficacy during the Showcase phase.

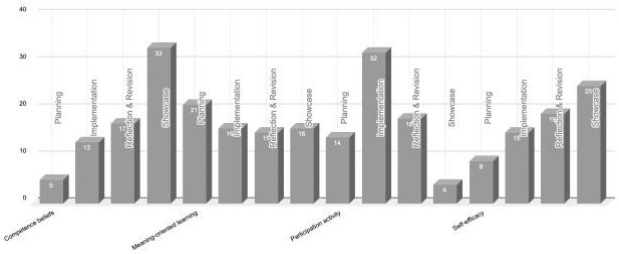

Figure. 3. Individual domain agency enactment in the Co-PIRS

5.1.2. Relational Domain agency

Within the relational domain, power relationships were most frequently reported in the Reflection & Revision phase, with 29 references. This was followed by Implementation (18 references), Showcase (12 references), and Planning (9 references), suggesting that negotiating interpersonal dynamics becomes particularly significant during the evaluative stages of the learning process.

Peers as resources for learning were most identified during the Implementation phase with 37 references, which is much higher than in Planning (15 references), Reflection & Revision (11 references), and Showcase (5 references). This indicates that collaborative learning is most prevalent when students are actively working on their tasks.

The emotional atmosphere was found to be most influential during the Planning phase, with 23 references, followed by Reflection & Revision (21 references), Implementation (16 references), and Showcase (8 references), suggesting that students' emotional engagement is heightened during the initial planning and reflective stages of the Co-PIRS process.

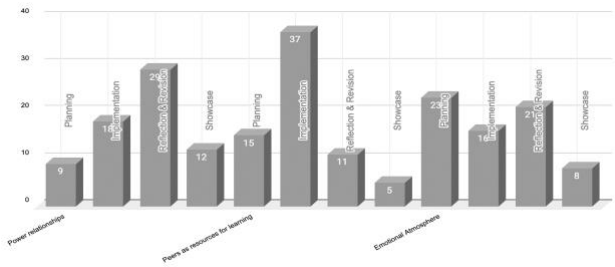

Figure. 4. Relational domain agency enactment in the Co-PIRS

5.1.3. Contextual Domain Agency

In the contextual domain, opportunities to make choices were reported to be highest in the Implementation stage with 24 references, and Showcase phase came second with 22 references. Planning and Reflection & Revision phases had 15 and 7 references, respectively. The results imply that students perceive a greater degree of autonomy while utilising e-portfolios to record their learning and exhibiting their learning outcome in the end.

Opportunities to influence were more evenly distributed, with the Reflection & Revision phase slightly leading with 21 references. Planning had 18 references, Implementation 17 references, and Showcase 12 references. This suggests that students feel they can impact the learning process across various stages, with a slight preference for reflecting on their own learning.

Opportunities for active participation were most frequently reported during the Implementation phase with 31 references, followed by Reflection & Revision (23 references), Planning (11 references), and the least during Showcase (3 references). This pattern emphasizes the active engagement of students, primarily during the implementation stage, where they actively use e-portfolios to document their learning evidence.

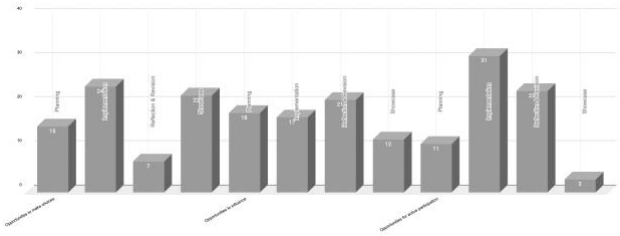

Figure. 5. Contextual domain agency enactment in the Co-PIRS

5.2 Students' perceptions on the e-portfolio learning co-design

After organizing the students' written reflection, Voyant was used to run an analysis of the general key information patterns underpinning the students' reflection. Cirrus and link visuals were generated. Cirrus provided a word cloud view of the most frequently occurring words from students' reflections; Links is a collocate graph that shows a graph of high-frequency terms appearing in proximity. Keywords are shown in blue, and collocates (words in proximity) are shown in orange.

