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Researching K-12 Online Learning: What Do We Know and What Should We Examine?

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As the former chair of the research committee for the International Association for K-12 Online Learning, an active blogger on K-12 online learning issues (e.g., http://virtualschooling.wordpress.com), and an academic with an interest in K-12 online learning, I often get requests from graduate students and practitioners seeking advice on potential research topics. For graduate students and others involved in higher education, I often direct them to the main reviews of literature related to K-12 online learning and advise them to examine what research has been done and what authors recommend should be done next (e.g., Barbour & Reeves, 2009; Cavanaugh, Barbour & Clark, 2009; Rice, 2006; Smith, Clark & Blomeyer, 2005). However, this is often not a suitable strategy for practitioners – as many do not have the time or background to be wading through the academic literature. In this article, I provide an overview of the research conducted in the field of K-12 online learning. I also outline some areas recommended for future research; and recommend a methodology for conducting that research.

Literature on K-12 Online Learning

While the use of web-based or online learning at the K-12 level has been practiced in the United States since the early 1990s, the literature and – particularly – the published research has not kept pace. Fifteen years after the first K-12 online learning schools began operation (e.g., Laurel Springs School and Utah eSchool), Cavanaugh et al. (2009) began their review of the literature with an initial sample of more than 500 published items. Their analysis indicated that most of the published literature related to K-12 online learning was "based upon the personal experiences of those involved in the practice of virtual schooling" (¶ 5). This was supported by their finding that much of the literature was focused upon the experience of the virtual school teacher or the virtual school administrator, as the majority of items reviewed were articles describing the experience and/or opinions of one or more of these individuals performing duties as a virtual school teacher or administrator.

Barbour and Reeves (2009) described the body of published literature as falling into one of two general categories:

- the potential benefits of K-12 online learning (e.g., higher levels of motivation; expanding educational access; providing high-quality learning opportunities; improving student outcomes and skills; allowing for educational choice; and administrative efficiency)
- the challenges facing K-12 online learning (e.g., high start-up costs associated with virtual schools; access issues surrounding the digital divide; approval or accreditation of virtual schools; and student readiness issues and retention issues)

It should be noted that in their discussion of the potential benefits of online learning, Barbour and Reeves were careful to remind readers that while online learning may allow for educational improvements such as a high levels of learner motivation, high quality learning opportunities or improvement in student outcomes, it certainly did not guarantee any of these potential benefits would be realized simply by the introduction of online learning. Cavanaugh et al. (2009) described the body of published literature as "focusing on statewide and consortium/multi-

district virtual schools, the roles of teachers and administrators, the promise of virtual schooling and its initial rationale for implementation, administrative challenges, the technology utilized, and interact with students" (Conclusions and Implications, ¶ 1).

In terms of the published research, Barbour and Reeves (2009) wrote that "there [had] been a deficit of rigorous reviews of the literature related to virtual schools" (p. 402). Not only had there been a deficit of rigorous reviews, but the authors also stated that much of the research conducted into K-12 online learning was found in evaluation and research center reports, along with unpublished Masters' theses and Doctoral dissertations. Further, Cavanaugh et al. (2009) found that only a small percentage of the literature was based upon systematic research. Rice (2006) lamented, "a paucity of research exists when examining high school students enrolled in virtual schools, and the research base is smaller still when the population of students is further narrowed to the elementary grades. Finally, DiPietro, Ferdig, Black and Preston (2008) were even more blunt in their assessment that research evidence in refereed journal publications and conference papers was limited.

For those involved in the study of K-12 online learning, the difference between published literature and published research is important. Published literature often does not go through a peer review process where other individuals with knowledge, experience and expertise in the area review the article to ensure that the information is accurate and credible. These individuals make suggestions to the author(s) on ways in which they can improve or strengthen their article. Without the peer review process, manuscripts accepted for publication are often based solely upon the beliefs of the author(s). Another distinction is that research is based upon a process of systematic data collection and analysis, which should be described in enough detail that if other researchers had access to the data they would come to similar conclusions and to allow other researchers to replicate the same study at a different time or setting. Published literature is almost always based upon personal experiences that have not been documented in a systematic way and that could not be replicated.

Research on K-12 Online Learning

Cavanaugh et al. (2009) described the limited amount of published research that is available as:

> indicative of the foundational descriptive work that often precedes experimentation in any scientific field. In other words, it is important to know how students in virtual school engage in their learning in this environment prior to conducting any rigorous examination of virtual schooling. (¶ 5)

Rice (2006) categorized the research into K-12 online learning as falling into two categories: comparisons of student performance based upon delivery model (i.e., classroom vs. online), and "studies examining the qualities and characteristics of the teaching/learning experience" (pp. 430-431). This second category was sub-divided into three additional areas: characteristics of, supports provided to, and issues related to isolation of online learners. Cavanaugh et al. (2009) identified two similar categories in their review of the research: effectiveness of virtual schooling and student readiness and retention issues.

