Predictors of teacher satisfaction with online professional development: evidence from the USA's e-Learning for Educators initiative

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Online professional development (OPD) is proliferating in an effort to eliminate barriers to high-quality in-service teacher training. Using the Internet as a vehicle for continuing professional development, however, introduces new concerns largely absent in its face-to-face counterpart. For example, evidence from the USA's e-Learning for Educators (EfE) initiative suggests that some OPD participants do not complete the online courses in which they enrol. In response to this evidence, the present study ($N = 3998$) investigates factors associated with teacher satisfaction with OPD via secondary analysis of EfE evaluation data. After considering participant variables, factors examined previously in the e-learning and professional development satisfaction literatures as well as novel predictors, a blockwise ordinary least squares regression model explains a considerably large share of the variance in participants' satisfaction with OPD (48.1%). Implications for the design and implementation of OPD and the training of facilitators to increase satisfaction are discussed.

Keywords: online professional development; satisfaction; teacher quality

Introduction

Contemporary educational research affirms that teacher quality matters (Darling-Hammond 1999, Rice 2003, Nye *et al.* 2004). Using data from a large-scale, randomized controlled trial, Nye *et al.* (2004, p. 253), for example, demonstrated that teacher effects both exist and are 'substantial' in magnitude. Darling-Hammond (1999) examined relationships between academic achievement and US state-level teacher quality policies, and similarly concluded that improvements to teacher quality should yield gains in student achievement outcomes. Advancing teacher quality, not surprisingly, is oftentimes viewed as integral to school reform efforts.

The No Child Left Behind Act 2001 (20 U.S.C. § 6319 (2008)) moreover reflects the importance of teacher quality in the United States. This legislation required that a 'highly qualified' teacher be in every classroom by the end of the 2005/06 school year. Since the passage of the No Child Left Behind Act, many have made similar calls for improvements to teacher quality (for example, Southern Regional Education Board n.d.). There are also indications that the forthcoming reauthorization of this legislation will echo an emphasis on teacher quality through accountability provisions targeting teacher effectiveness (US Department of Education 2010).

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Many assign high-quality professional development (PD) an essential role in both improving teacher quality and ensuring that students meet the rigorous academic standards spurred on by standards-based education reform policy (for example, Darling-Hammond and McLaughlin 1995, Garet *et al.* 2001, Borko 2004). Furthermore, Zucker (2008, p. 132) notes: 'There are no serious school improvement programs or practices that do not include teacher professional development as one vital component'. Such PD can also serve as a mechanism to keep in-service teachers abreast of research that occurs after they received their initial, formal training (Nir and Bogler 2008).

However, there are barriers to teachers' obtaining high-quality in-service training. Traditional PD necessitates the considerable investment of resources by school districts, for example (Killeen *et al.* 2002). Providing PD that is ongoing – one mark of effectiveness (for example, Garet *et al.* 2001, Desimone 2009) – is even more resource-intensive. It is not uncommon, then, for schools and districts to opt for 'much-maligned one-day workshops or lectures' (Sawchuck 2010, para. 6). Traditional, face-to-face PD sometimes lacks follow-through and feedback on the implementation of learned content (Galley 2002, Ingvarson *et al.* 2005). In addition, mandatory, school-based PD workshops that teachers may or may not find relevant to their needs compound teachers' already busy schedules and time constraints (Corcoran 1995, Dede 2006, Sawchuck 2010). Finally, the capacity or resources required to provide such efficacious in-service training might not even exist locally, particularly for isolated teachers in rural, high-needs areas (National Staff Development Council 2001, Dede *et al.* 2009, National Education Association 2010).

Consequently, online professional development (OPD) is proliferating in an effort to eliminate various barriers to high-quality PD (for example, Seal 2003, Sawchuck 2010). OPD offers a number of arguable advantages over traditional PD. Through asynchronous discussion, for example, it offers 'anytime, anywhere' flexibility and compatibility with teachers' busy schedules (Galley 2002). Using online rather than face-to-face meetings also removes geographic barriers, making it available to anyone with Internet access, as well as offering individual choice of PD activities (National Staff Development Council 2001, Seal 2003, Sawchuck 2010). Other purported benefits of OPD include: additional reflection time; implementation support; sustained interactions with peers; reduced cost; and opportunities for more reticent participants to contribute (National Staff Development Council 2001, Galley 2002, Seal 2003, Dede *et al.* 2009, Sawchuck 2010). Some argue that using technology to foster learning communities and deliver high-quality PD can even help reduce turnover by providing teachers with the ongoing professional support they need (Zucker 2008).

The e-Learning for Educators initiative

The e-Learning for Educators (EfE) initiative is a US Department of Education-funded project expressly aimed at removing scheduling and geographic barriers to high-quality teacher PD in 10 states. Spearheaded by Alabama Public Television, EfE intends to provide an effective, scalable, sustainable and replicable OPD model. The project capitalizes on many of the purported advantages of PD offered online. For instance, a course management system serves as a hub for asynchronous, ongoing interactions between course participants and an online facilitator. The initiative also partners State Departments of Education with a corresponding public broadcasting

organization to serve state and district teacher quality needs, initiatives and achievement goals for students.

There is also a capacity-building element to the project. This aims to cultivate cadres of skilled e-learning facilitators and course developers, and a pool of online courses. The initiative is the subject of a series of randomized controlled trials, being conducted by the Technology and Assessment Study Collaborative housed within Boston College's Center for the Study of Testing, Evaluation and Educational Policy (CSTEEP). CSTEEP is also conducting parallel external formative and summative outcome and implementation evaluations of the project. The Education Development Center, Inc., a non-profit research and development organization, provides training programmes for the e-learning facilitators, e-learning course development services and training and consultation.

The potential benefits of PD offered online for teachers are often touted (for example, Ginsberg *et al.* 2004, Dede 2006). However, using the Internet as a vehicle for autonomous PD introduces new concerns largely absent in its face-to-face counterpart. For example, evidence from the EfE initiative suggests that some OPD participants do not complete the online courses in which they enrol. Of the 29,104 enrolments in an OPD course during the first three-and-a-half years of the EfE project, 21,628 (74%) completed the course (Smith *et al.* 2009). Significantly, a failure to retain educators through course completion could possibly undermine these programmes' goals and objectives. In response to this evidence and a paucity of research on the topic, the present study investigates factors associated with teacher satisfaction with OPD.

