

Pre-service teachers' preconceptions, misconceptions, and concerns about virtual schooling

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Over the last decade, online distance education has become a common mode of study in most states in the USA, where it is known as virtual schooling (VS), but many people have misconceptions about it. Pre-service teachers' personal histories as students and their preconceptions, misconceptions, and concerns influence pre-service teacher training experiences. A qualitative study of an introductory field experience course that included this new mode of schooling for the first time analyzed the personal journals and online discussion responses of 65 pre-service teachers in the USA. Analysis identified that common misconceptions and concerns included career threat, viability of VS, academic dishonesty, reduced interaction, teacher feedback, and lack of rigor. The curriculum innovations in this innovative teacher preparation program were shown to address these misconceptions and concerns and facilitate understanding and acceptance of VS as an alternative form of education by many of these pre-service teachers.

Keywords: virtual schooling, teacher education, conceptual change

Introduction

Online distance education for kindergarten to 12th grade (K-12) students in the USA, also known as virtual schooling (VS), is growing exponentially (Barbour & Reeves, 2009). Of the 50 states, 45 have established a state virtual school and/or state-led online programs (North American Council of Online Learning, 2009). Although virtual schools tend to develop their own approach, there is a great diversity of approaches to VS in the USA, including organizational structures, pedagogies, and technologies deployed. For example, the large Florida Virtual School offers additional courses to students in bricks and mortar high schools mainly through web-based instruction (Hannum, Irvin, Lei, & Farmer, 2008; Roblyer, 2008).

One contrast with adult distance education is the importance of a facilitator on each K-12 student's site to complement the work of the distant teacher (Hannum et al., 2008). Indeed Bawane and Spector (2009) found that 'preparing teachers for online education involves preparing them for a wide variety of roles and developing related competencies' (p. 383). There are many calls for teacher education programs in the USA to prepare future teachers for this new mode of schooling (Barbour, Kinsella, & Toker, 2009; Davis & Ferdig, 2009; Smith, Clark, & Blomeyer, 2005). To do so, such programs must address misconceptions about VS.

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To situate this research for readers, it is important to note that this is an unusual topic in mainstream distance education research, both in terms of the learners and in a topic related to professional development. In a recent meta-analysis, Means, Toyama, Murphy, Bakia, and Jones (2009) noted the paucity of K-12 online distance education studies. In another recent review of distance education research from 2000 to 2008, Zawacki-Richter, Baecker, and Vogt (2009) grouped professional development and faculty support as one in their 15 categories and found that it was placed sixth in their ranking of research area by number of articles published (only 41 of the 695 published articles were in the area of professional development and faculty support).

Study purpose

The project, Teacher Education Goes Into Virtual Schooling (TEGIVS), was led by Iowa State University's (ISU) Center for Technology in Learning and Teaching from 2005 to 2008 in collaboration with the University of Florida, the University of Virginia, Graceland University, and Iowa Learning Online (Compton, in press; Compton, Davis, & Mackey, 2009; Davis et al., 2007; Harms, Niederhauser, Davis, Roblyer, & Gilbert, 2006). The goal of the project was to develop the curriculum in the four collaborating teacher education programs and Iowa Learning Online as a model of ways to include VS as an additional mode of schooling. The curriculum emphasized three VS roles: facilitator, teacher, and designer. As part of the project, a team of collaborators consisting of VS teachers, VS consultants, teacher educators, and field experience staff participated in discussions to conceptualize the new curriculum for VS. As a result, two innovations were implemented in the field experience components of the ISU teacher education program: virtual seminars on VS incorporated into an existing course in pre-service teaching experience, and virtual early field experience.

This study limited its scope to part of the data in the first of these innovations to identify pre-service teachers' common preconceptions, misconceptions, and concerns related to VS based on their responses in one of the virtual seminars on VS.

Conceptual change in teacher education incorporating VS

Since many pre-service teachers are likely to have an inaccurate or incomplete conception of VS, it was necessary to redesign the curriculum in the pre-service program to prompt and support conceptual change. The theory of conceptual change states that beliefs are changed when pre-service teachers recognize the discrepancies between their preconceptions and new ideas of teaching and learning (Posner, Strike, Hewson, & Gertoz, 1982; Strike & Posner, 1985, 1992). Posner et al. defined preconceptions as ideas or notions about a specific topic or issue possessed prior to any formal instruction on the matter. They were concerned that preconceptions are often inaccurate, incomplete, and can lead to a resistance to change. They argued that students need to experience conceptual change so they can alter their misguided beliefs. Pre-service teachers enter their teacher education programs with a wide range of preconceptions and misconceptions about teaching and learning. Knowles and Holt-Reynolds (1991) and Howey and Zimpher (1996) stressed the need to address pre-service teachers' beliefs about learning and learning to teach. Knowles and Holt-Reynolds warned that pre-service teachers' past classroom experiences as students

are more influential than any classroom discussions in their teacher education programs. They added that pre-service teachers should be given opportunities for 'acknowledging and understanding their previously unexamined, tacit beliefs' and opportunities to develop alternative beliefs (p. 103). Feiman-Nemser and Remillard (1996) explained that many pre-service teachers leave teacher preparation with their beliefs intact causing them to limit their consideration of new ideas and action. Therefore, it is vital that misconceptions are examined early in the program so as to leave time for development of the complex concepts of schooling, including VS.