The qualitative analysis of students' written reflections, facilitated by Voyant Tools, revealed several key patterns that offer insight into the e-portfolio learning experience from the student's perspective. The Cirrus and Links features enabled the visual interpretation of the data and the discernment of the most salient themes emerging from the student's reflections.

5.2.1. Cirrus Analysis

A word cloud generated by the Cirrus tool highlighted the most frequently used words in the students' reflections, indicating the emphasis on their experiences (see Figure 6). Among these, terms such as "Learning," "Portfolio," "Platform," "Provided," "Progress," "Self," "Language," "Motivation," "Experience," "Activities," "Process," and "Chinese" were prominent.

The term "learning" was prominent in the Cirrus visualization, confirming its importance in the reflective narratives. Given the term's prevalence in the dataset, there is a strong emphasis on the learning process. The word "portfolio" was also prominently displayed, indicating that it served as an educational tool essential to the student's educational process rather than merely a collection of works. The word "platform" is mentioned multiple times, pointing to its technical component. "Provided," "Progress," and "Self" were among the other phrases that frequently appeared, giving the impression that the e-portfolio is a resource that is offered and encourages self-guided progress. Notably, "progress" addresses the e-portfolio's progressive and formative features rather than summative ones. Agency enactment is related to the term "self," which refers to the portfolio's reflective and self-regulated components. Notable terms connected to the study's setting—students learning Chinese language—were "language" and "Chinese." The fact that "motivation," "experience," and "activities"

were important further suggests that the e-portfolio was connected to the students' motivational drivers, the depth of their learning experiences, and the variety of activities that were included in the e-portfolio framework.

Figure. 6. The cirrus generated by Voyant

5.2.2. Links Analysis

The Links visualization displayed a collocate graph demonstrating the connections between frequently used words and their linked concepts appearing in proximity (see Figure 7), as observed closely within the reflections. The graph visually represented individual terms and their interconnections, presenting a more comprehensive description of student experiences.

The term "learning" was central, strongly linked to "self," and indicative of agency, suggesting that students viewed learning as an active, self-directed process. Attributes such as "willingness," "beliefs," "competence," and "efficacy" connected to this central theme underscore the personal investment and growth integral to the student's experiences.

"Learning" was also shaped by a spectrum of "suited" "activities" that included resource sharing and discussions, emphasizing the importance of tailored and interactive experiences in the learning process. These activities, along with the "portfolio" "platform," which was seen as a catalyst for enriching the learning experience and bolstering motivation, highlight the dynamic nature of the e-portfolio environment. Feedback emerged as a component within the platform, underscoring its role in the iterative learning cycle.

Furthermore, "progress" stood out, reflecting the Co-PIRS model's emphasis on "documenting" and "showcasing" learning "achievements." This aspect of the model illustrates a process-oriented approach that values the documentation and celebration of academic progress.

Figure. 7. The links visualization

To better understand the links between these terms, some more data are added. First of all, the frequency of their key words and their collocation with others show the trend of their meaning (see table 1):

Ranking	Term	Frequency	Collocates	Frequency
1	learning	109	experience aim portfolio motivation self	12 12 11 10 9
2	portfolio	60	platform learning provided feedback experience	15 11 11 8 7
3	platform	24	learning provided range offered motivation	8 6 3 3 3
4	self	19	efficacy beliefs learning competence willingness	12 11 9 9 4
5	activities	18	tools discussion range suited resoucres	7 5 2 2 2
6	progress	18	document achievement showcase	4 4 4

Table. 1. Keywords frequency and collocates

Secondly, for a greater understanding of the trend that the link between the terms means, in the following table (see Table 2), some examples are shown (the text in bold are the words linked in Figure 7:

Link	Quotation example
learning - portfolio	"E-**portfolio** is an extremely helpful tool for me in **learning** and reflecting on my work, it helps me to remember the work that we've done and look through it in the future."
portfolio - platform	"The **e-portfolio platform** provided a dynamic and interactive way to showcase my progress and achievements."
learning - platform	"The **platform** provided a structured framework for setting **learning** aims and planning my learning activities."
self - learning	"The regular **self**-reflections and **self**-assessments facilitated by the e-portfolio did contribute to a better understanding of my strengths and weaknesses in **learning**."

