

Teachers' self-assessment of the effects of formative and summative electronic portfolios on professional development

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This study compared the effects of four electronic portfolio curricula on pre-service and beginning teachers' self-ratings of their professional development ($n=207$), using a 34 item electronic Portfolio Assessment Scale (ePAS). Three formative portfolios, A, C and D, had teacher development as a primary objective and used participants' narrative reflections on students over a 2–3 month period. One summative portfolio, B, assessed teacher accountability through participants' analyses of professional teaching standards concerning students during 1–2 week teaching units. Factor analyses of the ePAS assessments for each portfolio and all four combined yielded the same five factors concerning professional outcomes: overall teacher development, including reflective skill (F1), an understanding of assessment roles (F2), an understanding of backwards planning (F3), the benefit of analyzing student work (F4) and the benefit of teacher peer collaboration (F5). For F1, F3 and F5 the means of the formative portfolios A, C and D were significantly higher than those of portfolio B. No differences were found among the portfolios concerning the benefits of analyzing student work (F4). The researchers concluded that formative portfolios that focused on teacher development better supported professional outcomes than did the summative accountability portfolio. It was concluded that portfolios should not be used for the summative accountability of teachers.

Dans cette étude nous avons comparé les effets de quatre programmes scolaires à portefeuille électronique sur les autocritiques que des enseignants débutants ont faites de leur développement professionnel ($n=207$). Nous nous sommes servis d'une échelle d'évaluation à portefeuille électronique de 34 points (ePAS). L'objectif principal des trois portefeuilles formatifs A, B et D était le développement de l'enseignant. Pour y parvenir nous avons employé des réflexions narratives sur les élèves pendant une période de deux à trois mois. A travers un portefeuille sommaire, B, nous avons évalué la responsabilité des enseignants au moyen des analyses que les participants ont faites des normes de l'enseignement professionnel des unités d'apprentissage d'une à deux semaines. Nous avons conclu que les portefeuilles formatifs qui se concentraient sur le développement des enseignants ont mieux soutenu le rendement professionnel des jeunes enseignants.

Este estudio compara los efectos de cuatro portafolios electrónicos curriculares sobre las auto evaluaciones de profesores antes de que comiencen a ejercitar la enseñanza y de profesores que

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inician su desarrollo profesional ($n=207$), utilizando 34 ítemes de la escala de Portfolio Assessment (Valorización de Portafolios) (ePAS). Tres portafolios formativos, A, C y D, tienen como objetivo principal el desarrollo de la enseñanza usando las reflexiones por escrito de los participantes sobre estudiantes en un periodo de dos a tres meses. En un portafolio de síntesis, B, se valora la responsabilidad de los profesores. Durante una unidad educacional de una a dos semanas, los participantes evalúan métodos de enseñanza y, a través de este análisis, valoran la responsabilidad de los profesores. Se concluye que los portafolios formativos que se enfocan en el desarrollo de la enseñanza facilitan de mejor manera el resultado del desarrollo de los profesionales jóvenes.

Diese Arbeit vergleicht die Wirkungen von vier Lehrplänen im Bereich elektronischer Portfeuillees auf die beruflichen Selbstbewertungen von werdenden und neueingetretenen Lehrkräften. Verwendet wird ein elektronisches Portfeuillewertungssystem (ePAWS) von 34 Punkten. Die Entwicklung der Lehrer ist die primäre Absicht von drei formativen Portfeuillees, A, C und D, in denen die Teilnehmer ihre Selbstbeobachtungen über zwei bis drei Wochen aufgeschrieben haben. Die Verantwortlichkeit von Lehren wird in einem zusammenfassenden Portfeuille B eingeschätzt, durch eine Beurteilung von lehrberuflichen Maßstaben der Teilnehmer in Bezug auf Studenten im Verlauf einer ein- bis zweiwöchigen Lehreinheit. Bewiesen wurde, daß die formativen Portefeuelles, die sich auf Lehrentwicklung konzentrierten, die Weiterentfaltung von neueingestiegenen Lehrkräften besser fördern.

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Introduction

The purpose of this study was to compare the effects of four different portfolio curricula on pre-service and beginning teachers' professional development. A variety of portfolios were tested, including a summative accountability portfolio, two formative teacher development portfolios and one mixed formative/summative portfolio. To measure teachers' assessments of the electronic portfolios an electronic Portfolio Assessment Scale (ePAS) was employed. The scale consisted of 34 self-reported statements referring to various dimensions of professional practice that were expected to improve through portfolio making.

The problem of portfolio assessment is important because, in the USA approximately 90% of teacher preparation programs use portfolios to make decisions about candidates, while some 40% use portfolios in licensing and certification requirements (Salzman *et al.*, 2002). In a recent case study in Florida, Wilkerson and Lang (2003) found that 'virtually every institution in the State is using portfolios in some way to make certification decisions' (p. 2). In California a consortium of leading public and private universities has piloted the state legislature mandated Teacher Performance Assessment, a portfolio-based summative assessment. Despite the widespread use of portfolios, there is little research on teachers' assessments of the value of formative or summative portfolios on their professional development. Moreover, policy researchers have recently questioned whether portfolios should be used to make summative decisions about candidates' certification competencies (Wilkerson & Lang, 2003). It has been argued that

summative portfolios are deeply flawed and open to legal challenge on several grounds. First, it may be misguided to allow teachers to select the very evidence that is proof of competency to enter the profession. Second, the alignment of evidence with the multiple forms of standards is proving difficult. Such considerations, among others, call into question the validity, reliability and fairness of the summative portfolio as a sound psychometric instrument.

Nevertheless, electronic portfolios are increasingly used by credentialing authorities and school administrators as exhibits to ensure that content and teaching standards requirements are satisfied in both pre-service and induction programs. Wolf *et al.* (1997) advocated that the evaluation of a teacher's portfolio be based on content and performance standards, which should be spelled out in advance. Klecker (2000) and Campbell *et al.* (2000) stated that, among other goals, portfolios provide assessment information for the meeting of state educational standards. Tucker *et al.* (2002) also noted the use of portfolios for meeting educational standards in regard to planning, assessment and student outcomes. They cited teachers who, having undergone the assessment process, stated 'the certification process, especially the creation of the portfolio [is] a powerful and transforming professional development experience' (p.10). They believe that the portfolio contributes to professional development by enhancing pre-service teachers' thinking about instructional goals, whether activities match the goals, how students respond to activities, whether learning goals were achieved, what worked well and what could be improved.