The present study

Evaluation studies of PD programmes often emphasize participants' reactions to or satisfaction with the programme (Frechtling *et al.* 1995, Guskey 2000). While there have been calls for more rigorous impact studies of PD and its effects (Guskey 2000, Borko 2004, Desimone 2009), satisfaction with PD still represents an important construct. Ramsden and Entwistle (1981, cited in Palmer and Holt 2009) and Guskey (2002) respectively note that satisfaction is related to and requisite for participant learning outcomes. Palmer and Holt (2009) even employed satisfaction as a proxy for this cognitive outcome. Nir and Bogler (2008, p. 384) also contend that teacher satisfaction with PD is 'a very valuable factor in transforming knowledge and skills discussed during [PD] to classroom practices'.

While we do not contend that satisfaction with PD is as important as its impact, we do assume it represents an important construct in its own right through its aforementioned relationship with learning. Along these lines, increases in satisfaction could help realize OPD's intended impacts on both teacher quality and, less directly, student academic achievement. Crucially, the identification of factors related to OPD satisfaction can be used to optimize the design and implementation of OPD programmes in the future (for example, Guskey 2000, Russell *et al.* 2009b). Indeed, Palmer and Holt (2009, p. 101) suggest that the identification of factors associated with learner satisfaction in online environments can be: 'used as an input to the appropriate design of learning environments, and for the provision of targeted support to students, with an aim to positively influence the student online learning experience'. Such data might also provide more of an empirical basis for the training of online facilitators.

This study, then, endeavoured to identify factors that co-vary with satisfaction with OPD for primary and secondary educators. More specifically, we investigate both participant background and OPD design and implementation features that are potentially related to satisfaction with OPD. Care is taken both to re-examine findings extant in the face-to-face, OPD and e-learning satisfaction literatures (replication), as well as to identify new factors that may be relevant to satisfaction with PD offered online for teachers (extension).

Literature review

While much is known about effective face-to-face PD for teachers (see Desimone 2009), there is currently a dearth of research about the design and implementation features of effective OPD programmes (for example, Dede *et al*. 2009, Russell *et al.* 2009b). Given that OPD for teachers is a relatively new educational innovation, this is not surprising. Nevertheless, there remain significant gaps in the literature on why teachers discontinue OPD and why others do so in e-learning environments (Sun *et al.* 2008). In an extensive review of what is known about OPD for teachers, Ketelhut et al. (2006, p. 237) noted a 'lack of teacher voice in [OPD's] design'. The present study directly addresses this lack of empirically garnered knowledge.

Before proceeding, addressing the relative effectiveness of online and traditional face-to-face PD is paramount. While many apply the face-to-face versus online learning 'no significant difference' phenomenon (Russel 2001) deductively to OPD for teachers, some comparative research has been conducted on this topic. Russell *et al.* (2009a), for example, compared the effects of face-to-face PD and OPD for mathematics teachers. The authors showed positive teacher outcomes in both conditions. Additionally, impact studies of the EfE initiative demonstrate positive effects. Across four separate randomized controlled trials, O'Dwyer *et al.* (2010) found medium to large, statistically significant positive effects of OPD on teacher knowledge and instructional practices. This nascent body of evidence suggests that OPD for teachers can be effective and warrants further empirical research for design improvement purposes.

In accordance with recommendations made in the work preceding it (that is, Dede *et al*. 2009), the present study invokes diverse literatures germane to new OPD scholarship. In particular, it draws from the literatures on teacher satisfaction with traditional PD, as well as satisfaction with both OPD in other professions (e.g. nursing) and e-learning more generally. This literature review yielded a set of predictors previously investigated *vis-à-vis* satisfaction with PD and in e-learning contexts.

The present study considers characteristics that teachers bring with them to OPD, both as independent variables of interest and as statistical controls. In particular, computer proficiency (for example, Tallent-Runnels *et al.* 2006, Sun *et al.* 2008), gender (for example, Arbaugh 2000, Arbaugh and Duray 2002), prior online course experience (for example, Artino 2008) and ease of access to technology (Galley 2002, Kleiman 2004) are investigated.

As discussed earlier, the present study also revisits factors either established or examined previously in PD or e-learning satisfaction research. These factors centre on design and implementation characteristics of the OPD courses themselves. Specifically, this study investigates: the number of contact hours (for example, Arbaugh

2000), the facilitator's provision of helpful feedback (Nir and Bogler 2008), the quality of learner interactions (for example, Frith and Key 2003, Carey *et al.* 2008, Russell *et al.* 2009b), the availability of technical assistance (for example, Kleiman 2004, Tallent-Runnels *et al*. 2006), the clarity of participation expectations (Palmer and Holt 2009), course organization (Swan 2001) and the user-friendliness of the website interface (Arbaugh 2000, Chiu *et al.* 2005).

We also test new design and implementation variables afforded by EfE evaluation data in an exploratory fashion. These include facilitator knowledgeableness, as well as facilitator effectiveness in encouraging active participation, fostering stimulating discussion, setting a welcoming tone, keeping discussions on-topic, communicating clear activity expectations and being accessible for support. We also examine systematic relations between OPD satisfaction and the ease of content transferability, alignment with PD needs or plans, and addressing of local needs. Finally, we examine whether the adequacy of compensation, the relevance and beneficence of discussion topics, the clarity of stated goals, the cultural non-bias of materials and the extent to which the course effectively linked pedagogical skills and content are related to satisfaction.

Method

The present study constitutes a secondary analysis of self-reported external evaluation data from the EfE initiative. Such secondary data analysis to improve the design and implementation of OPD was an explicit goal of the EfE project. While these data come from a particular model of OPD, its large-scale, multi-state implementation probably affords the variability requisite for explaining variance in satisfaction. An institutional review board at the authors' institution approved this research.

Participants

The sample (N = 3998) includes elementary and secondary teachers from nine states who completed an EfE course. Only those participants completing pre-evaluation and post-evaluation surveys were included. We exclude participants represented multiple times in the evaluation in order to ensure that statistical independence assumptions were met. For these participants, we only include evaluation data from their first course. This information is most comparable with that provided by those who participated in just one course. We exclude EfE participants who were not classroom teachers when they enrolled.

Instrumentation

The evaluation data employed include those collected before and immediately following each OPD course. Most of the items have rating scale response formats, although two (i.e. gender and prior online course experience) are dichotomous. In addition to employing intact pre-evaluation and post-evaluation survey items from the EfE project, this study also constructs three composite variables from multiple evaluation items. Principal component and scale analyses provided evidence of unidimensionality for each of the composites.

