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Using a mixed research method to evaluate the effectiveness of formative assessment in supporting student teachers' wiki authoring

利用混合式研究方法来评价形成性评价促进职前教师基于wiki的作品创作的效果

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ABSTRACT

本研究旨在探究在职前教师中，将学习性评价整合到教学过程中从而促进他们基于viki的作品质量是否有效。

学习型评价

This study aims to investigate whether for preservice early childhood teachers, integrating assessment for learning (AfL) is a viable pedagogy to improve the quality of their wiki-based projects. A total of 76 student teachers who were in their first year of study at a teacher training institute in Hong Kong participated in the study. The student teachers were required to apply the skills and knowledge they had learned about ICT skills and concepts of ICT in education to create digital learning materials for young children in a wiki environment and to peer assess their projects prior to formal submission using an assessment rubric created by the author. The data were triangulated from the responses collected from a discussion forum, a questionnaire, and focus group meetings. The content and number of comments made in the discussion forum indicated that the student teachers not only actively contributed ideas to their peers but also took their peers' comments seriously. Their comments were mainly related to project design, followed by content, organization, and credibility. The questionnaire findings suggested that although the students felt that feedback from their peers could facilitate their own learning, they valued their teacher's comments the most. Seven students participated in the focus group interviews to substantiate the opinions they gave in the questionnaire. The interviewees believed that even though their peers provided comments from different perspectives, their teacher's comments were the most important because she graded them. It was concluded that integrating AfL from the teacher and peers could improve the quality of wiki projects.

1. Introduction

Learning and assessment have traditionally been treated as two separate issues, but assessment should be an integral part of the learning experience for students that is embedded in the learning process rather than just occurring at the end of learning activities. Assessment is one of the basic components of a curriculum designed to support learning rather than to select learners, and it should be embedded in the learning process to provide formative feedback (Berry, 2008; Biggs, 1996; Black, Harrison, Lee, Marshall, & Wiliam, 2003, 2004; McInerney, Brown, & Liem, 2009; Morris, 1995). Typically, there are three approaches to assessment: (1) assessment of learning (AoL), that is, ranking students' abilities to enable teachers to know how much they have learned and whether some need extra help; (2) assessment for learning (AfL), which is using assessment to support learning and embedding assessment in the learning process through formative feedback and explicit guidelines (Berry, 2008; Biggs, 1996); and (3) assessment as learning (AaL), which develops students' metacognitive skills so that they can adjust and advance their own learning (Earl, 2003). The assessment process moves from being teacher-centered to student-centered in these assessment approaches: in the AoL approach, the teacher is the only person who assesses students; AfL requires collaboration from students and probably other teachers; and AaL requires students' self-awareness and monitoring.

The user-friendliness of Web 2.0 enables users not only to create a wide variety of materials (e.g., video podcasts, blogs, and wiki publications) but also to invite comments from others (Gray, Thompson, Sheard, Clerehan, & Hamilton, 2010). There are many popular Web 2.0 environments, such as Facebook, Twitter, and YouTube, that are mainly used for social networking, but wikis enable users to easily create and edit a variety of resources, such as text, pictures, hyperlinks to their own web pages and other uniform resource locators (URLs), and videos, on their wiki pages without learning html (Heafner & Friedman, 2008) or knowing how to write program codes. Integrating Wiki

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viki被应用到不同学科的研究有许多

into education is particularly attractive because there are no advertisements and wikis are provided free by online free share websites or learning platforms.

