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Early Childhood Preservice Teachers' Beliefs about e-Portfolios and Experiences in the Development of an e-Portfolio in the United States

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Abstract

This study examined preservice teachers' beliefs about e-portfolios as an indicator of their understanding of professional teaching standards through their experience in the development of an e-portfolio. This study analyzed a total of 112 pre-service teachers in an early childhood teacher education program in the U.S. Midwest. The results from hierarchical multiple regressions revealed that current program status and overall positive experience in the development of an e-portfolio were significant indicators of the preservice teachers' beliefs about e-portfolios reflecting their understanding of standards. The results stress the importance of a positive experience in the development of an e-portfolio in helping preservice teachers better understand the standards pertaining to quality teacher education and standards-based performance through the development of an e-portfolio.

Keywords: preservice teacher, standards, teacher education, e-portfolio

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Development of an e-Portfolio in the United States

Introduction

Standards-based reform entered the national discussion of professionalism, effectiveness, and accountability in teacher education programs in the wake of A Nation at Risk: The Imperative for Educational Reform in the United States (National Commission for Excellence in Education, 1983). Strong demands to reform teacher education also exist in various ways across nations (Dembélé & Schwille, 2006; Louden, 2000; Trupp, 2006; Thematic Network Teacher Education in Europe [TNTEE], 2000), reflecting the global trend of teaching professionalism and enhancing teacher performance through the establishment of professional teaching standards.

In the United States, standards have become detailed means of measuring teachers' performance and serve as a framework for performance-based teacher education programs (Huth, 2004). Standards-based reforms are commonplace in most state education policies, necessitating that teacher education programs adopt e-portfolios as a way to evaluate not only student achievement but also preservice teachers' knowledge, skills, and disposition for teaching (Council of Chief State School Officers, 2002). E-Portfolios are electronic compiles of preservice teachers' work that effectively present their efforts, growths, and performances, reflecting both teaching and learning experiences throughout the teacher education program. E-Portfolios are constructive mechanisms for authentic assessment that evaluate the professional development of early childhood preservice teachers.

While not required, the National Council for Accreditation of Teacher Education (NCATE) endorses the use of the e-portfolio as an effective instructional tool for both faculty

and teacher candidates (NCATE, 2010). Today, as a result, the majority of K-12 teacher education programs require preservice teachers to build an e-portfolio as part of the licensure process.

It has been well documented that building an e-portfolio, which is a reflective learning tool, benefits preservice teachers' learning (e.g., Adams, Swicegood, & Lynch, 2004; Hallman, 2007; Wall, Higgins, Miller, & Packard, 2006). The major goal of using the e-portfolio in teacher education is to stimulate reflective practice and provide evidence of this reflection (Foote & Vermette, 2001).

To make the e-portfolio effective as a reflective tool for preservice teachers' growth in knowledge and skills, teacher education programs need to dedicate extensive efforts to maximize its effectiveness. These efforts should include support for a basic technology course in how to build an e-portfolio, the provision of clear guidance to infuse preservice teachers with a disposition for teaching, and the delivering of pedagogical knowledge and skills to meet the standards (Foote & Vermette, 2001; Plasir, Hachey, & Theilheimer, 2011). As the standards policy involves high-stakes outcomes including teacher licensure and certification, without such congruent support, creating and maintaining an e-portfolio can be a time-consuming process teacher candidates need to complete for their teaching certification.

The Present Study

Whereas a considerable amount of research has focused on the benefits of e-portfolios from administrative perspectives, there is a lack of research on teachers' perspectives about e-portfolios and their experience in building such. Thus, there is a need to further examine preservice teachers' beliefs as an indicator of their understanding of the standards through their

experience in using e-portfolios to meet the standards in the teacher education program. Therefore, in this study we examined how preservice teachers understand the process of creating and maintaining an e-portfolio in order to better assist them to use e-portfolio as reflective tool for their professional development. The specific questions were as follows:

1. How do preservice teachers' beliefs about the e-portfolio relate to their experience of developing an e-portfolio?

2. How do preservice teachers' beliefs and experience in the development of an e-portfolio differ by technology courses taken, times of e-portfolio submission, and status in the program?

3. To what extent does preservice teachers' experience in the development of an e-portfolio, among other factors during the teacher education program, explain their beliefs on the e-portfolio, as a vehicle for understanding the standards?