Satisfaction

We constructed a satisfaction composite variable using two EfE evaluation survey items administered at post-course. The first item, 'Rate the overall quality of this workshop', employed a five-point rating scale ('Poor', 'Fair', 'Good', 'Very good' and 'Excellent'). The second item, 'How likely are you to take another online professional development workshop?', used a four-point rating scale ('Very unlikely', 'Somewhat unlikely', 'Somewhat likely' and 'Very likely'). Internal consistency (α; Cronbach 1951) reliability for the two items was 0.60. Principal components analysis of these items produced a single-factor solution with an eigenvalue of 1.43 and explained 71.6% of the observed variance. Factor loadings for both items were 0.85. Because these two variables were on different scales, we extracted the principal component with an eigenvalue greater than one via SPSS (unrotated), using the regression method.

Computer proficiency

We constructed this study's indicator of computer proficiency by taking the mean of eight items administered before the course. Participants were asked, 'How proficient are you at performing each of the following': navigating websites; performing an Internet search for educational resources; downloading documents; uploading documents; reading a threaded discussion; posting comments to a threaded discussion; installing support programmes (e.g. *QuickTime*, *RealPlayer*, *Flash*, *Java*, etc.); and troubleshooting computer problems. Responses were on a five-point scale: 'I don't know yet' (0), 'Not proficient' (1), 'Somewhat proficient' (2), 'Proficient' (3) or 'Highly proficient' (4). Principal components analysis of these items produced a single-factor solution with an eigenvalue of 5.486 and explained 68.6% of the observed variance. Factor loadings for the eight items ranged from 0.78 to 0.87, and internal consistency (α) reliability was 0.93.

Quality of learner interactions

We also constructed a composite representing the quality of participant interaction in the online discussion forum by taking the mean of two items administered post course. The composite was constructed from responses to 'Rate the effectiveness of each workshop component in helping you learn the workshop material' for 'Online discussions' and 'Collaborating with other participants'. Principal components analysis of these items produced a single-factor solution with an eigenvalue of 1.59 and explained 79.7% of the observed variance. Factor loadings for both items were 0.89, and internal consistency (α) reliability was 0.75.

Data assumptions

This study modified several other variables for analysis. First, rather than excluding a large share of participants responding 'I never needed it' to the item asking 'Was technical assistance available throughout this workshop' (availability of technical assistance), this response was re-coded to constitute a central category between the alternative responses (i.e. 'Yes' and 'No'). This assumes that these participants had no opinion regarding the availability of technical assistance.

We also modified the items used to construct our quality of learner interaction composite. Originally, response options for the two constituent items were on a five-point rating scale: 'Not applicable' (0), 'Very ineffective' (1), 'Ineffective' (2), 'Effective' (3) and 'Very effective' (4). In order to reduce the amount of missing data, the 'Not applicable' responses to the items were re-coded to represent a central category. The other categories were re-coded accordingly, relative to that new neutral category: 'Very ineffective' (0), 'Ineffective' (1), 'Not applicable' (2), 'Effective' (3) and 'Very effective' (4). This modification assumed that participants responding 'Not applicable' had a neutral opinion regarding the effectiveness of those particular course components.

Participants providing a numeric response of 40 or greater to a question asking, 'On average, how many hours per week did you spend completing all workshop activities' at post test were excluded from analysis; participating to this extent was clearly unlikely or, in some cases, impossible (e.g. participants responding '4000'). This variable is analogous to Ingvarson *et al.*'s (2005) contact-hours measure rather than duration, because our OPD courses do not exhibit much variability in terms of their duration (they all last approximately six to seven weeks).

Next, two pairs of items administered during both the post test and a follow-up were quite similar. The first pair represented the ease of content transferability construct, while the second pair represented the addressing of local need. For these constructs, the post-test items were selected in order to ensure that participants remembered the course content, as the follow-up survey could have been completed up to one year later. Given the ongoing nature of these particular OPD courses, it is likely that participants were able to apply the course content (or not) during their enrolment time and respond accurately. Lastly, gender was dummy coded such that zero and one represent 'Male' and 'Female', respectively. The remaining evaluation items are presented in Table 1.

Analytic approach

Hierarchical (blockwise) ordinary least squares linear multiple regression analysis is used to explain variance in the satisfaction criterion variable. Unreported analyses showed that hierarchical linear modelling was unnecessary. Although the authors conducted a series of very preliminary analyses, the modelling reported here followed the logic described next. Because of the inclusion of both previously examined and new predictors, there were both theory-driven and data-driven aspects to the model building.

To account for participant characteristics, the computer proficiency, gender, prior online course experience and ease of access to technology variables were first entered simultaneously in a regressor block. Next, we entered factors identified from the literature (e.g. interface user-friendliness, quality of learner interactions) into the model as a regressor block. These two blocks represent the theory-driven component of the model. The data-driven, or exploratory, component of the modelling tested the unique effects of novel predictors potentially relevant in the context of OPD. We specified a forward entry procedure ($p < 0.05$ for entry) for this third block.

Results and discussion

Descriptive statistics for, and Pearson product-moment correlations between, all variables are presented in Appendices 1 and 2, respectively. With the exception of number

Table 1.   Summary of evaluation items submitted to analysis without modifications.

Variable	Evaluation item	Response format
Prior online course experience	Have you ever taken an online course or workshop?	'Yes' = 1; 'No' = 0
Ease of access to technology	I had access to technology that allowed me to fully participate in this workshop	Agreement
Course organization	The workshop was well-organized	Agreement
Provision of helpful feedback	How successful was the facilitator at [providing helpful feedback]?	Effectiveness
Clarity of participation expectations	The expectations for workshop participation were clear	Agreement
Interface user-friendliness	The workshop website was user-friendly	Agreement
Facilitator knowledgeableness	The facilitator was knowledgeable in this content area	Agreement
Encouraging active participation	How successful was the facilitator at [encouraging active participation]?	Effectiveness
Fostering stimulating discussion	How successful was the facilitator at [fostering stimulating discussion]?	Effectiveness
Setting a welcoming tone	How successful was the facilitator at [setting a welcoming tone for the workshop]?	Effectiveness
Keeping discussions on-topic	How successful was the facilitator at [keeping discussions on-topic]?	Effectiveness
Communicating clear activity expectations	How successful was the facilitator at [clearly communicating expectations for activities]?	Effectiveness
Being accessible for support	How successful was the facilitator at [being accessible for support]?	Effectiveness
Alignment with PD needs or plans	The workshop was aligned with my school's professional development needs or plans	Agreement
Adequacy of compensation	I received adequate credit or compensation for taking this workshop	Agreement
Relevance of discussion topics	The topics chosen for discussion were relevant	Agreement
Beneficence of discussion topics	The topics chosen for discussion were beneficial	Agreement
Clarity of stated goals	The workshop goals were clearly stated	Agreement
Cultural non-bias of materials	The workshop materials were culturally unbiased	Agreement
Effective linking of pedagogical skills and content	The workshop effectively linked pedagogical skills and content	Agreement

Note: Agreement = four-point scale ranging from 'Strongly disagree' (1) to 'Strongly agree' (4), centrally anchored by 'Disagree' (2) and 'Agree' (3). Effectiveness = four-point scale ranging from 'Very unsuccessful' (1) to 'Very successful' (4), centrally anchored by 'Unsuccessful' (2) and 'Successful' (3).

of contact hours, all of the predictor variables were related to the criterion measure. Many of the regressor variables were also significantly correlated with one another. We report here only the first, second and final models owing to space constraints, although Appendix 3 summarizes all the models. We also discuss which variables were added through the forward entry procedure and note any corresponding changes in significance.