Indeed, there are studies on the use of wikis in different disciplines; for example, wikis can foster collaborative learning in written English (Mak & Coniam, 2008; Wang, 2010), enable a deep understanding of social studies (Heafner & Friedman, 2008), help preservice teachers produce high-quality science materials (Nicholas & Ng, 2009), and develop preservice teachers' generic skills (Lai & Ng, 2011). However, there are also some problems associated with using wikis: for example, students are frustrated by the complex structure of wikis and the possibility of vandalism and plagiarism (Su & Beaumont, 2010); they are also concerned about the openness and high-level participation required when using them (Wheeler, Yeomans, & Wheeler, 2008). In light of the findings of research studies, this study aims to investigate whether AfL can improve early childhood preservice teachers' wiki-based authoring projects, the assessment of which has been found to be substantially different to assessing other Information and communication technologies (ICT)-based activities due to the interactivity and cooperative effort involved (Gray et al., 2010; Ng & Lai, 2012) and the fact that students are less ICT competent in this area. The data would be collected from a discussion forum, a questionnaire, and focus group meetings. The following section reviews the pertinent literature on the role of assessment and the employment of wikis to support learning. This review is followed by a discussion of the research setting and findings. Finally, conclusions are drawn and future research directions are discussed.

2. Literature review

The guiding principles of AfL suggest different formative assessment methods and multiple assessors, including the teacher, other teachers, the students themselves, and their peers (Assessment Reform Group, 1999, 2002; Berry, 2008, 2011). It has also been pointed out that if teachers are to raise the standards of their students, they should make AfL an essential component of classroom work (Assessment Reform Group, 1999, 2002; Berry, 2008, 2011; Berry & Adamson, 2011; Black et al., 2003, 2004; Black & Wiliam, 1998; James, 2008; Marshall & Drummond, 2006). It is found that student teachers who utilize peer assessment outperform their counterparts who do not use this approach and also unequivocally change their perception of assessment, instruction, and the role of the teacher educator (Sluijsmans, Brand-Gruwel, & van Merrienboer, 2002). On the other hand, feedback, questioning, dialog, and sharing successful criteria are also considered to be characteristics of AfL (Hodgen & Webb, 2008; Spendlove, 2009). Indeed, self-assessment and peer assessment have attracted a lot of attention in higher education (Falchikov & Boud, 1989; Falchikov & Goldfinch, 2000).

Peer assessment requires students to be more actively involved in their own assessment and their own learning activities than teacher assessment does (De Wever, Van Keer, Schellens, & Valcke, 2011). Topping (2003) defined peer assessment as "an arrangement for learners and/or workers to consider and specify the level, value or quality of a product or performance of other equal-status learners and/or workers" (p. 65). Usually, rating instruments or checklists are provided to students when they are performing peer assessment (Boud, 1999; Sluijsmans, Dochy, & Moerkerke, 1999). Furthermore, it is important for students to give feedback rather than just marks (Black & Wiliam, 1998; Holroyd, 2000), and timely feedback at an appropriate point in the learning process is also essential so that the receiving peers can use it promptly for their future learning (Brown & Knight, 1994).

ICT can undoubtedly provide a medium for providing timely feedback. Indeed, Macdonald, Weller, and Mason (2002) suggested that "Networking opens up possibilities for enhancing formative feedback to students through peer review, when scripts are posted electronically for comment and review" (p. 10). Ridgway, McCusker, and Pead (2004) believed that e-assessment could support current educational goals and also facilitate the assessment of problem-solving and process skills such as understanding and representing problems, identifying variables, generating and testing hypotheses, and finding rules and relationships among parameters. However, there are also challenges when conducting peer assessments: for example, the students conducting the assessments may not take things too seriously (Higgins, Hartley, & Skelton, 2002; Rada & Hu, 2002), some assessors may prefer to remain anonymous to avoid potential confrontations (Davies, 2003, 2006; Lin, Liu, & Yuan, 2001; Ng, 2002), and the validity of peer assessment is debatable (Davies, 2006; Ng & Lai, 2012).