Literature Review

Preservice teachers' beliefs on e-portfolios

According to Putman, Lampert, and Peterson (1990), teachers' knowledge structures are fundamentally linked to their perceptions, thoughts, and actions. Brown and Borko (1992) explicate this argument to suggest that knowledge structures directly influence thinking, which in turn, influences the actions of teachers in the classroom. If, as Cohen (1989) said, teachers are to be the mediating agents for reform, and if standards-based reform aims to produce the desired teachers and the students' desired level of achievement, teachers' thoughts and perspectives about standards would be a decisive factor in improving students' learning.

Indeed, the e-portfolio is a vehicle for reframing preservice teachers' perceptions, thoughts, and actions in understanding the standards to empower them in their learning process (Milmanm & Kilbane, 2005). Through the process of developing an e-portfolio, preservice teachers become more engaged and motivated to be confident and reflective in their work (Wang & Turner, 2006) and are enabled to measure their knowledge and growth in professional teaching by integrating technology into their lessons (Goldsby & Fazal, 2000).

According to Zubizaretta (2004), an e-portfolio functions as both a process and a product. An e-portfolio not only enables preservice teachers to focus on their learning process, it also enables them to reflect on how and what they have learned as the result of the process. It has been reported that preservice teachers who create and maintain an e-portfolio are more likely to delve into themselves to find effective teaching practices and to carve an image of their future as teachers (Barrett, 2007). By building an e-portfolio, preservice teachers gradually come to know their teaching and learning philosophy and become knowledgeable about teaching and learning (Britten, Mullen, & Stuve, 2003). Building an e-portfolio also infuses the purposes of the standards-based reform into preservice teachers' beliefs to produce quality teaching and to improve student learning. In short, through the development of an e-portfolio, early childhood preservice teachers experience what they will confront during their professional teaching and learn what skills they will need to make their teaching effective and reflective (Anderson & DeMeulle, 1998; Foote & Vermette, 2001).

Despite the benefits of using e-portfolios in teacher education, however, there is a rising concern on using e-portfolios to access preservice teahcers' growth in knowledge and skills in many ways. For instance, studies have shown that a majority of preservice teachers have no practical experience in developing e-portfolios before their student teaching, suggesting that they

will experience frustration and difficulties in building their e-portfolios (Meeusm, Questier, & Derks, 2006; Zubizaretta, 2004). Plasir, Hachey, and Theilheimer (2011) examined preservice teachers in an early childhood teacher education program to assess their perceptions of their preservice e-portfolio and their experience in constructing it. The results of this study revealed that while the preservice teachers considered the e-portfolio to be an academic reflection tool, they were not willing to take ownership by investing extra time in building or maintaining the e-portfolio. The preservice teachers also expressed that they needed more assistance and scaffolding from faculty members through seminars or introductory classes.

To maximize three major functions of the use of the e-portfolio: learning, assessment, and employment (Foote & Vermette, 2001), faculty members and e-portfolio reviewers need to understand preservice teachers' frustrations in building their e-portfolio and to provide preservice teachers with realistic assistance and guidance so that the teacher candidates can benefit from the development of an e-portfolio to meet state and national standards for professional teachers.

Factors that influence preservice teachers' experience in building an e-portfolio

As the use of the e-portfolio is now a common practice in teacher education, preservice teachers are encouraged to build an e-portfolio that they can access for their learning as teacher candidates and for their growth as professional teachers in the future. However, beyond the benefits of using an e-portfolio, there are prerequisites and obstacles that influence preserice teachers' beliefs on standards-based e-portfolios and their experience in building an e-portfolio. In fact, it has been reported that many preservice teachers without appropriate technological skills have difficulties in building an e-portfolio, develop negative beliefs on e-portfolios, and

perceive no benefits of building an e-portfolio in teacher education (Chung & Kim, 2010; Kraft, 2001). Most of all, technology skills ultimately influence preservice teachers' perception of the e-portfolio in the teacher education program (Chung & Kim; 2010; Plasir, Hachey, & Theilheimer, 2011). However, through the development of an e-portfolio, preservice teachers can enhance their understanding of the technology itself while learning the subject content knowledge at the same time. Furthermore, the use of the technology contributes to changing the preservice teachers' beliefs about it, as well as their perception of their teaching and of student learning (Goldsby & Fazal, 2000; Hartley, Urish, & Johnston, 2006). Technology courses taken, the actual preparation and submission of an e-portfolio, and their status in the teacher education program are associated with preservice teachers' technological skills, which in turn influence their beliefs on e-portfolios and their experience in building an e-portfolio in various ways (Foote & Vermette, 2001).

