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 the Department of Early Child Development at Wenzhou University in China. The finding shows in-service kindergarten teachers can be trained to carry out authentic tasks associated with ePortfolios 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 up group cohesiveness and having positive learning experiences.
Keywords: e-portfolio, in-service kindergarten teachers, self-assessment, self-regulation, self-reflection.

Архитектура электронного портфолио, основанная на поддержке знаний и разработке проектов

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Аннотация
е-Портфолио, основанное на принципах самооценивания, рефлексии и саморегуляции, рассматривается в статье как важный инструмент развития и поддержки личностно-ориентированной образовательной среды в рамках высшей школы. Данное исследование показывает, как электронная система создания портфолио была разработана и использована как удобный репозиторий для хранения образовательных продуктов, помогающих преподавательскому составу отслеживать прогресс будущих учителей дошкольного образования, предоставлять своевременную обратную связь и поддерживать формирование их способности к самооцениванию, рефлексии и саморегуляции через организацию кратковременных образовательных программ, используемых как комплексная мера определения уровня компетентности будущих учителей (на факультете раннего детского развития в Университете Вэньчжоу).

Собранные данные показывают, что учителя дошкольного образования могут быть подготовлены к тому, чтобы выполнять вне- аутентичные задания, предусматриваемые работой с е-Портфолио. Наши данные демонстрируют возможность преподавателей университета способствовать развитию будущих учителей путем формирования их мотивации и позитивного отношения к учебным программам и командной работе...
Ключевые слова: е-Портфолио, дошкольные преподаватели, самооценивание, саморегуляция, рефлексия.

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, and 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 & Johnson (1994) the use of portfolio is most suitable for longitude assessment. Portfolio 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 a growing process by research that is either in the practice of the engagement within personalized learning, or in the framework of reflective procedure(Clark & Eynon, 2009; Duncan-Pitt & Sutherland, 2006; Khoo, Maor & Schibecci, 2011). In fact, ePortfolio has been used to document student work to demonstrate ePortfolio learning (AAHE, 2008).

Unlike paper-based portfolio, 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 employed knowledge retrieval technology to establish a knowledge supporting portal, which enables an easy access to previously established project documents and provides decision support that is 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; Chatham-Carpenter, Seawel & Raschig, 2010; Jones, 2010; Joyes, Gray & Hartnell-Young, 2010; Meyer, Abrami, Wade, Aslan & Deault, 2010) and relating to higher education beyond teacher education (Mason, Pegler & Weller, 2004; Challis, 2008; Bolliger & Shepherd, 2010; Vernazza, Durham, Ellis, Teasdale, Cotterill, Scott, Thomason, 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 portfolio has distinct advantages. Ashelman & Lenhoff (1994) noted the use of port-

folio is a kind of tools to assess student learning (see also Ramey & Hay, 2003; Ring & Fopti, 2003; Stern & Kramer, 1994).

Barron & Sartori (1994) further pointed out that reflective feedback, personalized development, self-assessment process arising the implementation in ePortfolio provides students support in learning. (Schatz, 2004; 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 to meet such as assessment, presentation, learning, personal development, collaboration, and ongoing working documents through ePortfolio. In a word, self-regulation of 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

A. Hypotheses and Research Questions

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

1. The teachers' action pedagogy project will show the effect in ePortfolio environment.

2. The ePortfolio architecture improves teachers' performance

Q1) What is the effects of those teachers in ePortfolio environment (eg, collaboration Abilities, self-assessment, self-reflection, and self-regulation)?

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

B. Program Description

This study examined the effects on those teachers in 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), to name a few. 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 childood classrooms to promote 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 the activities associated with the participating subject.

C. Participants

This study invited teachers to participate in a short-term training program delivered by Department of Early Child Development in Wenzhou as participants from May to July in 2016. Despite considerable diversity in the social, economic, cultural and academic backgrounds of the participants, they were all involved as long term educators at least 5 years in the various preschools, and their participation played a significant role in this study as they shared their thoughts and opinions regarding quality preschool education in China. There was a total of 152 teachers, including 4 males (2.6%) and 149 females (97.4%).

In addition, those 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.

D. 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. 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

A. System Design

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

Figure 1: Portfolios buiding process

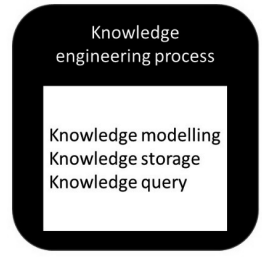

Figure 2: Knowledge engineering process

In the collection and selection stage, teachers would like to view their history in order to understand their research expertise. Teachers in this study means those whose training in a college of education has been completed and who have entered into service as a teacher. In the 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 experience on solution could save valuable time. During the process, teachers also put their learning data in a portfolio folder, thus constructing their own personal learning portfolio. In the presentation stage, the student portfolio will be made public along with their final product for summative assessment. Through the teachers portfolio, the grading committee can have an easy understanding of each participant's contribution to the project, thus have more authentic information for assessment.