The portfolio has also been characterized as an activity for teacher development. Barrett (2000) viewed the portfolio as a tool for demonstrating teacher growth over time, while Zeichner and Wray (2001) stated that the portfolio

encourages student teachers to think more deeply about their teaching and about subject matter content, to become more conscious of the theories and assumptions that guide their practices, and to develop a greater desire to engage in collaborative dialogues about teaching. (p. 614)

Consistent with these outcomes, Zidon (1996) noted that the portfolio fosters continuous self-assessment, personal growth and heightened self-awareness. Anderson and DeMeulle (1998) cited the portfolio as enabling teachers to become learner centered and clearer about professional standards. In the same vein, McKinney (1998) saw portfolios as encouraging a teacher inquiry approach and a shift in responsibility of learning to the learner and Freeman (1998) stated that portfolio making increases teacher self-assessment. Dutt-Doner and Gilman (1998) described the portfolio as aiding in the development of knowledge about teaching and the teaching profession, as well as skills in organization and development. They also felt that the portfolio fosters professional attitudes and improves relationships with colleagues and peers, as well as serves as a reference work for beliefs and a knowledge base for the teaching profession. Finally, Richardson and Kile (1992) saw the portfolio as bridging theory and practice, as well as providing teachers with information to take a long-term view of their own performance development.

As a form of teacher development, improvement in reflective skills is frequently cited as a major benefit of portfolio making. Anderson and DeMeulle (1998) characterized the portfolio as enabling pre-service teachers to become 'reflective practitioners', while Freeman (1998) cited 'increased reflection' as an outcome. McKinney (1998) noted the benefit of a 'reflective stance' in which pre-service teachers revisit and revise their ideas over time. Snyder *et al.* (1988) stated 'if we provide opportunities for thoughtful practice, our students would generate equally appropriate, generally consistent, higher caliber, more personally valuable 'standards' of their own' (p. 128). Finally, Tucker *et al.* (2002) discussed the role of portfolios, which they saw as a 'tool for self-reflection', evaluation, and professional development.

Two types of portfolios: teacher accountability versus teacher development

An important dilemma in designing portfolios for pre-service and beginning teachers is, therefore, whether the portfolio is primarily a vehicle for teacher licensing assessment or teacher development and whether these two objectives are compatible. On the one hand, from a teacher accountability perspective Wolf *et al.* (1997), Klecker (2000) and Campbell *et al.* (2000) advocated that the portfolio be used to evaluate the achievement of state content and performance standards. On the other hand, researchers such as Darling (2001) proposed that teacher development should take precedence and that narrative reflection is the best way to foster such development. To illustrate the differences between the two types of portfolio, we compare the Teacher Performance Assessment (TPA), a recent California summative accountability portfolio prototype (pact.gse.uci.edu/uci_tpa), with Darling's formative development oriented portfolio.

Summative accountability portfolios: California teacher performance assessment cases. While the TPA was intended, in part, to promote teacher development, the largely summative assessment system was organized in response to increased demands for standards-based teacher accountability by the California legislature (Senate Bill 2042). The goal of the TPA is to demonstrate and ensure that teachers have fulfilled mandated standards of teaching and educational quality. The TPA requires that teachers show satisfactory performance in relation to state mandated Teacher Performance Expectations, which include making subject matter comprehensible to students, assessing student learning, engaging and supporting students in learning, planning instruction, creating and maintaining effective classroom environments and developing as a professional educator. Many educators and legislators who supported the TPA viewed the portfolio as a method of accountability for these teaching standards. The instructions and prompts of the TPA portfolio referred only to making connections between planning, instruction and assessment according to different teaching standards as part of the daily/weekly teaching cycle. Teachers were also encouraged to reflect on understandings achieved through this process in order to revise future practice, but only minimal guidance was offered on how to reflect.

Teacher formative development portfolios: narrative cases. Darling (2001), who conducted one of the few empirical studies of portfolios, emphasized that pre-service teacher development portfolios were most effective when they told coherent stories of their learning experiences. In her case study of 12 teachers preparing a relatively open-ended personal and creative portfolio she found that if novice teachers were able to narrate coherent stories of their learning experiences, most could achieve personal growth and transformation in the process of becoming teachers. In fact, Darling had prompted them to think of the portfolio as a narrative:

A portfolio is a narrative that tells a coherent story of your learning experiences in the program, and highlights thoughtful reflection on, and analysis of, these experiences. It is not simply an acquisition of pieces and products; it is an unfolding of your understandings about teaching and learning, and about your development as a professional. (p. 111)

Darling's principal finding was that those students who were capable of narrating their experiences created successful, thematic portfolios. She explained her finding as follows:

Making sense of one's experience and communicating it to others is a useful description of creating a narrative, especially when applied to building a portfolio. For eight of the students interviewed, the portfolio assignment turned out to be a unique story of their experiences in 'learning to teach'. Their emerging professional identities were documented, sometimes powerfully, through combinations of words and images expressing understanding, anticipation, intellectual vigor, disappointment, empathy, etc. (pp. 119–120)

Students who wrote meaningful narratives of their experiences also expressed satisfaction with the portfolio as a learning experience about themselves and their students. However, some novice teachers were confused about what was required in the portfolio and experienced it as undefined and ambiguous. They also had 'anxiety about the scope and nature and value of the task' and 'little academic preparation for a creative and personal piece' (p. 118). With regard to assessment by others, they had 'concern about the subjectivity of evaluation' (p. 118). Some of these teachers wanted models of portfolios, at least to guide the early phases of instruction. As such, to assist novice teachers in creating a formative portfolio detailed scaffolding may be needed. It is evident as well that Darling's limited sample requires that the assessment of narrative portfolios be conducted on a much larger scale.

Research question

The most important goal and process shared by both types of portfolios is that they require teacher documentation of their thoughtful investigations of practice. In teacher development portfolios relatively long-term reflections predominate, while in teacher accountability portfolios relatively short-term standards-based analyses of the planning, instructing and assessment teaching cycle are more central. The

central research question of this study is: which type of portfolio has a stronger impact on teachers' self-assessment of benefits to their professional development?

Our position is that the promise of the portfolio consists of fostering a powerful habit of mind, reflection, which will better enable teachers to make sense of and introduce effective change into their classrooms. We propose that portfolios relatively oriented to teacher development and that used narrative methods would better support teachers' positively evaluated outcomes than would a portfolio relatively oriented to the assessment of their understanding of professional standards. Although no published studies were found on sex differences in portfolios, we were curious as to whether females, as compared with males, might benefit more from a narrative approach to portfolio making.

