Electronic Portfolio Architecture Based on Knowledge Support in Senior Project Design

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Abstract
ePortfolios based on the practice in self-assessment, and self-reflection and self-regulation are viewed as important tools in facilitating and supporting learner-centered environment at higher education. This study explains how an electronic portfolio system was designed and used as a useful repository for learning products to help instructors monitor in-service kindergarten teachers' progress, provide feedback and develop in-service kindergarten teachers' self-assessment, and self-reflection and self-regulation through the presentation of a detailed and ongoing short-term training program used as a comprehensive measure to determine degree mastery in Department of Early Child Development at Wenzhou University in China. The finding show in-service kindergarten teachers can be trained to carry out authentic tasks associated with ePortfolio and reveals that instructors can improve in-service kindergarten teachers' skills by enhancing their motivation and inspiring their positive training in the curriculum, such as building group cohesiveness and having positive learning experiences.
Keywords: in-service, kindergarten, teachers, self-assessment, self-regulation, self-reflection.

Архитектура электронного портфолио, ориетированная на образовательную поддержку в рамках разработки проектов

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Аннотация
Электронное портфолио, в основе которого лежат методы самооценки, самоанализа и самоконтроля, считается важным инструментом в создании личностно-ориентированной среды

в сфере высшего образования. В настоящей работе описан механизм разработки системы е-портфолио, которая используется в качестве ценной базы продуктов обучения. Данная система позволяет преподавателям следить за прогрессом педагогов дошкольного образования, предоставлять обратную связь и развивать их навыки самооценки, самоанализа и самоконтроля благодаря краткосрочной программе обучения, которую специалисты кафедры дошкольного образования в университете Вэньчжоу используют в качестве комплексной меры для определения уровня профессионализма и компетентности воспитателей. Результаты исследования показали, что после прохождения курса обучения педагоги дошкольных учреждений успешно выполняют практические задания, связанные с е-портфолио. Анализ данных выявил, что преподаватели способствуют повышению квалификации дошкольных учителей, мотивируя их на успешное завершение программы, уделяя особое внимание сплоченности группы и положительным моментам в процессе обучения.
Ключевые слова: рефлексивные практики, саморазвитие учителей, подготовка учителей, гуманистическое образование, мастер-классы по саморазвитию.

Introduction

Many critics say that current educational infrastructures are incapable of preparing future scientists and engineers to solve the complex and multidisciplinary problems this society will face within personalized learning. Students should be trained for curriculum practice based on the practices of collaboration, self-assessment, self-reflection, self-regulation. However, much effort needs to be done in advance before getting the most out of senior project design. The most essential task is assessment. Among those assessments proposed by Prus and Johnson (1996), the use of portfolios is most suitable for longitude assessment. Portfolios were introduced in the field of education as an instructional tool in the 1970s. ePortfolio, by and large, is an all-encompassing term used to refer to an electronic space for learners to store their work and share with others and instructors. It frequently includes the use of blog, web-based materials and hypermedia. Specifically, ePortfolio, the accessible network space to exhibit students' achievement, can be assessed by themselves, other students, and teachers. ePortfolio is growing process by research that is either in the practice of the engagement within personalized learning, or in the framework of reflective procedure (Clarke & Enyon, 2009; Duncan-Pitt & Sutherland, 2006; Khoo, Maor & Schibeci, 2011). In fact, ePortfolio has been used to document student work to demonstrate ePortfolio learning (Cambridge, Kahn, Tompkins & Yancey 2001). Unlike paper-based portfolios, ePortfolio allows information to be stored, accessed, updated, and presented in various electronic formats to record students achievements. This paper aims to provide this evidence by investigating the effect of ePortfolio architecture employing knowledge retrieval technology to establish a knowledge supporting portal, which enables an easy access to previously established project documents and provides decision support that used as an alternative assessment method to help teachers assess students, monitor their progress, provide feedback and develop students' self -reflecting and project management capability.