Examination of this research begins with a category identified by both of these literature reviews: the comparison of student performance between a traditional classroom and a distance environment. At present, this is the area of published research that has received the most attention. Unfortunately, it is also an area of research that has been most problematic. To provide

two recent examples, Cavanaugh, Gillan, Bosnick, Hess and Scott (2005) found that Florida Virtual School (FLVS) students performed better on a non-mandatory assessment tool than students from the traditional classroom. They also speculated that the virtual school students who did take the assessment may have been more academically motivated and naturally higher achieving students. McLeod, Hughes, Brown, Choi and Maeda (2005) found FLVS students performed better on an assessment of algebraic understanding than their classroom counterpart, while stating they believed the student performance results were due to the high dropout rate in virtual school courses. These two examples highlight an issue present in most of the research into student performances: many of the lower performing students had either dropped out of their virtual school courses or failed to participate in the assessment. Rice (2006) described the problems as "issues of small sample size, dissimilar comparison groups, and differences in instructor experience and training" (p. 431), and concluded by stating "that the effectiveness of distance education appears to have more to do with who is teaching, who is learning, and how that learning is accomplished, and less to do with the medium" (p. 440).

The second category identified by Rice (2006) was studies examining the qualities and characteristics of the teaching/learning experience. This category included a number of studies that spoke to the characteristics that were perceived as desirable or necessary to be successful as an online learner. The list of characteristics was probably best summarized by Haughey and Muirhead (1999), who described the preferred K-12 online learner as being highly motivated, self-directed, self-disciplined, independent, and who could read and write well and had a strong interest in or ability to use technology. However, as Barbour (2009) indicated "this is clearly not an accurate description of the entire or possibly even the majority of students attending virtual schools and, particularly, cyber schools" (p. 18). This category also included research studies that underlined the important role of the teacher in the online learning environment (both the online teacher and the local or school-based teacher that was physically present to supervise and facilitate the students' learning). The third area that Rice discussed within the broad category of the teaching/learning experience was the role of the affective domain, specifically research on the potential for students to feel isolated in a distance education environment. This line of inquiry mainly focused on ways to provide support to decrease the transactional or perceived distance that a student felt in their online learning environment.

The second category identified by Cavanaugh et al. (2009) was issues related to student readiness and retention. Much of the research in this category has focused upon the limited sample of students often engaged in online learning, and how online learning opportunities should be designed and delivered to allow for the greatest range of students to be successful. The research on the design and delivery of online learning provides two examples of how the published research can provide misleading conclusions and implications, particularly for practitioners. Barbour (2005, 2007) outlined seven principles for effective web-based design for adolescent learners, which appear to be an excellent guide for those involved in designing online learning opportunities. The limitation is that Barbour's principles are based upon a series of interviews that he did with virtual school teachers and developers in a single Canadian virtual school. Similarly, DePietro et al. (2008) outlined a series of best practices for teaching students in an online environment based upon interviews conducted with teachers in a single US-based virtual school.

In both studies no data were collected that verified whether the opinions of the virtual school course developers and teachers were valid. Something a course developer may have found to be quite effective, a student may have found useless; in the same way something a teacher

may have thought was an effective pedagogical strategy, a student may have found quite boring. There was no examination of student performance to determine if the design principle or teaching best practice was actually effective in terms of student learning. Finally, there was no examination of the actual course content or teaching practices of those interviewed to determine whether the way they described the principle or best practice was even how they were implemented (and there is a sizable body of research that indicates a teachers' stated beliefs or practices often differ from their actual implementation – e.g., Fishman, Marx, Best, & Tal, 2003; Schneider, Krajcik, & Blumenfeld, 2005). Even within the three areas where research has been published, there are still many methodological issues that need to be addressed.

Future Research in K-12 Online Learning

Blomeyer (2002) advised that:
online learning or e-learning isn't about digital technologies any more than classroom teaching is about blackboards. E-learning should be about creating and deploying technology systems that enable constructive human interaction and support the improvement of *all* teaching and learning. (p. 19)
Essentially the focus of future research should be on how to use online learning to improve teaching and learning at the K-12 level.

In their synthesis of a series of quantitative K-12 online learning studies, Smith et al. (2005) recommended future research focus upon seven areas:
1. interpreting "equal of better' achievement findings;
2. understanding and improving student persistence;
3. instructional models that lead to student process skills;
4. issues related to student satisfaction and motivation;
5. identifying and remediating characteristics for successful online learning;
6. leveraging the features of online learning systems; and
7. discriminating online learning based upon a variety of educational contexts.

