Students’ Perceptions of Doing Virtual Science Labs in a Hybrid Charter School

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Abstract

Research looking at students completing virtual science labs is substantial in physical brick-and-mortar K-12 classrooms and the college setting. However, it is lacking when students are completing these labs in a blended or cyber charter K-12 school. This interpretive, phenomenographic study explored the perceptions that students hold regarding their virtual labs in a blended charter school. Four students were interviewed to discuss their understanding and perceptions that they have of completing their science labs virtually in a blended school. Working from a theoretical framework of constructivism, community of inquiry, and 21st century literacy the data was analyzed. This framework helps to situate the work in the context of the learning environment and include the skills that students in these schools are using on a daily basis. The findings from this pilot study tend to refute some of the commonly held views of virtual labs regarding their interactivity and authenticity to physical experiments. However, the value and alternative worth of virtual labs is a conception held by two participants. In addition to this, the communication and collaboration strategies of participants varied with which information processing and clarification methods they used to understand the material.

Introduction

Cyber charter schools and blended charter schools are a relatively recent development in the public school landscape that offer a choice to traditional public schools with consistent increases in enrollments since they first appeared. In the 2011-2012 school year there were approximately 275,000 students enrolled in a fully online school in 31 states (Watson, Murin, Vashaw, Gumin, & Rapp, 2012). In Pennsylvania, 32,322 students attend 16 cyber charter schools, some of which enroll regionally and others statewide. (Watson et al., 2012). While these schools are expanding within several states, there is not a significant amount of research on the effectiveness or success of them. Even the people who have researched the effectiveness have not focused on specific subjects (Darrow, 2010; Hubbard & Mitchell, 2011; Zimmer et al., 2009). In addition to totally virtual schools, there are a certain number of charter schools that follow a blended model. In blended schools, students receive some of their instruction in a physical location, but also use the computer for delivery of at least some of their instruction. The school selected for this study, Tullahoma Blended Charter School, follows an interesting model in which some students stayed home and others went to the school but still interacted with their teacher through the computer. These students rely heavily on the computer for the majority of their coursework and yet the current research does not focus on their experiences with computer simulations, and rather researches students completing these virtual labs while still in the context of a direct and physical relationship with their teachers and peers.
Learning does not occur in a vacuum and “situated cognition that emphasize the reciprocal character of the interaction in which individuals, as well as cognition and meaning, are considered socially and culturally constructed” (Lave, 1988, 1993; Collins, 2006; as cited in Barab & Duffy, 2012, p. 26) emphasize the construction of knowledge that is contingent on the context of the learning environment. Therefore, the studies that have compared virtual and physical laboratories that have been conducted when students are present in the classroom (Pyatt & Sims, 2011; Klahr, Triona, & Williams, 2007) are not relevant to direct transfer in online learning environments. Tullahoma students are situated in a variety of contexts and learning environments and come from a diverse geographic region. For example, students in this school are likely to come from different school districts and thus have a wider range of prior knowledge than students who are relatively static in the same district. Blended schools that use the computer as their main delivery system typically utilize simulations to help students learn and grasp concepts through modeling or visual representations.

The Next Generation Science Standards (NGSS) Nature of Science appendix states that one of the fundamental goals “for K-12 science education is a scientifically literate person who can understand the nature of scientific knowledge. (NGSS Appendix H, 2013, p. 2). The underlying ideas that students should take away from science to apply to their lives as an educated citizen that relate closely to virtual simulation are “scientific investigations use a variety of methods, scientific models, laws, mechanisms, and theories explain natural phenomena, scientific knowledge is open to revision in light of new evidence, and science addresses questions about the natural and material world” (NGSS Appendix H, 2013, p. 4). Effective science instruction that helps students take away an integrated understanding of these skills increases the probability that students will apply the knowledge gained in their science education later in life. In the College and Career Readiness appendix, this knowledge of science is tied into being successful later in life by stating that “an education grounded in acquiring and applying knowledge positions students to improve their options in a rapidly changing menu of jobs” (NGSS Appendix C, 2013, pgs. 1-2). According to a study by Millennial Branding Inc., the most important skills to employers that are hardest to find in students are communication skills (91%), the ability to adapt to change (85%), and strategic thinking and analytical skills (78%) (Schwabel, 2013).