Method

Participants

The participants consisted of a total of 207 teachers who were either in credential or Master of Arts in Teaching (MAT) programs at a research university or were beginning (1–2 years) in-service teachers. There were four samples of pre-service and in-service teachers drawn from MAT portfolio courses given by the first author or credential program activities. Of the three samples of pre-service teachers, one group, the portfolio A sample, had 62 participants (48 females and 14 males) on a MAT course in 2002; another, the portfolio B sample, had 67 pre-service teacher participants (56 females and 11 males) on a credential program activity in 2003; a third, the portfolio C sample, had 59 pre-service teacher participants (50 females and 9 males) on an MAT course in 2003; a fourth, the portfolio D sample, consisted of 19 in-service teachers (14 females and 5 males) who were enrolled on an MAT portfolio course in 2003.

Portfolio curricula: electronic case studies

Students in all portfolio programs created electronic case studies on K–12 students. They electronically submitted and stored a variety of descriptions and artifacts (e.g. plans, videos, student work) and wrote word-processed reflections on these data.

Portfolio A. Portfolio A consisted of 21 questions that directed the construction of a formative teaching and assessment case. Teachers selected one or more lessons that they taught for which they had collected samples of work from two students with 'challenging learning characteristics'. The case instructions called for teachers to write two different student narratives and a comprehensive lesson narrative. Some questions prompted teachers to analyze how planning, teaching and different assessment roles were used as part of the teaching cycle to improve their practice and know students better. Teachers interpreted artifacts as evidence to support their case analyses. During portfolio making teachers collaborated by sharing their portfolios and received support from established teachers, including National Board Certified

Teachers. While portfolio A was primarily oriented to teacher development, it is considered a hybrid because it contained some summative assessment activities. Portfolio A was primarily concerned, therefore, with teacher development, understanding of assessment roles, understanding of backwards planning [links between intended assessments and plans (Wiggins & McTighe, 1998)], the benefits of analyzing student work and teacher peer collaboration. The questions for portfolio A can be found in Appendix A.

Portfolio B. The TPA summative portfolio directs teachers' analyses of a 'teaching event', which is a teacher-selected connected series of lessons and related artifacts over a week or two. There are four areas of focus: instructional design, instructional performance, formal and informal assessment of student learning and reflection on practice. The instructions that follow detail the numerous aspects for which novices were expected to account.

The tasks for instructional design instructed the teacher to:

1. select a series of lessons around a common concept, theme or pedagogical goal;
2. provide relevant information about students as learners of your subject matter and about expectations for student learning during the lessons;
3. keep a daily log of the lessons and reflections on your instructions.

The tasks for instructional performance included:

1. document your role as instructor and as facilitator of student learning in your subject area;
2. analyze the quality of your instruction as well as your students' learning.

The tasks for formal and informal assessment of student learning included:

1. collect and review samples of work done by three students (including one English learner) during the entire unit of learning;
2. analyze the progress of students' learning of the subject matter in a written commentary.

Finally, the tasks for reflection on practice included:

1. Analyze the effectiveness of your teaching overall, based on a review of your activities and your students' achievements;
2. identify changes and improvements for future teaching.

Other than in their analyses of teaching and learning, pre-service teachers had little opportunity to reflect on discoveries they may have made that were not in specifically prescribed areas. Nevertheless, as an example of a summative accountability portfolio the TPA is a well-organized, comprehensive instructional activity that might have some benefits for teacher professional development, if these are not overshadowed by the myriad analytical exercises the process entails. Portfolio B was, therefore, primarily concerned with understanding of assessment roles, backwards planning and the benefits of analyzing student work.

Portfolio C. This formative portfolio was based on Schon's (1983) model of reflective inquiry, with some modifications. Teachers were instructed that the reflective inquiry should be a story about their interactions with a student who had learning challenges. The story should tell of the transformation of their beliefs about this student and the changes in the student's performance or explain why performance was still inadequate. In addition, teachers were prompted to develop an experimental inquiry that described the evolution of their thinking about factors that might have contributed to the student's problem and the transformation of their instructional approaches with the student. The inquiry included the development of questions and problems and their representations, hypothesis formation, testing interventions, collecting and analyzing data and theory making. Finally, teachers were asked to assess the value of reflective inquiry for their problem solving. This portfolio involved a greater emphasis on collaborative learning and metacognitive understanding than did Schon's reflective inquiry. Portfolio C was, therefore, primarily concerned with teacher development, the benefit of analyzing student work and teacher peer collaboration. [2]

Portfolio D. This formative portfolio was also based, in part, on Schon's (1983) model of reflective inquiry, with some modifications, involving a greater emphasis than portfolio C on using dialogic evidence. In particular, this portfolio used analyses of teacher–student dialogue as evidence of instructional effectiveness. Based on Lampert and Ball's (1998) guidelines, teachers were asked to record dialogues with a student, analyze their teaching strategies and evaluate the student's learning difficulties. They were also asked to propose what could be done to foster student growth. During portfolio making teachers collaborated by sharing their portfolios and received support from experienced teachers. Questions were employed that encouraged teachers' metacognitive understanding of the value of the portfolio to future practice. Portfolio D was, therefore, primarily concerned with teacher development, understanding of assessment roles, understanding of backwards planning, the benefit of analyzing student work and teacher peer collaboration. [3]

In conclusion, all four portfolios involved the use of K–12 student case study data and teachers' demonstrations of their understanding of the interrelatedness of planning, teaching and assessment of student work. Portfolio A was a hybrid type, containing both summative accountability objectives focused on the teaching cycle and formatively oriented student biographical and teacher-centered classroom narratives. The accountability portfolio B had a greater emphasis on teaching standards, including a greater number of teacher performance and English language standards, and was considerably longer than any of the others. Portfolios C and D drew largely on narrative and dialogical reflections during portfolio making. Portfolios A, C and D employed peer collaborative reflections and teacher support during portfolio making, whereas portfolio B did not. Portfolio D was completed by beginning in-service teachers, while portfolios A–C were constructed by pre-service teachers.

Table 1. The four portfolios: expected outcomes

	Teacher development	Understanding of assessment roles	Understanding of backwards planning	Benefit of analyzing student work	Teacher peer collaboration
Portfolio A	✓	✓	✓	✓	✓
Portfolio B		✓	✓	✓	
Portfolio C	✓			✓	✓
Portfolio D	✓			✓	✓

Table 1 presents a comparison of the four portfolios in terms of their expected outcomes.