The control block of regressors provided a statistically significant model, $F(4,3993) = 101.69$, $p < 0.001$. Participant computer proficiency, gender, prior online course experience and ease of access to technology were significant. Increases in participant ease of access to technology, being female and having taken an OPD course were associated with increases in satisfaction. Increases in participant computer proficiency were associated with decreases in satisfaction. This block of predictors together explained 9.2% of the variation (R^2_A) in the satisfaction measure.

The second block of predictors explained significantly more variance in the satisfaction outcome, $\Delta F(7,3986) = 316.41$, $p < 0.001$, again resulting in a significant model, $F(11,3986) = 258.77$, $p < 0.001$. Course organization, facilitator's provision of helpful feedback, quality of learner interactions, clarity of participation expectations and interface user-friendliness were significant. Increases in each of these variables were associated with increases in satisfaction. On the other hand, contact hours and the availability of technical assistance were not significant (see Appendix 3). After including these predictors, participant ease of access to technology and prior online course experience remained significant, while computer proficiency and gender did not. The second block of predictors contributed considerable explanatory power to the model, $\Delta R^2 = 0.324$, and together, the first two blocks explained 41.5% of the variance.

The forward entry procedure used for Block 3 added nine variables (see Appendix 3). The first variable was the ease of content transferability. Increases in this measure were associated with increased satisfaction. The next variable entered was the adequacy of compensation. Increases in the adequacy of compensation were also associated with increased satisfaction. Participant ease of access to technology was no longer significant with the addition of this compensation variable. The next seven variables entered into the model were: the beneficence of discussion topics, facilitator knowledgeableness, the effective linking of pedagogical skills and content, the cultural non-bias of materials, the facilitator's both keeping discussions on-topic and communicating clear activity expectations, and the clarity of stated goals. While increases in the beneficence of discussion topics, effective linking of pedagogical skills and content, and the facilitator's communicating clear activity expectations were associated with increased satisfaction, increases in the other four variables were associated with decreased satisfaction. These four unexpected negative, although very small, relationships are addressed later. No changes to the statistical significance of the earlier variables were seen with the addition of these seven variables. The variables in Block 3 explained 6.6% more variance in our OPD satisfaction measure, and all of the predictors in concert explained an impressive 48.1%.

Not surprisingly, the blocks of participant and previously examined predictors added the most to the model's explanatory power. The squared semi-partial correlation coefficients for the first and second models, respectively, were 0.092 and 0.324. The increases in explained variance seen with the inclusion of the nine variables added in Block 3 were decreasingly of statistical import. The increases in explained variance for the first three variables entered in Block 3, for example, were 3.0%, 1.5% and

1.2%. Beginning with the addition of the fourth predictor in Block 3, the increases in explained variance were quite negligible (all increases in explained variance being less than 0.5%).

In the final model, the following variables were significant (with directions noted): prior online course experience (+), course organization (+), the facilitator's provision of helpful feedback (+), quality of learner interactions (+), clarity of participation expectations (+), interface user-friendliness (+), the ease of content transferability (+), the adequacy of compensation (+), the beneficence of discussion topics (+), facilitator knowledgeableness (−), effective linking of pedagogical skills and content (+), the cultural non-bias of materials (−), facilitators' keeping discussions on-topic (−), facilitators' communicating clear activity expectations (+) and the clarity of stated goals (−).

Statistical significance and directionality are not all that can be taken from these findings. It is also important to address the practical significance of each of these variables' relations with OPD satisfaction. Using standardized regression coefficients (Betas), one can compare the relative magnitude of each predictor's relationship with the criterion variable, while accounting for the others. The absolute magnitudes of the Betas were relatively small, although they varied (0.045–0.191). In this final model, the variables most related to satisfaction were the beneficence of discussion topics (0.191), quality of learner interactions (0.167), the ease of content transferability (0.158), the adequacy of compensation (0.131), course organization (0.126) and the clarity of participation expectations (0.123).

Capitalizing on variability across EfE OPD courses, this study provides new evidence that teacher satisfaction with OPD is not independent of its design and implementation features. After considering participant characteristics, factors examined previously in various literatures as well as novel predictors, the final model reported here explains a considerable share of the variance in OPD satisfaction. While this high amount of explained variance was in keeping with some other research along these lines (that is, Gunawardena and Duphorne 2001, Palmer and Holt 2009), it was much larger than in other published studies (for example, Nir and Bogler 2008).

Importantly, this study finds some support for variables previously identified as predictive of satisfaction in the face-to-face and online learning literature. For example, we replicate the relationship between participants' prior online course experience and current OPD satisfaction (Arbaugh and Duray 2002). The clarity of participation expectations was related to course satisfaction, as shown by Palmer and Holt (2009). Similarly, our findings regarding a relationship between perceived interface user-friendliness and satisfaction converge with those of Chiu *et al*. (2005). Regarding these findings, the participating states used various course management systems (CMSs) for their OPD courses. It is possible that variability across these various CMSs accounts for this difference.

In order to shed more light on this issue, we conducted supplementary analyses. Our sample participated in online courses housed within three CMSs (i.e. Blackboard, Moodle and Desire2Learn). We first examined differences in participants' satisfaction and ratings of the interface user-friendliness as a function of the CMS. An analysis of variance revealed a statistically significant omnibus difference in satisfaction as a function of the CMS, $F(2,6662) = 14.05$, $p < 0.05$. Scheffé's *post hoc* contrasts showed that participants taking a course using Blackboard and Desire2Learn were significantly more satisfied than participants using Moodle; there was no difference in

satisfaction among participants using Blackboard or Desire2Learn. An analysis of variance also revealed a difference in ratings of interface user-friendliness by CMS, $F(2,6694) = 22.19$, $p < 0.05$. Scheffé's *post hoc* contrasts showed that participants taking a course using Blackboard rated the interface as significantly more user-friendly than participants using both Moodle and Desire2Learn; ratings of interface user-friendliness were not statistically distinguishable among participants who used either Moodle or Desire2Learn. These simple analyses suggested an advantage of using Blackboard and Desire2Learn, in terms of satisfaction, and an advantage of using Blackboard, in terms of interface user-friendliness.