Studies comparing virtual and physical laboratories have been conducted when students are still physically present in the classroom (Pyatt & Sims, 2011; Klahr, Triona, & Williams, 2007) have found that students can experience conceptual change in both ways either by ‘hands-on’ activities or using models. There are also many studies that demonstrate student attitudes towards learning and conceptual change can impact their learning gains while completing their labs (Winn et al., 2006). An inquiry-based lab fielded in the pedagogical theory of constructivism can evoke more curiosity and learning gains than traditional teacher-led classrooms (Tsai, 1998). One of the goals of the laboratory experience is for students to develop teamwork abilities (Singer, Hilton, & Schweingruber, 2006). Due to the novel structure of Tullahoma students may have a different experience based on their location and ability to access peers and the teacher. This study fills a gap in the literature by examining in an in-depth way the collective perceptions of students who are completing labs in this innovative manner and the variations in student experience based on past experiences.

Theoretical Framework

Constructivist based learning environments evoke concepts such as authentic learning, problem-based coursework, ownership of inquiry, scaffolding, the zone of proximal development, metacognitiveness, knowledge construction, and reflection on learning (Duffy & Jonassen, 1992; Fosnot & Perry, 1996; Jonassen, 1999; Jonassen 2013; Mayer, 1999). The above characteristics should be visible in any well-designed science course, whether face-to-face or online. In addition to these, effective science instruction is seen as allowing students to work through scientific concepts and build understandings similar to how scientists in the field operate (Bransford et al., 2000; NGSS – Appendix C, 2013). Constructivism states that “there are many ways to structure the world and that there are many meanings or perspectives for any event or concept” (Duffy & Jonassen, 1992, p. 3). An individual’s “present conceptions are products of diverse personal experiences, observations of objects and events, culture, language, and teachers’ explanations” (Anderson, Lucas, & Ginn, 2003). Situated cognition emphasizes this idea by incorporating the context of learning into the knowledge structure and experience of individuals in that environment (Barab & Duffy, 2012; Durning & Artino, 2011). The activity and setting in which people learn cannot be removed from the cognitive process of learning and the situations can be said to be a co-influence the learning process and experience of a student (Brown, Collins, & Duguid, 1989). Students who are completing their science coursework in a blended school have flexibility in how and when they complete their labs and likely will ascribe several different meanings of the labs that they experience based on prior experiences, scientific conceptions, scaffolding, and feedback.
Lave recognized a community of practice as a group that helps to build a meaningful learning system that implies participation in an activity system “about which participants share understandings concerning what they are doing and what that means in their lives and for their communities (as cited in Barab & Duffy, 2012, p. 40). The tools that a culture uses help to define the learning that takes place by contextualizing the tools (Brown, Collins, & Duguid, 1989). The online science students at Tullahoma use the computer and simulations as mindtools to help add meaning to their learning. A community of inquiry is a popular notion within higher education online environments that helps to support collaborative learning and helping learners to perceive what they are learning (Garrison & Arbaugh, 2007) and “it provided a collaborative-constructivist perspective to understanding the dynamics of an online learning experience” (Arbaugh et al., 2008). The community of inquiry is also appropriate for students in K-12 online learning environments because of the systemic and nonlinear view of learning and the popular model of conceptualizing the online learning experience. The following figure shows the parts of the learning environment that affect an online community of inquiry. It has been adapted for the context of the students at Tullahoma charter school.