Instrument: Electronic Portfolio Assessment Scale (ePAS)

The ePAS consisted of 34 self-report statements, of which 17 were positively phrased statements and 17 were negatively phrased statements about various effects of portfolio making, such as self-discovery, increased understanding of reflective practice, greater knowledge of students, backwards planning, better understanding of the role of assessment in planning and instruction and support for the value of collaboration. Each item was scored on a 5 point Likert-type scale, ranging from 1, 'disagree very much', to 5, 'agree very much'. The internal consistency of the scale was 0.92. In 2002 the ePAS consisted of only 31 items (a few negative statements were not included). The internal consistency of this 31 item scale was 0.91. The ePAS was administered to the four groups of teachers, after constructing one of the electronic portfolios described above, portfolio A, B, C or D. The ePAS scale questions can be found in Appendix B.

Hypotheses

Based on the differences in the portfolios, we made the following predictions.

Hypothesis 1. Because they employed narrative methods, portfolios A, C and D would be associated with greater benefits to teacher development than would portfolio B.

Hypothesis 2. Because they focused on the assessment of teaching standards to a greater degree, portfolios A and B would be associated with a better understanding of assessment roles than would Pportfolios C and D.

Hypothesis 3. Because they focused on teaching standards linking assessment and planning to a greater degree, portfolios A and B would be associated with a better understanding of backwards planning than would portfolios C and D.

Hypothesis 4. Because all portfolios focused on the analysis of student work, portfolios A, B, C and D would not differ in terms of being associated with a better understanding of the benefits of using student work.

Hypothesis 5. Because portfolios A, C and D involved peer collaboration during portfolio making, they would lead to more perceived benefits of teacher peer collaboration than would portfolio B, which did not employ peer collaboration.

While no formal hypothesis was put forth, the investigators were also interested in determining whether there were sex differences in participants' self-assessment of the benefits associated with the construction of portfolios.

Results

Overall benefits of portfolios for professional development

To determine the overall benefits of each of the four portfolios on teachers' professional development the differences in their total mean scores on the ePAS were examined by a one-way analysis of variance. The results indicated that there was a significant difference between each of the three means of portfolios A, C and D versus the mean of portfolio B, with $F[3]=12.26$ ($p<0.0001$) (mean= 3.90 ± 0.49 , 3.95 ± 0.46 , 4.09 ± 0.40 versus 3.52 ± 0.55 , respectively). This finding showed that teachers rated each of the four portfolios favorably, with mean scores above the midpoint. However, portfolios A, C and D were rated significantly higher for overall contribution to their professional development.

Factor analysis of the ePAS

Based on the expected differences among the portfolios presented above, the validity of the internal structure of the ePAS was investigated by means of an exploratory factor analysis, with a varimax rotation method. For each portfolio independently the analysis resulted in five factors. Factor 1 consisted of 12 items that related to overall teacher development, including 'better understand my challenges as a teacher', 'will help me to improve my future practice', 'better understand how to reflect on practice' and 'led to self-discovery as a teacher'. This factor also included items indicating that the teacher had 'better understanding of students as the major challenge I face', 'learned a lot about the student who was the subject of my portfolio', 'can better meet students' needs through planning lessons' and 'am a better observer of classroom events'.

Factor 2 consisted of four items concerning understanding of assessment roles and included 'better understand the role of assessment in planning instruction', 'understand the different assessment roles played by teachers', 'improved my ability to consider and meet students' needs when I plan lessons' and 'creating portfolio analyses about my classroom enabled me to better understand the challenges of

being a teacher'. Factor 3 consisted of four items that tapped teachers' understanding of backwards planning (Wiggins & McTighe, 1998) and included 'backwards planning is a very useful strategy in designing instruction' and 'thinking like an assessor enabled me to see useful patterns of events in my classroom'. Factor 4 contained three items related to the benefit of analyzing student work and included 'analyzing examples of student work can be of much help in understanding students'. However, this factor also included the item 'understand what it means to reflect on practice'. Finally, factor 5 contained five items concerning the benefit of teacher peer collaboration and included 'reading the case answers from other classmates via email is helpful', 'giving and getting constructive feedback about the case answers via email is helpful' and 'discussing case responses in small groups during class is helpful'. Thus, of the original 34 test items, 28 items were represented by the five factors.

These five factors explained 64, 60, 61 and 73% of the variance for the four portfolios A, B, C and D, respectively. For factor 1 loadings for the 12 component measures ranged from 0.51 to 0.80, 0.52 to 0.83, 0.51 to 0.78 and 0.50 to 0.85 for portfolios A, B, C and D, respectively. For factor 2 loadings for the four factor scores ranged from 0.53 to 0.78, 0.49 to 0.89, 0.54 to 0.86 and 0.53 to 0.78 for portfolios A, B, C and D, respectively. For factor 3 loadings for the four scores ranged from 0.54 to 0.68, 0.53 to 0.74, 0.54 to 0.69 and 0.74 to 0.90 for portfolios A, B, C and D, respectively. For factor 4 loadings for the three scores ranged from 0.58 to 0.86, 0.56 to 0.74, 0.54 to 0.74 and 0.51 to 0.86, for portfolios A, B, C and D, respectively. For factor 5 loadings for the three scores ranged from 0.48 to 0.81, 0.63 to 0.79, 0.64 to 0.77 and 0.48 to 0.86, for portfolios A, B, C and D, respectively. These findings indicated that the five measures, teacher development, understanding of assessment roles, understanding of backwards planning, the benefit of analyzing student work and the benefit of teacher peer collaboration, were identified as distinct components of a model of professional portfolio development outcomes, based on independent samples of teachers.

Because five components had been found for each of the four portfolio groups, the internal structure of the ePAS was further examined by means of an exploratory factor analysis, with a varimax rotation method, on the combined sample of the four groups of teachers ($n=207$). The same five factors identified in the independent groups were also found for the aggregate sample. Factor 1 included the 12 items concerning teacher development, factor 2 consisted of the four items of understanding of assessment roles, factor 3 consisted of the four items of understanding of backwards planning, factor 4 consisted of the three items concerning the benefit of analyzing student work and factor 5 included the five items concerning the benefit of teacher peer collaboration. The five factors, comprising the same 28 of the 34 original items as in the analysis of the four independent samples, explained 56% of the variance. The item components and loadings in the combined samples analysis were highly comparable with those found in the independent samples analyses. Taken together, the findings supported a model of professional development outcomes consisting of five distinct components associated with the benefits of

portfolio making. In subsequent analyses we used only items that had high loadings (>0.50).

Differences in the factor mean scores

On the basis of the five factors presented above, factor scores were used to measure differences among the participants' self-assessments. The degree of distinctiveness among the five factor mean scores of the four portfolios was examined by means of a multivariate general linear model analysis, considered the most appropriate for multiple measures in between-subject measurement in multiple groups (Stevens, 1996; Howell, 1997; Brace *et al.*, 2000). In particular, the analysis enabled comparisons of the same mean scores that measure a single component of the same professional development outcome domain among different groups.

