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Everything, Everywhere, All at Once: ePortfolio Content Analysis for Program Improvement

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A university's educational technology and media programs have used student ePortfolios as a culminating activity and assessment. Because students choose which work artifacts to include in their ePortfolios, I investigated these choices from 2020-2023 student ePortfolios in the spirit of scholarship of teaching and learning. The content analysis of the students' choices of artifacts indicated that the program's ePortfolio has served as an informative summative assessment instrument over time and is not dependent on the program's delivery modes or the program track. The design and implementation of the ePortfolio assignment appear to reflect good instructional design. The findings can help optimize student learning and facilitate faculty decision-making for program improvement.

Mainstream educational portfolios were noted as early as the 1970s, and digital portfolios—ePortfolios—date back to the 1990s (Farrell, 2020). *The International Journal of ePortfolio*, launched in 2011, is one piece of evidence of ePortfolio's increasing use. ePortfolios are used for both formative and summative assessment. When COVID-19 caused much of education to pivot to online delivery, ePortfolios became even more important as a flexible way to assess students' progress and achievements authentically (Koris & Pál, 2021).

At a large Western comprehensive university, its educational technology and media leadership (ETEC) program has used student ePortfolios since 2003 as a culminating activity and assessment tool for its students. One of the key elements of the ePortfolio was the requirement that students choose artifacts from their coursework to demonstrate that they met the program's learning outcomes. This feature intrigued me to examine students' choices to discern possible patterns, particularly longitudinally, considering changing program delivery modes. Furthermore, exiting students had remarked that some course content and activities seemed to duplicate or overlap other courses within the program, so a cross-course examination was called for.

These examples let me leverage this information to inform the rest of the program faculty so that all of us could make good decisions about our program design and delivery to improve student learning. This kind of evidence-based inquiry fits under the concept of the scholarship of teaching and learning (SoTL): "an informed, questioning, reflecting, critical and inquiring teacher, whose focus is on the improvement of their teaching so as to improve their students' learning" (Tight, 2018, p. 64).

Therefore, I investigated this program's students' ePortfolios from 2020 to 2023, using the following research questions to guide the research:

1. Which courses did the students draw upon as they chose the artifacts to demonstrate that they met each learning outcome of the program?
2. What artifacts did students choose to demonstrate that they met each learning outcome of the program?
3. What trends in students' chosen artifacts existed between 2020 and 2024?
4. To what extent, if any, did the program's delivery mode impact the choice of artifacts?

Literature Review

A portfolio is a collection of work that demonstrates a person's expertise. While common in the art world to represent one's best representative work, portfolios gained traction in mainstream education as a reaction to quantitative standardized testing (Johnson et al., 2009). As technology afforded more formats to gain and demonstrate knowledge and skills, ePortfolios became the default medium (Farrell, 2020). In their digital form, ePortfolios also have the advantage of easy, convenient centralized storage and sharing, which fosters transparent learning. ePortfolios also show that learning can occur any place any time, according to Farrell.

Buente et al. (2015) considered ePortfolios as a useful framework to document the intersection of learners' experiences, achievements, and reflections. ePortfolios also drew upon constructivist learning theory whereby the learner constructs meaning from engagement and reflection (Farrell, 2020).

As a learning tool, ePortfolios have several advantages. Not only do ePortfolios emphasize learning responsibility and accountability, but they also support learner autonomy (Marinho et al., 2021). Pitts and Lehner-Quam (2019) pointed out that ePortfolios help learners value their courses more, and see the overall meaning of their program, which motivates learning. More generally, ePortfolios help students to reflect, frame, and integrate their disciplinary learning with intention (Galeucia et al., 2023). In that process, Beckers et al. (2016) noted that creating ePortfolios helps learners gain curation skills and construct a professional self-

identify. Fu et al. (2022) also noted how ePortfolios help students interconnect learning and think like a professional, thus helping to form an assessment identity. In short, ePortfolios serve as a model for self-regulated learning and empowerment, which generates more motivation, active learning, and higher learning outcomes (Segaran & Hasim, 2021).

ePortfolios also have their disadvantages. From the students' perspective, ePortfolios take time to plan and construct (Douglas et al., 2019). They require some technical skill that may overshadow the artifacts being shared. If the program stipulates which artifacts to include, learners have less control and sense of ownership in providing evidence of their competence. On the part of educators, assessing ePortfolios can be time-consuming (Farrell, 2020). Furthermore, rubrics and pre-assessment calibration are needed to ensure consistent assessment.

These factors reveal the importance of designing the ePortfolio experience. As Segaran and Hasim (2021) noted, learners need to understand the task and how to do it, as well as why to do the task, to shape their ePortfolio. In that respect, instructors need to align assessment with program outcomes and define criteria for assessment (Sowers & Meyers, 2021). Even for ePortfolios that are used for summative evaluation, formative instructor feedback is needed to deepen knowledge and reflection (Marinho et al., 2021). Koris and Pál (2021) went further to state that ePortfolios need to be student-driven, that the artifacts should reflect complex tasks, and that both artifacts and processes should be considered. While these studies illustrate the advantages of using ePortfolios, they also reveal that a deeper dive into student curation is needed.

Program Use of ePortfolios

Since 2012, the university's ETEC program has used ePortfolios as a summative evaluation of students' meeting the program's learning outcomes. This practice originated with the teacher librarian (TL) services credential program, which required a print-based portfolio of evidence to demonstrate meeting state preparation standards as early as 1998, before I became the current program coordinator in 1999. In 2003, when the credential led to a master's degree in librarianship, I transitioned the print portfolio format into a required ePortfolio digital format to reflect the need for teacher librarians to be competent technologically. Then, in 2012, when the credential program merged with the existing educational technology program because of the overlap in learning outcomes, the ePortfolio served as a culminating assessment for both aspects of the overall program. It should be noted that learners could earn the TL credential without the master's degree, but they still needed to submit an ePortfolio that showed they met all the program learning outcomes.

The ePortfolio assignment was introduced in the ETEC 523 Information and Digital Literacies course, where students learned how technology impacted education, and they created an initial ePortfolio to show how they met program learning outcomes in their course. Each course included a signature assignment that demonstrated the student's ability to meet the course's learning objectives, and students were encouraged to use those assignments as part of their ultimate program ePortfolios. In their culminating credential program course (ETEC 580 Field Experience) and/or their master's degree ETEC 695 Comps course, students were required to complete and submit their ePortfolio to demonstrate that they met the program's learning outcomes (PLO). Each course served as the main source of accomplishment, providing several assignments that assessed specific learning outcomes that supported the program learning outcomes (PLO), which follow. In each case, an abbreviated term (in parentheses) is provided to facilitate reading.

- PLO #1: Apply knowledge of multicultural, ethical, and legal issues pertaining to using educational technologies and communication within the global community. (Culture)
- PLO #2: Synthesize leadership principles within the practice of information and educational technology (Lead)
- PLO #3: Apply instructional design principles to design and develop educational materials (Design)
- PLO #4: Integrate theoretical perspectives to review, interpret, and apply research in learning technology (Research)
- PLO #5: Demonstrate effective written, electronic, and oral communications that reflect critical thinking and information literacy (Communicate)
- PLO #6: Locate, assess, and apply online resources to create learning experiences (Experience)
- PLO #7: Promote reading for learning, personal growth, and enjoyment (Reading; Teacher Librarians only)
- PLO #8: Organize collections according to standard library cataloging and classification principles (Cataloging: Teacher Librarians only)

The master's program consists of six core courses:

- ETEC 510 Foundations of Educational Technology and Media (Foundations)
- ETEC 523 Information and Digital Literacies (Literacies)

- ETEC 525 Digital Culture and Society (Digital Society)
- ETEC 530 Leadership in Technology and Media (Leadership)
- ETEC 551 Education and the Internet (Educational Internet)
- ETEC 570 E-Learning Design and Development (E-Learning)

All students took two elective courses, which could draw from several departments. The most popular course was ETEC 535 Accessible Electronic and Information Technologies (Accessible Tech), which is offered every other year. All TLs are required to take ETEC 540 Organization of Resources (Catalog) and ETEC 545 Reading for Leisure and Learning (Read), which are offered alternative year. The culminating program options are a comprehensive exam (ETEC695 [Comps]), a thesis, or a project. Only three students chose the thesis option during this time period, and they too had to submit an ePortfolio.

The directions for assembling the ePortfolio required that artifacts had to be arranged by PLO. A rubric was made available to provide students with the criteria for assessment: choice of evidence/artifact/artifact, self-reflection in terms of the basis for choice and its evidence of learning and professional impact, technical skills, and communication skills. Students could choose any assignments or even those workplace artifacts to showcase their competence. In all cases, student coursework had been graded within the associated course so that reviewing the ePortfolio could concentrate on the curation, reflection, and technical aspects of the ePortfolio.

Students in the master's degree program shared their draft ePortfolios in terms of process and artifact to their classmates and the instructor to receive feedback to polish their ePortfolios. At least half of the master's degree students also pursued their TL credentials, so they also received peer feedback.

Methodology

Research Design

To answer the research questions, I conducted a content analysis of the students' ePortfolios for the years 2020 to 2024 as provided in ETEC 695 (Comps): the culminating course that helped students to synthesize their knowledge across the program and demonstrate their knowledge through a comprehensive examination and their ePortfolios. I taught the course and assessed the students' ePortfolios for years 2020, 2022, 2023, and 2024. I copied the course content and structure for 2021's instructor, and I worked with that person to ensure an equitable ePortfolio experience in 2021.

For all five years, I assessed the students' ePortfolios at the end of the Comps course. I located each artifact, which assignment it fulfilled in which course the artifact was created, and the program learning outcome that the student identified for each artifact. To facilitate my documentation, I created a spreadsheet that listed all the assignments that the students chose, by row; the spreadsheet columns indicated which PLO was addressed, as designated by the student. I tallied each time I saw an artifact. I also read the students' reflections about how they met the PLO. All data were anonymized.

Participants

The student population consisted of 19 students in 2020, 20 students in 2021, 18 students in 2022, 17 students in 2023, and 15 students in 2024. About half of the students each year were pursuing their TL services credential, and half of those students were also pursuing their ETEC master's degree (which consisted of just two additional courses to the courses taken for the credential). The majority of students pursuing the credential were females, and the majority of degree-only students were males. The ethnic representation was diverse; while the majority were White, at least a quarter were Latinx, a smaller proportion were Asian/Pacific Islander, and less than 5% were Black. These demographics did not vary significantly from the university's graduate demographics. The ages ranged from the 20s to the 60s, with the majority of the ETEC-only students in their 30s and the majority of credential-only students in their 40s. Most students were K-12 classroom teachers, and about half of the TL credential students were working in the school library by the end of their program.

Students in the 2020 Comps course had experienced mainly hybrid courses (i.e., about half the time face-to-face and half the time asynchronously). Mid-March, the program pivoted completely to online, replacing the face-to-face with synchronous online class sessions. Students in the 2021 course were almost completely online. Students in the 2022 course experienced some hybrid courses at the end, although the Comps course remained completely online. Students in the 2023 course had a couple of hybrid courses, but the program moved completely online starting spring 2023. Just a few students in 2024 Comps course had taken any face-to-face sources. The instructors did not change during this time period, although they occasionally switched which courses they taught.

Findings

The content analysis of the artifacts chosen for students' ePortfolios answered the research questions. No two ePortfolios completely duplicated the choice of artifacts. Nor were the ePortfolio designs the same across students.

Table 1
*Frequency of Assignments Chosen Within Each Course by Year (*indicates required course)*

Course	2020	2021	2022	2023	2024	Total
ETEC 510 Foundations of Educational Technology & Media*	26	53	29	38	25	171
ETEC 523 Information & Digital Literacies*	31	48	35	46	59	219
ETEC 525 Digital Culture & Society*	22	22	21	19	27	111
ETEC 530 Leadership in Technology & Media*	23	20	15	22	26	106
ETEC 551 Education and the Internet*	32	32	17	29	24	134
ETEC 570 eLearning Design & Development*	17	20	21	24	21	103
ETEC 580 Field Experience	0	0	1	1	5	7
ETEC 695 Seminar in Educational Technology & Media	2	1	0	2	2	7
ETEC 540 Organization of Resources	10	15	12	16	14	67
ETEC 545 Reading for Leisure & Learning	13	27	16	23	19	98
ETEC 535 Accessible Electronic & Information Technology	5	3	0	5	0	13
Program total	181	211	149	225	222	1018

For RQ1, "Which courses did the students draw upon as they chose the artifacts to demonstrate that they met each learning outcome of the program?", Table 1 shows the frequency that artifacts from each course were chosen to meet at least one PLO, both by year and as a total. Of the six core courses (noted by an asterisk), the frequency of core course artifacts chosen ranged from 104 for the design course to 219 for the literacies course.

All students included at least one artifact from each core course. Very few students drew upon their capstone course (field experience, Comps, or thesis) or their workplace, although they were allowed to. Every assignment worth at least 10% of the course grade was chosen by at least one student. All courses had at least one collaborative assignment, and most students chose at least one such assignment in their ePortfolios.

For RQ2, "What artifacts did students choose to demonstrate that they met each learning outcome of the program?", Appendix A details the frequency of each assignment chosen to meet each PLO. Some assignments met several PLOs. The following assignments from single courses were chosen to meet the majority of PLOs (abbreviated course titles in parentheses, signature assignments noted with asterisks). When two assignments were both frequently chosen, their rank is noted.

- PLO #1 Culture: Action research* (Digital Society)
- PLO#2 Lead: Staff development or technology plan (Leadership)
- PLO #3 Resources: Online course design* (Instructional Design)
- PLO #4 Research: Literature review* (Foundations)
- PLO #5 Communicate: (1) Podcast, (2) infographic, (3) Webquest* (Literacies)
- PLO #6 Experience: (1) E-course evaluation, (2) online tools comparison (Educational Internet)
- PLO #7 Cataloging: Process evaluation (Cataloging)
- PLO #8 Read: (1) Booktalk, (2) display, (3) graphic novel* (Reading)

A few assignments were seldom chosen. Those that were chosen less than 10 times altogether are listed next by course (individual assignment noted with *). Only core courses are mentioned; elective courses are omitted as fewer students enrolled in them.

- Foundations: Technology timeline, learning/teaching theories, professional development plan*, final exam*
- Literacies: Information theories comparison*, transliteracy lesson*, pathfinder*
- Digital Society: Global project*, reflective paper*
- Leadership: Grant plan (compared to the staff development or technology)*, CUE talk*, vision/mission essay*, leader style essay*, final exam*
- Educational Internet: Final exam*
- Design: None

Within each core course, every PLO was met by some assignment within that course, except for the Leadership course, which did not have an assignment that those chosen to meet PLO #5 Communicate. PLO #1 Culture included artifacts from every course. Artifacts for PLO #2 Lead drew almost completely from the Leadership course. PLO #3 Resources also included artifacts from every course, although mainly from the Educational Internet course. PLO #4 Research drew largely from the introductory courses (Foundations and Literacies), although theories were also addressed in more advanced courses (Leadership and Instructional Design). PLO #5 Communication/Information Literacy

drew mainly from the Literacies course. Likewise, PLO #6 Learning Experiences artifacts drew mainly from the two lab-type courses: Literacies and Instructional Design. Interestingly, the TL-only PLOs #7 Cataloging and #8 Read drew from their two focused courses: Cataloging and Reading.

Several other findings emerged from the data. For instance, the number of assignments varied by course. In general, introductory courses had more, smaller assignments, and more advanced courses had fewer, more complex assignments. To show mastery, the more substantial assignments (signified by boldface in Appendix A) such as literature reviews, action research, substantive plans, WebQuests, and online course development were chosen by the majority of students. It should also be noted that a few types of assignments—literature reviews, book presentations, and tool presentations—were used in two or three courses, so it was not surprising that they were often chosen. The ethnographic study was a feature of an introductory course and field experience, so it was not surprising that it was seldom chosen; nevertheless, it was linked to five PLOs.

For RQ3, "What trends in students' chosen artifacts existed between 2020 and 2024?", Appendix B shows the frequency and trend of chosen assignments per year. The number of assignments chosen from each course fluctuated over the time period, but no distinguishing pattern emerged. Nor did the comparative frequency between artifacts change significantly from year to year. The Literacies and Educational Internet courses generally had more assignments chosen, but they also had more varied activities as well than the more theoretical courses. Most of the courses did not change assignments during this time period, which was consistent with the students' choices of artifacts. ETEC 510 and 570 assignments changed the most, which was reflected in the artifacts chosen each year; the same instructor taught these courses consistently.

For RQ4, "To what extent, if any, did the program's delivery mode impact the choice of artifacts?", Table 1 and Appendix B show the trends of artifacts chosen each year. There appears to be no impact of delivery on the assignments chosen.

Discussion

Findings about RQ1, which courses students drew upon for their artifacts, revealed that every core course was represented by every student. Findings about RQ2, which artifacts were chosen, revealed that students tended to select signature assignments and individual projects, but they usually included at least one group assignment. Every assignment worth at least ten percent of a course group was chosen by at least one student within the study's time period, and no two individuals chose the same set of artifacts. The range of artifacts chosen to meet each PLOs differed per PLO; some PLOs were met by largely assignments in one course (e.g., Resources) while other PLOs were met by assignments in every course (e.g., Culture). Finding about RQ3, trends in students' chosen artifacts between 2020 and 2024, revealed a stable set of artifacts. Likewise, findings about RQ4, possible program delivery mode, revealed that the presence of the pandemic and the switch to a completely online program did not impact the choice of artifacts. The following paragraphs delve into the discussion of each research question.

RQ1: Course Representation

The fact that each course provided several opportunities to demonstrate competence enabled students to tailor their ePortfolios to their strengths while meeting the overall PLOs (Meth et al., 2020). While the program faculty identified one core course for each PLO, the students drew from across courses, except to some degree the leadership course for PLO #3 Lead. PLO #1 Culture had assignments drawn from every core course, probably because the college has a strong diversity/equity/inclusion emphasis that the program' faculty wove across the curriculum. The programs also try to balance theory and practice/skills, so it was no surprise that artifacts for theory, resources and learning experiences were widespread as well.

In terms of SoTL, this finding reinforces the concept of providing learning activities that build a knowledge and skill base for substantive projects, and that these introductory activities can cross course lines to program-level outcomes (Stagg-Taylor, 2004).

RQ2: Student Selection of Artifacts

These findings confirm the importance of student-driven assessment (Farrell, 2020; Koris & Pál, 2021), student autonomy (Marinho et al., 2021), and the development of professional identity as part of the learning process (Beckers et al., 2016; Sowers & Meyers, 2021); each ePortfolio reflected a unique combination of artifacts and reflects. Nevertheless, for over 90% of the ePortfolios, alignment of the artifact and PLO was clearly appropriate, which indicates that students were able to see the connection between their coursework and the PLO (Meth et al., 2020). In effect, their choices reflect a constructivist approach to meaning making, which optimizes their internalizing of learning (Kuhn et al., 2009). A few times, their choices were unusual, such as the Learning Theory for PLO #1 Culture, but the accompanying reflection usually made a satisfactory case for its appropriateness. All students drew from all core courses, which showed a widespread basis for satisfying the program's goals and signaled broad preparation. Fieldwork and Comps assignments

were rarely chosen, probably because the TLs had to create a web page about their field experience, so that set of artifacts was already represented. Some students may have felt that Comps assignments would constitute "double dipping" for the ePortfolio.

Nevertheless, the frequency of assignments chosen from any individual course varied. These differences inform faculty who teach each course regularly. For instance, to show mastery, students tended to choose more complex assignments; in their reflections, they tended to state that the assignment was hard, they learned a lot in doing it and were proud of their resultant artifact. Typically, these larger assignments also gave students the opportunity to choose the topic that they wanted to address, and the instructors encouraged students to choose something that would be personally or professionally meaningful to them. Because one of the advantages of ePortfolios is to capture professional growth (Fu et al., 2022), directions for the ePortfolio might require an introductory artifact and a later masterful artifact with a reflection to explain professional growth for each PLO.

A deeper dive into book presentations revealed the relative impact of updating course materials over time. For instance, two newer books replaced older titles in the Culture course, with a corresponding higher frequency of those new titles being mentioned. One of them, *Algorithms of Oppression* (Noble, 2018), was especially impactful for students because of artificial intelligence implications and the need for social justice. In short, the findings can serve as a catalyst for continual program efforts for currency and improvement (Angel & Robinson, 2017; Beckers et al., 2016), which informs SoLT.