Related work

Much has been written about portfolios and ePortfolio in teacher education (Loughran & Corrigan, 1995; Wright, Stallworth & Ray, 2002; Lorenzo & Ittelson, 2005; Park & Lim, 2006; Hartmann & Calandra, 2007; Zellers & Mudrey, 2007; Young, 2008; Imhof & Picard, 2009; Charham-Carpenter, Seawel & Raschig, 2010; Jones, 2010; Joyes, Gray & Hartnell-Younf, 2010; Meyer, Abrami, Wade, Aslan & Deault, 2010) and relating to higher education beyond teacher education (Mason, Pegler & Weller, 2004; Challis, 2008; Bolliger & SHaepherd, 2010; Vernazza, Durham, Ellis, Teasdale, Cotterill, Scott, Yhomason, Drummond & Moss, 2011). ePortfolio, by and large, is an all-encompassing term used to refer to an electronic space for learners to store their work and share with

others and instructors. It frequently includes the use of blogs, web-based materials and hypermedia. Specifically, ePortfolio, the accessible network space to exhibit students' achievement, can be assessed by themselves, other students, and teachers. Examining content through developing portfolio is a common use to ensure students accountability from teachers. Several studies reported that the portfolio has distinct advantages. Ashelman & Lenhoff. (1994), Ramey & Hay (2003), Ring &Foti (2003) Stern & Kramer (1994) noted that the use of portfolios is a tool to assess student learning. Barron & Sartori (1994) and Schatz (2004) further pointed out that the reflective feedback, personalized development, self-assessment process arising from the implementation in ePortfolio provide students support in learning (Neill & Mitchell, 1995; Smith & Ylvisaker, 1993; Cohen & Wiener, 1993; Adelman, King & Treacher, 1990). With the increased use of ePortfolio, a comprehensive range of functions has been identified. The key learning elements include assessment, presentation, learning, personal development, collaboration, and ongoing working documents through ePortfolio. In a word, self-regulated learning, self-reflection, self-assessment, collaboration and the students' performing outcome is illustrated as well as the core of authentic task, contextual feedback, and student responsibility (Brown, Campione, Webber & McGilly, 1992; Blumenfeld, 1992; Butler & Winne, 1995; Schon, 1983).

Experimental study

Hypotheses and Research Questions

The hypotheses (1, 2) and research questions (Q1, Q2) were derived from an examination of the effects of those In-service kindergarten teachers (henceforth, 'teachers') in an ePortfolio environment as follows.

1. Teachers' action pedagogy project shows the effect in ePortfolio environment.
2. The ePortfolio architecture improves teachers' performance.

Q1) What are the effects of those teachers in an ePortfolio environment (e.g., collaboration abilities, self-assessment, self-reflection, and self-regulation)?

Q2) Is the teachers ' action pedagogy project correlated to ePortfolio?

Program Description

This study examined the effects on teachers in an ePortfolio environment when they worked in action pedagogy project of their course: *Instruction of Pre-kindergarten Science Subject* at Wenzhou in China. In the preschool curriculum, science activities pervade the early childhood curriculum studies, including nature (plants, animals, geology), cooking (chemistry), weather (wind, rain), and the environment (air, water, recycling). It uses skills such as observing, comparing, predicting, and documenting. The point of the action pedagogy project is what teachers need to teach children throughout early childhood classrooms, and promotes children's development in cognitive, social, emotional, and physical domains. As a consequence, an individual action pedagogy project is treated and is concerned with the extent to which activities associated with for the participating subject are involved with it.

Participants

This study invited in-service kindergarten teachers participating short-term training program delivered by Department of Early Child Development in Wenzhou from May to July in 2016 to be involved. Despite considerable diversity in the social, economic, cultural and academic backgrounds of the participants, they were all involved as long term educators for at least five years in various preschools. Their participation played

a significant role in this study as they shared their thoughts and opinions regarding quality preschool education in China. There were 153 In-service kindergarten Teachers, comprising 4 males (2.6%) and 149 females (97.4%). Furthermore, participants in this study had previously enrolled in the 2011 intake of the BA (Ed) degree program of Teacher College in Wenzhou University at Zhejiang, China. Only one instructor participated in and was responsible for planning, conducting, and reporting the study.

Instrument

This study is descriptive and relational. The effect size of an experiment is the extent to which the independent variable affects the dependent variable. A large effect size demonstrates stronger effects of the independent variables. In other words, effect size is a rank of the strength or magnitude of a reported relationship. Unlike significance tests, these measures are independent of sample size. A small effect size suggests that the difference is primarily due to the large sample size in a study. Therefore, the difference might not be considered practically important or significant.

System Architecture

System Design

The concept of portfolios system in the learning process can be summarised as collection, selection, reflection, projection, and presentation (see Figure 1). The process such as knowledge modeling, knowledge storage, and knowledge query compose in knowledge engineering process would build those elements of institutional self-assessment and legacy archived reports in the ePortfolio system (see Figure 2).