However, because these bivariate relationships could be spurious, we also re-ran our regression analysis to include two dummy variables representing use of the Blackboard and Moodle CMSs (with Desire2Learn as a reference group). Because our CMS variable was also related to interface user-friendliness, we retain it in the model. The interface user-friendliness variable remained significant with the addition of these two dummy variables to the final regression model. The dummy representing Blackboard use relative to the use of Desire2Learn was not significant ($p = 0.60$). However, the dummy representing the use of Moodle relative to the use of Desire2Learn was significant (Beta = –0.05) such that participants using Moodle were less satisfied than those using Desire2Learn. Largely, these analyses suggest higher satisfaction when the CMS employed is Blackboard or Desire2Learn, both of which are commercially available, rather than Moodle, an open-source platform.

This study also provides evidence for the importance of discussion and collaborative interactions among course participants. This has been the subject of considerable research, albeit with mixed findings in OPD and e-learning research (for example, Tallent-Runnels *et al*. 2006, Carey *et al*. 2008, Russell *et al.* 2009b). We also found relationships between satisfaction and both the facilitator's provision of helpful feedback and the organization of the course itself. The former is consistent with findings that feedback on PD activities is important in the context of teacher learning (Joyce and Showers 1995, cited in Ingvarson *et al*. 2005). The latter, course organization, is consistent with Swan (2001).

This study's final model also failed to find evidence for relationships between some previously investigated variables and satisfaction. We do not find evidence for a gender difference in satisfaction, which is consistent with all the research we reviewed (for example, Arbaugh 2000). Next, relationships between satisfaction and both participants' computer proficiency and ease of access to technology were not significant in our study. While these null effects diverge from some literature (see Kleiman 2004, Tallent-Runnels *et al*. 2006), it is possible that satisfaction was unrelated to these variables in our OPD programme because participation was voluntary. Furthermore, the OPD courses were designed to require minimal technical specifications (e.g., Internet connection and computer processor speeds).

Finally, design and implementation features such as the number of contact hours and the availability of technical assistance were also unrelated to OPD satisfaction in our final model. Regarding the former, it is noteworthy that Ingvarson *et al*. (2005) found that contact hours were indirectly related to programme impact (rather than satisfaction) through its relationship with intervening variables (e.g. feedback, active participation). It is possible that it is not so much the number of hours during which a teacher participates that matters, but instead what he or she does with that time. The null relationship between the availability of technical assistance and satisfaction is

also not surprising given that technical assistance was available via an externally maintained email address.

This study also finds evidence for new factors that may be relevant to teacher satisfaction with OPD. In fact, the forward entry regression procedure provides evidence for unique relationships between OPD satisfaction and nine other variables. We here differentiate among these variables based on the extent to which they contributed either meaningful or negligible explanatory power to the model. First, the item contributing the most explained variance was the ease of content transferability. We suspect that this finding indicates that teachers are more satisfied with OPD that has practical, concrete and readily usable content than they are with content that is more theoretical (see Darling-Hammond and McLaughlin 1995). This finding is consistent with adult learning principles, which suggest that this population desires knowledge that can be applied immediately (Cercone 2008).

Second, we find that the adequacy of compensation received for course participation was meaningfully related to satisfaction in our model. While there has been no empirical evidence for this to the authors' knowledge, many have speculated that it matters (see Frith and Key 2003, Kleiman 2004). Regarding this finding, unreported analyses we conducted did not provide strong evidence of a benefit to satisfaction of any particular type of compensation (e.g. course credit toward a degree, or professional development points). Therefore, it is possible that the type of compensation participants receive may be less important than the extent to which they deem it to be adequate.

Third, we find meaningful evidence for a relationship between our measure of satisfaction and the beneficence of the discussion topics. This is not surprising given the nature of the EfE online courses, which involve session readings as an essential, undergirding feature. These readings form a basis for the asynchronous discussion among participants.

This study also found statistically significant relationships between satisfaction and facilitator knowledgeableness, the course's effective linking of pedagogical skills and content, the clarity of stated goals, the cultural non-bias of materials as well as facilitator effectiveness as it relates to keeping discussions on-topic and communicating clear activity expectations. For reasons discussed later, we maintain that these new findings are quite tenuous.

On the other hand, some new course design and facilitator implementation variables were not significant. In terms of the courses themselves, the relevance of discussion topics, alignment with PD needs or plans and their addressing of local needs, did not add to our model's explanatory power. In terms of the facilitators, fostering stimulating discussion, encouraging active participation, setting a welcoming tone and being accessible for support, were not significant predictors of satisfaction. Some of these findings are interesting, given that the actions of facilitators in OPD courses can undermine the fruitfulness of discussion and satisfaction (Lowes *et al.* 2007). However, earlier research using EfE data did not find such facilitator effects, and it is possible that the training undergone by EfE facilitators ensures that all facilitators are high quality in this regard. The finding regarding the availability of support, however, converges with some literature. In an experimental study, Russell *et al.* (2009b) also showed that varying participants' access to course supports (a mathematics education instructor and an online facilitator) did not affect perceptions of course quality. Many of these null findings are perhaps easily explained by the fact that our data were drawn from a particular OPD programme implementation.

Limitations

This study's findings must be interpreted in light of its limitations. These potentially include selection bias, the quality of the evaluation data employed and, most importantly, its observational nature. Given these potential threats, however, a number of things are worth noting. With regard to internal validity, our study did attempt to exercise control of extraneous variables that might bear on participants' satisfaction. We also explained a large share of the OPD satisfaction variance. In light of the possible selection bias, we restrict our target population to only teachers who chose to enrol in OPD (rather than all teachers). Notwithstanding this threat, our findings do emerge from an investigation of a sizeable sample of both participants and OPD courses. Lastly, we refrain from drawing implications regarding predictors with either unexpectedly negative, or significant but negligible, relations with the criterion; we suspect that the former are suppressor variables, and the latter simply consequences of high statistical power.

Nonetheless, as with any study, future research should surely attempt to replicate our findings. Subsequent studies should furthermore attempt to link OPD's design and implementation features to its *outcomes*, including favourable changes in: teacher knowledge, skills, attitudes and beliefs; instruction; and student achievement (see Desimone 2009). While satisfaction is important, it is not tantamount to impact. We draw our implications with these caveats in mind.