Three main findings emerged from the analysis. First, there were significant differences among four of the five mean scores for the four portfolios by sex. The F coefficients were $F[3]=6.49, 2.98, 3.68$ and 21.92 ($p<0.05$) for the means of teacher development, understanding of assessment roles, understanding of backwards planning and the benefit of teacher peer collaboration factors, respectively. Second, no significant differences were found among the means of factor 4, the benefit of analyzing student work for the portfolios. Third, no significant differences were found among the mean scores of female and male teachers by portfolio groups. The resulting factor mean scores and standard deviations for each of the four portfolios are presented by portfolio and sex in Table 2.

Summary of findings by research hypotheses

This section presents the results relevant to each hypothesis.

Hypothesis 1. It had been predicted that the use of narrative methods in the formative portfolios (A, C and D) would be associated with greater overall teacher development benefits, such as greater reflective understanding, self-improvement as a teacher and meeting students' needs, than would be associated with an accountability portfolio. Concerning teacher development (F1), the mean scores for portfolios A, C and D (3.84, 3.92 and 4.13, respectively) were significantly higher ($p<0.0001$) than the mean score for portfolio B (3.42). While not significantly different from A and C, the mean for portfolio D (4.13) was highest of all. Thus, hypothesis 1, that the narrative case portfolios contributed to greater overall teacher development than did the summative portfolio, was confirmed.

Hypothesis 2. Because they focused on assessment teaching standards to a greater degree, it had been predicted that portfolios A and B would be associated with a better understanding of assessment roles than would portfolios C and D. With respect to understanding of assessment roles (F2) there was a significant difference between each of the mean scores of portfolios C and D and those of portfolios A and B (3.98 and 4.04 for C and D versus 3.59 and 3.76, for A and B, $p<0.005$). These

Table 2. Factor mean scores, standard deviations and *p* values by portfolio and sex (*n*=207)

Factor	Sex	Portfolio A (<i>n</i> =62)		Portfolio B (<i>n</i> =67)		Portfolio C (<i>n</i> =59)		Portfolio D (<i>n</i> =19)		Total		<i>n</i>
		Summer 2002		Spring 2003		Summer 2003		Summer 2003				
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
F1 Teacher development	M	3.80	0.81	3.10	0.83	3.54	0.86	4.10	0.71	3.63	0.12	39
	F	3.85	0.75	3.48	0.72	3.99	0.67	4.15	0.31	3.87	0.06	168
	Total	3.84 ^a	0.54	3.42 ^b	0.74	3.92 ^a	0.72	4.13 ^a	0.42	3.75	0.75	207
F2 Assessment roles	M	3.64	0.81	3.34	0.79	3.64	0.57	4.05	0.54	3.67	0.12	39
	F	3.57	0.97	3.84	0.69	4.04	0.46	4.04	0.53	3.87	0.07	168
	Total	3.59 ^b	0.44	3.76 ^b	0.73	3.98 ^a	0.50	4.04 ^a	0.52	3.80	0.74	207
F3 Backwards planning	M	3.80	0.70	3.43	0.63	3.67	0.80	3.65	0.74	3.64	0.11	39
	F	4.09	0.50	3.55	0.72	3.89	0.53	3.86	0.51	3.85	0.06	168
	Total	4.02 ^a	0.42	3.53 ^b	0.70	3.86 ^a	0.55	3.80 ^a	0.56	3.80	0.64	207
F4 Student work	M	3.80	0.70	4.49	0.30	4.52	0.34	3.93	0.93	4.19	0.09	39
	F	4.09	0.50	4.32	0.46	4.27	0.50	4.36	0.50	4.25	0.04	168
	Total	4.07	0.74	4.34	0.44	4.31	0.48	4.25	0.57	4.23	0.51	207
F5 Teacher peer collaboration	M	4.11	0.90	2.82	1.14	4.14	0.71	4.20	0.76	3.82	0.13	39
	F	4.40	0.48	3.21	0.04	4.40	0.61	4.25	0.45	3.97	0.07	168
	Total	4.33 ^a	0.65	3.15 ^b	0.97	4.02 ^a	0.62	4.24 ^a	0.52	3.85	0.89	
<i>n</i>		62		67		59		19				207

Means in the same row with different superscripts (a, b) differ significantly based on Scheffe statistics at $p < 0.005$.

scores, however, were not in the expected direction. For portfolio D the mean score was significantly higher than that for either portfolio A or B, whereas for portfolio C the mean was significantly higher than the mean for portfolio A only. These results, although not in keeping with the prediction of hypothesis 2, further supported the strength of the design of portfolios C and D as concerned with teachers' narrative reflective inquiry on their practice. Apparently, the inquiry methods used in portfolios C and D contributed to a greater understanding and applicability of the role of assessment as an outcome of portfolio making than did a portfolio activity in which assessments of short-term units were analyzed according to teaching standards.

Hypothesis 3. Because they focused on teaching standards that linked assessment and planning, it had been predicted that portfolios A and B would be associated with a better understanding of backwards planning than would portfolios C and D. However, concerning understanding of backwards planning (F3) the means for portfolios A, C and D (4.02, 3.86 and 3.80, respectively) were significantly higher than the mean of portfolio B (3.53, $p < 0.002$). Thus, unexpectedly, portfolio B was not associated with an improvement in backwards planning.

Hypothesis 4. Because all portfolios focused on student work, it had been predicted that portfolios A, B, C and D would not differ in terms of being associated with better understanding of the benefits of using student work as evidence (F4). The findings showed that, in fact, there was no significant difference between the four portfolios on the benefit of analyzing student work. The means for portfolios A, B, C and D were 4.07, 4.34, 4.31 and 4.25, respectively. Thus, the four portfolios apparently had an equal effect on this dimension.

Hypothesis 5. Because portfolios A, C and D involved peer collaboration during portfolio making it had been predicted that they would lead to greater perceived benefits of teacher peer collaboration (F5) than would portfolio B, which did not employ peer collaboration. The results indicated that for teacher peer collaboration the means for portfolios A, C and D were 4.33, 4.02 4.24, respectively, compared with portfolio B, with mean=3.15, thus strongly confirming the hypothesis ($p < 0.005$).