After the projects are finished and graded, 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 managing 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 to be modeled and classified by the knowledge management system for future reusability.

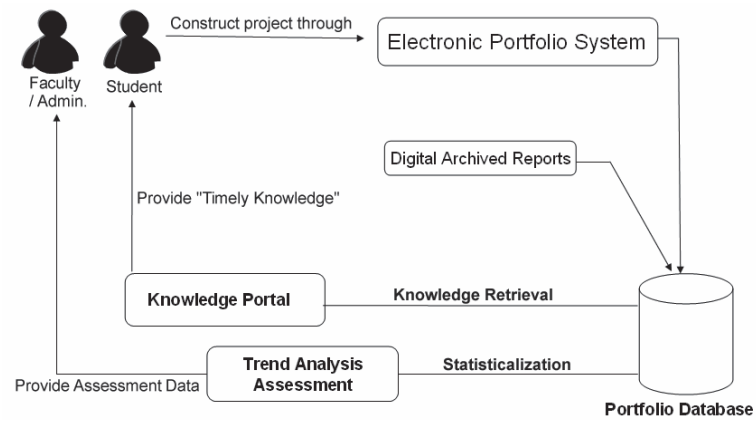

Figure 3: System architecture

In addition, the portfolio database is analyzed, generating information useful for both institutional-level assessments as well as providing new students as references. Furthermore, the knowledge support system classifies objects in the 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). Thus, it was proposed that the portfolio learning process which is composed of in-service kindergarten teachers project design, and portfolio building processes; teachers build their own learning portfolio in the process of conducting project design, collecting learning evidence.

B. System Prototype

This section shows the usage of the portfolio system along with screenshots of these systems. When using the portfolio system for project designing, 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 each. Instructors can also assign a task for them, thus generating an expected progress. By the due day, in-service kindergarten teachers must upload evidence or result to show that they have achieved the goal. These entries will be marked as evidence presented.

Also, instructors can design or edit a rubric for different tasks for summative assessment purpose. That is, when a grade is given, the rubric data will also be attached so that the student knows the merit of the grading. While portfolio objects can be graded according to rubric, they can also be formatively assessed, and comments from either peers or instructors are then attached (see Figure 4).

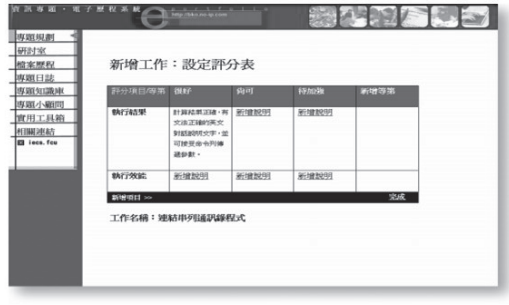

Figure 4. ePortfolio Content

C. Access Log

The portal of portfolio system opened to students on May 23, 2016. The access time of each day from May 23 to June 13 is list below 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.)

The total number of accesses was 945 and the average per day was 41.08. The average weekday access was 48. In-service kindergarten teachers use the portal most often on Mondays, then less and less as the week went on. At weekends, the average dropped to 18 per day. The peak value 104 on June 2nd 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.

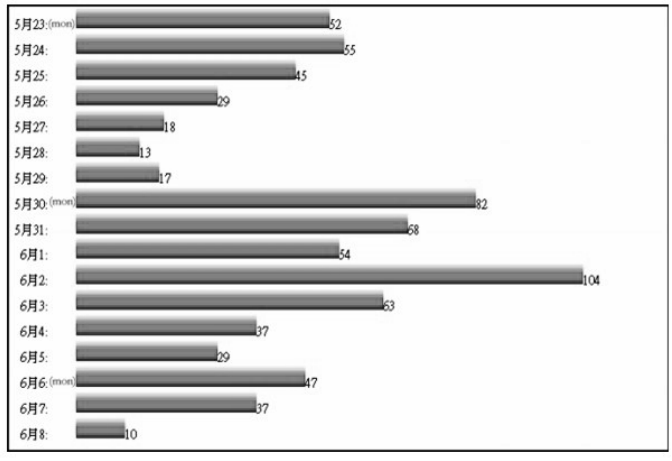

Figure 5. Access Log From May 23 to June 8,2016

D. Subject Feedback

The survey was undertaken after this project was completed. The research was guided by the primary research question of: what are the effects on those teachers in 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)

Teachers were instructed 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 1). 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 who received an email reminder from the instructor if they had not completed the survey.

Table 1: Correlation matrix

	Self-regulation	Self-reflection	Self-assessment	Collaboration
Self-regulation	1.000			
Self-reflection	0.531*	1.000		
Self-assessment	0.539*	0.880*	1.000	
Collaboration	0.393	0.593*	0.553	1.000

Note: * = significant at 0.01 level (2-tailed).

E. Assumption and Limitation

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 applicable to all scenarios uniformly.

