

## **Supporting Teachers' Reflection and Learning through Digital Teaching Portfolios with Multiple Aids**

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**Abstract:** This study proposed the design of digital portfolios with multiple aids, such as self-assessment, peer assessment, discussion, and journal writing. This study also empirically evaluated the reflection and professional development as demonstrated in digital teaching portfolios with multiple supporting measures. Forty-four in-service substitute teachers participated in a course of classroom assessment and used a digital portfolio system. Based on the framework of teacher reflective thinking developed by Sparks-Langer, Simmons, Pasch, Colton, and Starko (1990), we found that most teachers demonstrated moderate levels of reflection in their journals, although did not show the highest level of reflection. We also found that the professional knowledge of teachers about classroom assessment, as shown by their implementation of it, improved significantly during the process of constructing portfolios. The above findings provide substantial evidence that using portfolios, specifically digital portfolios with multiple aids, improved teacher reflection and professional development.

**Keywords:** reflection, learning, digital teaching portfolios

### **Background and Purposes**

In the past decade, many scholars have promoted the application of teaching portfolios in teacher training institutions or other in-service training occasions (Darling-Hammond & Snyder, 2000; Yost, Sentner, & Forlenza-Bailey, 2000; Zeichner & Wray, 2001). Many teacher training institutions use teaching portfolios as an instruction method for enhancing teachers' professional development. Scholars also find that teaching portfolios are helpful to enhance teachers' domain knowledge or pedagogical knowledge, teaching practice, learning, and reflection (Athanases, 1994; Bart & Collins, 1993; Borko, Michalec, Timmons, & Siddle, 1997; Darling, 2001; Krause, 1996; Loughran & Corrigan, 1995). Though the application effects of teaching portfolios in teacher training institutions have been widely recognized and appreciated, it is worth noting that related studies are currently subject to several limitations (Zeicher & Wray, 2001).

One of the issues is that the evaluation of the empirical effects of teaching portfolios on teachers' professional growth has yet to be made. Although teacher's professional growth has always been one of the most important topics of the study on teacher training, the issue of effectiveness has been ignored until recent years. What of particular interest are: What do teachers learn in the professional growth programs (Wilson & Berne, 1999)? What is the impact of the changes in their teaching practices as a result of professional growth programs

on the students' learning (Fishman, Marx, Best, & Tal, in press; Garet, Porter, Desimone, Birman, & Yoon, 2001)? Teaching portfolio is also a tool used to enhance the professional growth of teachers, but there are only very limited studies exploring the empirical effects of teaching portfolios as a tool for teachers' professional growth (Borko et al., 1997; Wade & Yarborough, 1996; Zeichner & Wray, 2001). For example, most of the studies exploring teaching portfolios and teachers' reflective thinking in the past ten years agree that teaching portfolio can be used as a tool for teachers to "demonstrate" their teaching reflections. But because many of the studies use descriptions or anecdotal records to illustrate the experience of implementing teaching portfolios in the curriculum or the performance of the learners, many researchers question if descriptions and anecdotal records are capable of providing objective evidence of the proposition that teaching portfolios are related to reflective thinking (Borko et al., 1997; Wade & Yarborough, 1996). Further, although some scholars (Borko et al., 1997) use qualitative description to present the changes in students' knowledge about teaching, practices, or beliefs during the construction of teaching portfolios, and some use quantitative methods in exploring the factors affecting the application of teaching portfolios (Wade & Yarborough, 1996), we still know very little about what actually happens to the teachers' professional growth after they have learned in programs mainly using teaching portfolios—such as the improvement in professional knowledge, the interaction with peers in the professional community, the reflections on their professional roles, etc. The first objective of this study is to use empirical and quantitative methods to find out the changes in teachers' professional knowledge and the level of teaching reflection they demonstrate.