Summary of findings

The results indicated a generally positive assessment of portfolios A, C and D as they contributed to overall teacher development, backwards planning and teacher peer collaboration in professional development. Surprisingly, portfolios A and B did not contribute to a greater understanding of assessment roles, as did portfolios C and D. While portfolios C and D did not emphasize this understanding of assessment roles, it was concluded that their use of theory-based reflective inquiry may have contributed to their effects on professional development in this regard. Moreover, portfolio B, despite focusing on connections between planning and assessment, had a significantly different lower mean score on backwards planning as a perceived benefit of portfolio construction. According to our results, portfolio B, the accountability portfolio, fared the most poorly.

Additionally, no significant differences were found between the mean scores of male and female teachers concerning professional development on any of the portfolios or factors. This result suggested that electronic portfolios might provide a useful technique to enhance teacher development, irrespective of their sex, and that narrative methods were not unusually useful to females, as had been suspected.

Discussion

The findings support the conclusion that teacher portfolio designs should incorporate formative strategies, such as reflective inquiry, individual student and lesson narratives and professional and peer support. The current TPA summative accountability portfolio was not found to contribute to teacher professional development as strongly as did other portfolios, except as supporting the analysis of student work in making assessments. Because the TPA fared worst in relation to three different competitors, and given that the use of summative portfolios are also

under attack on legal grounds, the conclusion that portfolios should not be used for summative accountability seems persuasive.

The ePAS, in successfully differentiating between the portfolios on the factors of teacher development, backwards planning and collaborative learning, as predicted, should be considered a promising portfolio assessment technique. However, we were puzzled by the findings which, contrary to expectations, showed that portfolios C and D contributed significantly more to teachers' understanding of assessment roles than did portfolios A and B. We had predicted that because portfolios A and B had targeted assessment roles, they would have been rated as superior. It could be argued, however, that the reflective inquiry strategies used in portfolios C and D provided teachers with an experimental approach in which assessment was used more or less continuously to appraise results of interventions in relations with students, as well as in curricular innovations. Further, portfolios C and D provided more theoretical guidance when directing teachers to assess change in their own beliefs and encouraged the use of learning theories in understanding and assessing teacher–student interactions. Therefore, these portfolios addressed the objectives of overall teacher development, including self-discovery and reflection, which were not addressed in portfolio B. We speculate that portfolio A, with its hybrid approach, was less successful in developing teachers' understanding of assessment roles because, on the one hand, this portfolio contained some accountability tasks, but, on the other, lacked an overall reflective inquiry strategy.

We also wondered whether the dimensions of assessment roles and backwards planning are distinct enough, insofar as they share similar (but not identical) items referring to backwards planning. The assessment roles dimension addresses both specific assessment and planning concerns as well as teacher development in general, as seen in the item 'better understand the challenges of being a teacher'. The presence of this item suggests that the conceptual domain being measured includes considerations beyond planning and curriculum, a feature of portfolios A, C and D. In contrast, in portfolio B training in different assessment roles may have been more limited, as assessments were made about curriculum alone. The backwards planning dimension uses the specific labels of 'backwards planning' and 'thinking like an assessor', and these may refer to the more general constructs of the related activities of planning and assessment. Therefore, backwards planning probably does stand as a distinctive outcome dimension, independent of assessment.

Model of professional development outcomes of portfolios

The results also contribute to a model of professional development outcomes through portfolio making that might be understood by interpreting the possible relationships among the five dimensions. The following model proposes causal connections among the dimensions and is written in the self-descriptive language of teachers' self-assessment of professional development, as drawn from the items of the ePAS factors.

By making the portfolio, I understand better how to reflect on practice and this has led to self-discovery. The portfolio process was enhanced through collaborative activity in interactively exchanging portfolio information electronically or being able to read others' portfolios electronically. As a result, I have better understanding of my students as the major challenge I face. I learned a lot about the student who was the subject of my portfolio than I knew before. So, I can better meet students' needs through planning lessons. Additionally, I can better understand students because I am a better observer of classroom events. I also can better understand students by analyzing examples of student work.

Constructing the portfolio has led to an increase in my understanding of assessment in planning. I also understand different assessment roles better. As a result, I have an improved ability to meet students' needs when I plan. This view of planning is consistent with my belief in thinking like an assessor and doing backwards planning.

This integrated model might suggest ways to expand and elaborate the ePAS instrument. For example, the statement 'By making the portfolio, I understand better how to reflect on practice and this has led to self-discovery' represents a postulated causal relationship between two different self-assessment statements. Inclusion of such an item on a new version of the ePAS would allow us to test teachers' perceived causal linkages between portfolio components. Similarly, consider a statement such as 'The portfolio process was enhanced through collaborative activity in interactively exchanging portfolio information electronically or being able to read others' portfolios electronically. As a result, I have better understanding of my students as the major challenge I face'. This statement becomes a more complex proposition to be tested as an outcome of portfolio making. It is our intention to elaborate the ePAS in these directions.

Limitations of the study

There were several limitations to the study that advise caution concerning these conclusions. Among these problems are the classification of portfolios and the lack of external validity of the ePAS instrument. Because portfolios consist of complex, multifaceted activities, it is difficult to discriminate between them precisely. Given the range of portfolios that might be designed, it would be necessary to study a great many more variations before we could definitively support the conclusions reached above. For example, while it may be reasonable to conclude that portfolios A, C and D differed from B on certain dimensions, such as long-term narrative and collaborative methods, nevertheless portfolio B did employ a form of short-term narrative of the teaching cycle of subject units and this portfolio may have benefited from collaborations in ways that were not measurable. Further, perhaps those in the portfolio B group were reacting more to situational variables, such as the greater length and relatively compressed time frame of their portfolios, and less so to the kinds of reflective activities employed. Thus, attitudinal differences might have been responsible for this group's lower ratings. Because portfolio D was the only one involving teachers who had some in-service experience, perhaps the high scores relative to portfolio B were attributable in part to the teachers' tenure, as well as the portfolio curriculum method employed.

While our findings provide support for the validity of the internal structure of the ePAS, e.g. the factors and some confirmed predictions, external sources of data were only available for portfolio A. These included one objective measure of the portfolio and course grades. For the former measure, in which the classroom narratives were analyzed reliably by two raters for their level of detail and completeness, there was a moderately significant correlation with overall performance on the ePAS ($r=0.26$, $p<0.05$). Additionally, there was a comparable correlation between the overall ePAS score and course grades ($r=0.28$, $p<0.05$). Thus, there is some external validity for the ePAS. Finally, the authors are aware of forthcoming revisions to portfolio B that would make it more reflective and less focused on repetitive dimensions of the teaching cycle. This is important because it is likely that accountability portfolios also represent some learning opportunities for teachers. We look forward to assessing this new portfolio.