Table 2. Quotation example of the links

The sentiment analysis conducted using NVivo 14 on students' reflections towards the e-portfolio experience generated a hierarchy chart that categorizes sentiments into positive and negative codes with varying intensities (see Figure 8).

Figure. 8. Sentiments codes hierarchy chart

The chart displayed an apparent tendency towards sentiments of optimism. A total of 60 reflections were identified as positive, indicating a generally favourable perception of the e-portfolio learning experience. Among the positive sentiment category, 23 reflections were categorized as "Very positive," indicating the students who enjoyed using e-portfolios following the Co-PIRS model. The reflections expressed positive endorsement of the learning process, appreciation of teachers' support, awareness of self-motivation, and personal accomplishments supported by the reflective practices.

Student L: E-portfolio is an extremely helpful tool for us to learn and reflect on our work, it helps us to remember the work that we've done and look through it in the future.

Student P: My teacher is really supportive and gives us suggestions and examples on what would be a good portfolio and how to achieve it.

Student H: In the past year, I was able to successfully motivate myself to update what I have learnt in class into e-portfolio. I really liked the reflections, aims, and the new vocabulary that we had to input to the e-portfolio. I believe that this is one of the best ways for me to understand the concepts better.

Student D: Using an e-portfolio has given me a very clearer understanding of the importance of learning and has greatly improved my motivation and self-efficacy. By keeping track of learning goals and plans, I am able to organize learning materials more systematically, set clear objectives, and create plans to achieve those goals. Reflecting on the learning process has also made me more aware of my abilities and progress, further enhancing my belief in my capabilities. Additionally, the opportunity to showcase my learning achievements encourages me to engage in learning more proactively, as I know that my efforts will be recognized and rewarded.

In addition, 37 reflections were defined as "moderately positive." The sentiment demonstrates a more sophisticated form of acceptance, in which students recognize the advantages of the e-portfolio while maintaining balanced evaluations, which might involve constructive suggestions or subtle criticisms. The students moderately favoured various aspects of their e-portfolio learning, including flexibility in choosing learning activities, learning evidence-recording, promotion for motivation, and active, autonomous learning,

Student E: I like how I could choose which activities to do my homework on as I can choose things I like. And that can incentivize me to present my learning in the portfolio too as everything did something different.

Student J: The learner portfolio is a good way to take notes and record progress, and is also helpful for revision.

Student P: Using e-portfolios in the previous semester increased my belief in my abilities and willingness to engage in proactive and autonomous learning.

Student C: I am decently motivated to complete my studies because the e-portfolio allows me to have a collection of my past work, allowing me to see my progress.

On the other side of the sentiment spectrum, the analysis discovered 14 codes of negative sentiment. Notably, all negative sentiments were classified as "moderately negative," with no instances reaching the intensity of "very negative." The lack of "very negative" sentiments indicates that any challenges or difficulties did not substantially hinder the e-portfolio's overall effectiveness as a learning tool. The moderate scepticism conveyed through this feedback indicates specific aspects of the e-portfolio learning that fell short of student expectations or areas that could be enhanced to facilitate a more fulfilling educational experience. Those moderate negative sentiments mainly include concerns about inconvenience and workload.

Student S: Although it is a great tool for us to revise, I think it is kind of too much work and inconvenient. I don't like to revise and do my work again; after finishing my assignment, I have to upload it to my e-portfolio, and it's extra work for me.

Student A: I feel that an e-portfolio can improve my learning, but it often feels like a hassle to copy everything I've done from one document to another. The process of e-portfolio use is a bit complicated.

Student M: My motivation, self-efficacy, and belief in my abilities regarding learning will not change because of an e-portfolio, as I see it merely as another form of a "process journal."