The second concern regarding that the process and effects of implementing digital teaching portfolios requires exploration. Considering that portfolios based on printed material are subject to difficulties of search and query, transportation and exchange, management, and determining the ownership (Georgi & Crowe, 1998), many researchers in recent years attempt to implement portfolio assessment with the help of information technology. The advantages of electronic portfolios can be generally described as: diversity of portfolio content production, convenience of storing/managing portfolio items, facilitated distribution/presentation of materials, etc. (Georgi & Crowe, 1998; Kilbane & Milman, 2003).

Studies on the application of digital portfolios in teacher training courses are very rare (e.g. Kariuki & Turner, 2001; Wright & Stollworth, 2002). Little has been learned about issues related to digital teaching portfolios, such as the process of applying digital portfolios in the teaching or learning of teachers and its advantages and weaknesses; the effects of applying digital portfolios on promoting teachers' professional growth; and the comparison of its effects with the effects produced by portfolios based on printed material. Therefore, more effort is required to address this issue (Zeichner & Wray, 2001). The second objective of this study is to learn about the process that teachers experience in constructing digital

portfolios through a Web-based portfolio assessment system, and to take advantage of the convenience of presenting works, making exchange and interaction, and making records in an Internet-based environment to find out the level of teachers' reflection and the changes in their professional knowledge during the construction of digital portfolios.

## **Method**

### *Participants*

The participants of this study are 44 substitute teachers of elementary schools attending a credit program on classroom assessment in National Taipei Teacher's College, Taiwan. All these substitute teachers have a bachelor's degree or higher, but have not yet finished the mandatory program of education studies for teacher certification. All were still teaching in elementary schools as they attended the program.

### *Research Design*

The study used the single group pre- and post-test design. The quantified observation variables are the teachers' state of self-reflection demonstrated in the teaching portfolios and scores of their homework. The content analysis of the teachers' reflection journal in their teaching portfolios and the content of their interactive dialogue on the Internet are used as the basis of reinforcing and refining the quantified information.

### *Research Tools and Materials*

*The classroom assessment course:* Class assessment is one of the mandatory courses of education studies program for obtaining the teacher certificate at the National Taipei Teacher's College. Each teacher is supposed to present their required homework or learning results through the System of Portfolio Assessment on the Net. There are three designated entries for portfolios in this study: the first is "required homework"; the second is "other efforts besides the homework", and the third is "reflection journals". In the required homework category, students submit related homework according to the curriculum topics laid out in the plan of this study. The curriculum topics include seven units, in which six units with homework are listed as Table 1. Each of the units has a corresponding homework and supporting activity. The objective of the supporting activities is to promote teachers' introspection regarding what they have learned in the classroom and their works in the portfolios through the peer review of and opinion- exchange about the contents in the portfolios of their fellow learners. Most of the supporting activities are implemented through the Web-based Self- and Peer-Assessments System, or Web-SPA (Sung, Lin, Lee, Chang, in press).

In the part of "other efforts besides the homework," the teachers are asked to select and present five instances of the results from efforts other than the required homework. For the sake of comparison, this study also required that of the five items in the "other efforts" entry, teachers include two items using the same assessment methods as in the "required

homework” but administered to different students or on different subjects. Moreover, the two items must be submitted two weeks after the submission of all the “required homework” and the completion of supporting activities such as peer-review, assessment or discussion.

The reflection journal is a journal of a teacher’s thoughts after contemplating on her own learning or the results of her teaching, or after peer review and discussion about the content of the portfolios. The journals should cover at least two main aspects: one is the reflection on the practices of class assessment; the other is the thought and reflection stimulated by peer-review, discussions, or evaluation of the products of other learners. Teachers have to write at least one journal article every other week.

*The System of Portfolio Assessment on the Net (SPAN):* The SPAN (Chang, Sung, & Huang, 2002) is designed for this study so that teachers and students may conduct portfolio assessment activities. SPAN has an authoring tool interface allows teachers to design customized portfolio assessment that contains the portfolio entries suited to their needs. The teachers do not need to be familiar with knowledge about web page design or database. Further, SPAN is convenient for students to use. Students may construct their own portfolio content effortlessly by uploading the works they have completed to the web-based database designated by the teacher. Moreover, the sharing and communication interface provided by the system helps students share and communicate the content of their portfolios at any time, in any place.