Creating wiki pages is simple and is similar to creating any other types of web pages except that it does not require any application software, only the use of features supported by a dedicated web hosting service provider. Among all of the features of a wiki, editing is described as "the ultimate typical feature" (Ebersbach, Glaser, & Heigl, 2006, p. 19); other functions include tracking functions, reverting to different versions (Parker & Chao, 2007; Wagner & Bolloju, 2005), and enabling users to post comments. The tracking features also enable educators and researchers to monitor learners' progress by tracing the content, time, and number of revisions (Ng & Lai, 2012; Trentin, 2009). The most unique feature of wiki authoring is collaboration, which enables the owner of a wiki site to grant ownership, collaborative and view rights to other people so that team members can edit and view at anytime and anywhere (Lai & Ng, 2011; Leuf & Cunningham, 2001). Wikis provide the ideal environment for group work when students have to interact and cooperate through actions: for example, to create wiki pages to present their learned knowledge (Elgort, Smith, & Toland, 2008). Lai and Ng (2011) uncovered the potential of using wikis to develop student teachers' knowledge and various generic skills, such as ICT skills, collaboration skills, and organization skills, through collaborative activities and inspiration gained from peers' work. In sum, wiki authoring enables collaboration, fosters creative expression and knowledge sharing, and develops communication skills and information literacy (Barnes & Tynan, 2007; Berlanga et al., 2007; Brown & Adler, 2008; Elgort et al., 2008; Lai & Ng, 2011; Lamb & McLaughlin, 2008).

viki的作用

wiki提供了理想的环境小组工作,当学生必须通过行为互动和合作时

Assessing the collaborative efforts involved in wiki authoring work also poses significant challenges to teachers and inhibits the use of AfL, especially for large-sized groups (Gehringer, Cassel, Deibel, & Joel, 2008; Palomo-Duarte, Dodero, Medina-Bulo, Rodríguez-Posada, & Ruiz-Rube, 2012), and yet when students are given assessment rubrics prior to an assessment, they can be guided to perform to the level they wish to achieve (Huba & Freed, 2000; Palloff & Pratt, 2003). Using rubrics for assessment can facilitate communication and feedback between teachers and students: Teachers use rubrics to provide feedback to students while taking into consideration the various aspects of the assessment, and by referring to the assessment rubrics, students know which aspects of their work they have to improve (Andrade, 2000).

强调评价量表的重要性。

An assessment rubric usually consists of a range of performance criteria with ratings or descriptors to further delineate the assessment criteria. More importantly, a rubric makes key criteria public so that students can use them in developing, revising, and judging their own work (Huba & Freed, 2000; Piedra, Chicaiza, Lôpez, Remergro, & Tovar, 2010). Penny and Murphy (2009) reviewed 50 assessment rubrics that were used to evaluate an online asynchronous discussion and found that the criteria fell into four broad categories: cognitive (44.0%),

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mechanical (19.0%), procedural/managerial (18.29%), and interaction (17.7%). Piedra et al. (2010) created a rubric for assessing wiki authoring, in particular to measure collaboration and creativity skills; the rubric included (1) intellectual engagement with key concepts, (2) structure, spelling, and grammatical errors, (3) content and understanding, and (4) creative construction. However, there are some other points that need to be taken into consideration such as some students are more lenient than others (Ng & Lai, 2012) and repeating peer assessment procedures could improve their acceptability, reliability, and validity (De Wever et al., 2011; Gehringer et al., 2008).

3. The research questions

The wiki-based project in this study was designed not only to enable the participants to complete their assignments but also to enable the author to explore whether AfL, in particular, peer assessment, can support learning, because the versatility of wiki authoring has proved difficult to assess (Anderson, 2007; Elliott, 2007; New Media Consortium & EDUCAUSE Learning Initiative, 2008; Selwyn, 2007). To attain the research objective, the following four broad research questions were formulated:

1. *What types of comments did the students give to improve their peers' wiki projects?*
2. *Did peers' comments help to improve the students' wiki projects?*
3. *What are the more helpful formative assessment approaches to improve students' wiki projects?*
4. *What are the less helpful formative assessment approaches to improve students' wiki projects?*

Mixed methods, both qualitative and quantitative, were used to collect data. Robson (1993) stated that "using more than one method in an investigation can have substantial advantages, even though it almost inevitably adds to the time investment required" (p. 290). He also argued that one important benefit of multiple methods is the reduction of inappropriate certainty. A mixed methods research design is a procedure for collecting, analyzing, and "mixing" both quantitative and qualitative research data in a single study to understand a research problem (Creswell & Plano Clark, 2007). Quantitative data were gathered from postings on the discussion forum to answer questions 1 and 2 and from responses to the questionnaire to answer questions 3 and 4, while qualitative data were gathered from focus group meetings to substantiate the questionnaire responses. The quantitative and qualitative data complemented each other to elicit a holistic picture of whether formative assessment can support wiki authoring.