In terms of an assessment instrument as a pivot point of SoLT, the ePortfolio offers an insight into the assignments that the students consider worthy of showcasing; every assignment in each core course was chosen by at least one person. The less chosen artifacts also provide opportunities for the program faculty to consider the role of those assignments in advancing students' learning. For instance, the information theories assignment in the Literacy course serves as a preparatory basis as information theory is one required aspect of that course's ethnographic study. Furthermore, for TL students, one of their required activities in their field experience is to conduct an ethnographic study.

RQs 3 and 4: Trends Over Time and Across Delivery Modes

No significant difference was found in terms of artifacts chosen over time or in reaction to delivery modes. This finding was also observed by the program faculty, which helped them to decide to transition to a completely online program. The findings were not surprising as most assignments did not depend on a face-to-face in-course setting. Even those assignments that were site-based did not require face-to-face data gathering. In that respect, the assignments were delivery-mode neutral, which made them more robust in terms of learning environmental context.

Conclusions

The culminating ePortfolio assignment has served as an appropriate summative assessment instrument for the ETEC and TL programs as it provides a means for students to synthesize their learning experiences and deliberately align them to the program learning outcomes. The design and implementation of the ePortfolio assignment appears to have captured each individual's priorities through those choices and reflections (Segaran & Hasim, 2021). Furthermore, the ePortfolios confirmed that students not only met the PLOs but that they applied critical analysis to select appropriate artifacts that showcased their competencies.

This study was a fruitful investigation, and it confirmed the usefulness and quality of ePortfolios for assessment and engaged learning for the program under investigation. The study was limited to one program, one assessment type, two instructors, and four cohorts for a total of 74 graduate students. Nevertheless, this exploratory research provides a proof-of-concept approach to ePortfolio assessment and use, not only to optimize student learning but also to facilitate continuous program improvement. Furthermore, the scope and methodology of ePortfolio use can be used in several disciplines and, to some extent, different educational levels. In many other programs or institutions, students have little say in which artifacts to include (Walland & Shaw, 2022), but I found that student-driven assessment that gives student agency in choosing what artifacts to represent their professional competence and identity offers a more authentic and personalized assessment.

In reaction to these findings, and in the context of SoTL, several recommendations may be considered. For instance, faculty might explicitly explain how in-class activities and individual assignments lay the groundwork for substantial, often signature, assignments in their course and more advanced courses, thus transparently demonstrating a systematic programmatic design where faculty link learning activities across courses to prepare student for signature assignments (Meth et al., 2020). Faculty might also check for possible overlapping assignments, such as tool presentation, to make sure that distinguishing features are emphasized and that different types of tools are being presented.

As another recommendation that arises from the findings and informs SoTL, faculty should provide students with several opportunities to learn, practice, and master PLOs, which can also lead to more professional growth (Galeucia et al., 2023). This practice can be

conveyed by having students include artifacts from early on to the program's end and provide reflections that analyze their professional journey including next steps in their careers. Indeed, although I reminded students at the end of each course to store and keep track of professionally meaningful assignments, it might be a good idea to take time during class time to have students revise their ePortfolios as they go along, and have peers give feedback in the process. Particularly since the program addresses instructional design, instructors might frame this activity as an iterative instructional design process (Matthews-DeNatale et al., 2017).

This study also lends itself to further research. Portfolio reflections could be analyzed and compared to the artifact more thoroughly. Students could be interviewed about their process as part of the data analysis. As mentioned above, ePortfolios could be used as formative assessment and then assessed for their impact, including the usefulness of feedback, on the quality of culminating ePortfolios. Portfolios could be assessed by potential employers (Mitchell et al., 2021). Portfolio effectiveness could be assessed and compared for different disciplines at different educational levels. Different levels of technology self-efficacy and competence could be studied in terms of ePortfolio development and its validity in assessing student performance; in cases where designing ePortfolios is a cognitive overload, to what extent would boilerplate templates facilitate the process and result in more equitable assessment (Gladhart & Kaltenbach, 2006)?

In sum, instructors can learn just as much from using ePortfolios as their students, and these efforts can lead to improved learning and curriculum.

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Appendix A
Frequency of Assignments Chosen for Each Program Learning Outcome

Course Number, Title Assignment	Total	PLO 1: Culture	PLO 2: Lead	PLO 3: Resources	PLO 4: Resea-rch	PLO 5: Com-municate	PLO 6: Experi-ence	PLO 7: Read	PLO 8: Catalog
510 Foundation									
510 Tech timeline	9	2	2	1	4				
510 Article critique	22	2			20				
510 Diffusion interview	19		2		15	1		1	
510 Case study	19	14	2		3				
510 Learning/teaching theories	7	2		2	1	1	1		
510 Prof. devt.	5		2		2		1		
510 Final exam	1					1			
510,695 **Lit Review**	94	18	2	4	65	3	1	1	
523 Literacies									
523 AT Spreadsheet	15	2			6	5	2		
523 Podcast	61	2		1		57	1		
523 Infographic	43	3		2	2	33	3		
523 Info literacy DB	11			1		4	6		
523 **Webquest**	40	3		5	1	26	5		
523 Info. theories	6	1			3	1	1		
523 Info. formats	12				6	3	3		
523 Translit. lesson	9		1		7		1		
523 Pathfinder	2			1			1		
523 Screencast	17			3	2	6	6		
523, 580 Ethnography	8	2			2	2		1	1
525 Digital Society									
525 Act. research	61	50	1		7		3		
525 Global project	2	2							
525 Reflective paper	5	3		2					
525 Discussion	38	13	23	1	1				
525, 530, 570 Present Book	67	32	19	8	4	1	3		
523, 551 Present Tool	46	2	6	12		10	16		
530 Leadership									
530 Vision/mission	5		5						
530 Leader style	2		2						
530 Staff devt. plan	33		33						
530 Tech plan	31	3	24	2	1		1		
530 Grant plan	6		6						
530 Interview	10		9	1					
530 CUE talk	7		7						
530 **Final exam**	2		2						
551 Educational Internet									
551 Compare online tools	37			8	1	2	26		
551 Periodic table	21		2	13			6		
551 eBook	12			2		2	8		
551 eCourse eval.	47	1	1	11			34		
551 Website	24	2	1	9		1	11		
551 Final exam	1						1		
570 Instruct. Design									
570 **Online course**	75		1	54	1		19		
570 Ted talk	28	1		12	3	3	9		
695 Comps Review	7	1	1	1		1	3		
535 Accessible Tech.									
535 Case study	4	2		2					
535 **Action plan**	9	2		4	1		2		
540 Cataloging									
540 Process	25								25
540 **Catalog**	13								13
540 ILMS	6								6
540 Lesson	16			3			3	1	9
545 Reading									
545 **Graphic novel**	20							20	
545 Public library	1							1	
545 Storyhour	1							1	
545 Literature circle	2							2	

545 Booktalk	22			1	1	20	
545 Display	21				1	19	1
545 Collection devt.	15	1	1	1		4	8
545 Book review	11					7	4
545 **Reading promo.**	5		1			4	
580 Field Exp. Lesson	5	1	1			2	1

Note. Significant assignments in boldface.

Appendix B
Frequency of Assignments Chosen for Each Year

Course number/Short title Assignment and frequency per year	2020	2021	2022	2023	2024	Total
510 Foundations						
510 Tech timeline	1	2	4	1	1	9
510 Article critique	7	4	1	4	6	22
510 Diffusion interview	2	7	4	3	2	18
510 Case study	2	7	2	6	2	19
510 Learning/teaching theories	1	0	1	0	4	6
510 Professional development	0	1	1	1	1	4
510 Final exam	0	0	0	1	0	1
510,695 Comps **Lit Review**	13	30	17	23	11	94
523 Information & Digital Literacies						
523 AT spreadsheet	1	2	2	6	4	15
523 Podcast	12	9	11	15	14	61
523 Infographic	4	10	9	7	13	43
523 Info literacy database	0	0	1	1	8	10
523 **Webquest**	8	9	8	7	8	40
523 Information theories	0	2	0	2	2	6
523 Information formats	0	3	0	3	6	12
523 Transliteracy lesson	0	0	0	3	6	9
523 Subject pathfinder	0	2	0	0	0	2
523 Screencast	5	8	2	1	2	18
523, 580 Field experience Ethnographic Study	3	2	2	0	1	8
525 Digital Culture						
525 Action Research	10	12	12	13	13	60
525 Global Artifact	1	0	1	0	0	2
525 Reflective Paper	0	2	2	0	1	5
525 Discussion Board	11	8	6	6	7	38
525, 530 Leader, 570 Experience Present Book	14	19	7	11	16	67
523, 551 Educational Internet Present Tool	14	8	11	6	6	45
530 Leadership						
530 Vision/mission	1	1	0	1	2	5
530 Leader style	1	0	1	0	0	2
530 Staff devt. plan	9	3	7	11	3	33
530 Tech plan	6	10	5	4	6	31
530 Grant plan	2	1	1	1	1	6
530 Leader interview	1	4	1	1	3	10
530 CUE presentation	2	1	0	3	1	7
530 **Final exam**	1	0	0	1	0	2
551 Educational Internet						
551 Compare online tools	7	6	5	6	5	29
551 Periodic table	0	4	2	9	6	21
551 eBook	5	6	1	0	0	12
551 Online course eval.	7	13	7	10	11	48
551 Website	13	6	2	2	2	25
551 Final exam	0	0	0	1	0	1
570 Instructional Design						
570 **Online course**	17	14	14	17	13	75
570 Ted talk	0	6	7	7	8	28
695 Comprehensive Exam Course Review	2	1	0	2	2	5
535 Accessible Technology						
535 Case study	2	0	0	2	0	4

535 **Action plan**	3	3	0	3	0	9
540 Cataloging						
540 Process	4	7	4	6	4	25
540 **Catalog**	4	2	1	3	3	13
540 ILMS	2	2	1	0	1	6
540 Lesson	0	4	4	3	5	16
545 Reading						
545 **Graphic Novel**	2	7	2	4	5	20
545 Public library	0	0	0	0	1	1
545 Story hour	0	1	0	0	0	1
545 Literature circle	0	0	0	2	0	2
545 Booktalk	4	4	3	6	5	22
545 Display	5	4	5	4	2	20
545 Collection development	1	6	2	4	2	15
545 Book review	3	4	3	1	0	11
545 **Reading promotion plan**	0	2	0	1	3	6
580 Field Experience Lesson	0	0	1	1	3	5

Note. Significant assignments in boldface. Comps students chose a wider variety of evidence to meet the leadership PLO, largely because some students focused on collaboration rather than leadership.

* NOT USED: Foundations course technology timeline (4), 510 diffusion interview (4), 523 assistive technology spreadsheet (4), 523 infographic (5), 525 action research (4),530 tech plan (4), 551 compare online tools (4), 570 online course (4), 523 WebQuest (5), 551 website (5), 570 TED talk (5).

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Enacting Learning Agency Through ePortfolio Implementation: An Exploratory Study

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ePortfolios have emerged as a potential tool for enacting agentic learning, allowing learners to document and demonstrate their learning. However, there is a gap in investigating students' enactment of agency resources while implementing ePortfolios. To address this, this study investigates the impact of ePortfolios on promoting learner agency among high school students. By employing a mixed-methods strategy, this research examines how ePortfolios enhance the contextual, relational, and individual domains of learner agency. The study includes a group of 34 students from an international school in Hong Kong. It utilizes an ad-hoc survey, based on the agency concept underlying the Agency of University Students (AUS) Scale, that includes both rank-order items and open-ended items. The purpose of the research is to explore the influence of ePortfolios on agentic learning. The results suggest that ePortfolios significantly improve learner agency at an individual level, promoting active participation, competence beliefs, and more profound and meaningful engagement with the learning content. Besides, the value of peer support was highlighted in the relational dimension, and in the contextual dimension, opportunities to influence and active participation are most evident. This study emphasizes the importance of ePortfolios in facilitating active and reflective learning. Conclusions also highlighted the importance of promoting student agency during ePortfolio-facilitated learning by addressing various factors of agency resources in individual, contextual, and relational domains. The recommendations for enacting learners' agency in ePortfolio implementation were also provided.

Learner agency, integral to the educational narrative, epitomizes the capacity of learners to orchestrate their learning journey, which encapsulates pivotal aspects such as self-regulation, goal setting, decision-making, self-monitoring, and reflective thinking (Reeve, 2013; Schunk & Zimmerman, 2011), characteristics fundamental to academic success (Code, 2020). This notion aligns with the perspective that learner agency is a multidimensional phenomenon intricately linked to individual and collective components of learning, power, and control (Eteläpelto et al., 2013). The capacity for self-directed, proactive engagement in learning is not just central to self-regulated learning but also resonates with contemporary educational paradigms aimed at fostering student engagement, intrinsic motivation, and self-efficacy (Schunk & Zimmerman, 2011).

In the evolving landscape of educational technology, ePortfolios have emerged as an important tool for promoting agentic learning and enhancing learning agency by facilitating learner autonomy and providing a means to track and reflect on educational growth (Sarwandi et al., 2022). These digital platforms provide a medium for learners to document, reflect upon, and showcase their learning journey, thereby facilitating a reflective and integrative learning experience (Castañeda & Tur, 2020; Zhang & Tur, 2022). ePortfolios, characterized as digital collections of authentic and diverse learning evidence (Mummalaneni, 2014), enable learners to direct their learning, a core aspect of learner agency (Tong & An, 2022). These platforms support the development of self-directed learning skills, including self-evaluation, goal formulation, and selection of future learning tasks, thereby fostering self-monitoring and evaluation, and enabling learners to share and reflect on their learning (Beckers et al., 2016; El-Senousy, 2020; Yamaguchi, 2011; Yastibas & Cepik, 2015).

Despite the recognition of ePortfolios as valuable tools for enhancing learning agency, there is a discernible gap in understanding how they can be optimally utilized to measure and evaluate learner agency, a multifaceted and complex construct (Jääskelä et al., 2017). Specifically, there is a need for studies that delve into how students perceive and enact different sources of agency when engaging with ePortfolios in their learning journey (Zhang & Tur, 2023).

To address this research gap, we designed the current study to dissect the nuances of learner agency in the context of ePortfolio use. We seek to identify the specific dimensions of agency that learners engage with and to refine ePortfolio practices to better support agentic learning. Nonetheless, assessing learner agency is difficult, as it requires measuring what learners know, how they approach their learning, and the extent to which they adopt an active and self-directed approach (Jääskelä et al., 2017). Addressing the complexity of assessing learner agency, this study adopts a combination of choice-based and open-ended questionnaires, informed by the Agency of University Students (AUS) Scale (Jääskelä et al., 2017, 2023), to capture nuanced aspects of students' agentic engagements in ePortfolio learning contexts. A qualitative descriptive approach underpins this research, leading to the formulation of two primary research questions:

- What dimensions of learning agency are enacted through ePortfolio use?
- What manifestations of agency resources are evident in the ePortfolio-based agentic learning environment?

Literature Review

Learner Agency and Agentic Learning

Learner agency is inherent in a student's capability to regulate, control, and monitor their own learning, and it is fundamental to their academic success (Code, 2020). According to Eteläpelto et al. (2013), agency is a complex phenomenon encompassing both individual and collective components and is closely connected to power and control. They presented a theoretical framework for comprehending agency that consists of three dimensions: the capacity to act, the intentionality of action, and the reflexivity of action (Eteläpelto et al., 2013). Agentic learning is the learning process in which learners' agency is promoted by enabling them to take ownership of their educational experience and make conscious choices to attain their learning objectives (Code, 2020). In this learning setting, learners are required to be autonomous, proactive, and reflective during learning (Code, 2020). Learners with a higher sense of agency can identify their own needs, establish objectives, and take steps toward achieving those objectives. In addition, they can adapt to changing circumstances and take responsibility for their own learning outcomes (Code, 2020; Eddy, 2021). An essential aspect of learner-centered education is agentic learning (Eddy, 2021). Learner-centered education emphasizes learner agency and autonomy throughout the learning process. It acknowledges that learners have diverse needs, interests, and learning preferences, and learn most effectively when actively engaged in the learning process (Fletcher, 2016).

Multiple methods, such as agent-based learning support systems, have been shown to promote agentic learning (Peng, 2008). These systems use agents to adjust to meet the needs of learners, facilitate collaboration between learners, and make the system accessible. The agents can undertake various positions, such as tutor, mentor, motivator, expert, or peer student, and can influence various aspects of learning, including cognitive, affective, and metacognitive processes (Krishna et al., 2019). In this study, teachers and peer students are the agents in the learning process enabled by ePortfolios.

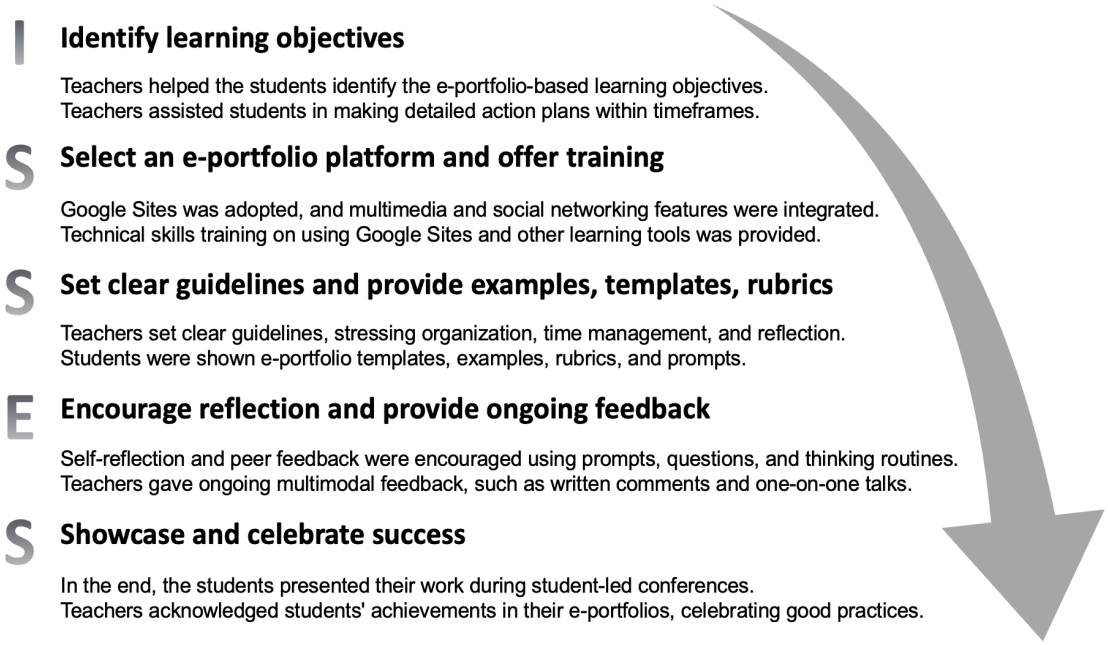
ePortfolio's Potential in Agentic Learning

Learner agency is a vital component of education, and ePortfolios can be a useful and valuable tool for fostering learner agency (Sarwandi et al., 2022; Tong & An, 2022). An ePortfolio is a digital compilation of authentic and diverse learning evidence derived from a more extensive archive that represents what a person has learned over time, reflects on, and is intended to showcase to one or more audiences for a particular rhetorical purpose (Mummalaneni, 2014). The use of ePortfolios can enable students to direct their own learning, which is a fundamental aspect of learner agency (Tong & An, 2022). ePortfolios can be used to facilitate the development of self-directed learning skills, such as self-evaluation of performance, formulation of learning objectives, and selection of future learning tasks (Beckers et al., 2016). They can help students self-monitor, self-evaluate, and share what they have learned, leading to better learning in future endeavors (Yamaguchi, 2011). Besides, ePortfolios can be applied to monitor student progress and enhance educational output (Tong & An, 2022). It can aid students in reflecting on their comprehension, resulting in a deeper grasp of the content (Tong & An, 2022). Also, an ePortfolio is a form of authentic assessment with formative features, such as showcasing and sharing learning artifacts, documenting reflective learning processes, connecting learning across multiple phases, and encouraging frequent feedback for growth (Yang et al., 2016).

The use of ePortfolios can also promote learner autonomy, which is another important aspect of learner agency (Yamaguchi, 2011). ePortfolios have become more prevalent in learning and student assessment because of the need for educators to foster student autonomy (Ghany & Alzouebi, 2019). ePortfolios enable students to reflect on their own learning process, promote collaborative and cooperative student work, and encourage feedback (Ghany & Alzouebi, 2019). Besides, an ePortfolio is not only a powerful tool for demonstrating evidence of learning and achievements, contributing to the enhancement of educational practices, but also an innovative platform that can be incorporated into the teaching and learning process to develop students' soft skills, including creativity, digital literacy, and critical thinking (Zain & Sailin, 2019). Consequently, an ePortfolio can be a valuable tool for agentic learning, emphasizing the learner's active role in the learning process and developing skills for self-directed learning (Beckers et al., 2016).