Methods

Sample

This study included a total of 112 preservice teachers enrolled in an early childhood teacher education program in a state university in the U.S. Midwest. All participants were female and ranged in age from 19 to 29 years old ($M = 20.86$, $SD = 1.18$). The racial and ethnic identity of the sample as reported by the participants was predominantly White (93.8%), with approximately 1.8% Native American, and less than 4.4% of the sample reporting as Latino, Asian, Biracial, or Others. Approximately 90% of the participants were single. The preservice teachers provided basic demographic information and their technology backgrounds.

Instrumentations

Preservice teachers' beliefs on e-portfolios. We used four items in a 5-point Likert scale with options that ranged from 1 (not at all important) to 5 (extremely important) to gather preservice teachers' beliefs regarding e-portfolios. This measure comprises four question items: (1) To gain admission to a program while providing the audience with an   opportunity to identify initial strengths and weaknesses for the purpose of providing appropriate assistance if needed, (2) "Demonstrate learning in course content or to fulfill specific course requirements", (3) "Present as the best candidate in application for an advertised position", (4) "For program review and certification, reflect professional growth and overall view of self as a teacher, including strengths and areas for improvement". This measure showed a Cronbach alpha of .96, showing high internal consistency and the items in the construct also showed high item factor loadings from .88 to .94. Higher scores represent that the preservice teachers perceived the importance of standards for effective teaching through the benefits of building an e-portfolio. This study used mean scores in subsequent analyses.

Preservice teachers' experience in the development of an e-portfolio. This study used Lin's e-portfolio survey (2008) pertaining to the perception of the development of an e-portfolio. For this study, we included 16 items (factor loading over .40) in a 5-point Likert scale format ranging from 1 (not at all) to 5 (most likely) regarding how the students perceived the use of an e-portfolio in the teacher education program and what they learned from the development of one. This measure consisted of (1) overall positive experience, (2) positive technology experience, (3) overall negative experience, and (4) negative technology, showed high internal consistencies of Cronbach's alphas, .93, .94, .86, and .81, respectively. A sample item reflecting overall positive experience in developing an e-portfolio state, "I thought about the connections between what I learned and what I am going to teach". One sample item reflecting positive technology

experience states, "I gained greater confidence in learning new technology applications such as

working with hypermedia software". A sample item in the overall negative experience states, "I

didn't see any value of reflection". Lastly, a sample item reflecting negative technology

experience states, "I became less confident in using technology in my future classroom".

This study used mean scores in subsequent analyses.

[Insert Table 2 about here]

Preservice teachers' e-portfolio Submission and current status in the program. The

preservice teachers in this program are required to submit e-portfolios three times to fulfill the

required qualifications for their teacher license after they are admitted to the professional school

of teacher education program. Once they completed all three required submissions to an online

work sampling system, LiveText, the preservice teachers are placed for their student teaching in

a public school system. The preservice teachers should submit their teaching philosophy,

statement of semester goals and competence in content knowledge, lesson plans, observations

and artifacts, self-reflections, etc., pertaining to their practicum experiences in terms of teaching

and learning. In this study, as e-portfolio submissions were in process, both submission status

and the current status (grade level) in the program were considered in analyses. The submission

status was sorted into five groups: (1) in submission I, (2) post submission I, (3) in submission II,

(4) post submission II, and (5) in submission III. The status in the program was sorted into four

groups: pre-ECE first semester, pre-ECE second semester, ECE 3-5 semester, and ECE 6-7

semester. The preservice teachers are supposed to have their pre-k internship during their 7th

semester in the early childhood education program.

Data Analysis

Multiple independent *t*-tests and univariate analyses of variance were performed to examine group differences in the preservice teachers' beliefs and experience in the development of the e-portfolios. In order to predict the power of independent variables (e.g., technology course taken, current status in terms of the e-portfolio, and experience in the development of the e-portfolio) on the dependent variable, the preservice teachers' belief in an e-portfolio as an indicator of their understanding the standards, this study employed a hierarchical linear regression. We checked the violation of multicollinearity by examining tolerance and the variance inflation factor (VIF) using two collinearity diagnostic factors, an individual R-square value and a VIF.