Implications

In spite of these limitations, some of our findings have implications for the design and implementation of OPD programmes and the training of facilitators. Given this study's operational definition of our outcome, it is expected that the application of these findings will yield OPD courses that participants find satisfying. That is, we expect that these findings could be used to produce OPD courses that participants deem to be of high quality and will complete, so that they would intend to enrol in further OPD. If OPD is in fact effective, then one would expect sustained and continued participation to produce better gains in teacher quality and, hopefully, student achievement.

Given our replication of earlier findings in this new context, and new evidence for meaningful relationships between various factors and satisfaction, we offer the following implications. Teacher OPD courses designed to foster high-quality interactions among learners, with clear expectations for participation, that are organized, feature a user-friendly interface, with content that is easily transferred to the classroom, that provide adequate compensation and feature beneficial discussion topics might be found more satisfying by participants. Training facilitators to provide helpful feedback to course participants should also be expected to yield higher satisfaction.

In conclusion, given that dissemination was an explicit part of Boston College's role in the EfE initiative, this study shares *empirical* lessons learned for others hoping to design and implement OPD for teachers. While OPD as a form of in-service teacher education is no panacea for school reform efforts, in light of evidence for its impact (for example, O'Dwyer *et al*. 2010), it does offer potential. It is clear that high-quality PD, including that offered online, can help tackle school reform and attain the ambitious standards for student achievement called for in the No Child Left Behind Act 2001 (20 U.S.C. § 6319 (2008); Borko 2004), that will no doubt continue with its reauthorization in the coming year.

Acknowledgements

References

Arbaugh, J.B., 2000. Virtual classroom characteristics and student satisfaction with Internet-based MBA courses. *Journal of management education,* 24 (1), 32–54.

Arbaugh, J.B. and Duray, R., 2002. Technology and structural characteristics, student learning and satisfaction with web-based courses: an exploratory study of two on-line MBA programs. *Management learning,* 33 (3), 331–347.

Artino, A.R., 2008. Motivational beliefs and perceptions of instructional quality: predicting satisfaction with online training. *Journal of computer assisted learning,* 24(3), 260–270.

Borko, H., 2004. Professional development and teacher learning: mapping the terrain. *Educational researcher,* 33 (8), 3–15.

Carey, R., *et al.,* 2008. Online courses for math teachers: comparing self-paced and facilitated cohort approaches [online]. *Journal of technology, learning, and assessment,* 7 (3). Available from: http://escholarship.bc.edu/cgi/viewcontent.cgi?article=1152&context= jtla [Accessed 5 July 2010].

Cercone, K., 2008. Characteristics of adult learners with implications for online learning design. *AACE journal,* 16 (2), 137–159.

Chiu, C.M., *et al.,* 2005. Usability, quality, value and e-learning continuance decisions. *Computers & education,* 45 (4), 399–416.

Corcoran, T.B., 1995. *Helping teachers teach well: transforming professional development.* New Brunswick, NJ: Consortium for Policy Research in Education.

Cronbach, L.J., 1951. Coefficient alpha and the internal structure of tests. *Psychometrika,* 16 (3), 297–334.

Darling-Hammond, L., 1999. *Teacher quality and student achievement: a review of state policy evidence.* Seattle, WA: University of Washington, Center for the Study of Teaching and Policy.

Darling-Hammond, L. and McLaughlin, M.W., 1995. Policies that support professional development in an era of reform. *The phi delta kappan,* 76 (8), 597–604.

Dede, C., 2006. The evolution of online teacher professional development. *In*: C. Dede, ed. *Online professional development for teachers: emerging models and methods.* Cambridge, MA: Harvard Education Press, 1–11.

Dede, C., *et al.,* 2009. A research agenda for online teacher professional development. *Journal of teacher education,* 60 (1), 8–19.

Desimone, L.M., 2009. Improving impact studies of teachers' professional development: toward better conceptualizations and measures. *Educational researcher,* 38 (3), 181–199.

Frechtling, J., *et al.,* 1995. *Teacher enhancement programs: a perspective on the last four decades.* Arlington, VA: National Science Foundation.

Frith, K.H. and Key, C.C., 2003. The effect of communication on nursing student outcomes in a web-based course. *Journal of nursing education,* 42 (8), 350–358.

Galley, M., 2002. E-training offers options. *Education week,* 21 (35), 41–44.

Garet, M.S., *et al.,* 2001. What makes professional development effective? Results from a national sample of teachers. *American educational research journal,* 38 (4), 915–945.

Ginsberg, A., Gray, T., and Levin, D., 2004. *Online professional development for mathematics teachers: a strategic analysis.* Washington, DC: American Institutes for Research.

Gunawardena, C.N. and Duphorne, P.L., 2001. Which learner readiness factors, online features, and CMC related learning approaches are associated with learner satisfaction in computer conferences? Paper presented at the American Educational Research Association annual meeting, 10–14 April, Seattle, WA.

Guskey, T.R., 2000. *Evaluating professional development.* Thousand Oaks, CA: Corwin Press.

Guskey, T.R., 2002. Does it make a difference? Evaluating professional development. *Educational leadership,* 59 (6), 45–51.

Ingvarson, L., Meiers, M., and Beavis, A., 2005. Factors affecting the impact of professional development programs on teachers' knowledge, practice, student outcomes & efficacy [online]. *Education policy analysis archives,* 13 (10). Available from: http://epaa.asu.edu/ojs/article/viewFile/115/241 [Accessed 5 July 2010].

Ketelhut, D.J., *et al.,* 2006. Core tensions in the evolution of online professional development. *In:* C. Dede, ed. *Online professional development for teachers: emerging models and methods.* Cambridge, MA: Harvard Education Press, 237–263.

Killeen, K.M., Monk, D.H., and Plecki, M.L., 2002. School district spending on professional development: insights available from national data (1992–1998). *Journal of education finance,* 28 (1), 25–50.

Kleiman, G.M., 2004. *Meeting the need for high quality teachers: e-learning solutions* [online]. Available from: http://www2.ed.gob/about/offices/list/os/technology/plan/2004/site/documents/Kleiman-MeetingtheNeed.pdf [Accessed 5 July 2010].

Lowes, S., Lin, P., and Wang, Y., 2007. Studying the effectiveness of the discussion forum in online professional development courses. *Journal of interactive online learning,* 6 (3), 181–210.

National Education Association, 2010. *Rural schools* [online]. Available from: http://www.nea.org/home/16358.htm [Accessed 5 July 2010].