Research in ePortfolios about students' agency enactment is normally carried out using general approaches in which agency is addressed as autonomous and independent learning without a closer analysis of its nuances (e.g., El-Senousy, 2020; Yastibas & Cepik, 2015). According to Yastibas and Cepik (2015), ePortfolios require students to organize and produce content for a specific purpose, assess their work, and reflect on the results regarding their learning process, experiences, and skills. This allows students to assume responsibility for their learning and encourages

Figure 1
The ePortfolio Learning Design



them to be motivated. Similarly, El-Senousy (2020) asserted that ePortfolios can promote self-reflection and assist students in developing specialized competencies. As observed in previous research, agentic skills can be enacted through learning; however, there is still a need for greater work to understand under which conditions and with the support of which resources students' agency in ePortfolio-based learning can be promoted.

Method

The Learning Design

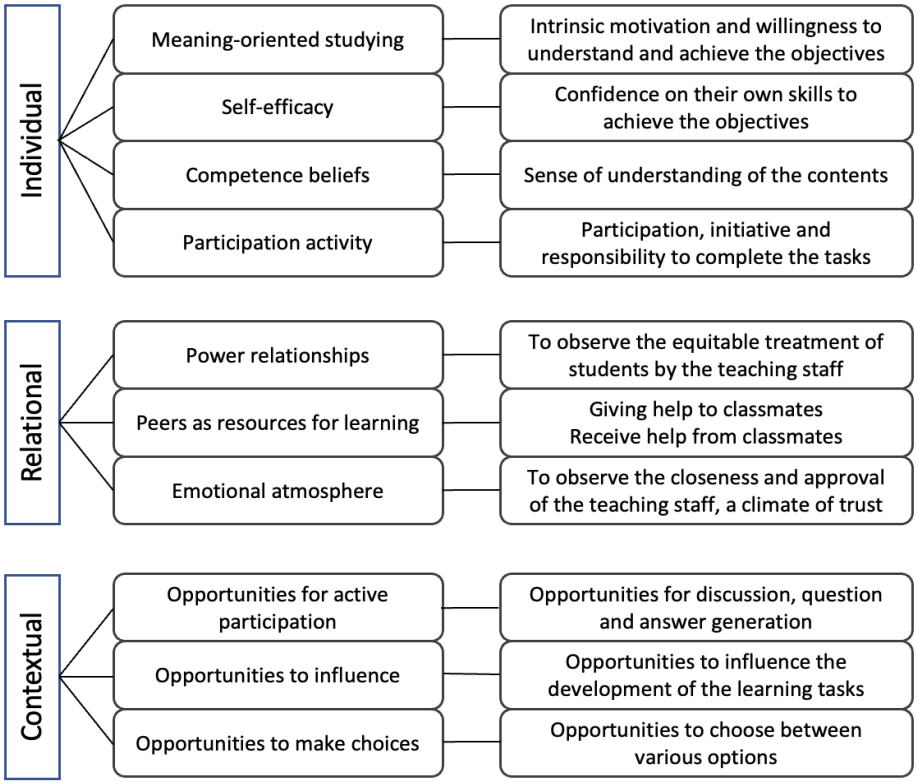
The present study was conducted over the course of a semester. It included ePortfolios implemented in various required subjects, including STEM, humanities, science, English, modern languages, art, music, drama, service learning, and some elective courses. Drawing upon Zhang and Tur's (2022) synthesized recommendations for effective ePortfolio implementation, the learning design was structured around five key components, as illustrated in Figure 1. The students were engaged in multiple learning tasks, including mini projects, essays, presentations, process journals, artifacts, research work, and reading logs, using ePortfolios to record, monitor, and reflect on their learning progress:

Instrument

Adopting an interpretivist paradigm with exploratory objectives, this study employed a mixed methods approach to gather both quantitative and qualitative data. To explore the learners' agency in this study, a survey was developed and implemented that included rank-order and open-ended items under each resource domain of learners' agency (see Figure 2). The AUS Scale inspired the design, which adhered to the description based on domains and dimensions and included general examples to be holistic but manageable. The AUS Scale is an instrument with a multidimensional structure developed for assessing the course-specific agency of students in higher education across disciplines (Jääskelä et al., 2017, 2023), evaluating the contextual, relational, and individual sources of agency (Jääskelä et al., 2017, 2023). It has good psychometric properties and has been validated in both Finland (Jääskelä et al., 2017, 2023) and Spain (Jääskelä et al., 2023).

In this study, an ad-hoc survey was built based on the framework of the AUS Scale to adapt to the context of secondary education and emphasize a qualitative approach. Given that this research concentrates on the agency of senior high school students transitioning to higher education, it is meaningful to investigate the resource dimensions of their agency and the effect of ePortfolio use on leveraging their agency. The instrument comprised a balanced mix of rank-order and

Figure 2
Domains of Learner Agency



Note. Adapted from "Assessing agency of university students: Validation of the AUS Scale," by P. Jääskelä et al., 2017, *Studies in Higher Education, 42*(11), 2061-2079. CC BY-NC.

open-ended items, based on previous research in k-12 (Bartholomew & Reeve, 2018), in which questions to facilitate students' answers by ordering different options were mixed with others for self-report in a freer way. Questions were crafted to resonate with the resource domains of learners' agency. We designed the items to elicit detailed responses pertinent to the study's research questions and objectives. Considering the participants' background and language preferences, the survey was English-Chinese bilingual to ensure all participants understood the instruction and content well. The instrument's structure and sample items are presented in the Appendix.

The survey was divided into three main sections:

- Introduction and Consent: Provided an overview of the study's objectives and sought participant consent.
- Personal Information: Gathered demographic data such as grade, age, and subjects involved.
- Agency Resource Domains: Featured a series of rank-order and open-ended items aimed at exploring the participants' agency in relation to their use of ePortfolios. The items were designed to allow participants to reflect on how ePortfolios influenced their intrinsic motivation, effort, sense of ability, participation, initiative, and responsibility (i.e., individual agency), interactions with peers and teachers (i.e., Relational Agency), and engagement with various learning opportunities (i.e., contextual agency; Jääskelä et al., 2017, 2023).

The individual domain (Jääskela et al., 2017) includes some of the self-regulated skills for learning, like having the intrinsic motivation to learn, which is the willingness to participate because of internal, personal interest in and value for the learning. Also, the individual domain includes the competence beliefs to understand the content/learning aims, whereas self-efficacy is about the learner's confidence in his/her own skills to achieve learning aims (Schunk & Zimmerman, 2011). The relational domain includes the peers who support learning, the relationships, the

diverse stakeholders, and the affective atmosphere (the climate of trust and caring in class). The contextual domain includes the opportunities to participate and influence the development of the group, along with the facilities to make choices.

Each domain section prompted participants to prioritize options and provide justifications, encouraging in-depth reflection and elaboration on their experiences with ePortfolios. The survey concluded with an open section for additional comments, allowing participants to share insights beyond the structured items.

Participants

The study involved 34 participants who were high school students in grades 10-12, aged 15-18 years old, and attending an international school in Hong Kong. A total of 41 students were involved in the ePortfolio learning activities, but only 34 of them responded to the surveys. The participants all participated in the research voluntarily and contributed to it without force or pressure. Furthermore, prior to the start of the study, the participants were fully informed about the research's purpose and objective, as well as what their involvement included. They were also allowed to ask questions and clarify any misunderstandings before agreeing to participate. The procedure for gathering consent from participants was carried out in compliance with the ethical guidelines and regulations guiding human subject research. Participants were also guaranteed confidentiality, and any identifying information that may be used to link them to the study was treated confidentially.

Data Collection

The data for this study were gathered from participants following the implementation of the ePortfolio-empowered learning experience. This study lasted one semester and was carried out at the school where the participants were enrolled. At one of their self-study sessions, the participants were asked to complete questionnaires to gather information. This form of data collection allowed participants to respond in a comfortable and familiar setting, which may have resulted in more accurate and trustworthy results. The items in the survey were presented in a bilingual manner, in Chinese and English; the participants were also allowed to respond in their native languages. Most participants answered in English, and only three answered in Chinese. Finally, all 34 responses were translated into English for data analysis.

Data Analysis

After collecting the data, we conducted a thorough analysis using both Excel and NVivo software. This section details the steps and methodologies involved in the data analysis process to ensure clarity and reproducibility.

Quantitative Analysis

For the quantitative analysis, participants' selected agency resources in their ePortfolio-based learning journey were assessed using descriptive statistics in Microsoft Excel. The frequency and percentage of each selected resource were calculated to determine the most and least common agency resources utilized by the participants.

Qualitative Analysis

A qualitative analysis was conducted on the participants' written comments reflecting their perspectives on their agency addressed in the ePortfolio implementation process. The written responses were imported into NVivo, a qualitative data analysis software, for coding and thematic analysis. The researchers followed a three-step process for the qualitative analysis (Corbin & Strauss, 2014):

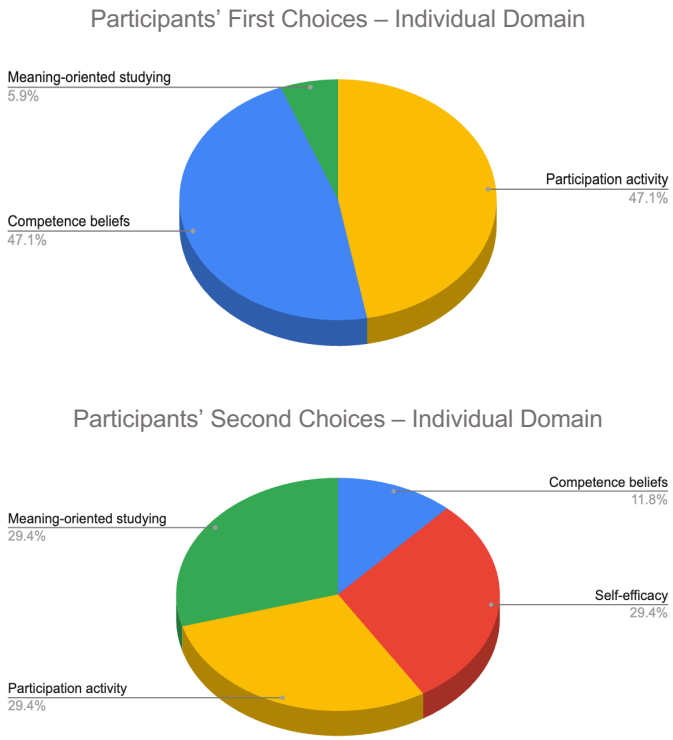
- Open coding: The written responses were read thoroughly, and initial codes were assigned to relevant text segments that captured key concepts or ideas related to participants' agency.
- Axial coding: The initial codes were reviewed, and similar codes were grouped together to form categories or themes. The categories were discussed and refined to ensure they accurately represented the participants' perspectives.
- Selective coding: The categories were further analyzed to identify the core themes that encompassed the participants' views on their agency enacted while using ePortfolios in the learning environment. Hierarchy charts were generated to visualize the number of coded references in each domain, providing a clear overview of the most prominent themes.

The quantitative and qualitative results were then compared and integrated to provide a comprehensive and accountable view of the participants' perspectives on their agency in the context of ePortfolio use. This mixed methods approach allowed for a deeper understanding of the participants' experiences and the factors that influenced their agency in the learning environment. By triangulating the findings from both the rank-order data and the written responses, we aimed to enhance the credibility and trustworthiness of the study's conclusions.

Results

Quantitative and qualitative results related to both research questions are presented in an integrated way

Figure 3
Individual Domain Pie Charts



according to the main themes that emerged: the individual, relational, and contextual domains of learners' agency.

Individual Domain

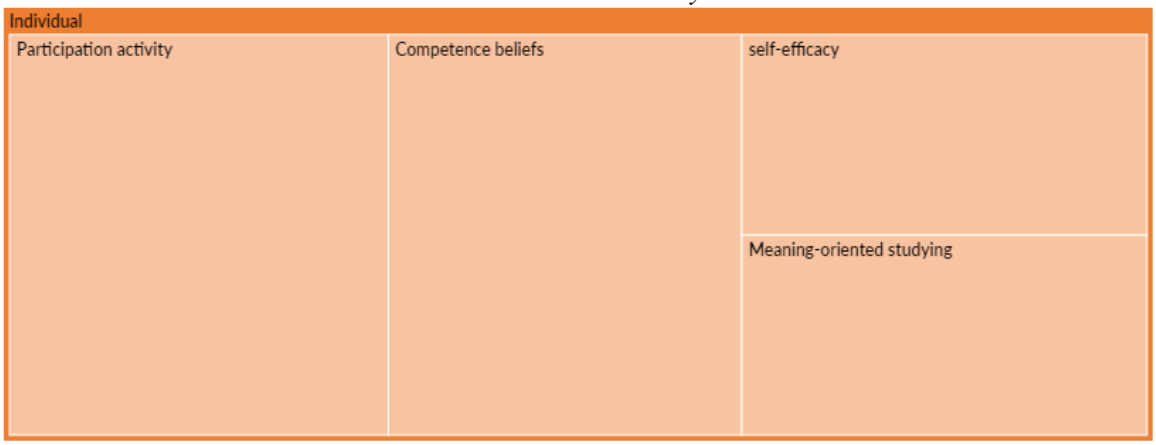
Figure 3 exhibits the participants' first and second choices of their resources for learning agency in the individual domain of agency. The participants' first choices were mainly participation activity (47.1%) and competence beliefs (47.1%); some also chose meaning-oriented studying (5.9%). Regarding their second choice, the choices of different agency resources in the individual domain are distributed more evenly. Apart from competency beliefs (11.8%), the choices in the remaining subcategories of learner agency, meaning-oriented studying, participation activity, and self-efficacy in the individual domain remain the same (29.4%).

The result in the hierarchy chart (see Figure 4) also indicated that participation activity is the most mentioned in students' written responses, with 30 references, followed by competence beliefs, with 28 references. The participants also identified self-efficacy and meaning-oriented studying, each with 16 references.

From participants' detailed written responses, we identified the following ePortfolio learning activities relating to participation activity: tracking learning progress, reflection, and learning evidence collection. The participants claimed that using the ePortfolio to document their learning progress and organize their previous work enabled them to take ownership of their learning. The possibility of creating their own ePortfolio to showcase their work and collect evidence of learning gave them a sense of control and ownership over their learning process. The ePortfolio also served as a reflective instrument that encouraged students to enhance their work through increased effort. For example, some excerpts of the participants' responses include: (a) "I can use it to track my learning progress and be responsible for my own learning," (b) "I can design my own ePortfolio to display my work and gather learning evidence," and (c) "The progress shown in the ePortfolio lets me reflect and work harder to improve upon it."

Participants' competence beliefs mainly lie in knowledge construction, learning development, and revision. Students stated that utilizing the ePortfolio to organize and reflect on what they learned helped them increase their comprehension and construction of

Figure 4
Individual Domain Hierarchy Chart



knowledge. They valued the opportunity to summarize what they had learned and update their ePortfolio, which helped them better understand the learning topic. Furthermore, the ePortfolio acted as a review tool, assisting students in retaining and applying their knowledge over time. For example, participants noted, "I can organize the things that I learned and reflect on what I learned, which can help me strengthen my understanding and build knowledge"; "I can summarize and review what I have learned"; and "[I] know better about the learning content while updating the ePortfolio."

Participants' self-efficacy in the ePortfolio-empowered learning journey reflects on various aspects, including self-confidence as a learner in achieving good learning results, addressing learning objectives, and readiness for challenges along the way. The participants reported that using ePortfolios helped them build a sense of confidence and belief in their learning abilities, which helped them succeed. They believed that if they worked diligently on their ePortfolios, they could achieve good grades and succeed in their studies. Students' confidence in accomplishing their learning objectives was bolstered by the collection of learning evidence, which allowed them to monitor their progress and view evidence of their learning. In addition, the electronic process journal served as a tool for reflection, which assisted students in overcoming learning obstacles and commenting on and criticizing their own work. For example, students wrote the following responses: (a) "If I work hard on my ePortfolios, I can get good grades"; (b) "The collection of learning evidence makes me confident in achieving the objectives"; and (c) "With my work being recorded in the process journal, I can reflect on my own work, overcome learning difficulties, and make comments and criticism on my work."

When it comes to meaning-oriented studying, participants address motivation, particularly intrinsic motivation, in their written responses. As the participants mentioned, using ePortfolios motivated them to work and helped them experience a sense of accomplishment as they completed tasks individually. They also reported that the inclusion of technology increased motivation and that the ability to monitor their progress in an organized manner provided them with a sense of purpose and direction. In addition, the students viewed the ePortfolio as a means to demonstrate their learning journey, which motivated them to continue pursuing their objectives. For instance, the students articulated their thoughts in the following ways: (a) "It gives me motivation to work because I enjoy the feeling of getting things done one by one; high-tech gives me motivation"; (b) "It can be proof of getting to the end of the unit step by step, letting people know how I get to the end, which motivates me to push forward"; and (c) "It kept me more organized with everything that I am learning, allowing me to have more motivation to acquire knowledge."

Relational Domain

In the relational domain of learning agency, as shown in Figure 5, peers as resources for learning were dominantly highlighted by participants in both their first and second choices (73.3%). Some participants chose items that fell into an affective atmosphere in their first (26.7%) and second choices (20%). The participants least mentioned power relationships: only 6.7% of the participants reflected on them in their second choice.

Similar patterns are notable in the hierarchy chart (Figure 6), which illustrates the frequency of themes identified in the students' qualitative responses. The most prominent theme was peers as resources for

Figure 5
Relational Domain Pie Charts

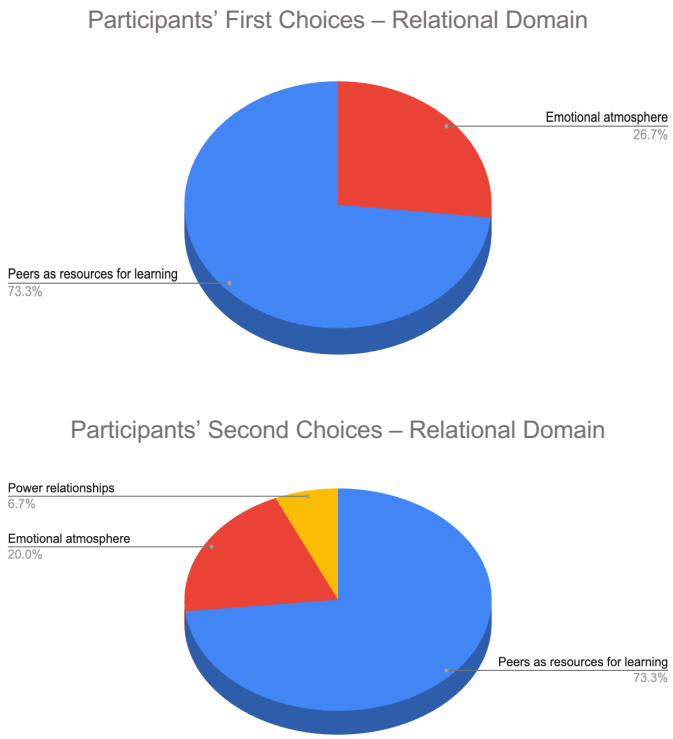


Figure 6
Relational Domain Hierarchy Chart

learning, with 32 coded references. The second most common theme was the emotional atmosphere, with 14 coded references. Lastly, power relationships were mentioned six times.

In the written responses concerning peers as resources for learning, we identified reciprocal peer support. It includes seeking help from other classmates and offering support to their learning peers through questioning, observing others' work, giving suggestions, and offering technical support while using ePortfolios. According to the participants, there is evidence that classmates can serve as learning

resources, as they can provide valuable feedback and inspiration for ePortfolio creation. Participants perceived that they could reference and learn from the ePortfolios of their peers, which can assist them in gaining a deeper understanding of certain topics. They also mentioned that having all their work on one site makes it easy for their classmates to view, which can facilitate peer feedback and support. In addition, students indicated that they could assist their classmates in the construction of ePortfolios, which can foster collaboration and knowledge sharing among students. Students responded with these statements: (a) "I can check other students' work and get inspired so that I can gain a better understanding of a topic"; (b) "I can help my classmates with ePortfolio making since I am more familiar with it"; and (c) "Our work being in one place allows our classmates to observe our work easily, allowing them to give us help when needed."