6 DISCUSSION

Self-regulated learning has been related to e-portfolios for a long time, as a recent literature review stated, where also a step forward to go beyond the individual elements was claimed (Tur et al., 2022). Thus, this work is an answer to contributing to learning from complex and sociomaterial approaches that require including relational and contextual elements (Eteläpleto et al., 2013; Jääskelä et al., 2017). This study's combination of qualitative and quantitative findings shed light on student agency in the e-portfolio process, guided by the Co-PIRS model. The qualitative narratives, including sentiment analysis, support the quantitative evidence of agency in individual, relational, and contextual domains, providing an understanding of students' e-portfolio experiences. The qualitative findings underscore that students experience and exercise their agency in multifaceted ways throughout their learning journey. These insights highlight the dynamic nature of student agency and the importance of each e-portfolio learning phase in supporting students' active engagement and learning. In general, the many nuances that this work uncovers about e-portfolios in Secondary Education allows suggesting that it can be a contribution towards formative assessment (Moreno & Rochera, 2016), in which students can take ownership over the process.

The sentiment analysis results from NVivo 14 indicate that the student's response to the e-portfolio experience is predominantly satisfactory. The prevalence of favourable attitudes surpasses the negative ones, indicating the generally successful incorporation of the e-portfolio into the student's learning progress. Besides, the central role of "learning" in the qualitative data underscores the e-portfolio's function as a stimulant for learning and development. The multitude of mentions of "portfolio," "platform," and "activities" indicate the e-portfolio's instrumental role in fostering a favourable setting for active, self-regulated learning, and is aligned with early research where the development of digital skills were prominent at that moment (Tur & Urbina, 2014). The quantitative data, which show high references to competence beliefs and self-efficacy in the Showcase and Reflection & Revision phases, support this. They show that the e-portfolio fosters the development of confident, autonomous learners and the highly relevant influence of epistemic knowledge to enact individual elements of agency (Ayaawan & Adika, 2021).

The observed patterns across the three domains of agency—individual, relational, and contextual—underline the multifaceted nature of agency enactment within the Co-PIRS model. Within the individual domain, the Showcase phase was particularly noteworthy, suggesting that the process of selecting and presenting learning evidence can significantly enhance students' competence beliefs and self-efficacy. Due to the connection between the Planning phase and meaning-oriented learning, the early stages of the e-portfolio process are crucial for establishing the tone of engagement and objectiveness. The identification of implementation as a critical stage for participation activity is consistent with the notion that active participation in learning tasks is fundamental to the educational value of the e-portfolio, since active participation in learning tasks within e-portfolios promotes metacognition, as students are required to think critically about their own learning and progress; this metacognitive awareness can lead to greater self-regulation and autonomy, essential skills for lifelong learning and success (Barrett, 2007). Besides, reflective practices are associated with the highest quantitative findings of self-efficacy during the Reflection & Revision phase. This reinforces the value of reflection in enhancing students' belief in their abilities and in fostering autonomous learning behaviours. This finding is highly interesting and suggests that metacognitive processes, when addressed through collaborative processes such as in the co-design approaches, are better accepted by students since previous studies of e-portfolio research pointed out the difficulties of reflection (Tur et al., 2019).

The relational domain, manifested through power relationships, emotional atmosphere, and peer interactions, was most evident in the Implementation and Reflection & Revision phases. This suggests that the e-portfolio co-design process facilitates an environment where students can negotiate interpersonal dynamics and leverage peer resources effectively, aligning with the social constructivist principles where learning is a collaborative endeavour and challenging the solitary and passive student's role (Bovill et al., 2016; Breaden et al., 2023). As revealed in both data sets, the emotional atmosphere's prominence in the Planning phase highlights the affective dimensions of student engagement, confirming the motivational aspects of self-regulated learning (Zimmerman, 2002).

Agency enactment is more prominent in the contextual domain during the Implementation phase when students believe they have the opportunity to make choices and participate. Students' engagement and motivation can be increased by allowing them to personalize and record their learning evidence (Zhang & Tur, 2023a). This can foster a sense of ownership and satisfaction in their accomplishments, improving their overall learning experience. In the same domain, the sense of an opportunity to influence is evident during the Reflection & Revision stage. This shows that e-portfolios may support self-reflection and metacognitive skills, resulting in deeper comprehension and critical thinking (Reynolds & Patton, 2015).