Few researchers have looked at conceptual change in pre-service teacher education. Even fewer (Niederhauser, Salem, & Fields, 1999; Sadera, 2001; Sadera & Hargrave, 1999) have looked at conceptual change in pre-service teacher and technology education. Niederhauser et al. and Sadera focused on examining pre-service teachers' reactions toward behaviorist and constructivist instruction in a technology classroom; they showed that participants' conceptual change progressed at different rates depending on their preconceptions and willingness to reflect on their personal learning experiences. Sadera and Hargrave's examination of pre-service teachers' preconceptions and conceptual development about educational computing found that pre-service teachers possess simplistic preconceptions about the role of technology in teaching and learning, and that their computer competence, epistemological beliefs, and attitudes toward computers influence their preconceptions about educational technology.

Using Posner et al.'s conceptual change theory (1982), Sadera and Hargrave (2005) proposed a three-stage conceptual change framework for pre-service teacher technology preparation: pre-dissatisfaction, dissatisfaction, and post-dissatisfaction.

- (1) In the first stage, pre-dissatisfaction, learners acknowledge their pre-existing beliefs about educational technology. Sadera and Hargrave believed that pre-service teachers have not consciously contemplated their beliefs and therefore are not cognizant of them. Therefore, they must be directed to 'access, engage, and activate their basic beliefs about teaching and learning,' followed by their beliefs about technology and its role in teaching and learning (p. 297).
- (2) Next, learners acquire relevant knowledge about the alternative concept and compare the new concept with their preconceptions. In this stage, learners must be challenged to reconsider their beliefs in relation to the new concept. In order to do so, learners have to be exposed to information that will ignite dissatisfaction about their preconceptions. This dissatisfaction stage is similar to Posner et al.'s (1982) and Strike and Posner's dissatisfaction (1992), who described this condition as critical to the reconceptualization of preconceptions. Sadera and Hargrave (2005) recommended that instructional activities be engaging and require pre-service teachers to 'articulate deliberate and definitive positions regarding their beliefs ... [and] formulate rational arguments to defend and advance their positions' (p. 298). They noted that, 'dissatisfaction must be sustained over a period of time for accommodation to occur' (p. 297). They therefore stressed the need for pre-service teachers to continue their exploration and evaluation of the two concepts so they have a better understanding of the alternative concept. Given that the original conceptual change theory states the need for the alternative concept to be intelligible, plausible, and fruitful, they recommended activities that would provide pre-service teachers with relevant information and opportunities to test the alternative concept.

- (3) Useful strategies for the post-dissatisfaction stage include effective modeling, idea exchanges, and journal keeping.

A pre-service teaching field experience course that covered educational topics ranging from classroom discipline to reflective teaching practices was redesigned to include VS as it was developing in the USA. The design drew upon recommendations on developing activities that would provide pre-service teachers with relevant information and opportunities to test the alternative concept. In the ISU teacher education program, pre-service teachers participated in eight or nine weekly 1-hour seminars prior to their observation in a school. During spring 2006, an additional online seminar on VS was integrated into this existing pre-service teaching experience. Three learning tasks that used web-based learning were added to the pilot seminar: exploration of a VS demo provided by a virtual school (ISU, 2005a), review of a VS case study (ISU, 2005b), and production of written reflection about VS that was posted online. Based on the feedback from participants of this pilot seminar, additional readings and discussion activities were included and the number of seminars that included VS were increased from one to three. The readings covered the challenges of VS, the efficacy and influence of VS on student learning, and legislative issues pertaining to VS. These preparatory seminars on VS were moved to WebCT (the learning management system used at ISU) and integrated in all subsequent course offerings between fall 2006 and spring 2008. The pre-service teachers had to reflect on and respond to the curriculum materials on VS and interact by writing and posting journal responses and a summative report for their peers and course instructor on WebCT, which was used to manage all the curriculum materials in the learning modules and participants' responses. The participants explored two exemplary examples of VS that utilized the Iowa Communications Network (ICN), a two-way interactive video system with studio classrooms at schools in every Iowa school district (ICN, 2009).