For the emotional atmosphere, the participants emphasized teachers' support, approval, and approachability in the cultivation of a safe, trusting, caring, and collaborative learning environment. Support, feedback, and collaboration were found to be the key elements in students' answers to the emotional climate in the ePortfolio-facilitated learning experience. According to the qualitative data analysis, students perceived a positive emotional atmosphere in the relational dimension of their learning agency. The participants reported receiving a great deal of support from their teachers, which they found to be highly beneficial, particularly when the teachers provided multiple comments on their ePortfolios, thereby increasing the level of interaction. The teachers' approval and review of the students' work demonstrated that they cared about the students' work, thus further fostering a caring environment. Furthermore, sharing ePortfolios among classmates and collaboration led to a collaborative and secure learning environment, thereby improving the emotional atmosphere. To demonstrate, here are some of the students' responses: (a) "I received lots of support from teachers. Teachers' feedback helps me a lot. Teachers can give numerous comments on ePortfolios; hence, interaction will increase. I really appreciate that." (b) "The teacher's approval and review of our work shows that they care about our work, creating a caring environment." Also, (c) "The ePortfolios are all shared among our classmates, and we collaborate a lot. I feel like the learning environment is collaborative and safe."

Power relationships are an essential source of agency in relational domains because they determine who has the authority to make decisions, control resources, and exert influence over others. In this study, it is relatively rarely mentioned in the collected data. For the students who mentioned power relationships in their written elaborations, we discovered that the participants highlighted empowerment, relationships, and equity. Students mentioned that incorporating reflections and responding to instructor feedback could facilitate relationship building. In addition, they noted that the ePortfolio allowed them to observe how organized teachers are with their work and how they manage their responsibilities, which may influence their perception of the teacher's power and authority. In addition, students valued the ability to view the feedback that teachers provided to different students to determine if they were being treated equally, indicating that power dynamics are essential to them. The following are examples of responses given by students: (a) "Build relationships with teachers by adding reflections and responding to their feedback," (b) "Using the ePortfolio also allows students to see how organized the teacher is with their work and how they handle their responsibilities," and (c) "I can see teachers' feedback on different students to see if they treat us equally."

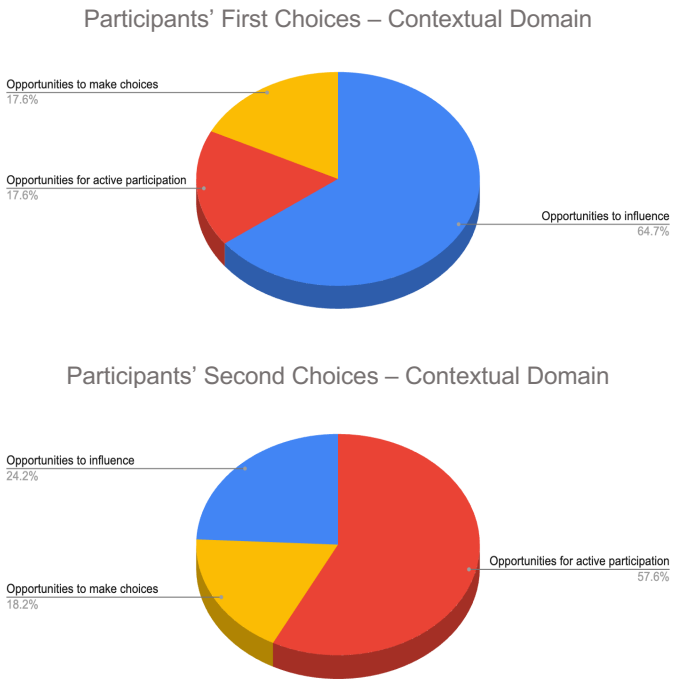
Contextual Domain

According to the pie chart (see Figure 7), most participants selected opportunities to influence as their first choice of the contextual domain of agency, with nearly two-thirds choosing this option. In contrast, 17.6% of participants chose the opportunity to make choices and opportunities for active participation as their first option. Interestingly, participants' second selections demonstrated a change in preference towards opportunities for active participation, with 57.6% choosing this category. Opportunities to influence, the most popular initial choice, was the second choice for 24.2% of participants. These findings imply that while opportunities to influence may be participants' first preference when assessing agency, the relevance of opportunities for active participation may become more apparent after further consideration.

Similarly, the hierarchy chart of the students' qualitative responses demonstrated that opportunities to influence was the code most frequently referenced by participants, with 28 references (see Figure 8). Opportunities for active participation was the second most referenced code, with 20 mentions in total. Finally, opportunities to make choices had the lowest number of references, with only 10. The comparatively low frequency of references to opportunities to make choices suggests that this domain may be less fundamental to participants' understanding of agency or may be perceived as less empowering than the other domains.

The opportunity to influence is a crucial dimension of the contextual resources of learner agency. The students' perceptions reflect that they can affect their own learning through self-direction, taking the initiative, process management, and tracking learning. Moreover,

Figure 7
Contextual Domain Pie Charts



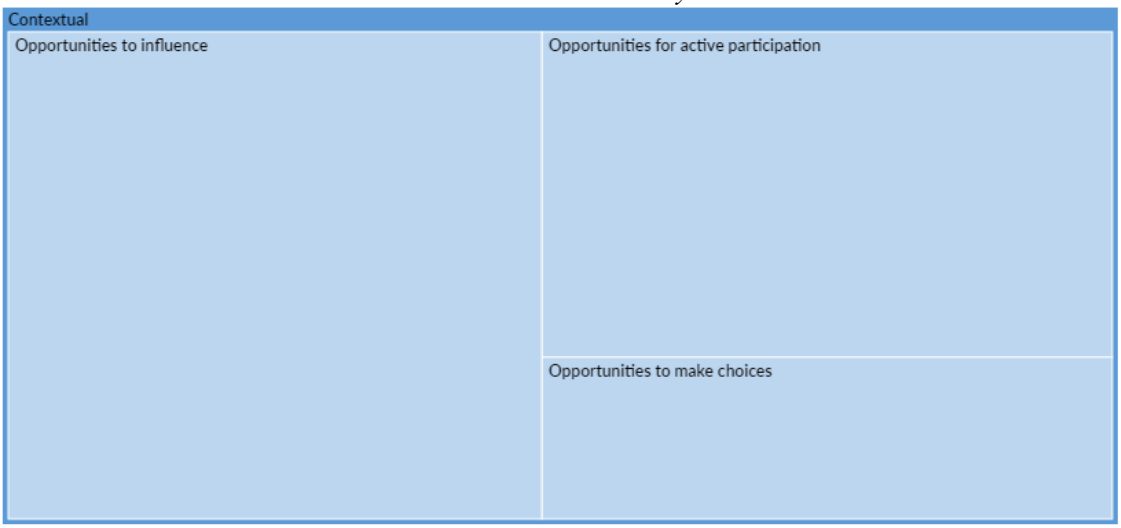
implementing ePortfolios positively influenced their learning outcomes and trained their skills, such as critical thinking. Illustratively, students conveyed their views through these responses: (a) "Our individualized learning through process journals allows us to direct our own learning." (b) "We can find what we want to study, what we want to put on our ePortfolios and track our learning. We can use it to review and achieve better learning results." (c) "The use of process journal trains my critical thinking." Also, (d)

> Through using an ePortfolio, I can understand the learning content better and have evidence of my learning. If I have any gaps in my knowledge, I would be able to spot them easier with the ePortfolio. It helps me gain more responsibility in learning.

The findings from data reflecting students' perceptions imply that opportunities for active participation are a crucial element of learning agency in the contextual domain. According to the students, participating in peer discussions, reflecting on their own work through learning journals and process journals, and collaborating with classmates to improve ePortfolio content all contributed to a deeper understanding and enhanced learning outcomes. These opportunities for active participation gave students a sense of autonomy by allowing them to take an active role in their own learning and engage in critical reflection and discussion. In addition, the ability to raise inquiries and seek support from peers and teachers through these activities highlights the relevance of social interactions and collaborative learning in fostering agency. To exemplify, students expressed their opinions as follows: (a) "The peer reflection part helped me a lot since I gained a deeper understanding of the topic through discussing it. I can discuss with my classmates how to make the ePortfolio content better." (b) "It helps me organize thoughts and ideas into a simple site for further discussion. With what we have learned all in one place, questions about the topic would be generated with more ease, leading to more discussion between classmates." Additionally, (c) "With my work being recorded in a process journal, I can reflect on my own work and make comments and criticisms on it."

The students' written responses reflected the opportunities to make decisions in agentic learning. The opportunity to choose their own learning pace and the content they wished to include in their ePortfolio gave students a sense of control and ownership over the learning process, as reported by students. They valued the flexibility enabled by these opportunities to choose, which they felt empowered them to demonstrate their own perspectives and approaches to

Figure 8
Contextual Domain Hierarchy Chart



their learning. The ability to select various development topics highlights the relevance of personalization and customization in cultivating agency. Students' written reflections can be seen in the following examples: (a) "I can be the master of my own learning and make choices based on my own learning pace"; (b) "I can choose whatever I want to put on my ePortfolio following the guidelines; it's flexible"; and (c)

> As I can choose different topics for me to develop on, even when the whole class has the same classes, but as we have different approaches to the same topic, creating an ePortfolio allows us to show what our approach to the unit is.

Discussion

The present research investigated the perspectives of learners on agency in implementing ePortfolios across three domains: individual, relational, and contextual. The findings reveal valuable information about the resources students believe are necessary for their agency in each domain. According to the findings of this study, students perceive their agency in ePortfolio implementation to be influenced by a variety of factors; the highly referenced ones include their own participation activities, competence beliefs, meaning-oriented studying, peer support, and opportunities to influence their learning environment. Previous research on agency has demonstrated that it is a complex concept impacted by individual and contextual factors (e.g., Jääskelä et al., 2017; Reeve & Jang, 2006).

Individual Domain

In the individual domain of agency, participation activity and competence belief were the most frequently cited resources for learning agency. This finding is consistent with previous research (Ryan & Deci, 2000), suggesting that students who actively participate in their learning and have confidence in their capacity for learning are more likely to experience a sense of agency. The findings suggest that incorporating participation activities into the learning process may strengthen students' agency by fostering self-regulation, self-motivation, and a sense of ownership over their own educational journey (Hagger & Hamilton, 2017). Participation activities enable students to interact actively with the learning materials and assume responsibility for their learning experience. Collaborative learning activities, such as peer work and project-based learning, are examples of participation activities that can have a positive effect on student achievement and agency (Balan et al., 2015).

Moreover, fostering competence beliefs and self-efficacy is a crucial part of leveraging learning agency, as it allows learners to control and master their own learning process and feel confident in their ability to acquire and successfully apply new knowledge, further enabling them to succeed in learning (Qudsyi et al., 2018). Academic achievement and motivation are positively correlated with self-efficacy beliefs, according to Qudsyi et al. (2018). Students with high competence beliefs are more likely to establish challenging learning objectives and persevere in the face of obstacles (Qudsyi et al., 2018). Thus, educators should help students develop these beliefs during the

ePortfolio implementation process by providing opportunities for success, offering constructive feedback, and motivating students to set ambitious and feasible objectives for themselves.

The findings also indicate that the use of ePortfolios can enhance students' sense of meaning and motivation in their learning. This is in accordance with the findings of Tosh et al. (2005), who determined that ePortfolios have lots of potential to motivate and engage students and facilitate deep learning. The fact that meaning-oriented studying was also designated as a source of agency in the study suggests that students' motivation and engagement in their learning process play an essential role in their sense of agency (Reeve, 2013). Also, this implies that students who perceive their learning as meaningful are more likely to experience a sense of ownership over it and to be motivated to actively participate in it (Reeve & Jang, 2006). In addition, the relatively even distribution of resources in the second option suggests that students may have a variety of options for enacting their agency in this domain during the ePortfolio implementation journey.

Unlike previous studies, which commonly reveal students' negative perspectives, such as doubts about their own abilities, lack of confidence, or the overwhelming workload that may hinder their motivation and willingness to participate (Tur et al., 2019), this research did not identify any such negative perceptions. This could be explained by the fact that the instrument prioritized enacting the concept of agency in ePortfolio learning rather than capturing students' own opinions of their ePortfolio learning experiences. Consequently, the previously reported negative opinions were not witnessed in this situation.

Relational Domain

In the relational domain of agency, the most prevalent first and second choices for learning agency were peers as resources, followed by the emotional atmosphere. It is implied that students may value the interpersonal relationships and emotional support they receive from classmates during the learning experience. This aligns with prior studies (Anderman & Wolters, 2007), indicating that collaboration with learning buddies is essential for promoting learners' agency. Peer collaboration is an educational approach currently employed to facilitate learning in classroom settings (Montgomery et al., 2015; Scott et al., 2013), and it is also extensively addressed in the implementation of ePortfolios (Ismailov & Laurier, 2021; Tur & Urbina, 2016; Zhang & Tur, 2022). Collaborative, peer-mediated learning activities contribute to developing deep learning approaches and establishing learning communities (Scott et al., 2013). Montgomery et al. (2015) argued that peer support strategies effectively empower students to step in and assist other classmates.

We discovered that the emotional atmosphere of the learning environment was also a relevant resource for learning agency, which suggests that students who feel supported and valued by their peers are more likely to develop an awareness of agency (Anderman & Wolters, 2007). Peers can play a vital role in supporting students as they learn through the creation of ePortfolios and emphasize the importance of fostering a collaborative and supportive learning environment in the classroom (Tur & Urbina, 2016); additionally, a positive emotional atmosphere in the relational domain can promote students' agency in their learning (Jennings & Greenberg, 2009). The relatively low representation of power relationships in this domain may suggest that students are unaware of their relationships with teachers or authority figures as notable agency resources. However, teacher impartiality in dealing with students should be considered as well to provide students with a sense of equity and fairness so that they can enact their agency more effectively (Jääskelä et al., 2017).

Contextual Domain

In terms of the contextual domain of agency, most participants chose opportunities to influence as their first choice, with opportunities for active participation coming in second. Recognizing that opportunities to influence were the most often mentioned resources for learning agency in the contextual domain corresponds with the assumption that students who feel they have a voice in their learning are more likely to consider themselves to have agency (Ryan & Deci, 2000). The revelation that opportunities for active participation were also a relevant resource for learning agency indicates that students who feel actively involved in their learning tend to feel a sense of ownership over it and have the incentive to participate actively in it (Reeve & Jang, 2006). Integrating opportunities for active participation into learning activities may strengthen students' agency and foster deeper learning (Ahshan, 2021).

Interestingly, opportunities to make choices were the least selected and discussed aspect of the contextual domain in this study. This finding contrasts with the work of Patall et al. (2010), which demonstrated that providing students with choices in their homework assignments led to increased intrinsic motivation, perceived competence, and academic performance. The discrepancy between the current study and Patall et al.'s (2010) findings may be explained by the high correlation between the constructs of opportunities to influence and opportunities to make choices. As making choices is a way to exert influence over one's learning context, students in this study may not have clearly differentiated between these two aspects of agency. The strong conceptual overlap between these constructs could have

led participants to prioritize opportunities to influence, as it encompasses the more specific act of making choices. This interpretation aligns with the recommendation made in the previous review, highlighting the potential difficulty in distinguishing between highly correlated constructs during data analysis.

Despite the lower emphasis on opportunities to make choices in this study, it is important to acknowledge the potential benefits of offering students choices in their learning, as demonstrated by Patall et al. (2010). Providing students with options and autonomy over their learning tasks can foster a sense of empowerment and intrinsic motivation, ultimately leading to improved academic outcomes. Future research could further explore the relationship between opportunities to influence and opportunities to make choices, as well as investigate strategies for effectively integrating both aspects of agency into learning environments.

Implications for Practice

This study provides valuable insights into the role of ePortfolios in promoting learner agency across multiple domains, including individual, relational, and contextual. The results indicate that ePortfolios function not just as a repository for evidence of learning but also as dynamic platforms that promote active involvement, competence beliefs, and a sense of connection with the learning material. The study consolidated the methods of promoting learners' agency in ePortfolio implementation, as depicted in Figure 9, leveraging the concept of agency dimensions in different resource domains (Jääskelä et al., 2017). The study has identified some specific implications and recommendations for practical application:

Individual Domain

- Active Participation and Competence Beliefs: The study demonstrated that active participation and a belief in competence are essential for cultivating a sense of agency. This aligns with the findings of Ryan and Deci (2000) and Reeve and Jang (2006). Consequently, educators should incorporate interactive activities such as project-based learning and collaborative tasks into the curriculum (Hagger & Hamilton, 2017). One possible approach is establishing collaborative projects where learners employ ePortfolios to record their learning progress and reflect on their learning experiences.
- Enhancing Meaning-Oriented Studying: Students valued the potential of ePortfolios to facilitate a deeper understanding and engagement with the learning content. Teachers should promote the use of ePortfolios among students to establish individual learning objectives and reflect on their educational progress, thus enhancing the relevance and intrinsic motivation of the learning experience.

Relational Domain

- Peer Support: The substantial importance of peers as resources for learning and acquiring knowledge underscores the importance of collaborative learning. To cultivate a collaborative learning environment, teachers could integrate peer review and feedback mechanisms into the ePortfolio implementation process. This may entail learners exchanging their ePortfolios with others to receive constructive comments, thus increasing learning through social interaction (Getman-Eraso & Culkin, 2017).
- Affective Atmosphere: The necessity for teachers to actively participate in the ePortfolio process is underscored by the positive affective environment created by teacher support, caring, and approval. Educators ought to consistently offer constructive feedback on students' ePortfolios and establish an inclusive classroom atmosphere that fosters a sense of value, caring, and support for students.

Contextual Domain

- Opportunities to Influence and Active Participation: The study reveals that students value the opportunity to participate actively and have a voice in their learning process. As demonstrated by Patall et al. (2010), offering students choices in their learning can enhance their sense of autonomy and agency. Teachers should provide learners with the opportunity to have ownership over their learning by allowing them to select the content for their ePortfolio. Furthermore, including features such as forums or group projects within ePortfolios can allow students to participate and engage actively.

In implementing these recommendations, educators and educational institutions can harness the full potential of ePortfolios, making them not just a tool for assessment but a powerful tool for enhancing learner agency during the learning process. By doing so, educators can create a more engaging, collaborative, and student-centered learning environment that prepares students academically and for future endeavors.

Figure 9
Approaches to Enacting Agency in ePortfolio Implementation

Individual Domain			
Meaning-oriented studying	Self-efficacy	Competence beliefs	Participation activity
Students and teachers set clear goals and expectations collaboratively. Students are motivated and enthusiastic for using e-portfolios to facilitate their learning. Teachers motivate students and encourage them to motivate each other continuously.	Students become confident and believe that they will use e-portfolios effectively. Students make efforts and be willing to overcome challenges in implementing e-portfolios.	Teachers help students develop a sense of understanding of how to use e-portfolios and collect learning evidence. Students are well-trained and feel competent in e-portfolio use. Self-reflection and self-assessment.	Implement e-portfolio collaboratively. Take the initiative in collaboration and discussion while using e-portfolio. Students actively track their learning, collect learning evidence in their e-portfolios. Students feel responsible for completing assigned learning tasks through e-portfolios.
Relational Domain			
Power relationships	Peers as resources for learning	Emotional atmosphere	
Teachers ensure treating each student equally and advocate equity and fairness in the e-portfolio implementation process. Teachers have regular check-in with students and give ongoing feedback on students' e-portfolios and develop a good student-teacher rapport. Teachers form a reciprocal relationship with students while using e-portfolios.	Students receive peer support and feedback from others during the e-portfolio-enabled learning journey. Students offer support and give feedback to other learning peers while implementing e-portfolio.	Teachers try to be approachable when students have questions about e-portfolio use and have an approving attitude toward students. Foster a trust and safe environment during e-portfolio implementation.	
Contextual Domain			
Opportunities for active participation	Opportunities to influence	Opportunities to make choices	
Teachers encourage students to collaborate and engage in discussion and collective meaning-making through co-constructing e-portfolio and peer feedback. Students actively participate in their own learning and collaborate with others during e-portfolio use continuously.	Students have a good sense of self-direction and affect their own learning. Students have opportunities to influence their own learning through self-reflection, self-assessment, and revision. Teachers respect students' perspectives and empower them to influence their own learning during e-portfolio practice.	Students can choose the e-portfolios design, learning collections, and showcase format based on their own thoughts, plans, and needs. Teachers give students opportunities to make choices to address their own e-portfolio development plan and learning.	