4. The study

4.1. The participants

The study was conducted during the Autumn Semester of 2012 at the Hong Kong Institute of Education. The participants were student teachers enrolled in preservice early childhood education programs, all of whom were training to become kindergarten teachers (K1–K3). There were two classes of participants (76 students in total), and each class consisted of 38 students. All of the students were females who had just graduated from secondary school; none of them had ever used ICT as a medium for formative assessment.

4.2. The structure of the course

During the period of this study, the students were taking an "Information Technology in Education" course with the author during the first semester of their study program. This course was a 2-credit point course, which meant that the students attended a two hour lecture and/or a hands-on practical session every week. During the course, they learned some information technology and information technology for early childhood education concepts and some practical software skills, such as PhotoImpact, Photostory, Windows Movie Maker, and techniques of creating wiki pages using Google Sites. Most of the software taught was free of charge, and so the students could easily transfer the skills and techniques they acquired to their workplaces after they graduated. Prior to the study, they had learned how to evaluate multimedia resources and worked in groups of three to evaluate a web site for children; each group had evaluated the same site using one of three given assessment criteria (Haugland & Shade, 1997; Hong Kong Quality Education, 2012; Wong, 2002) and then compared their opinions afterward. The course lasted for 13 weeks, and there were two major assessments: (1) a group wiki project, the aim of which was to design a resource to teach any topic related to early childhood education, as online activities should be authentic, useful (Basque, Dao, & Contamines, 2005; Paige, Lloyda, & Chartres, 2008), and contain enough elements for every team member to have something to work on (Nicholas & Ng, 2009); (2) an individual essay on any critical issue related to ICT in early childhood education. Each assessment carried 50% of the total assessment. This study discusses the tasks involved for the first assignment.

4.3. The tasks

Groups of three to five students were formed, and there were 11 groups in each class. The task was to apply the skills and knowledge they had learned to create wiki pages. To integrate content, pedagogy, and technology (Hughes, 2005; Koehler, Mishra, & Yahya, 2007), the author created a wiki site for the students to link their wiki projects, as shown in Fig. 1. The first column shows the assessed groups; the second shows the identities of the groups; the third indicates the names of the students, but these have been removed to protect their identities and uphold privacy; the fourth indicates the themes of the wiki projects; and the fifth shows the universal resources locations of the wiki pages.

With reference to the literature (Barton & Heiman, 2012; Ng & Lai, 2012; Piedra et al., 2010) and web resources, the author came up with an assessment rubric that consisted of four criteria, namely, content, design, organization, and credibility. The assessment rubric was meant to give the students some guidance on giving comments rather than model answers to grade their peers' work. To avoid unnecessary ill feeling among them, the students were asked to give comments rather than to grade their peers (Davies, 2003, 2006; Lin et al., 2001; Ng, 2002). The wiki project guidelines and the assessment rubric were uploaded onto the wiki site for easy reference. The following requirements had to be fulfilled:

同學網頁

評估組別	組別	組員	報告題目	報告的網址
2, 3, 4, 5	1		新年	https://sites.google.com/a/s.ied.edu.hk/itgp1-chinesenewyear/
3, 4, 5, 6	2		新年	https://sites.google.com/a/s.ied.edu.hk/xin-nian-kuai-le/

Fig. 1. Sample page from wiki site.

(1) The students had to apply the knowledge and skills they had learned in class to create, on the designated wiki site, learning materials on any topic of their choice to enable kindergarten pupils to learn (Lee & Woods, 2010; Wong, Kamarish, & Tang, 2006).
(2) Each student had to provide constructive comments to four other groups (Berry, 2008; Morris, 1995) in a discussion forum in the last class with reference to the given assessment rubric, although they were free to add extra criteria. It was suggested that they give at least one positive remark and one suggestion for improvement. Peer assessment was deemed to be aligned with the collaborative nature of the wiki projects.
(3) Each group had to read and discuss the feedback from their peers and then respond to the comments on what to revise.
(4) Each group had to revise its wiki project according to its plans.