Methods

The purpose of this study was to identify pre-service teachers' common preconceptions, misconceptions, and concerns about VS using a grounded-theory approach (Strauss & Corbin, 1990, 1998), because this was the first research study of this topic. Instead of beginning with a theory, we examined rich empirical data from participants for 'interconnected thoughts or patterns linked to a whole' (Creswell, 2003, p. 133) and then used these relationships to develop a 'pattern theory' (Lincoln & Guba, 1985, p. 38) that was grounded in the participants' information (Esterberg, 2002; Merriam & Associates, 2002).

The student participants of this study were selected based on their participation in the first of three virtual seminars on VS integrated in a pre-service teaching experience course at ISU. Pre-service teachers volunteered to be part of this study before starting the seminars, but not all students' journals were used. From the fall 2006, spring 2007, and spring 2008 course offerings, 65 pre-service teachers were selected for inclusion in the study because they had completed all the tasks. As this was a secondary education course, only five of the participants were from elementary education. Table 1 shows the numbers of participants according to the semester in which they participated, as well as their declared major based on the enrollment data provided by the course instructor. Most student participants were Caucasian in their early 20s from Midwestern states in the USA. Pseudonyms are used to protect students' anonymity.

Table 1. Number of participants according to declared major, semester, and year.

Major	Fall 2006	Spring 2007	Spring 2008	Total
Curriculum and Instruction	0	0	1	1
Computer Science	0	1	0	1
Electrical and Computer Engineering	1	0	0	1
Elementary Education	3	1	1	5
English	13	9	7	29
World Languages and Culture	2	6	5	13
Health and Human Performance	1	0	0	1
History	0	0	11	11
Mathematics	2	0	0	2
Political Science	0	0	1	1
Total	22	17	26	65

We examined the online communication (through threaded discussions and personal e-journals) between learner–learner and learner–teacher and analyzed the VS curriculum materials. Because they were part of an online curriculum, these electronic texts provided rich qualitative data that represented the participants’ reflections on the assigned tasks in the first of three seminars. All journals and course content were archived automatically in WebCT and were treated as documents during the analysis (Creswell, 2003; Esterberg, 2002).

In addition, we interviewed the course instructor, Jason Follett, because of his role in the seminar as well as his 5 years of experience with pre-field experience seminars and his expert input during the curriculum development. We used open-ended questions in a semi-structured format to probe his thoughts about the need to expose pre-service teachers to VS and the pre-service teachers’ level of awareness of VS over the last few semesters, with follow-up questions via email throughout the analysis process.

In qualitative research, researchers must ‘make known who they are in the context of the study under investigation and make explicit the “subjective I,”’ be cognizant of their assumptions and explicit about the influences that these assumptions have on the research since they are the ‘instrument’ in the research design (Jones, 2002, p. 463). Therefore, the first author of this article (Compton) identified the roles, including researcher, curriculum developer, and course teaching assistant, that she undertook under the leadership and guidance of the second author (Davis). Circumstances and these intertwined roles may have influenced her thoughts and actions. From 2004 to 2008, she worked as a graduate research assistant funded by the TEGIVS project. Her experience with the project resulted in knowledge as well as personal ideas and perceptions of VS, which were reinforced by her experience as an online learner. Some of those perceptions include her acceptance of VS as an effective format of education as long as sound learning theories are incorporated and technology is used as the vehicle rather than the content. During this study she kept a researcher’s journal that included ruminations of her ‘experiences, ideas, fears, mistakes, confusions, breakthroughs, and problems’ (Spradley, 1980, p. 71). That research journal provided an additional data source in this study.

Data analysis followed the two-stage process of coding recommended by Strauss and Corbin (1990, 1998), that is, open coding followed by focused coding. During

open coding, the researchers used intensive line-by-line analysis of themes and categories of interest. No pre-established codes were used (Esterberg, 2002). Eventually common themes started to emerge and the coding system expanded as they became more specific. For example, the code ‘teacher’ was further divided into ‘teacher-feedback’ and ‘teacher-job.’ Focused coding was then used to analyze each line of text with the key themes that had emerged previously, including career, academic issues, pedagogical issues, and equity. This analysis process was repeated with the interview data and the codes were linked to the emerging themes from the pre-service teachers’ data. Analytic memos were added in the researcher’s journal to raise more questions and re-focus the coding process.

The primary strategy utilized to increase the ‘credibility, transferability, and confirmability’ (Lincoln & Guba, 1985) of this study was the collection of rich, thick, detailed descriptions of the research methods, analysis process, and the participants’ experiences to provide ‘sufficient information about the context in which an inquiry is carried out so that anyone else interested in transferability has a base of information appropriate to the judgment’ (Lincoln & Guba, 1985, p. 124). Different sources of data, including the students’ journal reflections from three different semesters, the course instructor’s interview data as well as the researcher’s journal, were triangulated to build a coherent justification for the themes.

Furthermore, we conducted member checking by sharing the findings with the course instructor and systematically soliciting his feedback and confirmation to determine if the interpretations and conclusions were valid. We also used the researcher’s journal to account for assumptions, biases, and insights throughout the study.