Limitations

While this study offers valuable insights into learner agency in ePortfolio implementation, it is important to acknowledge its limitations. First, the sample size of 34 participants from a single international school in Hong Kong limits the generalizability of the findings to other educational contexts. Future research should involve larger, more diverse samples from various educational settings to enhance the external validity of the results. Second, the study relied on self-reported data from surveys, which may be subject to response bias. Incorporating additional data sources, such as interviews or observations, could provide a more comprehensive understanding of learner agency in ePortfolio contexts and support further clarification. Finally, the study focused on a specific time frame (one semester) and did not explore the long-term effects of ePortfolio use on learner agency. Longitudinal studies could offer insights into how learner agency evolves over time in ePortfolio-based learning environments.

Conclusion

In summary, this study's findings indicate that students perceive their agency in ePortfolio

implementation to be influenced by a variety of factors in individual, contextual, and relational domains. Of these, the domains that seem mostly enacted are their own participation activities, competence beliefs, meaning-oriented studying, peer support, and opportunities to influence their learning environment. Furthermore, this study's findings have relevant implications for ePortfolio implementation and how educators might promote student agency and self-directed learning in the ePortfolio-empowered learning process. Educators can create ePortfolio learning environments that encourage student engagement, foster motivation, leverage social connectedness, and unpack opportunities for students to actively participate in the process of learning by understanding students' perceptions of agency resources in different domains. By doing so, educators may encourage students to take ownership of their learning and increase their sense of agency. These findings have broader implications for the design of ePortfolio-facilitated learning and for effectively using ePortfolios, which should be planned to promote student agency by facilitating various factors, including engagement, collaboration, and reflection.

Besides that, the results of this investigation suggest that future research should investigate the relationship between student agency and ePortfolio implementation in greater depth. For instance, future research could investigate the relationship between various dimensions of agency and different elements of ePortfolio use, such as the collaborative model, co-design, categories and quality of reflections, and satisfaction with ePortfolio use. Additionally, future research might investigate how this collaborative model might also influence the development of professional agency and, in this case, how the enactment of teachers' agency supports educational transformation (Corcelles-Seuba et al., 2022). Moreover, longitudinal studies could offer insights into how learner agency evolves over time in ePortfolio-based learning environments and support self-directed learning capabilities (Beckers et al., 2016; Tong & An, 2022), and future research should involve larger, more diverse samples from various educational settings to enhance the external validity of the results.

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Appendix
The Structure and Sample Items of the Survey

Section One:

Introduction
Consent Form
Therefore, I agree with participating in the study

- Yes, I agree.
- No. (Please leave the page)

Section Two:

Personal Information

- Grade
- Age
- Subject(s) involved (include all subjects)

Section Three:

1. The use of the e-portfolio has allowed me to implement: (choose two options in order of priority and give your reasons)

First of all,
Intrinsic motivation and willingness to understand and achieve the objectives
Effort and confidence to achieve the objectives
Sense of ability and understanding of the content
Participation, initiative, and responsibility to complete the tasks
Secondly,
Intrinsic motivation and willingness to understand and achieve the objectives
Effort and confidence to achieve the objectives
Sense of ability and understanding of the content
Participation, initiative, and responsibility to complete the tasks
Clarify/justify/elaborate on your option 1
Clarify/justify/elaborate on your option 2

2. The use of the e-portfolio has allowed me: (choose two options in order of priority and give your reasons)

First of all,
Observe the equitable treatment of students by the teaching staff
Give help to classmates
Receive help from classmates
Observe the closeness and approval of the teaching staff, a climate of trust
Secondly,
Observe the equitable treatment of students by the teaching staff
Give help to classmates
Receive help from classmates
Observe the closeness and approval of the teaching staff, a climate of trust
Clarify/justify/elaborate on your option 1
Clarify/justify/elaborate on your option 2

3. The use of the e-portfolio has allowed me to participate in: (choose two options in order of priority and give your reasons.)

First of all,
Opportunities for discussion, questioning, and answer generation
Opportunities to influence my own learning

Opportunities to choose between various options
Secondly,
Opportunities for discussion, questioning, and answer generation
Opportunities to influence my own learning
Opportunities to choose between various options
Clarify/justify/elaborate on your option 1
Clarify/justify/elaborate on your option 2

Other Comments.

End of the survey

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Integrating Competency-Based Education With ePortfolio Practice: The ASET Reflection Model

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This article introduces the ASET Reflection Model, an innovative framework to support ePortfolio assessment in competency-based health professions education. The model includes four components: analyzing evidence of competencies, synthesizing learning experiences, evaluating achievement of personal and professional goals through the metacognitive cycle, and transforming self and society through critical reflection. Implemented at the University of Rochester School of Nursing, the ASET Reflection Model provides a structured approach to integrate reflective practices into healthcare education, using faculty guidance to support students' competency development, application of theory to practice, professional identity formation, and self-directed learning. The model's adaptability across various nursing programs highlights its potential for fostering transformative learning experiences in the health professions, enhancing teaching and learning via ePortfolio reflection.

The Liberal Education and America's Promise (LEAP) initiative signaled a shift in higher education towards essential learning outcomes to better prepare students for work, life, and citizenship (Association of American Colleges and Universities [AAC&U], 2011). This pivot has been paralleled by a similar transition in the health professions, moving to competency-based education to ensure students are prepared to provide high-quality, safe, and effective patient care. This call has been reinforced by Englander et al. (2013), who endeavored to find common competencies across multiple health professions, including medicine, pharmacy, dentistry, public health, nursing, and others. Many professional organizations and accreditors in healthcare have embraced this call and have initiated a paradigm shift in teaching and learning. For example, the American Association of Colleges of Nursing (AACN, 2021) has adopted a new set of competencies as essential outcomes for practice-ready nurses.

The ePortfolio movement was accelerated by the LEAP initiative because it is a powerful method to promote the integrative learning required to develop professional competencies (Watson et al., 2016). Competency development requires integrating and applying knowledge from diverse sources to solve problems in the ever-changing modern workplace (Wolf, 2022). This process goes beyond the mere acquisition of declarative knowledge that can be learned in textbooks and lectures and assessed on multiple-choice tests. Instead, it requires multiple cycles of experiences enabling practiced application, feedback from mentors, and structured reflection to promote a profound transformation in how students understand and respond to the world (Gervais, 2016).

Reflection and metacognition have been important in teaching and learning for many years. There are multiple models aimed at guiding effective reflection, including those developed by Dewey (1933), Schön (1983, 1987), Kolb (1984), Gibbs (1988), and others. However, concrete applications of these models focus on learning through reflection on one discrete experience rather than the progressive development of competencies over time. Since a well-designed ePortfolio captures a trajectory of learning across a curriculum or even throughout a career, a reflective model should encourage and support learning across and between multiple experiences. Thus, there is a gap in understanding how to scaffold and sustain deep, critical reflection over time. We aim to address that gap by presenting a reflection model that supports students' progressive learning journeys as they strive to attain competencies or essential learning outcomes during a program of study.

As participants in AAC&U's 2023 Institute on ePortfolios, the University of Rochester School of Nursing implemented a new model to guide reflection and scaffold the development of knowledge and skills required for competency-based education. We designed the ASET Reflection Model to guide nursing students through four areas of critical reflection: analyzing evidence of their competencies, synthesizing their learning across a program of study, evaluating personal goals using the metacognitive cycle, and examining aspects of personal transformation. In our school's application of the ASET model, faculty meet with students at pre-set milestones each semester throughout a nursing program of study. Signature assignments are automatically uploaded into a student's ePortfolio to serve as evidence of competencies and to facilitate the reflection process. A signature assignment is a major assignment within a course designed to directly assess one or more program learning outcomes, serving as evidence of the progressive development of competencies. The ASET Reflection Model has been adapted to align with the expectations for competency-based education in nursing in both undergraduate and graduate programs (AACN, 2021). Reflection prompts guided by this model can be modified to scaffold

students' professional identity development as they proceed through a competency-based curriculum.

Literature Review on Reflection in ePortfolios

The initial motivation for ePortfolio adoption often begins with accreditation requirements or an effort to provide evidence of student learning to support program-level assessment. However, after adoption, faculty recognize the power of the tool to support higher-order thinking (Landis et al., 2015). Faculty also realize that this depends on a well-designed ePortfolio process that includes opportunities for reflection. However, faculty have acknowledged that the mere opportunity for reflection does not necessarily lead to high-quality reflective outcomes (Buckley et al., 2009).

Developing effective reflective practices within ePortfolios necessitates a well-designed learning framework (Baker & Jankowski, 2020). A practical learning framework provides explicit connections between competencies, learning outcomes, assessments, and learning activities, providing a roadmap for students to make sense of their experiences (Wolf et al., 2025). A competency-based framework promotes the integration of knowledge, allowing students to connect concepts and experiences within and between courses (Harrington & Luo, 2016). The process of making connections also requires students to reflect on their learning, not just in capstone courses immediately prior to graduation, but across their curriculum (Landis et al., 2015).

Structured reflection assignments within ePortfolios significantly improve students' confidence and reflective abilities (Harrington & Luo, 2016). Using structured reflection tied to the curriculum can increase recognition of the value of reflection and its importance for improving competency (Slepcevic-Zach & Stock, 2018). Well-designed reflection assignments provide a scaffolded approach, guiding students in the critical analysis required to learn from their experiences and become reflective practitioners.

Quality reflection also depends on frequent feedback from peers, faculty, or professionals. Hui et al. (2023) found that ePortfolios can provide a structure for a "feedback dialogue" between students and faculty, enabling the development of increased capacity for meaningful reflection. However, feedback may only be valuable if there is a clear structure and process providing a roadmap for both faculty and students (Peacock et al., 2011; Stock & Winkelbauer, 2012).

Models of Reflection

The field of reflective practice in education has evolved significantly over the past century, with various models building upon and refining earlier concepts. This overview examines key models of reflection, their interrelationships, and their practical applications in educational settings.

John Dewey's (1933) seminal work provides the foundation for reflection on learning. Dewey identified four essential elements for deep reflection:

- Meaning-making: Reflection connects past and future learning experiences, allowing for the continuous deepening of understanding through the integration of multiple concepts and experiences.
- Disciplined method: Reflection requires a systematic approach akin to scientific inquiry, involving cycles of lived experience, description, analysis, and planning future actions based on generated hypotheses.
- Social interaction: Dialogue is crucial for testing and strengthening one's thoughts against others' perspectives.
- Reflective dispositions: Attitudes such as thorough engagement, objectivity, open-mindedness, and commitment to action underpin reflective thinking.

Dewey emphasized reflection as a dynamic process that evolves with experience and knowledge, shaping understanding and morals, and ultimately serving societal progress. He broadly defined an experience as any interaction with the world or others, from reading a book to sensory encounters with nature.

Carol Rodgers (2002) expanded on Dewey's work. She defined reflection as

> a cognitive and affective process or activity that (1) requires active engagement on the part of the individual; (2) is triggered by an unusual or perplexing situation or experience; (3) involves examining one's own responses, beliefs, and premises in light of the situation at hand; and (4) results in integration of the new understanding into one's experience. (p. 41)

Rodgers added that an experience must challenge the learner's assumptions to instigate deeper reflection and accommodation of new thinking patterns.

Terry Borton (1970) created a process model for reflection based on the questions: What? So what? Now what? This model, though initially developed for high school students, has proven valuable in guiding reflective thinking on experiential learning in higher education (Rolfe, 2014). Borton's three questions can be viewed as a distilled version of Dewey's (1933) systematic method of thought. In the "What?" stage, learners describe the experience they are reflecting upon. The question "So what?" encourages students to analyze the importance of the situation and specify

what they learned from the experience. And the "Now what?" phase is a prompt to apply new learning to guide future action.

Donald Schön (1983, 1987) studied the role of reflection in professionals as they developed and refined "theories in use"—conscious or unconscious knowledge that guides actions. Schön differentiated between two types of reflection. Reflection-in-action involves applying knowledge to solve a specific thorny problem in the moment. Reflection-on-action is when the practitioner uses past experiences to learn from and refine theories for future actions. Schön (1987) also asserted that the ability to reflect effectively within a discipline requires intentional guidance and instruction through structured dialogue with more experienced practitioners. Through this dialogue, novices learn how to effectively frame problems, apply knowledge to solve real-world problems, and eventually use self-reflection to improve practice. While Schön's work provides a robust theoretical framework for understanding reflective practice, it is abstract and does not lend itself to a simple step-by-step guide to reflection or teaching reflection. However, his ideas have heavily influenced others who have used these abstract concepts to inform the use of reflection in practice and educating reflective practitioners.

David Kolb's (1984) experiential learning cycle operationalized Dewey's (1933) conception of reflection into four stages: (1) concrete learning, (2) reflective observation, (3) abstract conceptualization, and (4) active experimentation. Again, one can observe Dewey's work in Kolb's process of objectively reviewing a concrete experience to create a hypothesis to guide future actions and experimentation. This model provides a more structured approach to the reflective process based on a discrete learning experience.

Graham Gibbs (1988) expanded on Kolb's (1984) model. He created a six-step reflective cycle: (1) experience, (2) feelings, (3) evaluation, (4) analysis, (5) conclusion, and (6) action plan. Gibbs notably emphasized the learner's emotions about the experience, using analysis to make sense of the experience and concluding with a concrete plan for changing actions in the future.

Joyce-McCoach and Smith (2016) developed a contemporary three-stage teaching model for reflective practice in the health professions, synthesizing various reflective theories and concepts. They designed new learning outcomes and assignments to guide students through each stage of reflection over time. At first, students wrote in journals to reflect on their values, beliefs, and attitudes in relation to their professional roles. Next, students engaged in dialogue with classmates, comparing their personal reflections on various ethical, legal, and procedural issues within healthcare. Toward the end of their program, students read sociology, history, and critical theory to analyze healthcare at a systemic level and how the sociohistorical context influences their assumptions and biases. Students created a reflective portfolio to document each stage of the process. Their final assignment at the end of the program was to write a reflective report on a clinical experience.

Reflection and Metacognition

Flavell's (1979) work on metacognition laid the foundation for understanding how individuals monitor and regulate their cognitive processes. He conceptualized metacognition as consisting of both metacognitive knowledge and metacognitive experiences. Metacognitive knowledge encompasses one's understanding of cognitive tasks, strategies, and personal cognitive abilities, while metacognitive experiences are the conscious cognitive or affective experiences that occur during cognitive activities. Flavell further delineated metacognitive knowledge into three categories: person variables (knowledge about oneself and others as cognitive processors), task variables (knowledge about the nature of cognitive tasks), and strategy variables (knowledge about cognitive and metacognitive strategies). Flavell's (1979) work emphasized the importance of developing metacognitive skills for effective learning, arguing that learners who are more aware of their cognitive processes are better equipped to plan, monitor, and evaluate their learning strategies. His contributions have been pivotal in advancing our understanding of how learners can become more self-aware and self-directed in their educational pursuits, paving the way for later models of self-regulated learning and metacognitive instruction.

Reflection, a key process in activating and developing metacognition, plays a crucial role in learning by enabling individuals to think critically about their experiences and cognitive processes. As noted previously, Schön (1983) distinguished between reflection-in-action (thinking on one's feet) and reflection-on-action (retrospective thinking), both of which involve metacognitive processes. Reflection serves as a bridge between experience and learning, allowing individuals to make sense of new information, integrate it with existing knowledge, and adjust their understanding accordingly (Kolb, 1984). This reflective process is inherently metacognitive, as it requires learners to step back from their immediate experience and examine their thought processes, strategies, and assumptions. Boud et al.'s (1985) model of reflection in learning highlights the importance of returning to experience, attending to feelings, and re-evaluating—all of which involve metacognitive awareness and regulation. The application of these theories to

ePortfolio practice is supported by the work of Jenson (2011), who found that ePortfolios can serve as powerful tools for developing metacognitive skills when coupled with structured reflective activities.

In summary, the evolution of reflective practice models demonstrates a progression from broad theoretical concepts to more structured, practical frameworks. While Dewey's (1933) foundational ideas remain relevant, later models have added important elements such as the role of emotions, using a reflective process, and explicitly teaching metacognition. As education continues to evolve, particularly in digital learning contexts such as ePortfolios, these reflective models must undergo further adaptation to meet the changing needs of learners and educators.

Reflection in ePortfolio

Reflection is seen by many authors as critical for learning to occur in the use of ePortfolios. Riedinger (2006) observed that "without reflection, the ePortfolio is merely storage" (p. 91). However, a review of the literature suggests that we have not developed a robust research-based set of practices to guide educators in supporting students' effective use of ePortfolios for learning. Blakely (2016) noted that students often view ePortfolio learning experiences as discrete and even atomized and fail to connect them into an integrated understanding. She pointed out that this atomization is influenced not only by students' pre-existing epistemologies but also by the way instructors structure and communicate assignments and reflection prompts. Blakely stressed the need for effective reflection that invites students to make sense of their learning. Similarly, Landis et al. (2015) found that faculty were often surprised at students' limited ability to reflect meaningfully and found that effective reflection practice is complex and difficult to manage though worthwhile.

Other authors have evaluated the use of reflection in ePortfolios in various contexts, often finding that students are generally satisfied and find value in reflective practices. For instance, Weber et al. (2023) evaluated ePortfolios in a summer internship program and found that structured reflection questions significantly added to students' perceived learning. Weber and Myrick (2018) conducted a qualitative analysis of reflection assignments in an ePortfolio for summer semester college students. They noted that students found value in the assignments, particularly in the ability to look back at what they learned across the semester. Peet et al. (2011) created a structure using six dimensions of integrative knowledge aimed at helping students "identify, connect, synthesize, and demonstrate knowledge and skills" (p. 11), and found significant gains in perceived integrative learning using a pre-post survey.

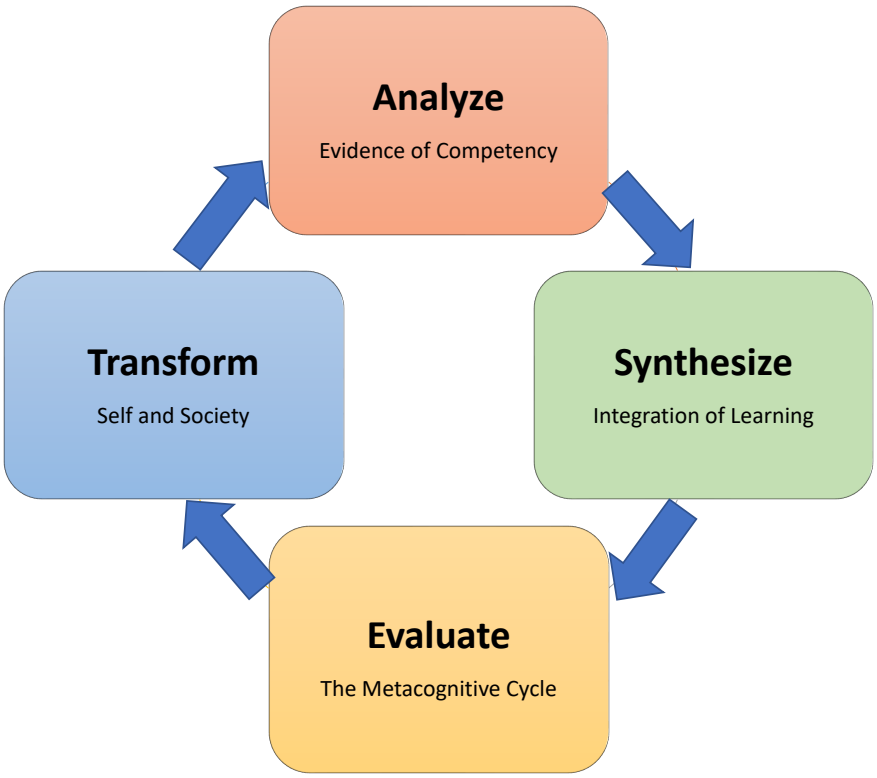
Thus, the literature on reflection in ePortfolio indicates the importance of structured reflective activities to support learning, yet there remains a need for more comprehensive research-based guidance on implementation. Additionally, there is a need for more robust theoretical frameworks or models of reflection that can guide effective instruction and future research. Such frameworks could enhance our understanding of how reflection in ePortfolios contributes to learning outcomes to support professional practice.

The Need for Reflection in Competency-Based Education

Reflection models have been primarily used in experiential learning to support a specific objective from a discrete experience. Although research exists on developing reflective practice in the clinical setting, we did note a need for more articles on facilitating learner reflection on competency development over time. Accumulated reflection is a vital consideration in higher education, where nursing students prepare for practice or advanced roles. Specifically, we sought a reflection framework to facilitate an ePortfolio implementation of competency-based learning.