F. Findings

The following tables (see Tables 2, 3, 4 and 5) show the effect sizes for the comparisons among groups. (Note there are four group based on teachers entrance exam scores. The maximum score is 100, and scores higher than 90 are in Group1, scores ranges 75-89 are Group 2, scores range 60-74 are Group 3, scores lower than 60 fall in Group 4). Statistically, an effect size helps to determine whether a statistically significant difference is a difference of practical concern. Cohen's *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 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-reg 1	Self-reg 2	Self-reg 3	Self-reg 4	Self-reg 5
(1,2)	0.0105	0.0773	0.2197*	0.0853	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)	0.6208	0.0996	0.1946	0.1566	0.2591*
(2,4)	0.0263*	0.3862*	0.4846*	0.4229*	0.4061*
(3,4)	0.7035*	0.2935*	0.3770*	0.3239&	0.1682

Note: * indicates 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).

There were also differences between group 1 and group 4 for 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 3: Effect size in self-reflection learning

	Effect size				
Groups	Self-ref 1	Self-ref 2	Self-ref 3	Self-ref 4	Self-ref 5
(1,2)	0.0307	0.0634	0.2211*	0.1773	0.0903
(1,3)	0.2442*	0.1916	0.3892*	0.1639	0.1259
(1,4)	0.3744*	0.2766*	0.5310*	0.3607*	0.4402*
(2,3)	0.2169*	0.1304	0.1307	0.0242	0.0218
(2,4)	0.3517*	0.2238*	0.2883*	0.1891	0.3426*
(3,4)	0.1610	0.1146	0.1946	0.2290*	0.3839*

Note: * indicates there is a significant difference in effect size.

Table 4: Effect size in self-assessment learning

	Effect size				
Groups	Self-ass 1	Self-ass 2	Self-ass 3	Self-ass 4	Self-ass 5
(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*	0.5319*	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 there is a significant difference in effect size.

There also were differences between other lower achieving groups and higher achieving groups in table 4. The comparison between group 1 and group 4 showed 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 ranking was related to In-service kindergarten teachers' action pedagogy project with the ePortfolio of this study.

Table 5: Effect size in Collaboration

	Effect size			
Groups	Collaboration 1	Collaboration 2	Collaboration 3	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 there is a significant difference in effect size.

Discussion and conclusion

The evidence in this study has provided empirical support for an ePortfolio environment for self-assessment, self-reflection, and self-regulation learning in this course: *In-*

struction 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.

The training for the components of ePortfolio-collaboration, self-assessment, self-reflection, and self-regulation-was extremely successful when performing action pedagogy projects in an electronic portfolio environment. The electronic portfolio architecture created in combination with the process such as knowledge modeling, knowledge storage, and knowledge query composed in knowledge engineering process allowed those elements of institutional self-assessment and legacy archived reports in the ePortfolio system. This prepared them for ePortfolio for those teachers' action pedagogy project designing and to offer a place for teachers to store their work. With project portfolio scheduler interface, it enables teachers' learning processes to be viewed transparently and longitudinally, fostering teachers' collaboration, self-assessment, self-reflection, and their ability in self-regulation and action pedagogy project management. The results presented with hypotheses 1 and 2 therefore support the reported findings of the importance of adequate time and authentic problems when teaching teachers in short-term training.

Q1 required examination of the effect for ePortfolio. 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 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 portfolio.

Therefore, we conclude that ePortfolio provided a place for recording assessment, self-regulation, reflections and developing a level of deep reflective practice, and 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 & Parker, 2009; McLoughlin & Lee, 2010; Van Dinther, Dochy & Segers, 2011).

Another question was related to ePortfolio and the teachers' pedagogy project. The results showed higher performance achievement individuals obtained higher ratings on selected items of collaboration, self-assessment, self-reflection and self-regulation, yet appeared insufficiently motivated to complete the required tasks. Help from instructors to recognize the benefit of ePortfolio are very critical. Zimmerman (1989) claimed that self-regulated learners who have the characteristic of metacognition, reflection, and self-assessment in learning achieve academic success more easily. Further, Minnaert & Janssen (1999) considered self-regulation as a key rubric of academic performance. ePortfolio consisting of self-reflection and self-assessment promotes students in their development and assessment.

In summary, this finding shows 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 the individuals' attitudes, the more they see themselves as being intrinsically motivated, and this can further increase their perseverance in pursuit of goals, joint efficacy, desire for success and joy of learning. Especially, since kindergarten in China is not what it used to be: there is more of it! 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, the figure of enrollment rate in kindergarten is up 85 percent by 2020.

Also, it is apparent from the analysis of teachers' portfolios is a simultaneously challenging and exciting experience. ePortfolio is interoperable from in-service teaching at

Wenzhou 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 developing embedded ePortfolio, linked to professional development and learning. As 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 conclud that teachers highly value the experience they gain through teaching, and they frequently ask for more practical training during their studies. Assessment could also be completed through ePortfolio by 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 in higher education. ePortfolio 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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