National Staff Development Council, 2001. *E-learning for educators: implementing the standards for staff development.* Oxford, OH: Author.

Nir, A.E. and Bogler, R., 2008. The antecedents of teacher satisfaction with professional development programs. *Teaching and teacher education,* 24 (2), 377–386.

Nye, B., Konstantopoulos, S., and Hedges, L.V., 2004. How large are teacher effects? *Educational evaluation and policy analysis,* 26 (3), 237–257.

O'Dwyer, L.M., *et al.,* 2010. *Effects of on-line professional development on teachers and their students: findings from four randomized trials* [online]. Available from: http://www.bc.edu/research/intasc/PDF/EFE_Findings2010_Report.pdf [Accessed 9 July 2010].

Palmer, S.R. and Holt, D.M., 2009. Examining student satisfaction with wholly online learning. *Journal of computer assisted learning,* 25 (2), 101–113.

Rice, J.K., 2003. *Teacher quality: understanding the effectiveness of teacher attributes.* Washington, DC: Economic Policy Institute.

Russel, T.L., 2001. *The no significant difference phenomenon.* Montgomery, AL: International Distance Education Certification Center.

Russell, M., *et al.,* 2009a. Face-to-face and online professional development for mathematics teachers: a comparative study. *Journal of asynchronous learning networks,* 13 (2), 71–87.

Russell, M., *et al.,* 2009b. Comparing self-paced and cohort-based online courses for teachers. *Journal of research on technology in education,* 41 (4), 443–466.

Sawchuck, S., 2010. *The online option* [online]. Available from: http://www.edweek.org/tsb/articles/2009/10/01online.h03.html [Accessed 5 July 2010].

Seal, K., 2003. *Transforming teaching & learning through technology* [online]. Available from: http://carnegie.org/publications/carnegie-reporter/single/view/article/item/79/ [Accessed 5 July 2010].

Smith, K., *et al.,* 2009. *Year four comprehensive report for the e-Learning for Educators project.* Chestnut Hill, MA: Center for the Study of Testing, Evaluation, and Educational Policy.

Southern Regional Education Board, n.d. *Standards for online professional development: guidelines for planning and evaluating online professional development courses and programs.* Atlanta, GA: Author.

Sun, P.C., *et al.,* 2008. What drives successful e-learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & education,* 50 (4), 1183–1202.

Swan, K., 2001. Virtual interaction: design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance education,* 22 (2), 306–331.

Tallent-Runnels, M.K., *et al.,* 2006. Teaching courses online: a review of the research. *Review of educational research,* 76 (1), 93–135.

US Department of Education, 2010. *ESEA blueprint for reform.* Washington, DC: Office of Planning, Evaluation and Policy Development.

Zucker, A.A., 2008. *Tranforming schools with technology.* Cambridge, MA: Harvard Education Press.

Appendix 1.   Descriptive statistics for all variables

Variable	M	SD
Satisfaction	−0.011	1.01
Computer proficiency	2.67	0.88
Gender	0.85	0.35
Prior online course experience	0.53	0.50
Ease of access to technology	3.60	0.56
Contact hours	3.97	3.23
Course organization	3.72	0.49
Provision of helpful feedback	3.70	0.53
Quality of learner interaction	3.37	0.66
Availability of technical assistance	1.50	0.53
Clarity of participation expectations	3.69	0.52
Interface user-friendliness	3.65	0.54
Facilitator knowledgeableness	3.74	0.46
Encouraging active participation	3.73	0.48
Fostering stimulating discussion	3.66	0.54
Setting a welcoming tone	3.82	0.40
Keeping discussions on-topic	3.71	0.49
Communicating clear activity expectations	3.73	0.50
Being accessible for support	3.74	0.49
Ease of content transferability	3.65	0.50
Alignment with PD needs or plans	3.55	0.54
Addressing of local need	3.55	0.53
Adequacy of compensation	3.50	0.58
Relevance of discussion topics	3.74	0.46
Beneficence of discussion topics	3.73	0.48
Clarity of stated goals	3.70	0.50
Cultural non-bias of materials	3.72	0.48
Effective linking of pedagogical skills and content	3.51	0.54

Note: PD = professional development.

Appendix 2.   Pearson product-moment bivariate correlation coefficients

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Satisfaction	1	0.06	0.06	0.06	0.30	–	0.55	0.44	0.45	0.07	0.53	0.49	0.42	0.43
2 Computer proficiency		1	–0.10	0.34	0.38	–0.10	0.03	–	–	–0.16	0.05	0.10	–	–
3 Gender			1	0.03	–	–	0.06	0.05	0.07	–0.03	0.07	0.08	0.04	0.04
4 Prior online course experience				1	0.11	–0.03	–	–	–	–0.06	–	0.05	–	–
5 Ease of access to technology					1	–0.07	0.33	0.20	0.22	–0.06	0.33	0.35	0.22	0.21
6 Contact hours						1	–	–	0.04	0.06	–	–0.04	–	–
7 Course organization							1	0.47	0.38	0.06	0.83	0.71	0.51	0.51
8 Provision of helpful feedback								1	0.35	0.14	0.44	0.38	0.62	0.74
9 Quality of learner interactions									1	0.09	0.36	0.38	0.34	0.37
10 Availability of technical assistance										1	0.07	–	0.11	0.10
11 Clarity of participation expectations											1	0.65	0.45	0.47
12 Interface user-friendliness												1	0.42	0.43
13 Facilitator knowledgeableness													1	0.63
14 Encouraging active participation														1
15 Fostering stimulating discussion														
16 Setting a welcoming tone														
17 Keeping discussions on-topic														
18 Communicating clear activity expectations														
19 Being accessible for support														
20 Ease of content transferability														
21 Alignment with PD needs or plans														
22 Addressing of local need														
23 Adequacy of compensation														
24 Relevance of discussion topics														
25 Beneficence of discussion topics														
26 Clarity of stated goals														
27 Cultural non-bias of materials														
28 Effective linking of pedagogical skills and content														