Results

Descriptive statistics

Descriptive statistics and correlation analysis were performed to examine the preservice teachers' beliefs on e-portfolios, their experience in the development of an e-portfolio, and the relationships between preservice teachers' beliefs on e-portfolios and their experience in the development of an e-portfolio.

On a 5-point Likert scale, preservice teachers' beliefs on e-portfolio were rated above the midpoint of 2.5 ($M = 3.65$, $SD = 1.07$). The preservice teachers' experience in the development of an e-portfolio indicated moderately higher rates on overall positive experience ($M = 3.32$, $SD = 1.10$) and positive technology experience in the development of an e-portfolio ($M = 3.04$, $SD = 1.27$), while lower rates indicated an overall negative experience ($M = 2.30$, $SD = 1.22$) and negative technology experience in the development of an e-portfolio ($M = 2.26$, $SD = 1.19$).

Correlations between beliefs on e-portfolios and experience in the development of an e-portfolio

The results from Pearson's correlation analysis showed that preservice teachers' beliefs were positively correlated with overall positive experience ($r = .77$, $p < .01$) and positive technology experience ($r = .66$, $p < .01$). In turn, the more overall positive experience and positive technology experience, the higher the beliefs on e-portfolios the preservice teachers had. On the other hand, preservice teachers' beliefs showed negative relations with overall negative experience ($r = -.48$, $p < .01$) and negative technology experience ($r = -.38$, $p < .01$), showing that the more overall negative experience and negative technology experience, the lower the beliefs on e-portfolios the preservice teachers had.

The results also showed that there was a strong relation between overall positive experience and positive technology experience in the development of e-portfolios ($r = .83$, $p < .01$) whereas there was a strong relation between overall negative experience and negative technology experience in the development of e-portfolios ($r = .82$, $p < .01$), implying the power of technology experience in overall experience or vice versa.

In addition, correlations among previous technology courses taken, current status in the teacher education program, experience in the development of e-portfolios, and beliefs regarding e-portfolios were examined. One interesting finding was that neither beliefs on e-portfolios nor any one of the experiences in the development of e-portfolios showed meaningful correlations with the technology courses taken (see Table 1).

[Insert Table 1 about here]

Group differences in the preservice teachers' beliefs on e-portfolios

Multiple independent *t*-tests and univariate analyses revealed that there were no significant differences by technology course taken ($t = -1.49$, $p > .05$). However, there were significant differences in preservice teachers' beliefs on the e-portfolio by current submission status in terms of the e-portfolio ($F(4) = 9.14$, $p < .001$) and status in the program ($F(3) = 12.28$, $p < .01$) (see Table 4). Preservice teachers who had completed their second submission of an e-portfolio ($M = 2.46$, $SD = .77$) showed the lowest score in their beliefs on the e-portfolio as an indicator of their understanding the standards. An interesting finding was that the more advanced a student was in the program, with accumulative experience in submitting an e-portfolio, the more negative the perspective the preservice teachers had on the use of an e-portfolio. In other words, as they passed through their semesters, the beliefs of preservice teachers about the functions/roles of e-portfolios became less positive (see Table 2).

[Insert Table 2 about here]

Group differences in the preservice teachers' experience in the development of an e-portfolio

Positive experience in the development of an e-portfolio

Mean differences by technology course taken, e-portfolio submission status, and current status in the program were examined. The results from *t*-test revealed that there were no significant differences in overall positive experience in the development of e-portfolios by technology course taken ($t = -1.02$, $p > .05$). On the other hand, the results from univariate analyses showed that there were significant differences in preservice teachers' overall positive experience in the development of an e-portfolio by current status in terms of the e-portfolio ($F(4) = 9.15$, $p < .001$) and program status ($F(3) = 13.64$, $p < .01$). The results from the differences in positive technology experience are available in Table 3.

[Insert Table 3 about here]

The results showed that the more advanced a student was in the program, with accumulative experience in submitting an e-portfolio, the less positive the experience, overall, and in technology use, the preservice teachers had in the development of an e-portfolio. In other words, as they passed through their semesters, the preservice teachers' overall experience, including technology use, in the development of an e-portfolio became less positive.