5. Data collection

Data were collected in three phases so that data from one source could enhance, elaborate, or complement the data from the other sources (Greene & Caracelli, 1997; Rossman & Wilson, 1985). Since some students had expressed some opinions while doing their wiki projects and some were just testing out the comment functions of wiki pages, when they were learning how to edit wiki pages, they were asked in the first phase to give their comments on the MOODLE discussion forum, the standard learning platform provided by the Institute, for easy reference.

In the second phase, the students were asked to fill in a 7-point Likert scale questionnaire ranging from 1 (very strongly disagree) to 7 (very strongly agree) after they had completed the above tasks; completion of the questionnaire was voluntary (please see Table 1 for the questionnaire items). The closed-ended questionnaire provided data that were efficient to collect and analyze (Teddlie, 2009). The questionnaire was adapted from the 10 guiding principles of AfL (Assessment Reform Group, 1999, 2002; Berry, 2008, 2011). Modifications were made to three questions: Question 4 was changed from "considering drawing on joint efforts among colleagues" to "whether ICT can provide a good platform to facilitate assessment" as there was only one teacher and no question was asked on the role of ICT; Question 7 was changed from "using assessment to uncover students' learning" to "whether assessing peers' work can uncover your own learning" as the students evaluated their peers rather than their pupils; and Question 10 was changed from "analyzing and reporting students' results" to "whether analyzing others' comments can help you to refine your project" as the students did not analyze or report any results of the class, nor did they play the teacher's role in understanding their class's performance. In addition, two items were added to reflect the research contexts: "I feel that the teacher giving feedback prior to final submission is a good approach" was added because the questionnaire primarily focused on peer assessment; "I feel that authoring a wiki project enables me to integrate technology with content, pedagogy, and knowledge" was added because this was the aim of the assignment. In fact, all of the 10 principles were slightly reworded to reflect the nature of a questionnaire.

Table 1
Means and standard deviations of questionnaire findings ($n = 62$).

Rank	Question	Mean	SD
1	Q.11) I feel that the teacher giving feedback prior to final submission is a good approach.	5.24	0.9
2	Q.8) I feel that having marking criteria accessible to me can guide me in group projects.	5.11	0.87
3	Q.9) I feel that feedback from my peers can facilitate my own learning.	5.08	0.893
4	Q.12) I feel that authoring a wiki project enables me to integrate technology with content, pedagogy, and knowledge.	4.98	1.349
5	Q.10) I feel that analyzing peers' comments can help me to refine our group project.	4.92	1.076
6	Q.7) I feel that assessing my peers' work can uncover their learning.	4.9	0.987
7	Q.6) I feel that allowing students (my peers and me) to take part in the assessment process is useful.	4.82	1.033
8	Q.4) I feel that ICT provides a good platform to facilitate assessment.	4.79	1.282
9	Q.1) I feel that my group project has aligned assessment to learning.	4.74	1.159
10	Q.3) I think that the assessment methods are conducive to learning.	4.74	1.085
11	Q.2) I feel that multidimensional assessment methods were used during the project.	4.53	1.141
12	Q.5) I liked having my project assessed throughout the learning process.	4.35	1.202

The third phase of data collection involved focus group interviews. Focus group interviews allow for interaction among interviewees, the collection of extensive data, and participation by all individuals in a group (Krueger, 1994). Krueger and Casey (2000) defined focus groups as "a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" (p. 5). The students were invited to take part in a semi-structured interview to substantiate the views on integrating AfL reflected in the questionnaire responses. Since only two students had initially indicated their interest in participating in the questionnaire, all of the students were again invited to do so by e-mail. The interview questions were the same as those in the questionnaire but without questions 3, 6, 7, and 10 as these might have taken up too much of the interviewees' time in the focus group interviews and the author did not expect that the students would have strong opinions on them. Nevertheless, they were asked if they had encountered any difficulties in performing peer assessment and whether they had any suggestions on how the activity could be improved. The research assistant conducted the focus group interviews in Chinese and then transcribed the interviews and sent the transcripts to the interviewees for confirmation. The Chinese transcription was translated by the research assistant and later edited by the author.