Appendix 2.   (*Continued*)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1 Satisfaction	0.44	0.43	0.41	0.47	0.41	0.46	0.42	0.41	0.43	0.48	0.51	0.51	0.44	0.44
2 Computer proficiency	–	–	–	–	–	0.10	0.05	0.04	0.08	–	–	0.04	0.06	0.05
3 Gender	0.06	0.04	0.06	0.05	0.04	0.08	0.09	0.09	0.06	0.06	0.06	0.07	0.06	0.10
4 Prior online course experience	–	–	–	–	–	0.05	–	–	0.03	–	–	–	–	0.03
5 Ease of access to technology	0.20	0.23	0.22	0.24	0.21	0.30	0.36	0.35	0.31	0.25	0.25	0.34	0.35	0.35
6 Contact hours	–	–	–	-0.05	-0.04	–	–	–	-0.06	–	–	–	–	–
7 Course organization	0.47	0.52	0.48	0.57	0.49	0.41	0.48	0.47	0.39	0.54	0.54	0.80	0.73	0.48
8 Provision of helpful feedback	0.74	0.67	0.74	0.74	0.77	0.29	0.32	0.31	0.32	0.55	0.55	0.45	0.37	0.33
9 Quality of learner interactions	0.42	0.30	0.37	0.33	0.31	0.31	0.32	0.32	0.27	0.37	0.40	0.36	0.34	0.34
10 Availability of technical assistance	0.10	0.06	0.09	0.09	0.13	–	0.05	0.05	0.07	0.08	0.09	0.06	0.03	0.07
11 Clarity of participation expectations	0.44	0.48	0.44	0.58	0.45	0.39	0.46	0.44	0.40	0.48	0.49	0.87	0.68	0.46
12 Interface user-friendliness	0.41	0.40	0.42	0.45	0.40	0.36	0.42	0.40	0.36	0.46	0.45	0.63	0.67	0.43
13 Facilitator knowledgeableness	0.63	0.60	0.63	0.61	0.62	0.31	0.36	0.37	0.33	0.80	0.78	0.47	0.44	0.38
14 Encouraging active participation	0.80	0.69	0.79	0.73	0.75	0.31	0.32	0.32	0.33	0.58	0.58	0.47	0.42	0.34
15 Fostering stimulating discussion	1	0.62	0.81	0.69	0.68	0.31	0.32	0.33	0.32	0.59	0.60	0.44	0.40	0.36
16 Setting a welcoming tone		1	0.67	0.73	0.66	0.30	0.34	0.33	0.33	0.57	0.57	0.47	0.42	0.33
17 Keeping discussions on-topic			1	0.73	0.70	0.30	0.33	0.32	0.33	0.60	0.59	0.46	0.42	0.35
18 Communicating clear activity expectations				1	0.72	0.32	0.35	0.35	0.35	0.58	0.59	0.57	0.44	0.36
19 Being accessible for support					1	0.30	0.33	0.33	0.33	0.55	0.54	0.45	0.40	0.34
20 Ease of content transferability						1	0.39	0.40	0.33	0.36	0.37	0.41	0.38	0.42
21 Alignment with PD needs or plans							1	0.76	0.37	0.40	0.40	0.48	0.47	0.72
22 Addressing of local need								1	0.35	0.42	0.43	0.46	0.46	0.83
23 Adequacy of compensation									1	0.35	0.35	0.40	0.37	0.36
24 Relevance of discussion topics										1	0.92	0.51	0.48	0.44
25 Beneficence of discussion topics											1	0.51	0.47	0.45
26 Clarity of stated goals												1	0.69	0.48
27 Cultural non-bias of materials													1	0.48
28 Effective linking of pedagogical skills and content														1

Note: PD = professional development. All relationships shown are statistically significant at $\alpha = 0.05$.

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Appendix 3.   Summary of blockwise linear multiple regression analysis

Predictors	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Block 1											
Computer proficiency	−0.036*	0.003	−0.008	−0.011	−0.005	−0.006	−0.005	−0.005	−0.006	−0.005	−0.006
Gender	0.044**	0.002	−0.007	−0.010	−0.011	−0.012	−0.015	−0.014	−0.014	−0.014	−0.014
Prior online course experience	0.043**	0.044**	0.043**	0.044***	0.044***	0.045***	0.045***	0.044***	0.044***	0.045***	0.045***
Ease of access to technology	0.301***	0.070***	0.042**	0.023	0.020	0.020	0.011	0.015	0.015	0.014	0.016
Block 2											
Contact hours		0.008	0.003	0.010	0.008	0.010	0.008	0.011	0.009	0.011	0.012
Course organization		0.161***	0.132***	0.128***	0.097***	0.103***	0.097***	0.119***	0.120***	0.116***	0.126***
Provision of helpful feedback		0.160***	0.145***	0.128***	0.082***	0.106***	0.107***	0.104***	0.131**	0.105***	0.104***
Quality of learner interactions		0.221***	0.195***	0.185***	0.169***	0.167***	0.163***	0.162***	0.165***	0.168***	0.167***
Availability of technical assistance		0.017	0.016	0.010	0.009	0.010	0.009	0.008	0.007	0.008	0.008
Clarity of participation expectations		0.149***	0.130***	0.108***	0.106***	0.102***	0.097***	0.108***	0.108***	0.090***	0.123***
Interface user-friendliness		0.109***	0.098***	0.089***	0.080***	0.083***	0.079***	0.097***	0.099***	0.100***	0.100**
Block 3											
Ease of content transferability			0.199***	0.180***	0.166***	0.165***	0.154***	0.156***	0.156***	0.156***	0.158***
Adequacy of compensation				0.141***	0.132***	0.134***	0.128***	0.130***	0.131***	0.130***	0.131***
Beneficence of discussion topics					0.143***	0.198***	0.188***	0.189***	0.195***	0.190***	0.191***

Appendix 3. (*Continued*)

Predictors	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Facilitator knowledgeable						−0.092***	−0.092***	−0.088***	−0.080***	−0.084***	−0.083***
Effective linking of pedagogical skills and content							0.062***	0.068***	0.068***	0.069***	0.071***
Cultural non-bias of materials								−0.070***	−0.068***	−0.063**	−0.057**
Keeping discussions on-topic									−0.051**	−0.073***	−0.072***
Clearly communicating expectations										0.073***	0.076***
Clarity of stated goals											−0.058*
Model F	101.69***	258.77***	268.33***	263.05***	255.77***	241.38***	228.47***	216.65***	205.37***	195.83***	186.52***
R^2	0.092	0.417	0.447	0.462	0.473	0.476	0.479	0.481	0.482	0.483	0.484
R^2_A	0.092	0.415	0.445	0.460	0.472	0.474	0.477	0.478	0.479	0.481	0.481
ΔR^2	0.092	0.324	0.030	0.015	0.012	0.003	0.002	0.002	0.001	0.002	0.001
ΔF	101.69***	316.41***	218.24***	110.94***	87.15***	21.47***	18.70***	14.83***	7.63**	12.91***	5.53*

Note: All reported regression coefficients are standardized, i.e. Betas. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.