Major findings

This study found that the most commonly held misconception among pre-service teachers concerned academic and pedagogical issues – that VS would automate teaching and reduce opportunities for teaching. This view influenced many other preconceptions and could be examined for many pre-service teachers through innovative VS content and web-based mode of study that had been implemented in three introductory seminars for the early field experience course. The prior online distance education experience of participants, particularly the lack of such experience or experience of poor quality courses, strongly influenced misconceptions. Preconceptions changed only if they were examined in the curriculum. The following discussion of the evidence illustrates these findings.

Career: loss of jobs and viability of VS

In their initial journals, participants in the early stages of their teacher education program expressed fears that VS would lead to cuts in teacher employment, meaning career threat was identified as a concern. Early reflections indicated a widely held misconception that computers would present the curriculum and automate grading of quizzes and tests, resulting in the elimination of teacher positions:

I am concerned for my job. This is not my chosen vocation for a whim. I want this job, and I find this to be a potential threat ... What will VS do [to] the population of working teachers? Theoretically, it has the power to replace vast numbers of them, thereby reducing overhead through budget cuts. (Bart)

My biggest concern about VS is that someday I may be out of a job because computers have taken over education. (Sho)

However, the misconception of VS as a form of automated course and participants' concerns of VS as a career threat disappeared by the end of their first seminar. A willingness to incorporate elements of VS into their future career or to consider a career related to VS showed that they no longer viewed VS as 'teacher-less':

I think VS is only effective when it is done right and that requires the teacher to be organized and clarify everything that is being done. (Tod)

Though I'm not very knowledgeable [*sic*] on the subject of VS, I think it would be to my benefit to take additional courses to enhance my understanding of VS and hope to use it in conjunction with my classroom. (Jon)

Participants also tended to view the viability of VS differently according to their declared major, especially those with majors in English education and foreign languages (Spanish and French). Almost all participants from the English education program indicated that it would be difficult to implement VS English courses even though they saw the possibility for VS in other subject areas. Many viewed face-to-face discussions and group work in traditional classroom settings as important components of any English class but did not accept online threaded discussions or online group work to be as effective, even though they thought the exemplary VS course used in the seminar illustrated excellent uses of online discussions and group work. The comments below typify these sentiments:

My content area is English, and I could see this kind of class to be a bit more difficult to teach in a virtual schooling setting simply because so much of English education involves reading, writing, and class discussion. These are often the kinds of activities that benefit a student more to experience one-on-one or in a physical class environment. (Sar)

If I were to teach a VS class in English, I would feel that deep constant discussion, as well as being able to hear how certain texts are read would be an issue. (Eng)

In contrast, participants from the foreign language programs, specifically those specializing in Spanish, were more open to the potential of Spanish in VS. Although they saw challenges in implementation, they considered adapting ideas from the exemplary VS course and the VS case study to provide effective learning tasks in a VS Spanish course:

For teaching a VS course in Spanish there are several resources, such as videos, podcasts, discussions, short writings, essays ... I think it is possible to design a Spanish VS course, yet it requires the use of different technologies and strategies for this kind of course. The students must demonstrate proficiency in the language in relation to communication, culture, connection, comparisons, and communities. These elements must be included in any language course either VS or regular classroom. (Gonz)

The differences between these content areas were likely to be influenced by the culture of their respective departments. While both groups expressed the importance of aural-oral activities such as read-aloud and choral repetition in English or pronunciation exercises in Spanish, more pre-service teachers of Spanish were open to the use of technology and the modification of the tasks for a VS course. The first author

of this article had noted the contrast between these departments' cultures and teaching style during her experience as a graduate student, as shown by this extract from her journal:

The English department ... houses the programs for English education and linguistics. In the linguistics program, there's strong technology culture because there is a CALL [computer-assisted language learning] emphasis. But the English faculty who deal with the English education program are more conservative when it comes to teacher training. Most of their faculty conduct traditional in-class methodologies for teaching English and do not integrate much technology into their lessons, at least not in the early part of their program. Thus, pre-service teachers do not have access to modeling for the use of technology for English education classes. I also think that many of the faculty members working with the English education pre-service teachers are from the older generation so they are less likely to be interested in working with technology. I know this is similar to the perceptions of the director of field experience based on my past interview (for a different study). On the other hand, the [World Languages and Cultures] department has a strong technology focus. They have a technology center with full time staff who supports research and teaching using technology. Their research grants have helped them to acquire different technologies that support their instruction such as videos, podcasts, digital recorders, etc. Their faculty members are also actively engaged in technology-assisted language learning and often model it through their classes. That is probably why their pre-service teachers are more willing to consider modifying in-class activities and using technology to support the delivery of a VS Spanish course. (Researcher's journal)

Mr Follett, the course instructor, during his interview expressed a similar opinion about the influences of faculty on pre-service teachers' view of educational technology. He thought that younger faculty tended to include technology in their classroom while older faculty 'who live and breathe their specialty don't necessarily live and breathe the technology aspects of it.' He added that pre-service teachers need to see effective modeling of online technology in order to realize the potential of VS in their content area. To do so, he recommended integration of online technology in existing courses because that would provide examples of how VS could be done.