6. Findings and discussion

6.1. *Responses gathered from the discussion forum*

From the statistics gathered from MOODLE, it was shown that a total of 541 comments were made, which suggested that the students were eager to render their comments to their peers. The comments were classified into different categories and entered into an Excel file by the research assistant as instructed by the author. Among the comments, there were 283 positive comments, 258 comments related to room for improvements, and 93 feedback comments from the evaluated group to the reviewers. On average, there were 3.7 positive comments, 3.4 comments per student related to room for improvements, and 3.9 feedback comments per group to their reviewers.

With regard to research question 1 (*What types of comments did the students give to improve their peers' wiki projects?),* it was found that 201 positive comments were related to design, 158 to content, 45 to organization, and only 1 to credibility, whereas 152 of the comments related to room for improvements were related to design, followed by 116 comments related to content, 25 comments related to organization, and only 8 related to credibility. The findings showed that most of the positive and negative comments were related to design issues, followed by content matters, and that none of the students came up with any other assessment criteria.

Some comments were short and fitted into one criterion, while others were longer and addressed more than one criterion. For example, one student said, *"You have created this wiki site with great dedication; it is rich in content and well structured, with good ideas which will attract children's attention"* (Example 1), a comment that was related to both content and organization; the same student also made a comment on room for improvements, "You could spend more time on organizing the materials, perhaps adjusting the fonts and the size of pictures", which was related to design and organization. Another student made comments to another group (Example 2): The positive comments *"The wiki matched the learning objective; the important points were in bold, which was clear"* were related to content and design, as were the comments on room for improvements: *"Regarding the four ways to be environmental friendly, the wordings might be too difficult for young children; it would be better to have background colors. On the recycle page, you might like to add some pictures"*.

It was observed that 11 groups gave an overall response, as suggested by the author; 3 groups replied to all of the comments; 3 groups gave responses to some reviewers; and 5 groups did not respond to peers' comments at all. Although some groups responded to each reviewer, one group responded *"Thanks for your comments and we shall revise soon"* in about half of its responses rather than addressing comments individually. Of the 17 responding groups, 6 responded after they had read their peers' reviews, 9 responded after they had revised their wiki site, and 2 responded to their peers' comments after reading them and also stated what they had revised. With regard to research question 2 *(Did peers' comments help to improve students' wiki projects?),* it was observed that all of the responses were related to reviewers' feedback regardless of when they responded, which suggested that their peers' comments were helpful in improving their projects; for example, the group feedback to the comments in Example 2 after they had read the reviews was *"Thanks for your comments. We have* consolidated your comments and will make changes such as reducing the number of words, increasing the font size, adding more images, and adding an instruction for the 'game' page and will consider how to make children become leaders in environmental protection". However, not all of the suggestions could be tackled due to some technical limitations; for example, the group feedback to the comments in Example 1 was "We made changes according to peers' feedback, such as enlarging the font size and photos. However, when we tried to enlarge the pictures, it affected the presentation of the whole page, which made the presentation very messy. Furthermore, we found that the presentation of the wiki site was different when using different browsers, so we had to stick to the original picture sizes". Nevertheless, it was very clear that peer assessment could improve the quality of the students' wiki projects.

6.2. *Responses from the questionnaire and focus group meetings*

A total of 62 returns were received, representing a return rate of 82%, which was very encouraging. The data were entered into an Excel file and were analyzed by using its functions. The mean of the responses ranged from 4.35 to 5.24, suggesting that the students were positive toward AfL as all of the responses were more than 3.5, which is the mean for a 7-point Likert-type questionnaire (see Table 1). Students were invited to participate in focus group meetings to substantiate the opinions they had expressed in the questionnaire. Three volunteer student teachers attended individual interviews, and four volunteer students attended semi-structured interviews together ($n = 7$). In the group interviews, not all of the students voiced their opinions on the questions asked.