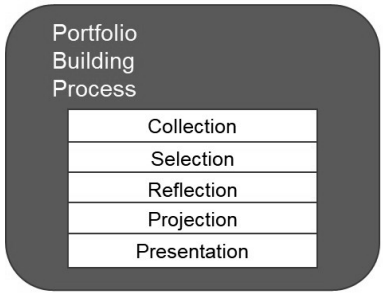

Figure 1: Portfolio building process

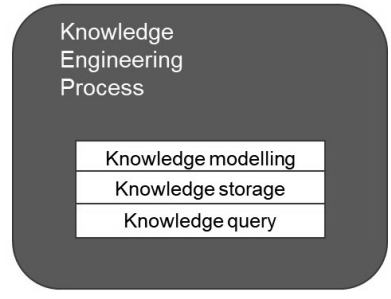

Figure 2: Knowledge engineering process

When conducting the project, ePortfolio, which represents the collective knowledge concerning from past, is ready to offer help. When in the collection and stage, teachers would like to look at faculty histories in order to understand their research expertise. The teachers in this study have completed their training in a college of education, have obtained their degree and have entered service as a teacher. In selection stage, when choosing development tools and platform, the choices from past projects could certainly help them make better decision. In the reflection stage, where endless problems are encountered, past experiences of solutions could save valuable time. During the process, the teachers also put their learning data in a portfolio folder, thus constructing their own personal learning portfolio. In the presentation stage, the student portfolio is made public along with their final product for summative assessment. Through the teacher's portfolio, the grading committee can have an easy understanding of the contribution to the project made by each participating student, thus have more authentic information for assessment. After the projects are finished and graded, the teachers' portfolios will undergo some

categorizing and indexing process, and then be merged into the program portfolio to provide help for next generation of teachers. The learning function is presented in the form of an electronic portfolio system, with learning and management functions, and serves as a way to promote interaction between team members and advisors, as well as constructing teachers' personal learning record. Learning data, representing valuable personal experience, stored in portfolio database, are also modeled and classified by the knowledge management system for future reuse.

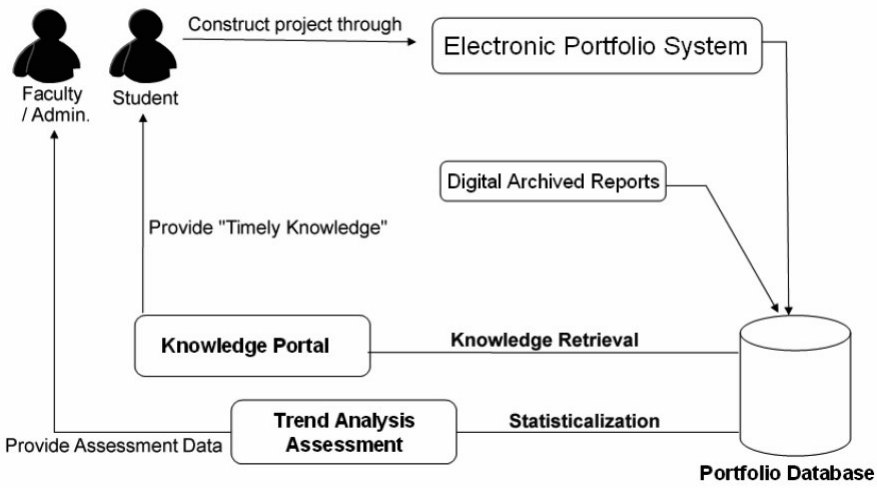

Fig. 3. System Architecture

In addition, the portfolio database is analyzed, generating information useful for both institutional-leveled assessments as well as providing new students with references. The knowledge support system classifies objects in portfolio database, stores user preferences, and provides knowledge in the forms of either fully concluded project report, or related discussion from portfolio system, according to users' individual interests (see Figure 3).The proposed portfolio learning process is composed of teachers' project design, and portfolio building processes; teachers build their own learning portfolio in the process of conducting project design, collecting learning evidences.

Prototype system

This section shows the usage of the portfolio system with screenshots of these systems. When using the portfolio system for project design, teachers can see their project schedule, with timeline as x-axis and task list as y-axis. They can add new entries for each task, setting goals and due day for it. Instructors can also assign a task for them, thus generating expected progress. By the due date, teachers must upload evidence or results to show that they have achieved the goal. These entries will be marked as evidence presented. Instructors can design or edit rubrics for different tasks for summative assessment purpose. When a grade is given, the rubric data will be attached so that the student knows the merit of the grading. While portfolio objects can be graded according to rubric, it can also be formatively assessed, and comments from either peers or instructors are attached (see Figure 4).