Negative experience in the development of an e-portfolio

Group differences in negative experience in the development of an e-portfolio were also examined. There were significant differences in the preservice teachers' overall negative experience in the development of an e-portfolio by current status in terms of the e-portfolio and program status ($F(4) = 4.46, p < .001$; $F(3) = 7.16, p < .001$ respectively). The results from the differences in negative experience of technology are available in Table 4.

[Insert Table 4 about here]

The results showed that the more advanced a student was in the program, with accumulative experience in submitting an e-portfolio, the more negative the experience, overall, and in technology use, the preservice teachers had in the development of an e-portfolio. In other words, as they passed through their semesters, the preservie teachers experience became less positive in technology use in the development of the e-portfolio and in the overall development of the e-portfolio.

Predictors of preservice teachers' beliefs on the e-portfolio

To predict the preservice teachers' beliefs on using an e-portfolio as an indicator of their understanding of the standards, we employed a hierarchical regression. To reduce multicollinearity problems, all predictor variables were standardized (Aiken & West, 1991), and

then interaction terms were created by multiplying the standardized predictor variables. Both an individual R-square value and a variance inflation factor (VIF) for all predictors revealed that there were no indications of multicollinearity (Tolerance > .1; VIF > 2.501) among predictors and between the dependent variable and predictors as well (see Table 5). Preservice teachers' technology course taken (yes/no) was dummy coded and entered with program status as covariates in the first step of the regression model and preservice teachers' experience in the development of an e-portfolio (overall positive experience and overall negative experience) were entered as the main effect predictor variables in the second step of the model, followed by interaction terms between preservice teachers' status in the program and experience in the development of e-portfolios in the third step. Based on a preliminary regression analysis, the only significant two-way interaction term between program status and overall positive experience in the development of an e-portfolio remained in the final regression model.

The overall regression model was significant, $F(5, 104) = 40.14$, $p < .001$, $R^2 = .66$, with a significant increase in R^2 in each step. The results showed that preservice teachers' current status in the program ($\beta = .176$, $t = 2.58$, $p < .01$) and overall positive experience in the development of an e-portfolio ($\beta = .617$, $t = 572$, $p < .001$) were positively related to their beliefs on e-portfolios as the indicator of the understanding of the standards (see Table 5). Entry of the preservice teachers' experience (overall positive experience and overall negative experience) resulted in a significant increase in R^2 and overall positive experience in building an e-portfolio emerged as a strong, positive predictor of the preservice teachers' beliefs on the e-portfolio ($\beta = .69$, $t = .64$, $p < .001$). Current status in the program remained significant even after the main effect predictor, overall positive experience in the development of an e-portfolio and an interaction term were added to the final regression model.

[Insert Table 5 about here]

[Insert Figure 1 about here]

To better understand the nature of the two-way interaction, we conducted simple slope

tests and graphed regression lines at a low (1 *SD* above the mean) and a high (1 *SD* below the

mean) level of teachers' sense of efficacy (see Figure 1), following the guidelines proposed by

Aiken and West (1991). The simple slope tests revealed that standardized regression coefficients

for the preservice teachers' current status in the program were significantly different from zero

for the preservice teachers who scored low on overall positive experience in the development of

an e-portfolio, while they were not significantly different from zero for the preservice teachers

who scored high on overall positive experience in the development of an e-portfolio. The result

suggested that current status in the program had a significant influence on the beliefs on e-

portfolios only when preservice teachers had a low level of overall positive experience in the

development of an e-portfolio, with high current status in the program leading to higher beliefs

on e-portfolios and low current status in the program leading to lower beliefs on e-portfolios.

Low current status resulted in the lowest beliefs on e-portfolios when it was accompanied by a

low level of overall positive experience in the development of an e-portfolio.

Discussion

As the use of the e-portfolio as an assessment tool is becoming more and more common in

early childhood education, it is worthwhile to examine preservice teachers' beliefs concerning e-

portfolios and their experience in the development of an e-portfolio to meet state and national

standards for professional teachers. This study examined 112 preservice teachers' beliefs about

e-portfolios as an indicator of their understanding of the standards through their experience in the

development of an e-portfolio. Findings from this study suggested that preservice teachers'

beliefs about e-portfolios were influenced by their experience in building an e-portfolio and their

status in their program. The results help us understand a majority of preservice teachers'

perceptions about the standards through their beliefs regarding the e-portfolio and their

experience throughout the teacher education program. The findings of this study also suggested

that while there are problems and issues regarding the use of e-portfolios in early childhood

education programs, the majority of early childhood preservice teachers extend their

understanding of the standards through the development of an e-portfolio as they pass through

the teacher education program. This study discusses the implications of the results in terms of

preparation and ongoing support to help preservice teachers understand the role of e-portfolios

related to the standards for teaching effectiveness.