With regard to research question 3 *(What are the more helpful formative assessment approaches to improve students' wiki projects?),* they treasured the educator's feedback most (question 11, ranked first item) (Biasutti & El-Deghaidy, 2012; Hanrahan, & Isaacs, 2001; Su & Beaumont; 2010) because *"the teacher's opinion is always more accurate and comprehensive than that of peers and so improvements can be made"* (Hanrahan & Isaacs, 2001). The students felt that when marking criteria were accessible, these could guide them in group projects (question 2, ranked second item) (Huba & Freed, 2000; Piedra et al., 2010). Three of the interviewees agreed with this opinion because they felt that access to marking criteria allowed them to *"know which aspects and criteria are required",* but three others thought that the criteria were too vague, and one did not give any comments because she believed that rubrics alone were inadequate to prepare for conducting a

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peer assessment (De Wever et al., 2011; Gehringer et al., 2008; Ng & Lai, 2012). All of the interviewees embraced peer assessment: *"feedback from my peers can facilitate my own learning"* (question 9, ranked third item) (Brown & Knight, 1994). Individual comments included *"evaluation from many people will always be more significant than self-checking"*, *"peer evaluation can help us to save time searching for mistakes"*, and *"different people might have different perspectives toward the topic and design"*.

Regarding research question 4 *(What are the less helpful formative assessment approaches to improve students' wiki projects?)*, the students disliked having their projects assessed throughout the learning process the most (question 5, the least rated question). However, opinions gathered from the focus group meeting were mixed. Three of the interviewees thought that it was a good idea to have their projects assessed throughout the learning process, while another three voiced some concerns, such as the process being time consuming and not having sufficient time to make revisions after receiving feedback from peers. The interviews helped to clarify that the issue was not the constant efforts required for formative assessments (Higgins et al., 2002; Rada & Hu, 2002); rather, the students had a realistic concern about such assessments. The students did not feel that multidimensional assessment methods were used during the project (question 2, the second least rated question). In the interviews, the students stated that only peer evaluation had taken place, and therefore they did not think that multidimensional assessment methods had been used, although some of them did self-evaluations of their own accord. In fact, there could be two ways of interpreting the term "multidimensional assessment methods": (1) the use of different assessment approaches, such as AoL, AfL, and AaL; and (2) the assessment of different aspects of the wiki project, such as content, design, and organization, rather than just one aspect (Berry, 2008, 2011; Berry & Adamson, 2011; Black et al., 2003, 2004; Black & Wiliam, 1998; Earl, 2003; James, 2008; Marshall & Drummond, 2006).

The third least rated questions were "*I feel that my group project has aligned assessment to learning*" (question 1) and "*I think that the assessment methods are conducive to learning*" (Question 3). Both questions had the same average scores. As mentioned above, the interviewees were not asked for their opinions on "*assessment methods are conducive to learning*". Although they all felt that their group project had aligned assessment to learning, their main concern was not having sufficient time to revise their projects prior to submission because they had to submit both an individual essay for this course and other assignments within two to three weeks, which reinforced what they had expressed earlier.

It was encouraging to know that none of them had encountered any difficulties with peer assessment, but one student thought that only being given one hour to do the peer assessment was too short. Regarding the suggestions for improving the research activity, one student suggested that the teacher should demonstrate how to evaluate a wiki site so that students could understand the criteria and assessment rubric better (Ng & Lai, 2012; Piedra et al., 2010), thus helping to produce more reliable results (De Wever, 2011). This suggestion was probably due to their lack of peer assessment experience rather than the complex structures of wiki. One student thought that using wiki as an environment for a group project is very restrictive as only one person can edit a page at one time; this comment is understandable as although wikis embrace collaboration, there is the logistic problem of tracking the time and the author of changes made. Another student suggested that the teacher should give comments after completion of the draft and again after revisions had been made, while another student believed that it would be better for the teacher to meet each group individually to give formative feedback. These suggestions further reinforces students' preference for teacher's input over that of their peers (question 11) (Biasutti & El-Deghaidy, 2012; Hanrahan & Isaacs, 2001; Su & Beaumont, 2010).