We found reflective models focused on discrete experiences (e.g., Galutira, 2018; Gibbs,1988; Kolb, 1984) or triggered by an unusual experience (e.g., Atkins & Murphy, 1993; Boyd & Fales, 1983; Rodgers, 2002; Ruth-Sahd, 2003) to be valuable for experiential learning but not sufficient alone for cumulative ePortfolio reflection. First, asking students to focus on one concrete experience does not guarantee they will integrate these experiences with others over time. Second, depending on a "perplexing situation" to instigate reflection (Rodgers, 2002) is an unreliable system. Third, with the nursing profession's move to competency-based learning, we required a model that would allow students to move beyond discrete experiences to encompass accumulated reflection over time. Fourth, there appeared to be a lack of structured reflection in helping students consider their role in broader issues at the forefront of healthcare, such as health equity and racially-based health disparities (Wakefield et al., 2021). Fifth, we needed consistent prompts for faculty to use in mentoring students through various aspects of reflection. The ASET Reflection Model was designed to facilitate students' holistic reflection on their cumulative learning experiences within a competency-based curriculum guided by faculty mentorship. Combined with ePortfolio assessment, this model fosters a comprehensive and integrated understanding of each student's professional identity formation and academic growth, providing valuable metrics at the student, teacher, program, and school levels.

Figure 1
The ASET Reflection Model



The ASET Reflection Model

The ASET Reflection Model provides a structured process for ePortfolio reflection and facilitates students' progress toward achieving competencies. The four components of the model include analysis, synthesis, evaluation, and transformation (Figure 1), which together create the acronym "ASET." This model underscores the iterative nature of reflection in learning and practice, although the elements are presented in the order of abstract thought required. It also addresses the need for scaffolded reflection of students' competency development over time using an ePortfolio. The model includes specific prompts faculty can use to guide student reflection on their academic performance, integration of learning, monitoring of goal achievement, and professional identity development. It assumes an initial faculty-facilitated meeting where students set personal and professional goals and determine how their program of study will help them achieve these goals.

Step 1: Analyze

Analysis is the first step of the ASET Reflection Model. This activity guides students in a critical review of their signature assignments from the previous semester. This initial phase serves multiple purposes: (a) it facilitates student identification of learning outcomes in their work, (b) encourages the processing of formative and summative feedback from faculty and peers, (c) provides an opportunity to explore emotional responses to academic challenges, and (d) promotes recognition of developing competencies.

Reflection on signature assignments is socially mediated by faculty through individual advising sessions or faculty-guided classroom activities and dialogues with peers. Guided reflection within a social context was emphasized by Dewey (1933), Joyce-McCoach and Smith (2016), Rodgers (2002), and Schön (1987). Furthermore, the Analyze step incorporates Schön's (1987) concept of reflection-on-action, Borton's (1970) "What [did I learn]?" stage, Kolb's (1984) "reflective observation" in the experiential learning cycle, and the "description and feelings" stages in Gibbs' (1988) reflective cycle. These theorists cite the importance of revisiting, describing, and reinterpreting prior learning experiences. By including a review of feedback, students can also consider how experts in the discipline received their work. This analysis lays the groundwork for deeper

reflective practice, fostering a clear picture of academic growth and achievement of competencies. Here are some prompts we used to lead students in their analysis:

1. Briefly summarize the content you presented in your signature assignment from last semester.
2. Describe the process you used to complete the assignment. This could include unexpected challenges and how you responded to them.
3. What formative feedback did you receive from peers, faculty, or clinical supervisors? How did you use this feedback to revise and strengthen your work?
4. What summative feedback did you receive on the rubric?
5. Analyze what you learned:
    - How do you feel about your work on this assignment?
    - What new knowledge, skills, or processes did you learn?
    - What strengths and weaknesses do you see in your work?
6. How does this signature assignment (and other work) demonstrate your progress toward achieving a specific competency or a program learning outcome (PLO)? If you think you have achieved competence, explain why.

In our comprehensive learner record system, signature assignments, rubrics, and feedback will automatically be uploaded to students' ePortfolios. To further support autonomy and creative analysis, students are encouraged to add self-selected artifacts to their ePortfolio and discuss how these demonstrate the achievement of PLOs or personal goals.

Step 2: Synthesize

Synthesis is the second step of the ASET Reflection Model, building upon the initial analysis of signature assignments. This stage encourages students to make sense of their learning by integrating new knowledge with prior experiences and theoretical foundations. The process involves connecting course theory with insights from scholarly sources and real-world experiences, particularly clinical practice for nursing students. Furthermore, students are prompted to relate these synthesized understandings to broader implications within healthcare, such as health inequities, social determinants of health, and patient advocacy.

Theoretically, this step is based on making meaning of one's learning. Dewey (1933) conceptualized reflection as a dynamic cognitive process that facilitates the construction of meaning by integrating past and future learning experiences. This iterative approach enables learners to progressively deepen their comprehension by synthesizing diverse concepts and experiences, fostering a more holistic understanding of complex phenomena. Dewey's model emphasizes the active role of the learner in continuously recontextualizing and reinterpreting knowledge, leading to more sophisticated cognitive frameworks and enhanced metacognitive abilities.

Carol Rodgers (2002) proclaimed that the goal of reflection is to integrate new knowledge with prior knowledge. Likewise, the analysis stage of Gibbs's (1988) reflective cycle ascribes meaning to novel situations by comparing them to previous experiences. This aligns with Schön's (1983) concept of reflection-on-action and Kolb's (1984) experiential learning cycle, both of which emphasize the importance of connecting new experiences with existing knowledge.

Integration of learning plays a critical role in the high-impact practice of ePortfolios (Eynon & Gambino, 2017; Watson et al., 2016). Integrative learning is defined as "an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations" (AAC&U, 2009, para. 1). After analyzing signature assignments in step one, we ask students to consider how they are synthesizing new knowledge. We provide students with specific prompts to support their exploration and application of new competencies in other settings. Here are some prompts we used to help our undergraduate RN-BS students make sense of their learning experiences, synthesize new knowledge across courses, and apply these skills to practice:

1. What were the most exciting things you learned last semester?
2. How can you connect what you learned with your clinical or work experience?
3. Describe how you are integrating what you learned in one course with other courses. Explain how your understanding of a challenging concept or idea has developed since you started this program.
4. How can you apply your new knowledge and skills to improve patient and community care? Explain how your understanding of patient or community health issues has grown (e.g., health equity, effects of the social determinants of health, patient advocacy, population health).
5. Describe a situation where you applied theoretical knowledge from your studies to solve a real-world problem in your clinical practice.
6. Compare and contrast a current nursing practice with what you've learned about ____ (e.g., evidence-based practice, ethics,

population health). How might you integrate this new knowledge to improve patient outcomes?

By engaging in this synthesis, nursing students develop a more sophisticated understanding of the discipline by integrating new knowledge and skills into practice. This leads to improved patient care and professional growth. This approach not only aligns with established theories of reflective practice but also prepares students for the complex, integrative thinking required in modern healthcare settings.

Step 3: Evaluate

Evaluation is the third element of reflection, providing an opportunity for students to monitor the progress they are making toward attaining program-level competencies and personal goals established at the beginning of the ePortfolio process. The evaluation component is grounded in the theories of metacognition and self-regulated learning. By incorporating these theoretical foundations into the ASET Reflection Model, we aim to foster not only the successful development of nursing competencies but also the metacognitive and self-regulatory skills essential for lifelong learning and professional development (Wolf et al., 2022). This approach aligns with the broader goals of competency-based education, which emphasizes the importance of learner autonomy and self-direction (Gravina, 2017).

We operationalized these theoretical principles within our ePortfolio system, providing a structured framework for student reflection and taking ownership of their learning process. The evaluation step is based on the three skills of metacognition and self-regulation: planning, monitoring, and assessing (Medina et al., 2017; Zimmerman, 1990). Planning involves setting clear goals and determining the strategies and resources needed to achieve them. Faculty help students develop a plan of study and identify personal and professional goals during orientation to the ePortfolio. The ASET Reflection Model cues students to revisit these goals and update their plans when they review their ePortfolio with faculty each semester.

Monitoring is the ongoing assessment of one's learning. The evaluation step aids students in tracking their performance and ensures learning aligns with previously set goals. Students are encouraged to develop a monitoring plan that includes pre-identified resources and learning strategies to address potential challenges. This approach not only supports ongoing self-assessment but also fosters the development of adaptive learning strategies, a key component of self-regulated learning (Panadero, 2017). Faculty play a crucial role in this process, guiding students to institutional resources such as our Center for Professional and Academic Success, which offers content-area tutoring and writing support.

Overall, the self-evaluation process instructs students not only in metacognitive skills but also in a personal process of continuous improvement. Essentially, students are guided through assessing their strengths, weaknesses, opportunities, and threats related to their competency development and then make or revise an action plan. Faculty are available to keep the students' reflective examination anchored in their actual performance as they problem-solve, fine-tune their learning strategies, and work to attain their goals. For instance, our DNP faculty guide students to write SMART goals (Doran, 1981) each semester.

Next are prompts for use during the evaluation phase of the ASET Reflection Model. These support students through the metacognitive cycle (setting goals, monitoring progress, and making adjustments based on ongoing assessment) and promote self-regulation:

1. Based on your analysis of signature assignment work, what new realizations do you have about yourself as a learner this semester?
2. How have the signature assignments contributed to your progress toward personal and/or professional goals? Where are the gaps in your competency development?
3. Reflecting on your academic performance in the program so far, what is your assessment of your strengths and weaknesses as a learner?
4. What are current opportunities or threats to your learning progress? What resources might help you manage these threats?
5. How might you adjust your goals or action plan based on this evaluation of your strengths and weaknesses, opportunities, and threats?

By deliberately incorporating metacognitive steps into our ePortfolio system, we aim to cultivate vital professional and lifelong skills such as goal setting, self-evaluation, and self-directed learning. In addition, learners are enabled to recognize patterns in their performance and develop the skills necessary for problem-solving and self-regulation with faculty guidance. In the context of competency-based education (CBE), this type of reflection is instrumental in fostering student awareness of continuous improvement in their own professional development.

Step 4: Transform

Transformation is the culmination of the ASET Reflection Model, embodying Dewey's (1933) assertion that the ultimate product of reflection is the transformation of both the individual and society. This

stage also aligns with Schön's (1983, 1987) concept of reflection-on-action, where learners use past experiences to refine their "theories in use" and guide future actions. Drawing on Kolb's (1984) experiential learning cycle, this stage encourages students to conceptualize their experiences abstractly and plan for active experimentation in their future practice.

The transform step facilitates student reflections on their evolving professional identity, leadership skills, and future career paths. It also encourages exploration of how diverse perspectives and learning experiences have shaped their views on societal issues and their responsibilities as healthcare professionals and global citizens. This deep reflection encompasses changes and challenges related to ethics, personal and professional values, cultural humility practices, acknowledgment of unconscious biases, and their personal response to systemic issues (e.g., structural inequalities, persistent health disparities, and social determinants of health).

In this frame of reflection, students are asked how they plan to use their personal power and developing expertise to effect change at organizational and societal levels. Here are some example prompts to assist in reflections on personal growth and change:

1. Professional Identity Integration: How are you integrating your new competencies into your professional identity?
2. Challenging Assumptions: How have your learning experiences challenged your personal assumptions, biases, values, or ethics? How have you become more aware of your unconscious biases or the importance of cultural humility?
3. Leadership Development: How are you developing leadership skills? This might be via enhanced patient advocacy or more formal leadership roles.
4. Systemic Awareness: How is your awareness of system-based health inequities growing (e.g., social determinants of health; institutionalized bias; and structural inequalities like racism, classism, sexism, homophobia)?
5. Inspired Action: What actions are you inspired to take based on your growing awareness of organizational and societal issues impacting patient care (e.g., community outreach, volunteerism, creating training or educational materials, lobbying, political activism)?

This model is designed to be flexible, catering to various educational programs, learning objectives, and student competencies. It can also be tailored to different learners, allowing customization according to program outcomes and student needs. This flexibility addresses the gap identified in the literature for models that facilitate reflection on competency development over time, particularly in healthcare education. For example, our ePortfolio pilot included one undergraduate (a fully online RN-BS Completion Program) and one Doctor of Nursing Practice (DNP) program. Both used the ASET model but customized the student support and prompts to suit competency development and program structure. Furthermore, these questions can be adapted at each milestone to promote deeper reflection, integrative learning, and application to practice. By methodically integrating each element of the model throughout the curriculum, faculty ensure that reflection becomes a fundamental component of nursing education. This systematic approach equips students to critically reflect on praxis and become influential agents of change within healthcare.

In conclusion, the transformation stage of the ASET Reflection Model provides a comprehensive framework for deep reflection, bridging the gap between theoretical models and practical application in ePortfolio-based learning. It addresses many of the limitations identified in existing reflective models and offers a structured approach to fostering meaningful reflection and professional growth within a competency-based ePortfolio.

Implementation of the Model

Design Considerations Prior to Implementation

We addressed several foundational elements before we launched our ePortfolio. First, we developed a logic model with outcomes specified for each program. This provided a clear rationale for all stakeholders to adopt ePortfolio. Instructional designers and faculty created a learning framework at the program level, including well-defined professional competencies aligned to signature assignments, rubrics, and learning activities. This learning framework specifies the competencies required for program completion. Part of this planning involved setting milestones for reflection and deciding how the reflection would occur. For instance, in our fully online RN-BS program, faculty advisors met with students individually via Zoom and recorded the initial meetings, asking for written student responses at later milestones. The DNP faculty chose to use class time for semesterly reflections, and students submitted their final written responses two weeks after class.

Second, the faculty discussed and recognized the necessity of providing students with substantive formative and summative feedback on signature assignments since this is a reflection requirement during the analysis phase. The ASET model prompts students to consider what others identify as their strengths and weaknesses to improve self-awareness, inform corrective actions the student can initiate, and

deepen understanding of expectations within the profession. Third, we communicated the rationale for the change and gave all program faculty an introduction to the reflection model, ePortfolio process, and pedagogy underlying the initiative.

Implementation began by communicating the learning framework and reflection process with new students, so they understood the learning outcomes expected at the course and program levels. Then, the faculty guided students in developing personal career and learning goals during their orientation to the ePortfolio. This planning is required for the third step of the reflection model to enhance metacognition and provide individualized metrics for students to use in their self-evaluation process.

Faculty Development

Faculty play a crucial role in preparing students for the ePortfolio reflection process, providing support, feedback, and assessment of competencies. Faculty reflection and mentorship skills are essential for student learning and an appropriate induction into the discipline. These skills necessitate ongoing training and professional development. Initial meetings with faculty aid students in reviewing expected competencies, creating a professional growth plan based on career goals, and reinforcing how program learning outcomes support students' goal attainment. This enhances student engagement, mentorship, and clear communication of PLOs.

To guide faculty development, we used cognitive apprenticeship theory (Collins et al., 1991) to explain the concept of scaffolding. With this approach, the goal is to coach students toward skill independence. The original theory included four areas for successful coaching: the method used to develop expertise, the sequence of activities, the content, and the social context for learning (Collins et al., 1991). Using this theory, faculty introduce students to structured reflection activities, modeling reflection and coaching students with the aim of progressively diminishing their support and encouraging students to take more of the lead in their reflective process. The ASET Reflection Model provides the sequence of activities and the procedural content for reflection. Professional competencies, operationalized as program learning outcomes, include the disciplinary content. Our social context was initially to take a student-centered approach. In retrospect, we plan to further articulate the importance of the learning environment by introducing faculty to autonomy-supportive teaching methods (Reeve, 2009) based on self-determination theory (Deci & Ryan, 1985).

Furthermore, we dedicate time during program faculty meetings once a semester to discuss how the ePortfolio initiative is progressing, share ideas for guiding student reflection, and review samples of student work together. We are in the process of developing a rubric based on the ASET model, not necessarily to grade student reflection but to help faculty keep track of student's proficiency with the process. In this way, we are operationalizing the reflection model to support faculty in more effectively scaffolding students' reflective journeys.

Conclusion

The University of Rochester School of Nursing began a pilot of ePortfolios and the ASET Reflection Model in the fall semester of 2023. This model, along with our participation in AAC&U's Institute on ePortfolios, strengthened our learning framework design as linked to professional competencies, guided faculty in creating reflection milestones and prompts, and helped our students develop their personal and professional goals for learning. Our ePortfolio system will serve as a direct measure of students' attainment of learning outcomes as well as document their transformative journey in becoming reflective professionals ready to meet the challenges of an evolving healthcare landscape.

We plan to continue our implementation of ePortfolio and the ASET Reflection Model in other programs at the nursing school. We will collect data from students and faculty regarding their experiences with this initiative. This plan also provides evidence of students' competency attainment to facilitate evaluation and continuous improvement data at the program and school levels. We invite other institutions to adapt the model to their unique settings. Ideally, nursing students would continue their ePortfolio use with employers as part of a clinical ladder and promotion process. This would provide a seamless connection from education to practice and allow students to continue setting professional goals, developing competencies, and engaging in socially mediated critical reflection of self and society.

The ASET model also has implications for research. First, this model could be implemented and evaluated in other competency-based education programs. Second, research could include methods of assessing students' development of critical reflection skills to measure and improve the effectiveness of this model. For example, Tsingos et al. (2015) created a rubric to measure the reflection practice of pharmacy students. Third, more work could be done to support faculty's reflective practice, feedback skills, and mentorship capacity. Our goal is to share the ASET Reflection Model and contribute to the dialogue on supporting competency development, ePortfolio assessment, and the critical reflection required of today's professionals.

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Navigating a Transition to Competency-Based Nursing Education With a Systematized ePortfolio Assessment

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As academic nursing transitions to competency-based education, ePortfolio has emerged as an ideal platform to support students' integration of learning and reflective practice. Following Eynon and Gambino's Catalyst Framework (2017), this article outlines the process the University of Rochester School of Nursing used for developing and implementing ePortfolio across undergraduate and graduate programs. School faculty and instructional designers created an assessment infrastructure aligning competency-based program learning outcomes to course learning outcomes and signature assignments. The ePortfolio implementation team facilitated faculty retreats focused on curriculum mapping, assignment redesign, and rubric development to clearly convey competency expectations. The team then incorporated a scaffolded reflection process to support students in analyzing their progress, addressing faculty feedback, building metacognitive skills, and reflecting on competency attainment at critical program milestones. This ePortfolio initiative demonstrates a commitment to competency-based education and improving patient outcomes by preparing practice-ready professionals who can lead the profession forward and navigate the complexities of contemporary healthcare.

The state of healthcare is in rapid flux. To respond to these complex needs, nursing education must ensure that future nurses are competent, critical thinkers capable of applying what they have learned to patient care (Lewis et al., 2022). Nurses practice in complex healthcare systems and serve in a variety of direct care and indirect care roles, managing the mounting healthcare burden of an aging population and persistent health disparities. The emphasis on practice readiness is becoming increasingly important as the demands on the nursing profession across the care continuum are growing. Graduates from undergraduate and graduate nursing programs must be well-prepared to address the myriad challenges of contemporary healthcare.

In the landmark book *Educating Nurses: A Call for Radical Transformation*, Benner et al. (2010) described a gap in what is learned in the classroom and what is needed for professional practice. To address these gaps, the American Association of Colleges of Nursing (AACN, 2021), the national organization that sets quality standards for nursing education, released a competency-based education (CBE) framework for all professional nursing programs (baccalaureate, master's, and practice doctorate) to ensure preparation of practice-ready graduates. AACN's (2021) educational framework, *The Essentials: Core Competencies for Professional Nursing Education,* defines expected competencies (and sub-competencies) for entry and advanced nursing education in 10 domains across four spheres of care—health promotion, restorative care, chronic condition management, and palliative/hospice care—throughout the lifespan and among diverse populations. The paradigm shift to outcomes-based learning challenges traditional educational methods and requires both new ways of thinking and new nursing education models.

CBE is a learner-centered, outcomes-focused approach to instruction, assessment, and program evaluation (Frank et al., 2010; Giddens & Bartells, 2021). Outcome-based education has also been adopted by other health professions, including medicine, pharmacy, and social work, among others (Frank et al., 2010). With a strong emphasis on higher-order thinking skills like clinical decision-making and application of learning to the practice environment, education in a competency-based paradigm "goes beyond knowing to being able to do what one knows" (Mentkowski et al., 2000, p. 57). CBE "is based on students demonstrating that they have learned the knowledge, attitudes, motivations, self-perceptions, and skills expected of them as they progress through their education" (AACN, n.d., para. 1). Furthermore, the CBE model provides a common language around performance expectations within multidisciplinary healthcare teams that is critical for delivering high-quality healthcare (AACN, 2021; Englander et al., 2017; Frank et al., 2010; Giddens & Bartels, 2021).