Academic issues: academic dishonesty and equity

Academic dishonesty appeared to be a common concern. Several participants reported that they or people they knew had cheated in online courses. They reported three popular ways of cheating:

- (1) getting someone else to do the assignment;
- (2) collaborating with someone else on an assignment;
- (3) downloading and saving the quiz in the first attempt, completing the quiz with the help of resources, either books or other people, then entering answers on the second attempt.

Additionally, several participants believed that cheating is more difficult to detect and that there are more opportunities to cheat in VS compared to a traditional classroom setting. Further, many participants did not favor collaborative learning: they saw changing answers as a form of cheating rather than as a learning process. These participants' preconceptions of assessment were based on their prior experiences as students in the USA, where testing is most often an individual effort and grades are assigned based on the knowledge:

Students working collaboratively together. They are able to share their results, and access their works. This may also be a negative. What does sharing results entail? Are students then able to change answers and cheat? (Eng)

After reading *Top Ten Myths about Virtual Schools* (North American Council of Online Learning, n.d.), some participants were convinced that ‘cheating is no more prevalent online than in the classroom’ (p. 2) while others reflected on ways to prevent cheating:

Some virtual classrooms require test to be taken in a testing center or traditional classroom situation that is no different than a bricks-and-mortar class. Some instructors simply remove much of the cheating factor by making VS assessments open-book and open-note. (Long)

In response to the analysis of the exemplary VS course, some participants took note of the two different functions of quizzes in the VS demo, that is, formative and summative assessment. The use of quizzes for different purposes drew mixed responses. While some saw these quizzes as useful to ‘prevent cheating’ as well as ‘keeping students from falling behind’ or ‘to find out what areas they may need assistance on,’ others felt the high number of quizzes took ‘too much time and energy’ and could be discouraging because ‘students need to be assessed in a constant and ongoing manner.’

By the end of the seminar, some participants maintained skepticism about preventing cheating because they believed that students were more likely and more able to cheat in a VS environment. Others, however, began to realize that there are ways of reducing cheating opportunities, such as proctored tests and open-book assessment. Some participants also expressed interest in learning more about VS and cheating prevention once they realized that ‘students can be kept accountable in VS’ (Mil).

Pre-service teachers were acutely aware of equity issues from personal experiences and according to Mr Follett they realized that ‘schools, states, students, etc. are not made from the same casts and thus some have more than others and not everyone is equal. Students also know other equality factors are at play in education.’ Many participants who had not been exposed to VS had preconceptions that VS was restricted to a small population that included only college students and talented and gifted high school students taking advance placement courses:

I was not, however aware of how many students participated in virtual schooling ... I would have thought that online courses would work best for talented and gifted students. (Bee)

However, this perception gradually changed for some after completing their assigned tasks. Many learned that students who are in rural areas and who do not learn well in traditional settings can benefit from VS as seen in the responses below:

Many classes are offered exclusively online because without them being offered this way, students wouldn’t get access to them at all. I imagine this is especially true in rural areas where access to a brick and mortar campus is difficult or where finding qualified local teachers is difficult. (Sar)

A few participants expressed concerns about equity in terms of technology access and cost. This was also noted by Mr Follett. They initially believed that many

students would miss out on the opportunities offered by VS because computers are ‘not readily available for everyone’ and many students do not have an Internet connection. Others were concerned that rural schools may be at a disadvantage due to the lack of funding:

One negative I see is adequate funding for rural schools ... (Solb)

What about poorer districts and low-income families? Will VS be another extension of the digital divide? (De)

The curriculum materials on VS did not explore the issue of cost or technology access in detail, so this misconception was not examined. Although their summative responses indicated that they were more open to the use of technology to support VS, participants still believed that the cost would be a major deterrent.

Pedagogical issues: interaction, teacher feedback, and course rigor

Participants who did not have any prior online experiences appeared to rely on their personal experiences as students within a traditional classroom to formulate their preconceptions of interaction in a VS setting. Those with experience applied it, but few appeared to have had experience of much interaction or of online learning communities that can emerge in exemplary courses. Those with prior VS experiences with high levels of interaction tended to show less concern about the loss of teacher feedback because they had actual experiences of interacting with their VS teacher ‘in order to get through the class successfully’ (Egg).