*Rating scales for evaluating homework:* To compare the works of the first round, which are submitted in the entry “required homework”, and the works of the second round, which use the same assessment methods but on different topics or students of different classes are submitted as part of the “other efforts,” four sets of rating scales are constructed for the four coincided homework, namely test-item design, performance assessment, assessment on affection and social interaction, and implementation plan for portfolio assessment. The rating scales designed in this study are all Likert type seven-point scales, as shown in Appendix 1.

#### *Research Procedure*

This study started in mid-January 2002 and ended in late July 2002, in a course of six and a half months. In this six-and-a-half-month course, class meetings took place about once every two weeks, with fourteen meetings in total. During the classroom instruction time, the researcher introduced the content and concepts of the six units, answered questions related to the homework of the last classroom meeting, and explained the requirement of the homework and possible solutions before the class was dismissed. After the classroom meetings, the students submit their homework on the Internet using SPAN. After all the students have submitted their homework, in case other activities such as self-assessment, observation, or peer assessment are scheduled, the teacher would make the homework accessible and sets up

the procedures in Web-SPA to allow student access for online activities (which usually lasts for one week).

## **Results**

### *The Reflection Demonstrated by Teachers in the Teaching Portfolio*

This study conducts content analysis of the content written by the students in the introspection journals. Since each student writes reflection journal every other week, each student should have 13 articles in his journal. But four of the students have actually written 16 articles, six of them 15 and one 14, the total number of journal entries is 597. This study makes analysis based on the interpretive content analysis by Baxter (1992): units of the journal content based on sentences are analyzed for the frequency of the semantic equivalent of “reflection” appearing in the students' journal content. For defining the semantic equivalent of reflection, we revised the framework of reflective thinking by Sparks-Langer et al. (1990). The journal content related to reflection is divided into seven levels as shown in Table 2. Two graduate students numbered the content of each sentence in every journal entry, and chose the paragraph that has the highest level of reflection to represent the level of reflection of the entire journal entry. When the two graduate students have discrepancy in their judgment of the highest level of reflection in a given journal entry, discussion is required to build consensus. Due to the limitation of the space, the content of the reflection journal can not be shown here. We present the qualitative analysis of the reflection and changes of learning as the following.

As shown in Table 2 are the number of teachers who have demonstrated reflection on levels 1 to 7, and the proportion of the number on each level to the total number. The maximum number of teachers on any level is 44; the minimum is 0. Each teacher can be marked no more than once on any level, but because not every journal article shows the same level of reflection, one teacher may be categorized in several introspection levels at once. The percentage means the number or proportion of teachers in the class that have achieved (or demonstrate) a certain level of reflection in the entire process of constructing portfolios. As Table 2 shows, more teachers have achieved introspection level 5 than on any other level, and all the teachers have explained their rationale of assessment based to the professional knowledge they have learned. The second largest number is on level 3, and 77.3% of the teachers have used professional jargons to state their own assessment methods without explaining the reasons. As for reflection of higher levels such as level 6, 68% of the teachers have achieved that. This means that  $\frac{2}{3}$  of the teachers are able to take other contexts, such as characteristics of the class or the students, into consideration when they think about the content of their own teaching assessment; but  $\frac{1}{3}$  of them fail to consider other contexts such as student or school characteristics in their introspection journal. Only 15 teachers have demonstrated reflective thinking on the highest level. In other words, about  $\frac{2}{3}$  of the teachers did not mention in their journals their observation on the possible influence of

education policies, social issues, and ethical and moral issues on teaching assessment or their interrelation.

### *The Changes of Learning Shown in the Teaching Portfolios*

In Table 3, among the assignments submitted in the “other efforts” entry by the participants with topics on assessment methods that overlap with those of required homework, 31 are about test-item design, 25 are about performance assessment, 14 are about assessment on affection and social interaction, and 18 are about portfolio assessment implementation plan. In those cases, all the students submit two versions of their homework to the “required homework” entry (before the peer review/sharing/interaction) and to the “other efforts” entry (after the peer review/sharing/interaction), respectively, so there are 88 copies of work with two versions. Two graduate students majoring in education assessment scored the works according to the four set of scoring scales in Appendix 2. When the scores are different by more than 10 points, they discuss the source of the discrepancy and make appropriate adjustments.