Although there is a generally favourable perspective, it is important not to disregard the moderately negative views. Observable concerns arise over the inconvenience and workload connected with the Co-PIRS model, aligned with previous research (Scully et al., 2018), which can impede the effective utilization of e-portfolios. The above observations indicate the necessity of improving the design of the model in order to streamline processes and relieve the perceived burden on students. However, the lack of strong negative criticism indicates that these problems do not outweigh the advantages of the co-design e-portfolio experience but should be carefully considered in future versions of the model and allow suggesting the hypothesis that a co-design strategy can be answer to contribute to balancing teachers' workload in e-portfolio tasks.

The moderate negative views primarily related to the Reflection & Revision phase suggest a need to streamline this stage. Integrating revision more seamlessly into the reflection process can make the model more efficient and less cumbersome for students, potentially enhancing both their learning outcomes and overall experience. Besides, it is noteworthy that while the collaborative process might have made learning more agile, students complain about workload and time constraints, as in previous studies where co-design was included in the strategy (Tur et al., 2019). Considering these, the revised Co-PIRS framework is proposed (see Figure 9).

In the revised model, the recommended tasks are more concise and streamlined. The core is co-design, which indicates that e-portfolio stakeholders, including learners, learning peers, and teachers, should collaborate effectively and efficiently. For all phases, learners themselves are the core, and they should make decisions and choices on their behalf after discussing with teachers and classmates and considering their input along with the help from

resources and materials. This relates to both self-regulated and agentic learning (Chang et al., 2018; Jääskelä et al., 2017) since it goes the individual learning action by promoting students' choice after the social and material feedback received. In this revised model, teachers serve the roles of facilitator and adviser, while classmates serve as peer support and learning company. At the same time, both peers and teachers can support by facilitating learning resources and materials for extended help.

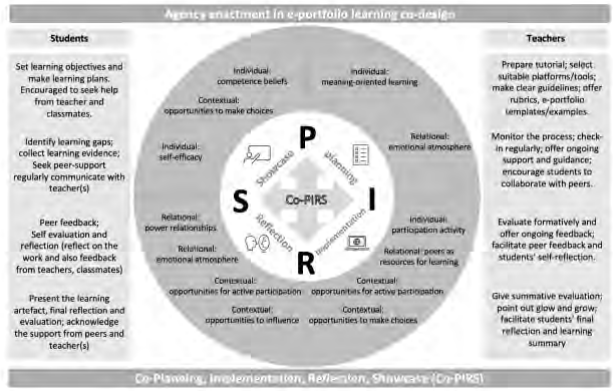

Figure. 9. The revised Co-PIRS model

7 CONCLUSION

This study investigates the influence of the Co-PIRS model on student agency enactment in e-portfolio learning processes, incorporating qualitative and quantitative insights. It highlights the potential function of the e-portfolio in promoting agency and facilitating collaboration in learning environments. Besides, the study explored the agency sources in each domain in different stages of the Co-PIRS e-portfolio learning model, and findings suggest the Co-PIRS model facilitates varying degrees of student agency across its phases with the highest engagement during the Implementation phase, indicating active student participation and collaborative learning, while also highlighting the importance of the Reflection & Revision phase for developing competence beliefs and self-efficacy. Further, the participant's perceptions of their e-portfolio learning were investigated and analyzed using Voyant and NVivo 14. Based on students' reflection, the subsequent modification of the Co-PIRS framework was carried out, specifically the streamlining of the "Reflection and Revision" step to only "Reflection," which addresses student input regarding the amount of work and the level of complexity. The study highlights the importance of learner decision-making, with teachers and peers playing supportive roles, emphasizing a collaborative co-design approach. The revised Co-PIRS model represents a more effective and learner-focused framework, encouraging learning beyond individual self-regulation by introducing social and contextual elements that support student-centred tasks and showcasing a flexible adaptation based on student feedback, providing a refined approach to e-portfolio deployment. The authors acknowledge that the main limitation of the study is about the collected data, which is exclusively self-perceived by students. Although we are aware of the need to support educational research with data beyond self-perceptions, in this study the aim was to understand agency from students' views to support the need of giving them greater control over the process, thus how to support and enhance becoming autonomous and agentic learning.