This shift to CBE provides an important context for our School of Nursing's ePortfolio implementation. To develop competencies, one must understand key concepts deeply, practice in real or simulated clinical settings, and integrate learning through reflective thinking (Mann et al., 2009). However, in lecture-based instruction, students do not reliably integrate learning from one course to the next, apply knowledge in authentic settings, or meaningfully reflect on content. Established as a high-impact practice, ePortfolio is an ideal platform for CBE because it supports integrative learning, reflective thinking, and authentic assessment (Kuh, 2008; Wolf et al., 2022). Moreover, ePortfolio encourages the development of appropriate learning

objectives, critical reflection, and the demonstration of critical thinking and is a tool that supports students' ability to personalize their learning experiences (Collins & O'Brien, 2018; Madden et al., 2019). Furthermore, the use of ePortfolio ensures timely feedback to allow for any necessary changes to student learning experiences (Collins & O'Brien, 2018). Perhaps the most important aspect of ePortfolio is that the practice allows the student more insight into their learning, thereby supporting ownership of their own educational journey (Madden et al., 2019). This paper describes how the University of Rochester School of Nursing implemented a systematized ePortfolio system to guide their transition to competency-based education.

Competency-Based Assessment

The University of Rochester School of Nursing participated in the American Association of Colleges and Universities Institute on ePortfolios in 2023. This year-long mentored engagement experience offered in collaboration with the Association for Authentic, Experiential, and Evidence-Based Learning (AAEEBL) and the National Association of Student Personnel Administrators (NASPA) provides guidance to schools interested in enhancing student engagement and success through the implementation of ePortfolios. Our goal was to create a learning framework (Travers et al., 2019) mapped to core learning outcomes (competencies) to facilitate assessment at the three levels of student, program, and institution to ensure education of the highest order. The seven-person ePortfolio team consisted of senior academic leaders, program directors, faculty, instructional designers, and a project manager as the team lead. We based our implementation on the five integrative principles of Eynon and Gambino's (2017) Catalyst Framework. These principles were designed to enhance best practices in ePortfolio development. The first principle, outcomes assessment, focuses on systematically evaluating student learning to ensure educational goals are met. Professional development, the second principle, emphasizes the continuous growth and skill enhancement of educators, ensuring they are equipped to use best practices. The third principle, integrative social pedagogy, advocates for student reflection within a community of practice to foster deep transformational learning. Technology, as the fourth principle, highlights the integration of digital resources to collect student artifacts and collect evidence of learning. Lastly, the principle of scaling up addresses the expansion of successful educational practices beyond the initial phase, aiming to impact a wider student population across the institution. Together, these principles form a comprehensive framework to improve the quality and effectiveness of launching an ePortfolio. We used this model to create a year-long action plan to guide the pilot of our initiative in two nursing programs: the Registered Nurse to Bachelor of Science (RN-BS) Completion Program and the Doctor of Nursing Practice (DNP) Program.

Outcomes Assessment

Developing a plan for outcomes assessment is considered a necessary step for both CBE and ePortfolio (Competency-Based Education Network, 2021; Eynon & Gambino, 2017; Leblanc, 2021). Using principles of backward design, faculty and instructional designers started with professional competencies to develop program learning outcomes (AACN, 2021). These were used to inform the development of rubrics and signature assignments to assess students' competency development throughout the program of study. Upon reviewing signature assignments, our team found that some faculty struggled to create assignment guidance documents and competency-based rubrics. Therefore, we required additional meetings with instructional designers focused on strengthening assignment design to accurately reflect learning outcomes. These changes directly benefited students, although we also found that more faculty development in this area is needed in our transition to competency-based education.

Although this planning process was time-consuming, it was a critical step to ensure that observable, measurable learning assessments were intentionally aligned with identified professional competencies. This process involved broad stakeholder input from school leaders, program directors, faculty, assessment personnel, information technologists, and instructional designers. As Collins and O'Brien (2018) noted, taking time to consider all stakeholders during the implementation process is vital to success. Our process resulted in a learning framework that accurately captured students' incremental progress toward achieving competencies as they worked through a program curriculum, affording us a reliable, direct measure of student performance.

Professional Development

Continuing with the Eynon and Gambino framework (2017), we focused on developing a plan for faculty development. Collins and O'Brien (2018) posited that faculty expertise and attitudes can impede implementation. Moreover, faculty need extensive training, as ePortfolio, for many faculty, is a paradigm shift in their pedagogical approach to teaching (Garrett et al., 2012). Tasked with evaluating and improving the existing course and program learning outcomes (PLOs), directors of both programs led faculty retreats focused on curriculum mapping, verifying that all PLOs aligned

with the requirements of our accreditors and were sufficiently mapped throughout the program. Our focus during these sessions was on the process of continuous improvement via the establishment of ePortfolio assessment. The ability to see, in real-time, how improved learning outcomes and course mapping could help faculty better state their intentions for student work, plus the ability to workshop with peers, resulted in a positive, productive experience for faculty who attended these sessions. Ultimately, the chance for faculty to gather in smaller groups to refine competencies (PLOs), consider a course's place within the overall program, and exchange ideas was vital to securing faculty buy-in and establishing the knowledge base required for a successful competency-based ePortfolio implementation.

Technology

Our next consideration in the Catalyst Framework was technology. The School of Nursing elected to use our university's assessment management system package, which includes an embedded ePortfolio system. The package has required many personnel hours of defining organizational nomenclature for the institution, school, and program levels, building the learning framework consisting of curriculum maps and outcomes (typically via manual input), linking to various accreditation standards, and building rubrics. Additionally, we faced the task of managing integrations with Learning Management Systems (LMS) and Assessment Management System (AMS) technology, continually updating and maintaining the assessment management site, dealing with bugs and learning tool interoperability (LTI) updates, and running reports. We found that consulting information and educational technology experts in the early stages of the ePortfolio process were critical to understanding the backend and frontend tools needed to organize the digital components of the ePortfolio. Our school is fortunate to have these personnel as part of our cross-functional implementation team.

Scaling Up

In the context of the Catalyst Framework, our approach to scaling up started with ensuring that we built a strong foundation for ePortfolio with a plan for outcomes assessment, faculty development, pedagogy, and technology. We developed these principles as a team and then intentionally implemented them via a year-long action plan, starting with two of the nine academic programs within our school as pilot initiatives. This allowed us to start small, revise learning frameworks for CBE, test technology, garner faculty and student support, and learn from our experiences before bringing ePortfolio to scale across the entire school. Later in this paper, we will discuss our experiences within these pilot projects, including lessons learned.

Integrative Social Pedagogy

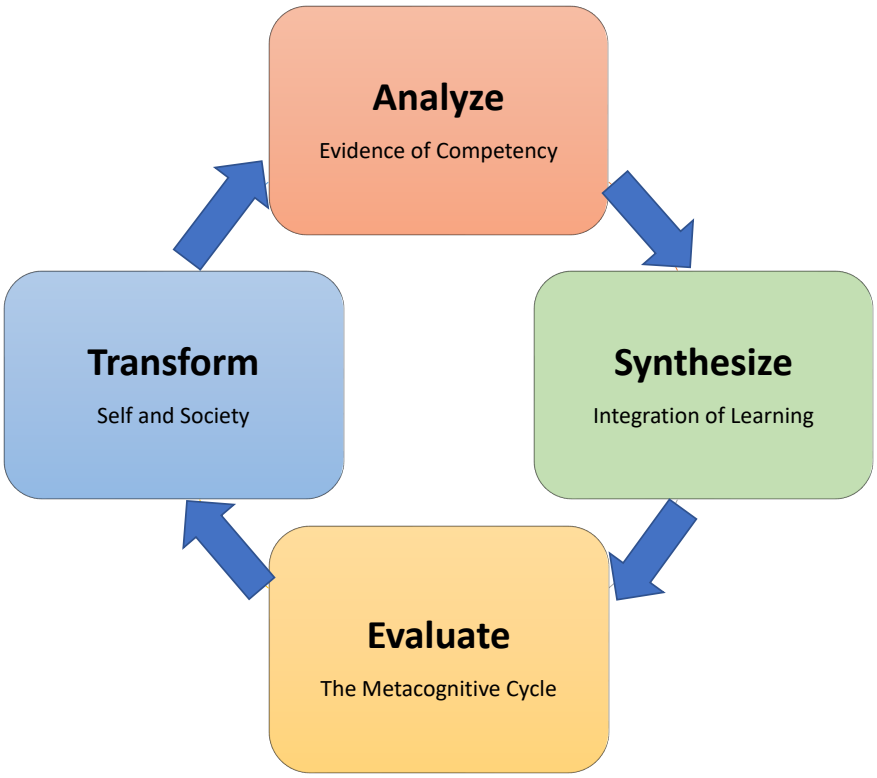
We used concepts of metacognition and reflective practice to implement the final element of Eynon and Gambino's framework—integrative social pedagogy. Integrative social pedagogy is a teaching approach that combines the collection, discussion, and reflection of learning artifacts in an ePortfolio (Eynon & Gambino, 2017). This practice enables students to make learning visible and connect diverse learning experiences within a supportive social context. For nurses, this reflection can occur with an advisor, within a class, in a clinical context, or in a professional community of practice. Integrative learning and guided reflection with social support are crucial in the formation of professional identity and the development of core nursing competencies like clinical judgment (Vabo et al., 2022). Wakimoto and Lewis (2014) found that the ePortfolio facilitated professional development by allowing students to reflect on their learning, ultimately providing an understanding of their own growth trajectory over time.

Metacognition Requires Reflection

Simply stated, metacognition is the consideration of one's learning or thinking processes. Metacognition guides learning by helping students assess what they know and do not yet know as "[i]t regulates thinking and learning and consists of three self-assessment skills: planning, monitoring, and evaluating" (Medina et al., 2017, p. 1). This metacognitive cycle is iterative and guides students through a personal process of continuous improvement, requiring active self-evaluation that connects factual knowledge to experience. Reflection is central to developing metacognitive awareness by helping learners become conscious of their cognitive processes. Through reflection, learners gain insights into their learning, enabling them to monitor their progress, problem-solve to overcome challenges, and adjust strategy usage to reach their goals. In the context of CBE, reflection supports a conscious and goal-oriented approach to attaining competencies. Without reflection and metacognition, learners may remain unaware of how they learn, hindering the development of critical thinking, problem-solving, and self-regulation skills.

Through a series of logically placed signature assignments within an established learning framework, students can continuously evaluate what they have learned throughout a program of study via ePortfolio

Figure 1
The ASET Reflection Model



Note. The ASET Reflection Model. Reprinted from "Integrating Competency-Based Education with ePortfolio Practice: The ASET Reflection Model," by R. R. Wolf and A. B. Wolf, 2025, *International Journal of ePortfolio, 15*(1). Copyright 2025 by the American Association of Colleges and Universities. Reprinted with permission.

milestones. Periodic and structured reflection helps the student understand their personal development as well as their individual strengths and weaknesses (de Jager, 2019; Whitmore & Thacker, 2021). Moreover, the self-directed learning embedded in the metacognitive cycle ultimately encourages learners to seek information that addresses known knowledge gaps (Wolf et al., 2022). To best achieve this, Harrington and Luo (2016) suggested that reflection exercises must include intentional prompts to reflect on current and previous learning.

Although reflective practice is vital to becoming a self-directed, life-long learner, the explicit teaching of reflection and metacognition is often overlooked. In Patel and Metersky's (2022) concept analysis of reflective practice, they note a need for reflection models and strategies in nursing education. After searching for a system to guide nursing students' development of reflective practice and metacognition, our ePortfolio team lead created a structured reflection model tailored to healthcare students and ePortfolio assessment (Wolf & Wolf, 2025).

ASET Reflection Model

The ASET Reflection Model (Figure 1) includes four elements: analysis, synthesis, evaluation, and transformation. Although each pilot program chose its own program milestones and methods of supporting students through ePortfolio reflection, they both incorporated the four components of the ASET Model. These touchpoints reinforce critical reflection as a core nursing skill that develops over time through guided practice. In the analyze step, students are asked to review signature assignments and faculty, peer, or clinical instructor feedback from the previous semester(s). They are prompted to analyze their performance for strengths, weaknesses, and evidence of competency development. The second step is synthesize. Students are asked to make sense of their learning and connect course content with clinical practice, scholarly texts, life experiences, and global issues with patient populations (e.g., social determinants of health, population health). The third step is to evaluate based on the metacognitive cycle

(plan, monitor, evaluate, and adjust goals). Students are asked to review their progress toward their previously established personal and professional goals, making revisions based on their academic performance and learning needs. The last step is to transform the self and society. Students are encouraged to reflect on the development of their professional role identity, leadership acumen, and expertise within an interprofessional community of practice. This element of reflection also prompts a closer examination of societal problems concerning ethics, values, sensitivity to different perspectives and cultures, unconscious biases, and systemic issues such as health equity, patient advocacy, and social justice. Recognition of one's growth, personal power, core values, life goals, and civic responsibility are integral for nurses to become influential change agents at the organizational, regional, political, and national levels.

To fully enact integrative social pedagogy, faculty must serve to guide students' reflective work. Using a cognitive apprenticeship approach (Collins et al., 1991), faculty can prompt structured reflection activities while gradually encouraging students to take ownership of their reflective processes over time. Reflection milestones, recorded as part of the ePortfolio, also provide documentation of students' growth as independent, reflective learners, problem solvers, and practice-ready professionals. Because students are at different levels of reflective skill, prompts within the four areas of the ASET Model can be adapted to a wide range of programs, learning outcomes, milestone benchmarks, and individual student needs. Faculty may also choose to introduce each reflection element separately across a program. Further details regarding the ASET Reflection Model's development can be found in a separate article in this issue by Wolf and Wolf (2025).

Implementation in an Undergraduate Nursing Program

The RN-BS program at our school provides an online pathway for registered nurses (RNs) with a nursing diploma or associate's degree to obtain their baccalaureate degree in four semesters (University of Rochester School of Nursing, 2024). With the AACN's focus on competency-based education, enabling students to demonstrate authentic learning is a crucial program goal. When the opportunity arose to pilot an ePortfolio system, the program director eagerly opted into this high-impact practice shown to increase students' knowledge and critical thinking via self-reflection on current and prior work (Eynon & Gambino, 2017; Oermann & Gaberson, 2014).

In early 2023, the RN-BS program director and the ePortfolio team developed the initial implementation plan. The first RN-BS cohort began in the fall 2023 semester with students entering RN/BS Transition: Reflective Professional Practice, the first core course. Because advisors are a consistent figure for students throughout the program, the director suggested these faculty meet with their students during pre-determined milestones. Faculty advisors were shown how to use the ASET model to guide student reflection on prior work samples, monitor progress toward program and course learning outcomes, and evaluate achievement of competencies.

To obtain buy-in from the RN-BS faculty and advisors, program faculty meetings were used to introduce the ePortfolio project and elicit feedback in the spring of 2023. Faculty and advisors were agreeable to the concept but apprehensive about the work required. In the summer of 2023, the ePortfolio team lead and the RN-BS program director presented a plan to the RN-BS advisors to address concerns. They shared goals and objectives for the student meetings and the four elements of the structured reflection model. Reflection milestones were set to occur over the four semesters of core nursing courses. The first meeting would start at the beginning of semester one and introduce students to the ePortfolio and personal goal setting. Milestones 1, 2, and 3 would occur at the beginning of semesters two, three, and four, when students would reflect on signature assignments from the prior semester with their advisor. The final reflection is slated for the end of the capstone course in semester four to serve as a culminating reflective activity for the program.

The RN-BS program director led a full-day faculty retreat in the summer of 2023 to establish a learning framework. Members of the ePortfolio team, including the program director, gave a detailed presentation of the ePortfolio project. After the overview was presented, faculty were asked to identify signature assignments for each core course. Once the assignments were identified, faculty mapped each assignment to the assessed course learning outcomes (CLOs) and program learning outcomes (PLOs). Following the retreat, the faculty worked with the program director and an instructional designer from the ePortfolio team to revise assignment guidance documents and rubrics to ensure all assessments were aligned with their identified competencies. Results of this process can be seen in the Curriculum Map for RN-BS Program Signature Assignments (Figure 2). The first cohort of 21 RN-BS students was introduced to the ePortfolio system in the fall of 2023, while a second cohort of 18 students joined in the spring of 2024. The inaugural RN-BS cohort is on track to graduate in December 2024, marking a significant milestone in their academic journey and our ePortfolio implementation. Anecdotally, the program director has heard positive reviews from students and advisors about the

Figure 2

University of Rochester School of Nursing Curriculum Map for RN-BS Program Signature Assignments

Program Learning Outcomes (PLOs) → / RN-BS Courses ↓	PLO 1 Patient- and Family-Centered Care	PLO 2 Clinical Judgment	PLO 3 Interprofessional Teamwork	PLO 4 Care Delivery in Complex Systems	PLO 5 Population Health	PLO 6 Professional Identity	PLO 7 Informatics
INTRODUCTION TO THE EPORTFOLIO AND COMPREHENSIVE LEARNER RECORD (CLR)							
RN/BS Transition: Reflective Professional Practice	Career Planning and Professional Identity Paper (CLO 1, 4)					Career Planning and Professional Identity Paper (CLO 1, 4)	
Biopsychosocial Health Assessment	SOAP Note (CLO 1, 4, 5, 6)	SOAP Note (CLO 1, 4, 5, 6)			SOAP Note (CLO 1, 4, 5, 6)		
REFLECTION MILESTONE 1							
Principles and Application of Evidence for Nursing Practice		Clinical Practice Guideline (CLO 1, 3, 4)			Clinical Practice Guideline (CLO 1, 3, 4)		
Patient and Population Care Management	Case Study Analysis Paper (CLO 1, 2, 3, 4, 5)	Case Study Analysis Paper (CLO 1, 2, 3, 4, 5)		Case Study Analysis Paper (CLO 1, 2, 3, 4, 5)	Case Study Analysis Paper (CLO 1, 2, 3, 4, 5)		
REFLECTION MILESTONE 2							
Nursing Leadership and Management of Care			Quality Improvement Project (CLO 3, 4, 5)	Quality Improvement Project (CLO 1, 2, 4, 5, 6)			Quality Improvement Project (CLO 2, 3, 7)
Health Care Policy, Finance, and Regulatory Environments	Social Disparities of Health (CLO 6, 8)			Social Disparities of Health (CLO 1, 3, 6, 8, 9)	Social Disparities of Health (CLO 2, 3, 4, 5, 6, 7, 8, 9)		
REFLECTION MILESTONE 3							
Population Health	Health Promotions Planning Project (CLO 1, 2, 3, 6, 7, 8)	Health Promotions Planning Project (CLO 1, 2, 3, 6, 7, 8)	Health Promotions Planning Project (CLO 1, 2, 3, 6, 7, 8)		Health Promotions Planning Project (CLO 1, 2, 3, 6, 7, 8)		
Capstone	Population Health Project/ Capstone (CLO 1, 2, 4)	Population Health Project/ Capstone (CLO 1, 2, 4)	Population Health Project/ Capstone (CLO 1, 2, 4)		Population Health Project/ Capstone (CLO 1, 2, 4)	Population Health Project/ Capstone (CLO 1, 2, 4)	Population Health Project/ Capstone (CLO 1, 2, 4)
CAPSTONE REFLECTION							
PROGRAM COMPLETION (following student's achievement of Program Learning Outcomes/Competencies)							

Note. The actual Program Learning Outcomes (PLOs) and course names have been adapted or condensed for this visual display.

introductory and milestone one ePortfolio reflection activities. Students have expressed an appreciation for the time dedicated to this reflective activity, which helped them identify and verbalize personal and professional growth by connecting prior academic work to their current healthcare practice. Ultimately, the ePortfolio can help RN-BS students consider the application of theory to practice as they are prompted to make connections between their classroom and clinical learning experiences (Cordie et al., 2019).

Implementation in a Graduate Nursing Program

During the Doctor of Nursing Practice (DNP) program's annual faculty retreat in July 2023, the program instructional designer presented background information about reflection and ePortfolio. We used an informal slide presentation to spark discussion among program faculty to gain buy-in for the proposed methodology and the timeline. To ensure that all faculty participants had similar knowledge, the instructional designer started by providing foundational information: (1) the purpose, uses, and benefits of a learning framework; (2) ePortfolio as a high-impact practice; (3) examples of content typically included in an ePortfolio; and (4) how to map program learning outcomes to specific courses to facilitate competency-based education. The assistant dean for education was in attendance and provided valuable insights gleaned from working with the undergraduate RN-BS program faculty during the planning phase of their journey. After the presentation, faculty expressed unanimous support and enthusiasm for the ePortfolio project, noting the importance of reflection, professional identity formation, CBE, and teaching students how to disseminate their work. Faculty then had a robust discussion wherein we solidified ideas, decided on student milestones, and re-examined signature assignments for alignment with program and course learning outcomes.