First, in terms of preparation, teacher education programs need to provide preservice

teachers with enough prep seminars or orientation about the standards and e-portfolios so that the

preservice teachers better understand what the standards are for, why they need to meet them, the

role of e-portfolios, and how e-portfolios can help them understand the standards. Knowing the

benefits of building an e-portfolio can motivate preservice teachers to develop their e-portfolios

to present their growth in knowledge and skills during their student teaching and for future

professional teaching.

Second, the findings of this study highlighted the need for ongoing support in the use of the

e-portfolio (Hewett, 2004). This study revealed that the more advanced a student was in the

program, with accumulative experience in submitting an e-portfolio, the more negative the

perspective the preservice teacher had on the use of an e-portfolio. As they passed through their

semesters, the beliefs of preservice teachers about the functions/roles of e-portfolios became less

positive. Although this result does not imply that the preservice teachers did not benefit from the e-portfolio to better understand their learning process, it does show that they need to be more motivated to engage in building an e-portfolio. By providing the preservice teachers with program-long positive experiences overall in building an e-portfolio and in the use of the technology, the teacher education program helps preservice teachers develop positive perspectives on e-portfolios.

Third, although using the technology may contribute to changing preservice teachers' beliefs about it and their perceptions of their teaching and of student learning in desirable ways (Hartley, Urish, & Johnston, 2006), we found that there was a strong relationship between experience in the technology and preservice teachers' beliefs about e-portfolios, implying that lack of technology skill is associated with low understanding of the role of e-portfolios vis a vis the standards. This result supports the results from recent case studies that many preservice teachers encounter technology difficulties in building an e-portfolio, which may influence their attitude related to the educational use of the technology in class (Chung & Kim, 2010; Lin, 2008). To maximize the effects of e-portfolios, the teacher education program should make authentic connections between coursework and professional teaching and between facilitation of employment and teaching qualifications (Foote & Vermette, 2001).

In conclusion, current program status and overall positive experience were significant in predicting preservice teachers' beliefs about e-portfolios, stressing the importance of positive experience in the development of an e-portfolio. Establishing a social network of peers within the teacher education program will be an alternative way to support preservice teachers in better understanding the standards and standards-based performance in order to become more effective teachers. We suggest that by providing advanced and systematic technology support, teacher

education programs should encourage preservice teachers to use the e-portfolio as a reflective

tool for learning to be a teacher and to ultimately enhance their teaching quality and improve

their future students' learning.

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Table 1

Correlations among Major Variables and Preservice Teachers' Beliefs on E-portfolio

Variables	1	2	3	4	5	6	7	8
1. Beliefs in e-portfolio	1	.66**	-.48**	-.38**	.77**	.16	-.51**	-.50**
2. Positive Technology experience		1	-.45**	-.38**	.83**	.16	-.40**	-.40**
3. Overall negative experience			1	.82**	-.48**	-.09	.30**	.33**
4. Negative technology experience				1	-.41**	-.05	.21*	.26**
5. Overall positive experience					1	.10	-.49**	-.50**
6. Technology courses taken						1	-.17	-.16
7. e-portfolio submission status							1	.93**
8. Current status in the program								1
N	111	111	111	111	111	112	112	112
M	3.65	3.04	2.31	2.26	2.31	.10	2.82	2.52
SD	1.07	1.27	1.22	1.19	1.10	.30	1.45	1.23

Note. **$p < .01$, *$p < .05$ (2-tailed).