7.1 Educational Implications and Future Directions

The findings of this study have significant implications for the development and implementation of e-portfolios as learning tools. While e-portfolios have been primarily implemented in secondary education, where the role of a more knowledgeable peer can be particularly beneficial, it would be valuable to extend this research to tertiary education. Specifically, investigating the effectiveness of e-portfolios in both vocational training programs and higher education institutions could yield interesting insights. The Co-PIRS model's capacity to promote agency and active learning is evident; however, there is potential for further iterative improvement. Further research might look into the effects of streamlined Co-PIRS procedures on pupil engagement and agency, including integrating modifications that address the workload and convenience concerns identified by students and applying the model to other educational levels like higher education. Finally, regarding the data collection approach, new work is needed to further support the model with evidence from students' performance.

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UNA EXPLORACIÓ DE LA MANIFESTACIÓ D'AGÈNCIA EN EL CO-DISSENY D'APRENENTATGE D'E-PORTOLIS

Tot i que la investigació sempre ha relacionat els e-portfolis amb l'aprenentatge autoregulat, recentment també s'ha destacat l'agència, que inclou elements individuals, relacionals i contextuals. Així mateix, s'ha investigat l'agència en entorns tecnològics que donen suport a processos col·laboratius d'aprenentatge i codiseny. Aquest estudi, que indaga en la manifestació de l'agència acadèmica dins del codi-disseny d'aprenentatge d'e-portfolis a l'educació secundària, se centra en com els estudiants perceben la seva agència dins d'un model de codiseny de l'aprenentatge d'e-portfolis, anomenat com el model Co-PIRS en etapes prèvies d'aquesta investigació. Entre els resultats, s'observa que l'alumnat mostra una consciència més gran d'agència, caracteritzada per creences de competència (domini individual) en la fase de presentació dels e-portfolis, aprenentatge entre parells (domini relacional) i les oportunitats per prendre decisions (domini contextual) a la fase d'implementació. L'estudi també revela les actituds positives dels estudiants cap a la reflexió, cosa que suggereix la idoneïtat d'estructurar la col·laboració en l'enfocament de codi-disseny. Aquestes percepcions serveixen com a base per implementar un model de codi-disseny d'e-portfolis per empoderar l'agència de l'alumnat i proporcionar orientació al professorat.

PARAULES CLAU: e-portolis; agència; co-disseny; tecnologia educativa; educació secundària

UNA EXPLORACIÓN DE LA MANIFESTACIÓN DE LA AGENCIA EN EL CO-DISEÑO DE APRENDIZAJE DE E-PORTFOLIOS

Aunque la investigación siempre ha relacionado los e-portfolios con el aprendizaje autorregulado, recientemente también se ha destacado la agencia, que abarca elementos individuales, relacionales y contextuales. Asimismo, se ha investigado la agencia en entornos tecnológicos que respaldan procesos colaborativos de aprendizaje y co-diseño. Este estudio, que indaga en la manifestación de la agencia académica dentro del co-diseño de aprendizaje de e-portfolios en la educación secundaria, se centra en cómo los estudiantes perciben su agencia dentro de un modelo de co-diseño del aprendizaje de e-portfolios, denominado como el modelo Co-PIRS en etapas previas de esta investigación. Entre los resultados, se observa que el alumnado muestra una mayor conciencia de agencia, caracterizada por creencias de competencia (dominio individual) en la fase de presentación de los e-portfolios, aprendizaje entre pares (dominio relacional) y las oportunidades para tomar decisiones (dominio contextual) en la fase de implementación. El estudio también revela las actitudes positivas de los estudiantes hacia la reflexión, lo que sugiere la idoneidad de estructurar la colaboración en el enfoque de co-diseño. Estas percepciones sirven como base para implementar un modelo de co-diseño de e-portfolios para empoderar la agencia del alumnado y proporcionar orientación al profesorado.

PALABRAS CLAVE: e-porfolio; agencia, co-diseño; tecnología educativa; educación secundaria

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