Most of the participants without experience commented in their initial posts that VS would lead to the loss of ‘socialization,’ ‘human connection,’ and ‘personal contact,’ as reflected in the example below:

My biggest concerns about virtual schooling are that it makes genuine and spontaneous interaction impossible and that it eliminates the public and social aspects of learning.... It seems to me students need more contact time with peers and teachers where they must develop social and political skills, not more time interacting with a machine. (Cop)

Such comments again indicate that some of the participants viewed VS as automated learning environments driven by technology rather than as environments using technology to support learning.

There also appeared to be a disparity in the way participants viewed interaction. Responses showed that some participants accepted only face-to-face interaction in traditional classrooms as interaction. Online interaction through asynchronous discussion boards was viewed as forced or not ‘spontaneous’ and, therefore, not ‘genuine’ interaction, whereas face-to-face online interaction supported by video technology was not accepted as interaction because there is a spatial distance, which affects the validity of the ‘face-to-face’ concept. For example, in response to the exemplary VS course, Ren noted, ‘The lack of physical human interaction makes me worry about the future.’

When exploring the exemplary VS course, some participants perceived limited interaction, while others saw high levels of interaction among students and between teacher and students. Two reflections follow to illustrate this contrast, starting with little perceived interaction:

Something that I didn't like about the VS course was that there is limited interaction with peers in the course ... The one thing that holds me back from taking more VS course is the lack of peer involvement. You don't really get a chance to work face-to-face with other peers. (Egg)

Even though the course is online, the teacher is still very active in interacting with the class. She gives them opportunities to interact with her in real time. She also gives them groups to work in as support if she's not available. The assignments go far beyond just quizzes and tests, and involve actual lab work within their groups ... There is also a great tool for discussion on the webpage. This way, students can communicate between each other and the teacher. (Will)

Because of their personal VS experiences, some participants also expressed skepticism toward the idea of teachers knowing their online students better than in face-to-face classrooms.

This skepticism was addressed in their exploration of the exemplary VS course where students were required to engage in the VS course through carefully structured tasks and learning activities. A participant commented that, 'the demo course proves that VS courses can be completely interactive and engaging as long as the teacher is willing to put the time into designing the course that way' (Sar). Others also realized that the level of interaction in a VS course can be high depending on the opportunities provided and reacted positively to the high 'amount of student involvement,' 'student to student contact,' and 'the different types of interactions,' as seen in the exemplary VS course. For example, Bee noted that she liked the level of engagement required by students through collaborative projects, discussion boards, and responsibility as constructive learners.

Many pre-service teachers' misconceptions included the loss of student-teacher interactions in VS. This misconception appeared to be based on their assumption either that VS was like a digital version of a correspondence course run by automated systems or that VS was conducted only asynchronously with the distant teacher unable to provide timely feedback to the students. Several participants expressed concerns that students would lose access to a teacher and the personal feedback necessary for learning:

Some students feel the need to have the teacher in the classroom to explain anything they are not understanding and are able to answer questions. (Perr)

The VS curriculum materials included information and evidence of interaction in VS. However, participants had different views about what is acceptable as interaction, which led to varied reactions about the level of interaction in VS. The VS curriculum could have been improved with specific guidelines for the exploration of the VS demo and a video that was later recorded of similar students observing the teacher's VS office hour held using videoconferencing technology.

Many participants expressed worries that the delay in teacher feedback would affect the learning process. They viewed the teacher's immediate feedback as crucial and did not believe that VS could provide that type of feedback. Others commented that teachers were responsible for giving feedback or correcting wrong information:

Though there is interaction between the teachers and the students and among the students, because of the time flexibility, not everyone is online at the same time. This means that a student that is doing his or her work cannot get immediate feedback. If they

have a question they can e-mail the instructor, but they may not get a reply for a day or more ... A student in the middle of an experiment can't raise their hand and say 'I don't get this' or 'what am I looking at' or any of that. Obviously a student can't just put their experiment on hold for two days while they wait for a reply from the professor. (Plum)

Only the few participants who had noted the difference between formative and summative assessment quizzes perceived that quizzes could provide feedback for the learning process:

I really like how she uses the quizzes as learning activities which let the students have feedback right away and then lets them retake it tell [*sic*] they get it right and learn that. (Cop)

A few more participants also noted at the end of their seminar that VS could be an effective mode of education if done well:

I think the demo course proves that VS courses can be completely interactive and engaging as long as the teacher is willing to put the time into designing the course that way. In the demo course, it was very clear that the teacher put a great deal of thought into making it an inclusive classroom. She gave her students multiple ways to communicate with each other. (Sar)

By the end of the course most participants realized that the learning feedback in VS could be provided in several ways, including feedback from the VS teacher, formative assessment quizzes, and classmates' posts.