7. Conclusions and directions for future research

This article has discussed a research study involving student teachers who intend to teach in kindergartens in Hong Kong. These students created digital learning materials for young children in a wiki environment and peer assessed their projects prior to formal submission. The data were triangulated from the responses collected from a discussion forum, a questionnaire, and focus group meetings. The findings from multiple sources were complementary to each other. Contrary to the common belief that students may encounter problems in assessing wiki projects which are complex and versatile (Anderson, 2007; Elliott, 2007; New Media Consortium & EDUCAUSE Learning Initiative, 2008; Ng & Lai, 2012; Selwyn, 2007), the students in this study did not encounter any such problems: perhaps being given an assessment rubric was helpful (Huba & Freed, 2000; Palloff & Pratt, 2003) or perhaps they had experiences of evaluating multimedia resources prior to peer assessment (De Wever et al., 2011; Gehringer et al., 2008).

The content and number of comments made during the discussion forum indicated that these early childhood education student teachers not only actively contributed ideas to their peers but also took their peers' comments seriously. Their comments were mainly related to the design of the wiki projects, followed by the content (research question 1). They found their peers' comments helpful and revised their wiki projects accordingly (research question 2). On the other hand, they believed that comments from their teacher were the most important because she would grade them (research question 3). They did not like having their projects assessed throughout the learning process due to time constraints, and they did not feel that multidimensional assessment methods (research question 4) had been used as only peer assessment had been conducted.

The triangulated findings revealed that the authority and experience of the teacher was most crucial for the AfL approach (Biasutti & El-Deghaidy, 2012; Hanrahan & Isaacs, 2001; Su & Beaumont, 2010) even though the student teachers valued peer assessment. Moreover, we have to be mindful that there are some limitations of this study. Firstly, the findings of the study may not be generalizable due to the limited sample size. Secondly, the responses of the students were based on their subjective perceptions rather than on objective data such as comparing their projects prior to and after formative assessment. Thirdly, the findings are confined solely to the context of the study.

It is encouraging that the findings confirm that AfL is a viable and preferred learning approach (Gray et al., 2010; Lai & Ng, 2010; Ng & Lai, 2012) not only for ICT major student teachers but also for early childhood education student teachers. Regarding the students' suggestions, these were mainly related to the insufficient amount of time given for assessment, revision, and further comments from the teacher rather than to AfL. Their concerns suggested that they embraced AfL and would like to improve their projects further. Sometimes, it is really hard to balance reality and wishes. For example, the students suggested that they should have been given more time to revise their wiki projects as they needed to apply the knowledge and skills they had learned in class to them, but providing this time would have been difficult due to time constraints. They would also have preferred the teacher to have given them her comments after they had made modifications, but this would have been even more difficult to implement as they finished their classes in early December and had to submit their assignments one

week later and the teacher had to submit the final grades within one month as there were holidays in late December and other assignments to grade.

There are two viable directions for future study. First, a training session on assessment could be arranged for participants so that they could gain a better idea of the requirements of peer assessment and also learn how to perform an assessment (Piedra et al., 2010). Similarly, the next cohort of students could be asked to use the author-designed assessment rubric to evaluate an educational web site rather than just using three different criteria so that they would become more familiar with the given rubric (De Wever, 2011) and could internalize the assessment criteria (Gibbs, 2006). Furthermore, the teacher could discuss constructive feedback with students to give them a clear idea of what it means (Sluijsmans et al., 2002). Second, since in this project, students provide their comments on a platform which is flexible and accessible, future students could be given a few more days to give more detailed reviews rather than restricting them to giving comments during class time as assessment requires lots of time when students treat peer assessment seriously. Thirdly, as students take the course in their first year of study, the author could seek research partners to examine the longitudinal effect of peer assessment as time appears to provide more reliable and helpful peer assessment (De Wever, 2011; Gehringer et al., 2008; Ng & Lai, 2012). Fourthly, to validate the value of peer assessment, perhaps one class could do peer assessment while another class (control group) does not and the quality of students' work could be compared (Sluijsmans et al., 2002).

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