Figure 4: ePortfolio content

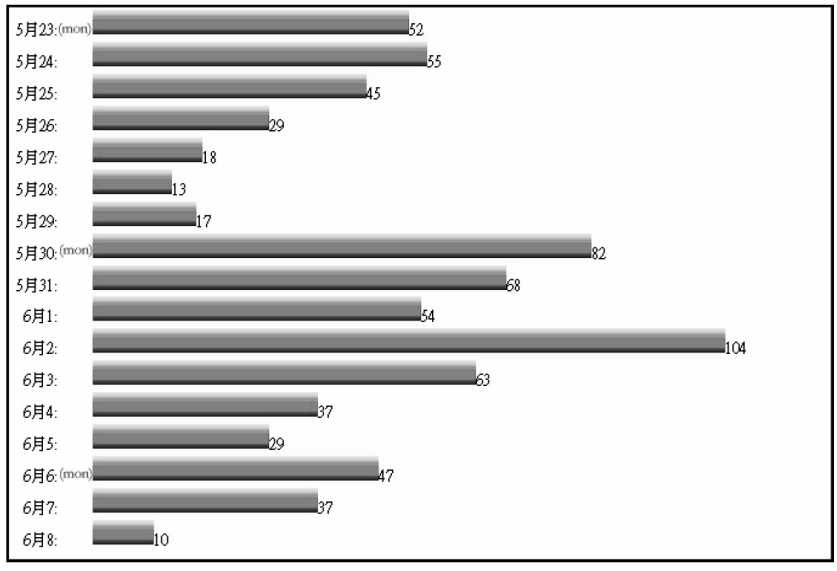

Figure 5. Access Log From May 23 to June 8,2016

Access log

The portfolio system portal opened to students on May 23, 2016. The access time of each day from May 23 to June 13 is shown in Figure 5. (Note that the access time means a single access to ePortfolio home page, thus multiple searches using ePortfolio without heading back to the home Page will be considered as only 1 access.) There were 945 total accesses, and average access per day was 41.08. The average during weekday was 48 accesses per day. Teachers use the portal most often on Mondays, then less and less as the week goes on. When it comes to weekends, the average dropped to only 18 accesses per day. The peak value 104 on June 2 was one day prior to the due date where teachers' had to turn in their semester progress report for the project design. In mid-June, the access rates start to wane, which was reasonable due to semester final exam. Although the

data was collected from only 20 days, we can see that students' access pattern are reflected in the access log.

Subject feedback

The survey was carried out after the completion this project. The research was guided by the primary research question: What are the effects on teachers in an ePortfolio environment?

The questionnaire consisted of 19 items within four sections: (a) Self-regulation Learning (questions 1 to 5), (b) Self-reflection (questions 6 to 10), (c) Self-assessment (questions 11 to 15), and, (d) Collaboration (questions 16-19) asked teachers to provide honest feedback about their experiences through portfolios. Each question in the survey allowed for five different levels of agreement by respondents about ePortfolio environment, including: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and, (5) strongly agree. To determine if the sections of the original questionnaire were highly related, a correlation analysis was conducted (see table I). Responses to the survey remained anonymous and it was not possible to identify participants. To generate more responses, the instructor made several announcements to the teachers and they received an email reminder from the instructor if they had not completed the survey.

Table 1: *Correlations matrix*

	Self-regulation	Self-reflection	Self-assessment	Collaboration
Self-regulation	1.000			
Self-reflection	.531	1.000		
Self-assessment	.539	.880	1.000	
Collaboration	.393	.593	.553	1.000

Note: All value significat at 0.01 level (2-tailed)

Assumptions and Limitations

The results presented here should be interpreted within the context of the assumptions and limitations of the study. First, the in-service teacher body at Wenzhou is considerably homogeneous. It is assumed that the course materials were presented by the same instructor. In other words, it is assumed that the course materials serve as the control variable and are reasonably homogeneous. Teachers' academic achievements are largely based on their efforts devoted to understand the course materials. Therefore, it is argued that teachers' academic achievements suffice as an indicator to show if ePortfolio constitutes a favorable approach. The results of this study are not uniformly applicable to all scenarios.