Participants who did not have prior experiences often perceived VS courses to be 'easy,' 'blowoff,' or 'an easy way to slack off.' In part, this preconception is linked to the previous preconceptions that VS courses do not require students to be actively engaged with other students or the teacher but instead have the freedom to 'do whatever they want' in the course with little accountability because they are isolated from the rest of the VS participants. For example:

My biggest concern about VS at this point is the thought of how intrapersonal it is and that it seems like a lazy way to learn. When I think of online classes, I usually think of courses people just want to take to get them over. There is no peer interaction and the response time between people in the class is delayed, unlike group discussion in the classroom. (Kli)

Those who did have prior VS experiences admitted that they too had similar perceptions before enrolling in their VS courses. This misconception disappeared with experience:

But I have actually found some of them [myths] to be false after I took an online course myself. My online course was not easier than a traditional course; it was just as hard if not harder. (Egg)

The quality of prior experience was important, particularly when it was limited to poor experience. Where their prior VS courses were less rigorous, the participants maintained their initial perceptions of VS. Participants who had encountered both rigorous and non-rigorous VS courses tended to have the best-balanced view. These participants realized that the rigor of VS courses depended on the teacher's expectations and the course set-up:

My experience with VS is that VS classes could be very challenging or very undemanding depending on the teacher's expectations and delivery. (Gonz)

Many participants who perceived VS courses to be non-rigorous reported that they were surprised to find through this field experience course how inaccurate their preconceptions were and that VS courses could be just as rigorous as traditional in-class courses. While some participants were persuaded as they advanced in the seminar, others were persuaded only after exploring the real-life VS cases (i.e., the exemplary VS course). As one of the participants concluded in her summative report:

I've always considered VS classes to be more remedial ... where a student takes easy ('blowoff') classes. This, of course was my own bias about VS. However, after reading about classes like the chef internship and the online anatomy class [VS demo and case study], I can see how these teachers end up putting a lot more time into their classes because they work very hard to make sure the class isn't just a 'read this and then answer the questions' kind of environment for students (which is what my past experience has been). When I started this unit on VS, I was rather against the idea of virtual schooling. I'm starting to see now, though, it does have applications to my content area and I would be interested to work with it more and perhaps try to develop my own course someday. (Cor)

Conclusions and recommendations

Pre-service teachers enter their teacher education program with years of experiences as students. They use these experiences to formulate their preconceptions, misconceptions, and concerns about VS. This study of an innovative curriculum experience deploying VS readings and learning activities in an online environment before early field experience in traditional schools enabled the study of their preconceptions, misconceptions, and concerns about VS. It also showed that pre-service teachers' awareness of VS can be raised and many of their misconceptions can be corrected.

The recurring themes about VS that were found in this study included career, academic, and pedagogical issues and they highlighted preconceptions, misconceptions, and concerns held by most of the 65 pre-service teachers enrolled in a teacher education program in the USA. Since most pre-service teachers enter the teacher education program with the goal of gaining teaching credentials to secure a job in the future, misconceptions of VS likely lead to concerns that VS would be a threat to their future job prospects. According to Strike and Posner (1992), the selection of resources and learning tasks should take these motives and goals into consideration so misconceptions and concerns can be addressed. In terms of VS, concerns about the loss of future job prospects due to VS can be addressed through relevant curriculum materials that illustrate the role of a VS teacher and the new skills and career opportunities in VS.

Innovative curriculum development designed to challenge pre-service teachers' preconceptions and misconceptions of VS included relevant activities with readings about VS in the USA, study of an exemplary case study of VS on the web, and reflection tasks. Most pre-service teachers accepted VS as a new mode of education where they found the curriculum to be plausible, intelligible, and fruitful. The most resistant included pre-service teachers who had had prior experience of poor online courses or whose faculty did not model the use of technology in their teacher education program with appropriate pedagogical design.

The design and variety of learning tasks and related resources are important for the conceptual change process and could be improved. Readings and online exploration of archived course demos did not provide a comprehensive overview of VS. Many pre-service teachers believed they understood how VS worked by exploring the VS demo, but their comprehension was limited to what they perceived in an archived course. Although the VS demo course was effective in showcasing a good model of VS, it did not provide all pre-service teachers with a complete view of VS consultation strategies (e.g., virtual office hours) or the ways in which online and face-to-face interactions (via videoconference and site meetings for laboratory work once a term) were included to facilitate learning and assessment activities. The number of reading materials and learning tasks provided in the context used in this study was restricted in the range of exemplars to VS in the USA and the issues considered. Consequently, some ideas and concerns that were raised, such as inequity of access, were not addressed and such misconceptions remained after the seminar ended. A further extension of such curriculum innovation with other complementary and relevant curriculum materials is recommended, including revision to increase students' experience of the large range of VS practices and to fit the distance learning that pre-service teachers are likely to meet in their future careers. In addition, technology and education continue to co-evolve and there are large cultural differences in VS practices across regions and nations (Bawane & Spector, 2009). Additionally, the findings suggest that misconceptions and concerns about VS are likely to change as the experience and practice of VS becomes more widespread and as more proficient users of technology emerge.