Table 2

Group Mean Differences in Beliefs by Technology Course, E-portfolio Submission Status, and Current Status in the Program

	Value Label	n	M	SD	
Technology course	No	100	4.33	1.08	$t(108) = -1.49$,
	Yes	10	3.72	0.88	$p > .05$
E-portfolio Submission Status	In submission I	30	4.04	.55	$F(4) = 9.14$
	Post submission 1	13	3.58	1.05	$p < .001$
	In submission II	36	3.29	1.22	
	Post submission II	9	2.49	.77	
	In submission III	23	2.61	.96	
Current status in the teacher education program	Pre ECE first semester	36	4.27	.60	$F(3) = 12.28$
	Pre ECE second semester	13	4.06	.89	$P < .001$
	ECE 3-5th semester	29	3.48	1.20	
	ECE Prek K internship 6 7th semester	33	2.96	1.00	

Note. ECE = early childhood education; The preservice teachers in the program are required to submit e-portfolios three times to fulfill the required qualifications for their teacher license after they are admitted to the professional school of teacher education program. Once they completed all three required submissions, the preservice teachers are place for their student teaching in a public school system.

Table 3

Group Mean Differences in Preservice Teachers' Positive Experience in the Development of E-portfolio by Technology Course, E-portfolio Submission Status, and Current Status in the Program

Factor	Group	*n*	*M*	*SD*	*p*
Overall Experience					
Technology course	No	101	3.29	1.11	*t*(109) = -1.02
	Yes	10	3.66	1.01	*p* >. 05
E-portfolio Submission Status	In submission I	30	4.04	.55	*F*(4) = 9.15
	Post submission 1	13	3.58	1.05	*P* < .001
	In submission II	36	3.29	1.22	
	Post submission II	9	2.49	.77	
	In submission III	23	2.61	.96	
Current status in the teacher education program	Pre ECE first semester	36	3.92	.65	*F*(3) = 13.64
	Pre ECE second semester	13	4.01	.93	*P* < .001
	ECE 3-5th semester	29	3.05	1.24	
	ECE 7th semester	33	2.62	.94	
Technology Experience					
Technology course	No	101	2.97	1.27	*t*(109) = -1.84
	Yes	11	3.70	1.16	*p* > .05
E-portfolio Submission Status	In submission I	30	3.74	.86	*F*(4) = 6.86
	Post submission 1	13	3.13	1.17	*P* < .001
	In submission II	36	3.06	1.42	
	Post submission II	9	2.15	.80	
	In submission III	23	2.38	1.21	
Current status in the teacher education program	Pre ECE first semester	36	3.59	.93	*F*(3) = 7.21
	Pre ECE second semester	13	3.56	1.29	*P* < .001
	ECE 3-5th semester	29	2.87	1.41	
	ECE 7th semester	33	2.37	1.14	

Note. *p* < .05, **p* < .01, ***p* < .001. ECE preservice teachers during their 7th semester have their pre-k internship.

Table 4

Group Mean Differences in Preservice Teachers' Negative Experience in the Development of E-portfolio by Technology Course, E-portfolio Submission Status, and Current Status in the Program

Factor	Group	n	M	SD	p
DV: Overall Experience					
Technology course	No	101	2.34	1.24	$t(109) = .92$
	Yes	10	1.97	1.02	$p > .05$
E-portfolio Submission Status	In submission I	30	1.62	.82	$F(4) = 4.46$
	Post submission 1	13	2.08	1.32	$P < .01$
	In submission II	36	2.69	1.32	
	Post submission II	9	2.85	.47	
	In submission III	23	2.51	1.32	
Current status in the teacher education program	Pre ECE first semester	36	1.75	.96	$F(3) = 7.16$
	Pre ECE second semester	13	1.82	.98	$P < .001$
	ECE 3-5th semester	29	2.93	1.33	
	ECE 7th semester	33	2.56	1.16	
DV: Technology Experience					
Technology course	No	101	2.28	1.18	$t(109) = .55$
	Yes	10	2.07	1.25	$p > .05$
E-portfolio Submission Status	In submission I	30	1.71	.99	$F(4) = 3.98$
	Post submission 1	13	1.97	1.22	$P < .01$
	In submission II	36	2.78	1.24	
	Post submission II	9	2.48	.88	
	In submission III	23	2.26	1.11	
Current status in the teacher education program	Pre ECE first semester	36	1.77	.99	$F(3) = 8.18$
	Pre ECE second semester	13	1.85	.93	$P < .001$
	ECE 3-5th semester	29	3.05	1.28	
	ECE 7th semester	33	2.28	1.19	

Note. *$p < .05$, **$p < .01$, ***$p < .001$. ECE preservice teachers during their 7th semester have their pre-k internship.