Notes on contributors

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Appendix A. Portfolio A

INSTRUCTIONS

You are going to build a Teaching and Assessment Case that provides evidence, arguments, and reflections on your ability to engage in assessment practices and to critically analyze and use what you know about students to inform your teaching. The case has several related parts that as a whole demonstrate your ability to learn from your experience, to understand and apply teaching standards, to plan, enact, assess, and revise your teaching, and to evaluate the effects of your case-making on your competency as a reflective practitioner.

In this case you will select one or more lessons that you have actually taught and for which you have collected samples of work from two students. You will analyze your teaching practice based on selected California Standards for the Teaching Profession (see below).

About the lesson(s):

Select a lesson that you think is worthy of analysis and for which you have collected samples of student work. If you have work samples from the selected students for more than one lesson in a given unit, then you may decide to use more than one lesson in your analyses and reflections, but this is optional.

About the samples of student work:

The student work samples should be from the lesson(s) that you have selected for analysis. To provide an opportunity for greater depth of analysis and comparison, select work samples from two students with different 'learning characteristics'. The following are some suggested categories to consider:

- High achievers or gifted students
- Underachievers or those with poor motivation
- ESL or ELD students
- Students from different cultural backgrounds
- Students with different learning styles
- Students with problems that may affect their ability to learn or engage in classroom activities (e.g. attention deficit hyperactivity disorder, dyslexia, sensory-motor problems)

CASE QUESTIONS

Please answer all the numbered questions and prompts comprehensively and extensively. The space for each question will, of course, expand to accommodate your writing.

1. Name
2. What topic(s) were covered in the lessons that you are analyzing for this case.
3. What grade level(s) are represented in the lessons that you are analyzing for this case?
4. Please type the names of file documents (Word files) that house student work samples that you will use in this case.
5. Please type the names of file documents (Word files) that house lesson plans that you will use in this case:
6. Please provide a comprehensive lesson narrative. This should include a description of the instruction that occurred that led to the student work samples that you have selected for this case. In composing your narrative, be sure to include the following:

Clearly state the intended learning objectives and/or goals in the beginning of the narrative.

Provide enough detail to allow a reader to really understand the instructional events and activities that took place. While your lesson plan tells what you 'planned', this narrative should include information about what actually happened when you taught this lesson, for example, things like sequence, in the moment instructional decisions, interactions between you and students, what you learned when you did a check for understanding, unexpected events and your response to them, important classroom management issues that arose, etc.

Note that in question 7 below, you will provide details about the actual 'task' or 'assignment' that produced the student work samples. Mention it in this narrative, but leave the details for question 7.

Include any memorable events in the lesson that you will want to reference later in your case as evidence of your knowledge and assessment of students.

If relevant, include some information about what kind of instruction and assignments preceded and followed the lesson(s) that generated your student work samples. This should provide the reader with context about how this lesson fits into a broader set of lessons.

In addition to this narrative, please supply a lesson plan (or lesson plans) as separate documents.

After you have completed the analysis section of this case, you may decide to return to this narrative of the lesson to add additional information.

7. Describe the assignment(s) or activity that produced the student work samples you have selected for this case.
8. Why did you select this lesson or set of lessons as an exhibit of you teaching and assessment competency?
9. Describe the students in the classroom.
10. Describe the relevant features of the classroom setting that influenced your teaching in the lesson(s) you selected for this case.
11. STUDENT 1 Initials and file name.
12. WRITE THE STUDENT 1 NARRATIVE HERE:

For both of the students for whom you have student work samples, please provide rich narrative(s) to describe what you know about these students. A rich narrative provides the reader with a picture of the student in the classroom. Later in the case, you will use their student work samples to analyze what you have learned about their performance on the selected task. However, in this section, you will provide the reader with other narrative details about the students. You will be asked to reference these student narratives as evidence about the students in later sections of this case. In each student narrative, please address all of the following for which you have some knowledge:

Describe the instructional challenges or issues that this student represents. What are the distinguishing characteristics of this student that have implications for learning? These could be cognitive, physical, emotional, or other kinds of characteristics. Include one or more memorable events that you recall that illustrate the student's distinguishing characteristics and/or instructional challenges that impact on his/her learning.

Describe this student's academic performance as compared with other students in the class. Include one or more memorable events that you recall that illustrate this student's academic performance.

Describe how this student interacts with other students in collaborative and other kinds of settings. Include one or more memorable events that you recall that illustrate this student's interactions with other students.

Describe your relationship with this student in the context of instruction. How would you characterize instructional interactions you have with this student? What kind of instructional support have you provided for this student and to what extent did it help? Provide any anecdotes or incidents you recall that illustrate this instructional relationship.

Describe your social relationship with this student and how it impacts student learning. Is it warm, neutral, or cool? Describe any attempts you have made to change

the social relationship you have with this student. Include one or more memorable events that you recall that illustrate this social relationship.

Add any other information about this student that you think is important.

File names of student work sample documents for this student:

13. STUDENT 2 Initials and file name.
14. WRITE THE STUDENT 2 NARRATIVE HERE:
15. Write your assessment of student 1's sample work here. (Refer the reader to concrete examples in the student work sample documents.)

For each of the two students you have selected for this case, and for which you have work samples from the selected lesson(s), please provide a written assessment of the student learning as evidenced in the work samples. Be sure to make connections between your learning objectives, the student work samples, and your assessment of student learning. Please address the following:

What does the work tell you about the student's performance on this task in terms of the instructional objectives you intended? Reference concrete examples from the work samples.

What does the work tell you about any problems the student demonstrates with conceptual understanding, knowledge, skills, or procedures? Reference concrete examples from the work samples.

Given what you know about the student from past performance, what does this work tell you about the student's growth related to particular concepts, knowledge, skills or procedures?

In what ways is the student's performance on the work samples representative of the instructional challenges or issues you identified in the student narrative?

How does the work from this student inform your understanding of other students with similar instructional challenges or issues?

When you answer questions 15 and 16, be sure to consider all of the bullet points in CSTP Key Element 5.4, as follows:

CSTP Key Element 5.4: Using the results of assessment to guide instruction

Use assessment to guide your planning

Use informal assessments of student learning to adjust instruction while teaching

Use assessment data to plan more effective ways of teaching subject matter concepts and processes

Use assessment information to determine when and how to revisit content that has been taught

Use assessment data to meet students' individual needs

Use assessment results to plan instruction to support students' individual educational plans (IEP)

16. Write your assessment of student 2's sample work here. (Refer the reader to concrete examples in the student work sample documents.)
17. Think about the lesson(s) you selected that produced your student work samples and any related lessons that preceded or followed it. Describe the behaviors and strategies you would expect to see from a teacher who is teaching your lesson(s), with your grade level students, and is demonstrating CSTP Key Element 5.4.