Limitations and further research

Great care should be taken when applying these findings beyond the institution in this study, particularly beyond the USA because VS is patchy and highly variable in practice. Technology in pre-service teacher education is also highly variable (Davis, in press). Changes can also be expected, particularly as technologies and related educational practices continue to co-evolve (Davis, 2008) and as pre-service teachers' level of exposure to technology as students and as users continues to increase in variety and proficiency.

In addition, this is one of the first studies of this topic. It relied on secondary data from three sets of pre-service teachers in one university course offered as part of a teacher education program in the USA. There were no follow-up interviews, observation, or video recording of the in-class discussion to explore the innovative VS curriculum experience. These would have yielded richer insights and stronger triangulation of data. Replication of this study is recommended to include these research activities in the methodology.

Recommendations

Three main recommendations are proposed. They apply most strongly to teacher education programs in the USA, where VS is now prevalent.

- (1) Our first recommendation is to implement VS in early field experiences because of the pervasiveness of VS as a new mode of schooling. This study shows that such experience can be effective in addressing misconceptions and enriching field experiences. To do this, further curriculum development is recommended for VS plus ongoing updates to resources and activities.

Additional materials that were later developed for the TEGIVS project include a digital video of VS office hours (TEGIVS, 2008) and a frequently asked questions (FAQ) page by the same VS instructor (ISU, n.d.-b) so we recommend that they be added to the VS curriculum to provide a more comprehensive view of the exemplary course. The inclusion of VS teachers, VS site-facilitators, and/or VS students as guest speakers is also recommended. The most beneficial experience would be a field experience for pre-service teachers that included both online activities and observation online and on-site to enable observation from multiple perspectives. Such field experiences could offer pre-service teachers more opportunities for exploration, and the opportunity to start to join the online teaching community of practice as a legitimate peripheral participant (Lave & Wenger, 1991). This view is informed by Correia and Davis' study (2008) of the initiation of a new teacher who was teaching online for the first time in which we discuss legitimate peripheral participation in an online teachers' community of practice.

- (2) Our second recommendation is to provide an increased range of curriculum materials reflecting VS in a greater range of content areas, virtual schools, and regions. The materials used in this study provided convincing information to many pre-service teachers in this Midwestern state. As a result, they were able to accept the possibility of VS as an alternative education model. However, some were not ready to accept the viability of VS in their content area because they, as future teachers of English, were unable to apply the knowledge from the VS demo and VS case study, which were based on science and the culinary arts. These materials could include VS demos or relevant publications or literature in different content areas (e.g., ISU, n.d.-a) so that pre-service teachers may explore the materials within their specialization, providing that web links can be updated as virtual school demos change. Most importantly we recommend VS resources be drawn from relevant VS practice and reflect cultures that the pre-service teachers will meet when they become teachers. Recent research has found the use of TEGIVS materials in New Zealand problematic due to the different VS practice as well as culture in New Zealand (see Davis, Charania, & McGrath, 2010).
- (3) Our third recommendation is to address institutional sources. For example, Strike and Posner (1992) noted that several sources within a pre-service institution can influence learners' belief systems. In this study, the faculty's view of educational technology is an example of institutional source that can influence the pre-service teachers' perception of VS. The impact of institutional sources, however, is challenging especially where it involves different departments. Since pre-service teachers learn through modeling in their teacher education programs, pedagogy in their primary teacher education program is especially influential. If pre-service teachers do not see technology modeled effectively, their existing perception of education practices will remain intact and there will be no dissatisfaction with the existing concepts. If there is no dissatisfaction (as indicated by the conceptual change theory), there will be little need to consider alternative ideas. Furthermore, where only some teacher educators advocate VS, conceptual change about VS (if any) is unlikely to last or transfer into future practices. Pre-service teachers need to continue their exploration and reflection about the alternative concepts during the post-dissatisfaction stage to facilitate long-term conceptual change (Sadera & Hargrave, 2005).

Otherwise, too brief an exposure to the alternative idea may result only in superficial and non-sustainable changes, as pointed out by Tillema and Knol (1997) and Sadera (2001). Therefore, teacher educators should also incorporate consideration of VS in their methods courses and model effective use of technology for learning and teaching, including online and blended learning.

This study has highlighted the need for more research in the area of pre-service teachers' preconceptions, misconceptions, and concerns of VS. In addition to replicating and increasing the diversity of resources and approaches to VS in pre-service teacher education, future studies should also examine whether nontraditional pre-service teachers require different types of curriculum materials and activities related to VS compared to traditional pre-service teachers and whether age and work experiences influence their conceptual change process. Researchers should also compare the conceptual change process of pre-service teachers according to their declared specialization to see how the content area can influence the acceptance or rejection of VS. Research is also recommended into professional development for VS for all school staff, including those in traditional and virtual schools.

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