Table 5

Hierarchical Regression Analyses for Variables Predicting Preservice Teachers' Beliefs in E-portfolio (N = 112)

Step Predictors	B	β	t	F	$R^2(\Delta)$	Tol.	VIF
Step 1				18.67***	.26		
Technology course taken	.096	.086	1.02			.980	1.02
Current Status in the program	.529	.489	5.83***			.980	1.02
Step 2				44.29***	.63 (.37)		
Technology course taken	.069	.061	1.02			.977	1.02
Current Status in the program	.145	.135	1.94			.734	1.36
Overall positive experience in e-portfolio	.688	.638	8.57***			.639	1.56
Overall negative experience in e-portfolio	.134	.124	1.82			.762	1.31
Step 3				40.14***	.66 (.03)		
Technology course taken	.038	.034	.58			.955	1.05
Current Status in the program	.190	.176	2.58*			.705	1.42
Overall positive experience in e-portfolio	.617	.572	7.65***			.587	1.70
Overall negative experience in e-portfolio	.128	.118	1.80			.761	1.31
Current Status × Overall positive experience	-.257	-.188	-3.06**			.876	1.14

Note. *p < .05, **p < .01, ***p < .001. $R^2(\Delta)$= Change in R^2 ; *Tol.* = Tolerance; *VIF* =Variance Inflation Factor.
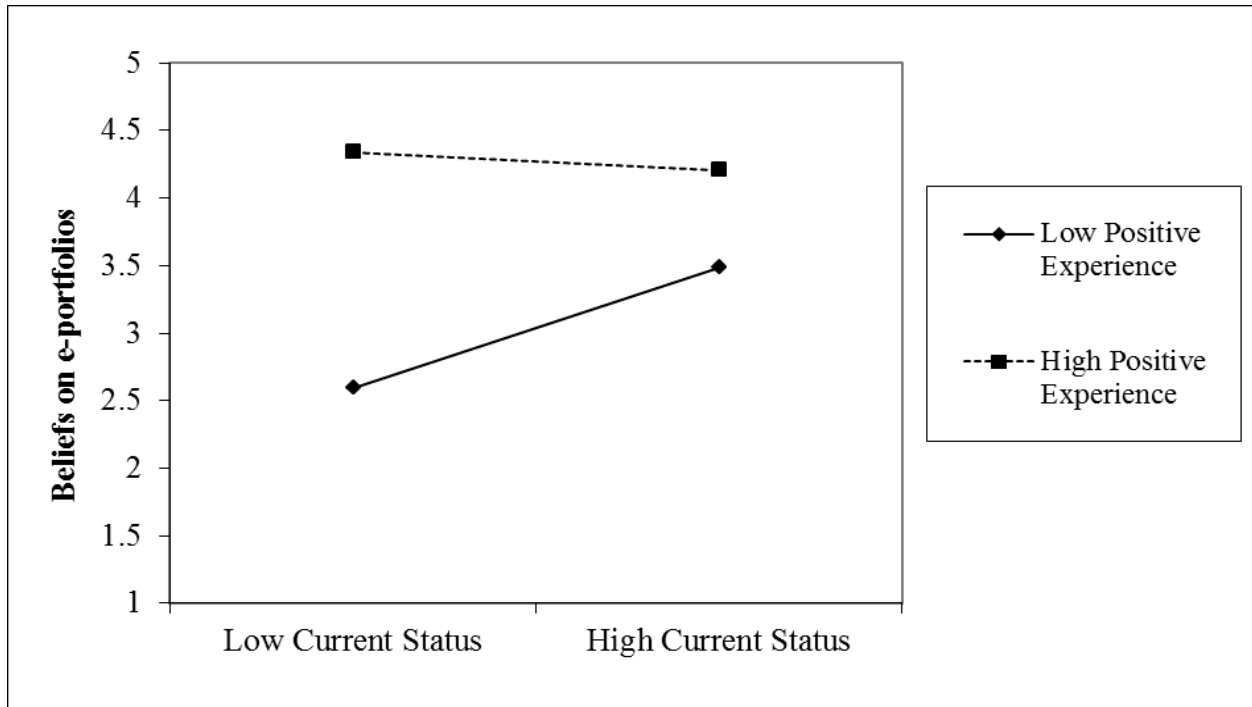
Figure 1. Interaction effects between current status and overall positive experience in the development of e-portfolios on preservice teachers' beliefs about e-portfolios