Finding

The following tables (tables 2, 3, 4, and 5) show the effect sizes for the comparisons among groups. (Note there are four group based on the teachers entrance exam scores, the full score is 100, and scores higher than 90 are in Group1, scores ranges 75-89 in Group 2, scores range 60-74 in Group 3, scores lower than 60 are in Group 4). Statistically, an effect size helps to determine whether a statistically significant difference is a difference of practical concern. Cohens' *d* is an appropriate measure of the effect size association in this study. Usually, a Cohen's *d* of 0.2 to 0.5 indicates a small effect size, a value of 0.5 to 0.8 indicates a moderate effect size, and 0.8 or larger indicates a large effect size. Effect size can relate to significance, but also can estimate the extent of the relationship between two variables. In a brief, the effect size comparison provided evidence of consistent differences among groups in the total survey ratings.

Table 2: *Effect size in self-regulation learning*

	Effect size				
Groups	Self-reg1	Self-reg2	Self-reg3	Self-reg4	Self-reg5
(1,2)	0.0105	0.0773	0.2197*	0.0852	0.1748
(1,3)	0.0364	0.0231	0.4859*	0.2569*	0.0715
(1,4)	0.5854	0.3173*	0.7611*	0.5145*	0.2265*
(2,3)	0.0263	0.0996	0.1946	0.1566	0.2591*
(2,4)	0.6208*	0.3862*	0.4846*	0.4229*	0.4061*
(3,4)	0.7035*	0.2935*	0.3770*	0.3230*	0.1682

Note * indicates that there is a significant difference in effect size

There were moderate effect size differences between group 2 and group 4, and group 3 and group 4 in Self-paced1, and there were difference in Self-regulation rubric between group 2 and group 4 (see table 2)

Table 3: *Effect size in self-reflection learning*

	Effect size				
Groups	Self-ref1	Self-ref2	Self-ref3	Self-ref4	Self-ref5
(1,2)	0.0203	0.0346	0.2411*	0.1337	0.0803
(1,3)	0.2244*	0.1816	0.3982*	0.1369	0.1359
(1,4)	0.3744*	0.2867*	0.5410*	0.3706*	0.4502*
(2,3)	0.2691*	0.1203	0.1207	0.0124	0.0208
(2,4)	0.3417*	0.2328*	0.2983*	0.1981	0.3536*
(3,4)	0.1160	0.1046	0.1846	0.3290*	0.3844*

Note * indicates that there is a significant difference in effect size

There were differences between group 1 and group 4 for the Self-reflection scoring rubric (range 0.2766 to 0.4402). In addition, there were differences greater than 0.38 for differences between group 1 and groups 3 and 4 in Self-ref3 (range 0.3892 to 0.5310) (See Table 3).

Table 4: *Effect size in self-assessment learning*

	Effect size				
Groups	Self-ass1	Self-ass2	Self-ass3	Self-ass4	Self-ass5
(1,2)	0.0307	0.0634	0.2211*	0.1773	0.0852
(1,3)	0.2442*	0.1916	0.3892*	0.1639	0.2569*
(1,4)	0.3744*	0.2766*	0.5310*	0.3607*	0.5145*
(2,3)	0.2169*	0.1304	0.1307	0.0242	0.1566
(2,4)	0.3517*	0.2238*	0.2883*	0.1891	0.4229*
(3,4)	0.1610	0.1146	0.1946	0.2290*	0.3230*

Note * indicates that there is a significant difference in effect size

There were also differences between other lower achieving groups and higher achieving groups in table 4. The comparison between group 1 and group 4 showed evidence differences with Self-assessment scoring rubric; the same was true with differences with group 2 and group 4, and group 3 and group 4. The comparison between group 1 and group 3 showed differences with Self-ass1 and Self-ass2 (See table 4). These results support the analysis showing the ranking was related to teachers' action pedagogy project with ePortfolio of this study.