The following year, Rice (2006) recommended:
- Improve the quality of research that examines the critical components of learning directly related to younger learners.
- Continue and expand on the development of prediction instructions that help identify successful learner attributes.
- Develop organized student evaluation systems to facilitate consistent data collection.
- Investigate the relationship between student supports and at-risk student needs in relation to distance education.
- Investigate the social and cognitive aspects of distance education and the effect of knowledge construction.
- Develop valid and reliable tools for identifying interactive qualities in course design and instruction. (p. 442)

Barbour and Reeves (2009) called for future research to focus on "factors that affect student success in virtual school environments" (p. 412); while Cavanaugh et al. (2009) recommended that researchers work to establish best practice for online teaching strategies, improve the identification and remediation of characteristics needed for success in the online environment, investigate how school-based teachers can support online learners and examine the student experience in online learning – particularly the lower performing student.

However, given the small amount of published research to date – and considering some of the methodological issues with that existing research – what may be more important to future research into K-12 online learning is not what is studied, but how it is studied. Smith et al. (2005) identified seven potential barriers that researchers needed to overcome to be able to conduct effective research on K-12 online learning. These barriers included:

1. access to critical data that is often not publicly available or even viewed as proprietary;
2. distributed nature of online learning and the need to involve multiple organizations in multiple jurisdictions;
3. the need to understand the school culture, but also be able to maintain a professional distance from that which is being studied;
4. the lack of high quality, reliable and valid assessments;
5. study time frames not matching up with school years or funding cycles;
6. insufficient funding to research and evaluation of K-12 online learning; and
7. the almost exclusive focus by the Department of Education of success as measure by student achievement on standardized testing.

While much has changed in the educational climate since these barriers were first described, most of these seven barriers are still applicable today.

Barbour and Reeves (2009) went even further in their discussion of how future research into K-12 online learning should be conducted. These authors recommended a design research approach. Design research is "a systematic but flexible methodology aimed to improve educational practice through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually sensitive design principles and theories" (Wang & Hannafin, 2005, pp. 6-7). Essentially, researchers work with practitioners to both identify a problem that needs to be addressed and to create a possible solution. That solution is implemented and data are collected. The data are used to refine the solution and the process is repeated. This continues until the solution addresses the original problem, and a theory is generated to explain why it works. Unlike traditional methodologies of educational research, the goal is not to generalize the findings to other contexts, but to work with those who are part of the research site to solve their problems. As a methodology, design research has been particularly welcomed by the K-12 education community, who have become accustomed to a team of researchers descending upon their school to implement one of the latest and greatest ideas, which works wonderfully as long as the research team is in place, but as soon as the funding is gone and the research team leaves, the staff revert back to the way they have always done things.

One illustration of design research in action within the K-12 online learning environment was the Virtual High School Global Consortium (VHS). Created through a five year, $7.4 million grant (Pape, Adams & Ribeiro, 2005), it had an expectation that annual evaluations (e.g., Espinoza, Dove, Zucker & Kozma, 1999; Kozma, Zucker & Espinoza, 1998; Kozma, Zucker, Espinoza, McGhee, Yarnall & Zalles, 2000), content-specific investigations (e.g., Elbaum, McIntyre & Smith, 2002; Yamashiro & Zucker, 1999), and a final evaluation (e.g., Zucker & Kozma, 2003) be conducted. This research was conducted with the VHS staff as a full participant (i.e., being involved in identifying the issues that needed to be examined, assisting in the design and completion of the research, implementing the recommendations, and then repeating the process to ensure the recommendations had the desired outcomes). As a result of these cycles of inquiry that examined a variety of problems in this specific context, along with

the close relationship between VHS staff and the SRI International evaluation team in the design of both the virtual school and the evaluations, much of what is still known about virtual schools comes from this refined approach (and the VHS has not only survived, but thrived since the conclusion of that federal funding).

Conclusions

While K-12 online learning has been practiced in the United States for almost two decades, the amount of published research in this area is still quite limited. Additionally, some of the research that has been conducted suffers from methodological flaws or attempts to reach beyond the scope of the researcher's inquiry. However, there have been several recent reviews of the K-12 online learning literature have provided a framework for future research, including: moving beyond comparisons of student performance to investigate issues related to the effective design and delivery of K-12 online learning, how best to support K-12 online learners – both within the online environment and at the local school level, and understanding the experience of the lower performing or at-risk learner in an effort to improve their chances of success in the online environment. Finally, as important as the topics being investigated, researchers should consider design research approaches to ensure a more lasting impact on those involved in the actual research study.

(2968 words)

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