In order to know how the quality of the works changes before and after the participants make their portfolios available for peer review, exchange, and interaction, we used the Wilcoxon matched-pairs signed-ranks test to compare the scoring scores of the two versions of work. As Table 3 illustrates, the differences of scores between the two versions on the topics of test-item design, performance assessment, and portfolio assessment implementation plan are significant (the Z values are -3.10, -2.19, -3.02, respectively). But the difference of scores between the two versions on the topic of assessment on affection and social interaction is not significant ( $Z=-1.67$ ). Table 3 also shows that the assessment scores of the second version are obviously higher than those of the first version, which means that the quality of the teachers' works on evaluation methods improved significantly after reviewing the portfolio of other students and the discussion and interaction with peers.

### **Conclusion and Implication**

In this study, we illustrate the level of reflection demonstrated by teachers using a digital teaching portfolio. We also found that teachers' professional knowledge of classroom assessment, which represented by the homework about using those assessment in teachers' classroom practices, increased after sharing and discussing the content of their portfolios. Though more detailed analyses of the data of the discourse, reflection, and learning are needed to determine the possible relationship among teachers' learning, reflection, and interaction initiated during the process of constructing portfolios, we believe our finding are helpful for providing more empirical evidence of using portfolios as a tool for teachers' professional development. We hope we can have more elaborate analyses for the data in the near future to get a clearer understanding about the relationships among those factors.

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Table 1: *The homework items and supporting activities of the class assessment course*

Number	Name of homework	Supporting activities
1.	Test-item design and test analysis	Self-assessment on one's own products according to the standards determined by the teacher
2	Performance assessment	Peer review of classmates' works
3	Assessment on affection and social interaction assessment	Peer review of classmates' works
4	Portfolio assessment implementation plan	Observation of other web sites (in the book??)
5.	Self/peer assessment	Peer assessment of classmates' works according to standards determined by the teacher
6	Multiple-approach assessment in integrated curriculum	Self- and peer- assessment according to the standards determined by the students themselves

Table 2: *The students' level of reflection in reflection journals and number of instances*

Level	Description	Number of articles (percentage)	Number of teachers (percentage)
1	The content of the journal has not connection with events or methods of classroom assessment	15(2.5%)	12(27.3%)
2	Description of classroom assessment events with simple, lay language	41(6.9%)	23(52.3%)
3	Description of classroom assessment events or methods using appropriate jargons without stating the reason or underlying rationale of adopting it	94(15.7%)	34(77.3%)
4	Statement of classroom assessment events or the underlying rationale for certain methods is guided only by traditional practices or personal preferences	86(14.4%)	29(65.9%)
5	Statement of classroom assessment events or underlying rationale for certain methods is guided by theories or principles introduced in the course	169(28.3%)	44(100%)
6	In stating assessment events or underlying rationale of certain methods, not only are theories or principles used as guideline, but the suitability to the class or school context is also taken into consideration	132(22.1%)	30(68.2%)
7	In stating events related to assessment or underlying rationale of certain methods, issues outside the school such as morality, ethics, needs of the society and policies.	60(10.1%)	15(34.1%)

Table 3: *Students' scores in two versions of homework on four topics*

Assessment results	Test-item design (N=31)		Performance assessment (N=25)		Assessment affection and social interaction (N=14)		on Portfolio assessment plan implementation (N=18)	
	Version 1	Version 2	Version 1	Version 2	Version 1	Version 2	Version 1	Version 2
<b>M</b>	30.23	34.13	31.48	33.52	29.64	31.50	31.33	34.94
<b>SD</b>	4.80	4.75	5.61	5.33	6.96	5.52	6.80	6.33
<b>Wilcoxon Test Z</b>	-3.80*		-2.19*		-1.67		-3.02*	

\* p < .05

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