18. In the analysis section of this case, you will build an argument about your ability to incorporate CSTP Key Element 5.4 into your teaching and assessment practices.

You must use the evidence from students you selected for this case as examples. You may also draw examples from other students in the class.

Address all bullets in the CSTP Key Element 5.4, making connections between the standard, your behaviors and strategies, and your sources of evidence.

You will draw on evidence from different sources to support and illustrate the points that you make. The sources of evidence include:

- Your lesson plan(s) [LP]
- Your lesson narratives [LN]
- The student narrative [SN]
- The samples of student work [SW]
- Your assessment of the student work samples [SWA]

Based on the main points and evidence you identified above, write a comprehensive analysis of the ways in which different sources of evidence demonstrate your performance of CSTP Key Element 5.4.

19. Reflection on your teaching and assessment.

Based on the analysis you wrote above about your performance of CSTP Key Element 5.4, what conclusions can you draw about your effectiveness and weaknesses in using the results of assessment to guide instruction. Be sure to include the following:

Discuss your successes.

Discuss which aspects of key element 5.4 posed challenges for you. Explain why and provide examples.

20. Based on your analyses and the conclusions you drew about your performance of CSTP Key Element 5.4, what would you change to address the challenges you have previously identified? Explain why and how you would make these changes. Provide concrete examples. Be sure to consider the following:

What would you change about your assessment practices?

What would you change about the lesson(s)?

21. In what specific ways has your practical understanding of the CSTP changed or broadened as a result of constructing this teaching and assessment case?

Appendix B. Electronic Portfolio Assessment Scale (ePAS)

You have previously completed an electronic portfolio or some form of comprehensive assessment of your teaching. How did your this portfolio work contribute to the following aspects of your learning and beliefs about teaching? Circle your choice on each statement: Agree very much, Agree, Don't know, Disagree, Disagree very much.

Name: _____

1. I think I am a better observer of classroom events.
Agree very much Agree Don't know Disagree Disagree very much
2. Compared to how I usually plan lessons, I don't think backwards planning is a very useful strategy in designing instruction.
Agree very much Agree Don't know Disagree Disagree very much
3. I think I have improved my ability to consider and meet students' needs when I plan lessons.
Agree very much Agree Don't know Disagree Disagree very much
4. I didn't learn very much more about my student that I analyzed in the portfolio than I knew before.
Agree very much Agree Don't know Disagree Disagree very much
5. I don't find 'thinking like an assessor' particularly valuable in being a teacher.
Agree very much Agree Don't know Disagree Disagree very much
6. I think I better understand the role of assessment in planning instruction.
Agree very much Agree Don't know Disagree Disagree very much
7. I feel I understand the different assessment roles played by teachers now.
Agree very much Agree Don't know Disagree Disagree very much
8. I didn't learn very much more about how my assessment of the students' performance influenced my planning of instruction.
Agree very much Agree Don't know Disagree Disagree very much
9. Compared to how I usually planned lessons, I find backwards planning a very useful strategy.
Agree very much Agree Don't know Disagree Disagree very much
10. I think that reading the case answers from other classmates via email might be helpful.
Agree very much Agree Don't know Disagree Disagree very much
11. I don't think I have improved my ability to consider and meet students' needs when I plan lessons.
Agree very much Agree Don't know Disagree Disagree very much
12. I do not think that analyzing examples of student work can be of much help in understanding students.
Agree very much Agree Don't know Disagree Disagree very much
13. The idea of 'thinking like an assessor' enabled me to see useful patterns of events in my classroom.
Agree very much Agree Don't know Disagree Disagree very much
14. I discovered things about myself as I wrote the case.
Agree very much Agree Don't know Disagree Disagree very much
15. I think that giving and getting constructive feedback about the case answers via email might be helpful.
Agree very much Agree Don't know Disagree Disagree very much
16. I think I better understand how students' outcomes are linked to my teaching.
Agree very much Agree Don't know Disagree Disagree very much
17. I still don't feel I understand the different assessment roles played by teachers.
Agree very much Agree Don't know Disagree Disagree very much

18. I don't think that giving and getting constructive feedback about the case answers via email might be helpful.
Agree very much Agree Don't know Disagree Disagree very much
19. I don't think that reading the case answers from other classmates via email might be helpful.
Agree very much Agree Don't know Disagree Disagree very much
20. In making the case, I thought of new ways to approach students with learning problems.
Agree very much Agree Don't know Disagree Disagree very much
21. I didn't discover things about myself as I wrote the case.
Agree very much Agree Don't know Disagree Disagree very much
22. I don't think that discussing case responses in small groups during class would be helpful.
Agree very much Agree Don't know Disagree Disagree very much
23. I understand better what it means to reflect on practice.
Agree very much Agree Don't know Disagree Disagree very much
24. Making a portfolio will probably lead to improvement in future practice.
Agree very much Agree Don't know Disagree Disagree very much
25. I found creating portfolio analyses about my classroom enabled me to better understand the challenges of being a teacher.
Agree very much Agree Don't know Disagree Disagree very much
26. I think that analyzing examples of student work can be of help in understanding students.
Agree very much Agree Don't know Disagree Disagree very much
27. I didn't find that creating portfolio analyses about my classroom enabled me to better understand the challenges of being a teacher.
Agree very much Agree Don't know Disagree Disagree very much
28. I still do not understand what it means to reflect on practice.
Agree very much Agree Don't know Disagree Disagree very much
29. In making the case, I was not able to think of new ways to approach students with learning problems.
Agree very much Agree Don't know Disagree Disagree very much
30. I don't think I am a better observer of classroom events.
Agree very much Agree Don't know Disagree Disagree very much
31. Making a portfolio will not lead to improvement in future practice.
Agree very much Agree Don't know Disagree Disagree very much
32. I learned a lot more about my student that I analyzed in the portfolio than I knew before.
Agree very much Agree Don't know Disagree Disagree very much
33. I don't think I better understand how students' outcomes are linked to my teaching.
Agree very much Agree Don't know Disagree Disagree very much
34. I don't think that giving and getting constructive feedback about the case answers via email might be helpful.

Authors Queries

Journal: **European Journal of Teacher Education**

Paper: **126856**

Title: **Teachers' self-assessment of the effects of formative and summative electronic portfolios on professional development**

Dear Author

During the preparation of your manuscript for publication, the questions listed below have arisen. Please attend to these matters and return this form with your proof. Many thanks for your assistance

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