Table 5: *Effect size in collaboration*

	Effect size			
Groups	Collaboration1	Collaboration2	Collaboration3	Collaboration 4
(1,2)	0.1748	0.0903	0.2211*	0.1773
(1,3)	0.0715	0.1259	0.3892*	0.1639
(1,4)	0.2265*	0.4402*	0.5310*	0.3607*
(2,3)	0.2591*	0.0218	0.1307	0.0242
(2,4)	0.4061*	0.3426*	0.2883*	0.1891
(3,4)	0.1682	0.3839*	0.1946	0.2290*

Note * indicates that there is a significant difference in effect size

Discussion and conclusion

The evidence in this study provided empirical support ePortfolio environment for self-assessment, self-reflection, and self-regulation learning in the course: *Instruction of Pre-kindergarten Science Subject* learning preference. The first two hypotheses served as a treatment check to show that teachers can be trained to carry out authentic tasks associated with ePortfolio. It can be stated that the training for the components of ePortfolio-collaboration, self-assessment, self-reflection, and self-regulation-was extremely successful when performing action pedagogy projects in electronic portfolio environment. The electronic portfolio architecture created in combination with processes including knowledge modeling, knowledge storage, and knowledge query allowed those elements of institutional self-assessment and legacy archived reports in the ePortfolio system. This prepared them well for ePortfolio for those teachers' action pedagogy project design and provides a place for teachers to store their work. With the project portfolio scheduler interface, it enables teachers' learning processes to be viewed transparently and longitudinally, fostering teachers' collaboration, self-assessment, self-reflection, and self-regulation and the ability to manage action pedagogy projects. The results presented with hypotheses 1 and 2 therefore support the reported findings of the importance of adequate time and authentic problems when teaching in-service kindergarten teachers in short courses.

Q1 required examination of the effect for ePortfolios. In this context, collaboration, self-assessment, self-reflection, and self-regulation (interest and frustration), workload (self-regulation demand), and knowledge were of interest. It was confirmed that a moderate effect size or a large effect size was related to variables through ePortfolio. The results showed that the ePortfolio architecture is mainly related to collaboration, self-assessment, self-reflection, and self-regulation, and the course *Instruction of Pre-kindergarten Science Subject*, as well as the portfolio. Therefore, we conclude that ePortfolio provided a place for recording assessment, self-regulation, reflections and developing a level of deep reflective practice. The development of reflective practice for in-service-teachers was identified earlier as a key component of ePortfolio drawing on

those studies Loughran, 2002; Yaffe, 2010; Housego and Parker, 2009; Van Donther, Dochy and Segers, 2011). Another question was related to ePortfolio and teachers' action pedagogy project. The results showed higher performance achievement individuals had higher ratings on selected items of collaboration, self-assessment, self-reflection, and self-regulation but appeared to be insufficiently motivated to complete the required tasks. The input from instructors to help teachers recognize the benefit of ePortfolio are very critical. Zimmerman (1981) claimed the self-regulated learners which have the characteristic of metacognition, reflection, and self-assessment in learning reach out academic success easily. Further, Minnaert & Janssen (1999) considered self-regulated is a key rubric of academic performance. So an ePortfolio consisting of self-reflection and self-assessment helps students in development and assessment.

In summary, this finding reveals that instructors can improve teachers' skills by enhancing their motivation and inspiring their positive training in the curriculum, such as building up group cohesiveness and having positive learning experiences. The more positive individuals' attitudes, the more they see themselves as being intrinsically motivated: this can further increase their perseverance in pursuit of goals, joint efficacy, desire for success and joy of learning. In particular, in-service kindergarten teachers in China is not what it used to be: it is longer. In 2010, only about 56 percent of children attended full-day kindergarten. In 2015, the ruling Communist Party of *China* (CPC) adopted the blueprint for the *13th Five -Year Plan* (13th FYP) for 2016-2020, increasing the enrollment rate in kindergarten to 85 percent by 2020.

It is apparent from the analysis that ePortfolios for teachers is a simultaneously challenging and exciting experience. ePortfolio is interoperable from in-service teaching to the Wenzhou year with an increasing sense of collaboration, self –assessment, self-reflection, and self-regulation in terms of goal setting. However, the functional use of ePortfolio within teachers training, at the time of the research, indicates that this is somewhat limited. It may be that most universities in China are still developmenting ePortfolios: the link to professional development and learning, needs to become embedded. As in-service kindergarten teachers become more competent and confident with using new technologies, ePortfolio may find a natural role for teachers. The findings from this research would suggest that an ePortfolio as a space for developing professional self-regulation through community needs to be embraced within higher education pedagogy and shared with pre-service teachers. We conclude that teachers value highly the experience they gain through teaching, and they frequently ask for more practical training during their studies. Assessments could also be completed through ePortfolio form providing feedback in an informal and relaxed atmosphere, self-reflection and assessment driven valuable tools both for teachers to improve their practices, and for instructors to point out and fill possible gaps of higher education. ePortfolios can also provide qualitative information on teaching and learning in real educational settings, emphasizing the special needs of newly qualified teachers.

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