During this working session, the need for dedicated time for student reflection became apparent. Faculty observations and discussions with current and former students indicated that students at the graduate level typically have full-time jobs and family responsibilities in addition to completing coursework, making it particularly difficult to set aside quiet time for meaningful reflection. Furthermore, faculty expressed concerns that students may lack experience with the reflective process, which aligns with the findings of Landis et al. (2015). As a result, we decided to connect the reflective activities within the specific courses that aligned with the timing of each reflective milestone rather than as a stand-alone student-academic advisor activity. Faculty members in each course agreed to dedicate time at the beginning of the semester for students to reflect on the previous semester(s) and set goals for the upcoming semester. We also decided to include faculty facilitators and a workshop-style educational session for the initial roll-out because most students and faculty have little to no experience with structured reflection activities.

The group of DNP students we targeted for the initial reflection workshop were the nine enrolling in the first of three practicum DNP scholarly project courses during the fall 2023 semester—Reflection Milestone 2, as shown in Figure 3. The assistant program director and instructional designer collaborated with the course faculty to confirm the dedicated time for the reflection workshop during the first classroom session of the practicum course at the end of August 2023. The facilitated workshop, Purposeful Reflection for DNP Practicum Students, was created and delivered by workshop faculty who adopted the ASET model (Figure 1) to guide students through structured reflection and goal development. Workshop faculty began with a review of the session's objectives with students: (1) Describe the benefits of reflective practice on a DNP student's professional identity, capacity, and competency as a leader and scholar; (2) Employ the metacognitive cycle to reflect on the previous semester's signature assignments; (3) Create a SMART goal, at least two immersion experiences (activities), and the corresponding DNP Essential Domains for a given scenario; and (4) List possible objectives with planned activities to address individual academic goals and reflections on personal growth. Students drafted initial responses to a series of reflection prompts during the session. They then refined their answers and submitted final versions within two weeks after the workshop. Facilitated pair-and-share activities enhanced peer discussion. For example, students paired up with a classmate to share their reflective thoughts about the prompt: How has this knowledge, plus faculty feedback, helped you develop ideas for your collaborative partnership team?

The process of guided reflection was repeated for the second of the two pre-DNP practicum courses taken the previous semester, followed by a final reflection on (a) students' motivation to enter the DNP program and (b) why earning a DNP degree was important to them. Next, workshop faculty helped students transition from reflecting on the previous semester to planning for the upcoming semester by reviewing the current course's learning outcomes and the DNP program learning outcomes. Students then drafted their responses to a set of questions designed to help them self-evaluate their performance related to achieving program milestones. An example of a prompt we used during the metacognitive cycle (evaluation phase) included: "As

Figure 3

University of Rochester School of Nursing Curriculum Map for DNP Program Signature Assignments

Program Learning Outcomes (PLOs) → / DNP Courses ↓	PLO 1 Person-Centered Care & Population Health	PLO 2 Quality, Safety, & Value in Healthcare	PLO 3 Leadership & Collaboration	PLO 4 Informatics & Healthcare Technology	PLO 5 Systems Thinking, Change, & Advocacy	PLO 6 Professional Identity, Knowledge, & Scholarship
PROGRAM ENTRY (students may take up to 2 courses prior to matriculation)						
Quality, Safety, Informatics	Final Presentation (CLO 2, 3, 4, 5)	Final Presentation (CLO 2, 3, 4, 5)	Final Presentation (CLO 2, 3, 4, 5)	Final Presentation (CLO 2, 3, 4, 5)	Final Presentation (CLO 2, 3, 4, 5)	Final Presentation (CLO 2, 3, 4, 5)
Population Health	Experiential Learning 1 (CLO 1, 3, 6)	Experiential Learning 3 (CLO 5, 7, 8)		Experiential Learning 2 (CLO 2)	Experiential Learning 4 (CLO 4)	Experiential Learning 4 (CLO 1-8)
Clinical Data Management	Final Presentation (CLO 2, 3, 4, 5, 6)	Final Presentation (CLO 2, 3, 4, 5, 6)		Final Presentation (CLO 2, 3, 4, 5, 6)	Final Presentation (CLO 2, 3, 4, 5, 6)	Final Presentation (CLO 2, 3, 4, 5, 6)
Interprofessional Partnerships			Final Paper (CLO 4, 5)		Final Paper (CLO 5)	Final Paper (CLO 4, 5)
Theory/ Conceptual Thinking	Application of Theory Project (CLO 1, 2, 3, 4)	Application of Theory Project (CLO 1, 2, 3, 4)	Application of Theory Project (CLO 1, 2, 3, 4)	Application of Theory Project (CLO 1, 2, 3, 4)	Application of Theory Project (CLO 1, 2, 3, 4)	Application of Theory Project (CLO 1, 2, 3, 4)
REFLECTION MILESTONE 1 (following completion of foundational courses in early Evidence Appraisal and Synthesis)						
Evidence Appraisal and Synthesis	Final Presentation (CLO 2, 3, 4, 5)	Final Presentation (CLO 2, 3, 4, 5)		Final Presentation (CLO 2, 3, 4, 5)		Final Presentation (CLO 2, 3, 4, 5)
Needs-Based Problems / Local Context	Synthesis Paper with Logic Model (CLO 1, 2, 3, 4, 5)	Synthesis Paper with Logic Model (CLO 1, 2, 3, 4, 5)	Synthesis Paper with Logic Model (CLO 1, 2, 3, 4, 5)	Synthesis Paper with Logic Model (CLO 1, 2, 3, 4, 5)	Synthesis Paper with Logic Model (CLO 1, 2, 3, 4, 5)	Synthesis Paper with Logic Model (CLO 1, 2, 3, 4, 5)
REFLECTION MILESTONE 2 (transition from foundational courses to pre-project coursework in early DNP Practicum I)						
DNP Practicum I Evidence Synthesis	Literature Synthesis (CLO 2, 3, 4, 5)	Literature Synthesis (CLO 2, 3, 4, 5)	Literature Synthesis (CLO 2, 3, 4, 5)	Literature Synthesis (CLO 2, 3, 4, 5)	Literature Synthesis (CLO 2, 3, 4, 5)	Literature Synthesis (CLO 2, 3, 4, 5)
Healthcare Policy	Policy Analysis & Policy Brief (CLO 2, 5)	Policy Analysis & Policy Brief (CLO 2, 5)	Final Presentation (CLO 1, 2, 3, 4)		Final Presentation (CLO 1, 2, 3, 4)	Final Presentation (CLO 1, 2, 3, 4)
MINI-REFLECTION (post DNP Practicum I in early DNP Practicum II)						
DNP Practicum II Project Design	Scholarly Project Proposal (CLO 3)	Scholarly Project Proposal (CLO 1)	Scholarly Project Proposal (CLO 4)	Scholarly Project Proposal (CLO 1)	Scholarly Project Proposal (CLO 2)	Scholarly Project Proposal (CLO 5)
Healthcare Finance		Business Plan (CLO 1, 2, 4, 5)		Business Plan (CLO 2, 3)	Business Plan (CLO 1-6)	
REFLECTION MILESTONE 3 (following student's scholarly project proposal presentation in either DNP Practicum II or III)						
DNP Practicum III Project Implementation	Scholarly Project Implementation (CLO 1-6)	Scholarly Project Implementation (CLO 1-6)	Scholarly Project Implementation (CLO 1-6)	Scholarly Project Implementation (CLO 1-6)	Scholarly Project Implementation (CLO 1-6)	Scholarly Project Implementation (CLO 1-6)
DNP Practicum III Project Evaluation	Scholarly Project Completion (CLO 1-6)	Scholarly Project Completion (CLO 1-6)	Scholarly Project Completion (CLO 1-6)	Scholarly Project Completion (CLO 1-6)	Scholarly Project Completion (CLO 1-6)	Scholarly Project Completion (CLO 1-6)
REFLECTION MILESTONE 4 (following student's scholarly project presentation in DNP Practicum III course)						
PROGRAM COMPLETION (following student's achievement of Program Learning Outcomes; PLOs)						

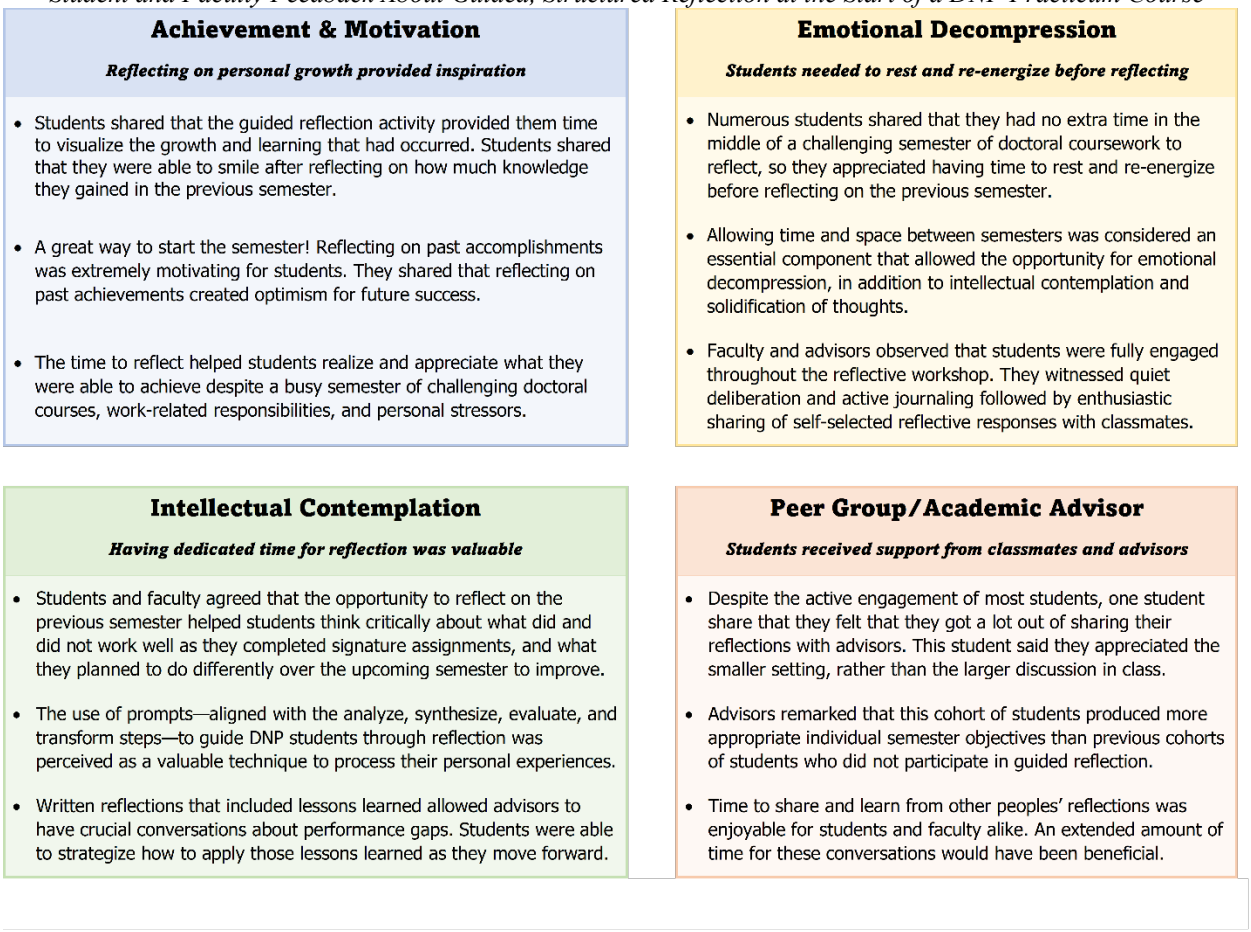
Note. DNP = Doctor of Nursing Practice. The actual Program Learning Outcomes (PLOs) and course names have been adapted or condensed for this visual display. Used with permission.

you think about the course expectations, what steps will you take to improve your literature search process and synthesis work throughout this semester?"

The final activity in the Purposeful Reflection workshop was setting individual semester objectives and planned activities. Workshop faculty and course faculty worked together to help students get started with drafting semester objectives. Workshop faculty had intended to begin the final activity with an overview of SMART goals (The Coaching Tools Company, 2020), but time constraints prevented in-class completion. Each student refined their individual objectives and planned activities in the two weeks following the workshop through formal consultation with their DNP Project Advisor (who was, intentionally, either workshop or course faculty).

Figure 4

Student and Faculty Feedback About Guided, Structured Reflection at the Start of a DNP Practicum Course



Despite running out of time, the facilitated workshop, Purposeful Reflection for DNP Practicum Students, and the subsequent consultation with DNP Project Advisors were overwhelmingly positive experiences for faculty and students alike. We asked participants to share their feedback using an online platform where they could post their favorite part(s), least favorite part(s), areas for improvement, and other suggestions for consideration. We also captured faculty and advisor feedback and observations through informal debriefing sessions. Figure 4 visually depicts the four themes that emerged when we examined student and faculty feedback following the workshop: (a) achievement and motivation, (b) emotional decompression, (c) intellectual contemplation, and (d) peer group/academic advisor. The feedback was overwhelmingly positive; for example, numerous students shared that reflection was a great way to start the semester. The prompted reflection allowed students to begin the semester with intention, focusing on expected competencies as they set goals for themselves. During consultation about individual semester objectives and planned activities, advisors noted that it was less awkward to discuss performance gaps when students had already identified steps for improving on a selected competency (e.g., literature review and synthesis). Based on the pilot semester using guided, structured reflection, DNP faculty and students agreed that (a) reflecting on personal growth provided inspiration, (b) students needed to rest and re-energize before reflecting, (c) having dedicated time for reflection was valuable, and (d) students received support from classmates and advisors.

We will continue to offer the workshop for future DNP practicum students and include modifications based on their suggestions. Seven students participated in the mini-reflection milestone in the spring of 2024. Lessons from facilitating these reflection activities revealed variability in individual and cohort achievement of milestones. Witnessing student stress in transitioning to the practicum courses highlighted potential gaps in supporting project specificity. Consequently, we can make informed curriculum revisions regarding the timing and content

of required courses. As Landis et al. (2015) suggested, the process of guiding student reflection within an ePortfolio can help improve overall faculty understanding of curricula, fostering a culture of continuous improvement. Ultimately, this experience has proven to be beneficial to program faculty as well as to current and future students alike.

Lessons Learned and Next Steps

We recognize that our ePortfolio implementation in a healthcare professions school is qualitatively different from liberal arts schools. Professional organizations and accrediting bodies hold nursing to exacting standards, with good reason. Clear competencies, including learning outcomes and authentic assessment to guide instruction, are indeed essential to ensuring the preparation of practice-ready nurses. Although signature assignments are pre-selected for students, ePortfolio still offers the benefits of guided, structured reflection of learning artifacts within a social context. Once the ePortfolio technology is running at full capacity, students will be able to select additional artifacts to supplement their required clinical and didactic coursework. Despite these differences, our systematized ePortfolio design has effectively combined CBE, scaffolded reflection, and integrative learning within a robust assessment framework.

Through implementing an ePortfolio to support competency-based education, we have gained valuable insights that will be useful as we scale up and share our experiences with others. First, structuring the curriculum around professional competencies required considerable effort in realigning program and course learning outcomes, assignments, and rubrics, as other implementers of ePortfolios, such as Morreale et al. (2017) and Wescott and Schwartz (2022) have learned. Additionally, the paradigm shift to competency-based assessment necessitated substantive faculty development. Annual retreats facilitated a deeper understanding of the instructional design process for establishing the learning framework and helped garner faculty buy-in for the ePortfolio initiative. However, adopting a competency-based mindset of "not yet" as opposed to grade-based, time-bound assessment remains an ongoing pedagogical challenge. Another issue involves supporting faculty's own reflection and mentorship skills and how to measure students' reflective skill development throughout the program.

The development of structured reflection processes and milestones elicited positive responses from faculty and students, who appreciated dedicated time for metacognitive skill building. However, variability among students' competency development necessitates further continuous improvement in curricular design and pedagogical strategies that scaffold learning across a wide range of abilities. This disparity was observed during the Purposeful Reflection for DNP Practicum Students activity. Furthermore, as we scale the ePortfolio throughout the school, intentionally integrating reflective practice across programs could enhance students' lifelong learning capacities and professional identity formation.

Our next steps involve collecting data on ePortfolio impacts and challenges from all stakeholders through surveys, focus groups, and assessment platform analytics. Then, once the learning framework for each program is completed in the electronic assessment system, our school will essentially have a comprehensive learner record—giving access to assessment data at the student, program, and institution levels—to track students' development of essential competencies, guide continuous improvement, and satisfy accreditation reporting (Wolf et al., 2022). Scaling participation in our ePortfolio initiative across the school and developing interprofessional collaborations is a benefit we can offer to other educational institutions within the healthcare professions. We have created an "Implementation Guide for a Systematized ePortfolio to Assess Competency-Based Education" in the Appendix as a resource for others to use. Despite requiring investments in establishing a learning framework, professional development, technology, and integrative social pedagogy, the ePortfolio pilot has enabled our school to leverage competency-based education's potential to transform nursing education and better prepare our students for the ever-evolving landscape of contemporary healthcare.

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Appendix

Implementation Guide for a Systematized ePortfolio to Assess Competency-Based Education

A. Designing Integrative Social Pedagogy

1. Describe learners in each program and identify their needs.
2. Explain how learners will benefit from ePortfolio reflection and assessment.
3. Define the reflective ePortfolio practice, including:
    - How reflection connects experiences at the course, program, and student levels (Review the ASET Model as a framework).
    - How the reflective practice will facilitate students' growth and professional identity development.
    - How the student reflection process will be scaffolded and systematized (In specific courses? With advisors?).
    - How to integrate social pedagogy by identifying audiences for students to share their ePortfolios with and determine who will provide feedback.
4. Design activities to guide how learners will document their learning in the ePortfolio based on answers to question 3.
5. Develop reflection milestone assignments that scaffold students' competency development across the program of study.
6. Design a system for ePortfolio assessment (gathering, evaluation, and feedback) within the program.

B. Outcomes Assessment and Comprehensive Learner Record (CLR) Design:

1. Identify/develop one signature assignment in each course, aligned with Program Learning Outcomes (PLOs), so all competencies are assessed.
2. Develop rubrics that measure student achievement of PLOs.
3. Enter course maps, assignments, and rubrics into the CLR.
4. Set up the CLR backend, including data entry, user testing, and building connections between course maps and rubrics.
5. Review and analyze assessment data regularly to inform program improvements and demonstrate the impact of ePortfolio on student learning outcomes.

C. Faculty Development:

1. Create a program-specific ePortfolio team and engage faculty in ePortfolio planning.
2. Employ an assignment charrette peer review process to help program faculty revise signature assignments, assignment guidance, and rubrics across the program.
3. Provide training and professional development opportunities for program faculty to build their skills and knowledge of reflection activities and ePortfolio assessment.
4. Create a tiered faculty development plan to deepen faculty knowledge of ePortfolio assessment, foster student reflection and metacognition, and use CLR data for evaluation at the student, course, and program levels.
5. Encourage faculty to create their own ePortfolios to model reflective practice and demonstrate the value of ePortfolios for professional development.

D. Technology, Data Management, and Program Evaluation:

1. Ensure the chosen ePortfolio platform is user-friendly, accessible, and compatible with existing institutional systems and technologies.
2. Develop an assessment cycle and timeline for continuous improvement of curriculum and retention.
3. Collaborate with the IT team to develop a technology plan and provide ePortfolio support to students and faculty within the program.
4. Set up the front end for the program, including data entry, user testing, and building connections between course maps and rubrics.
5. Integrate achievement data with an early alert system/advising for the program.
6. Regularly share aggregated program data with advisors, program directors, faculty, and student affairs.
7. Collect, analyze, and share evidence of ePortfolio's impact on student achievement of program-specific PLOs/competencies for dissemination.

E. Considerations for Communication Plans and Scaling Up:

1. Develop a student orientation program and ePortfolio guides.
2. Create faculty and advisor guides for ePortfolio processes tailored to the program.
3. Engage students in learning showcases and build support with various stakeholders.
4. Create an external-facing showcase of select student ePortfolios from the program (optional).
5. Develop an internal and external communication plan for ePortfolio assessment.
6. Establish a plan for scaling up ePortfolio implementation across the institution, including identifying resources, support, and timelines.

Note: The Catalyst Framework (Eynon & Gambino, 2017) was used as a structure for this guide.