Figure 1: A preliminary adaption of the community of inquiry framework oriented for K-12 students in online schooling. Modified from Garrison and Arbaugh’s (2007) work on the COI

Blended charter school students use the computer frequently to access their coursework, communicate with their teachers and peers, complete their assignments, and view videos and interactive tools. The computer is essential to their schoolwork and their ability to successfully navigate the curriculum. These students are gaining valuable computer skills and “Information literacy is conceivably the foundation for learning in our contemporary environment of continuous technological change” (Bruce, 2004, p. 8). Since Tullahoma blended charter school students receive all of their instruction via the computer they are engaging with information and communication technologies (ICT) on a regular basis. This important skill to have in the 21st century is something that virtual labs can help to develop by having students interact with different software, different communication platforms, and navigating between multiple pages and integrating many sources of information. Additional 21st century skills such as self-directed learning, collaboration, problem-solving, and information seeking and knowledge building through strategies like Just-in time teaching. Online classes utilize many web 2.0 tools and the science class selected in this study has synchronous classes, video technologies, lessons sequentially arranged online, and interactive demonstrations. As mentioned previously, building teamwork and collaboration is an important part of science labs (NSTA, 2007, Singer et. al., 2006). The research questions posed for this pilot study are:

- How do students perceive their learning in these laboratory investigations related to the structure of the activities?
- How do students make sense and understand the activity that they are completing?
Research Methods

To build structure for understanding student experience with their online virtual simulations in a blended charter school this study employed an interpretive, phenomenographic methodology. Phenomenography aims to examine the variations in the world as people experience it and to adequately explain this to others who have different experiences with the world (Sjöström & Dahlgren, 2002). According to Marton, phenomenography aims to “deal with both the conceptual and the experiential, as well as with what is thought of as that which is lived. It also deals with what is culturally learned and with what are individually developed ways of relating ourselves to the world around us.” (1981, p. 181). This research approach is appropriate for this study because students will be directly asked about their learning experiences with their science labs and knowledge will be viewed from a second-order perspective. The units of analysis will be the various collective conceptions that students form about their virtual labs (Marton & Pong, 2005). The phenomenographic approach can then be used to give a collective foundation for the perceptions that students ascribe to their lab work.

Description of Research Settings

For clarity, a definition of simulated labs is provided: “simulated labs are the imitations of real experiments. All of the infrastructure required for laboratories is not real, but simulated on computers” (Ma & Nickerson, 2006). By real, they refer to the need to have physical materials and equipment in the lab to carry out the experiments that the simulations are demonstrating. Virtual labs do not necessarily have all of the components of a physical lab. They can be altered to eliminate procedures, materials, tasks, or features that would not aid in helping the students to undergo conceptual change. Wieman and Perkins (2005) realize that “a real-life demonstration or lab includes enormous amounts of peripheral information that the expert instructor filters out without even thinking about it” (p. 36). Using virtual labs with specific features enhanced and others hidden can attempt to alter the perception that students learn from the labs so that they walk away with the intended conceptual change as defined by the developers of the lab. The software chosen for this school is Odysseyware which “provides innovative, eLearning solutions to schools nationwide. With more than thirty years of experience behind us, we offer 21st century learning opportunities for today’s digital natives” (Odysseyware, 2013).

This research took place within the context of a blended charter school using the computer as an active communication medium (Winn et al., 2006). Tullahoma features a hybrid learning model. There are two physical buildings that the students can go to and then other students can log in virtually and attend school in a traditional ‘cyber’ sense. Even the students who are in the same room with their teacher are logged in through a virtual classroom and interact via the platform. This is an ideal setting to answer the research question because there is a significant amount of literature comparing virtual and physical labs within the traditional brick-and-mortar school, but little to none on how learning happens when the students are completing these labs in different locations and communicating with their instructor and peers through synchronous and asynchronous virtual interactions. In a study by Pyatt & Sims (2011) that examined the learning dimensions that occur through physical and virtual laboratory work. This study and others like it have not looked at labs that occur in blended cyber charter schools. The NSTA advises that blended schools use “a range of active scientific investigative experiences should be integrated into the instructional process for all students” (NSTA, 2007). Tullahoma uses the computer as their main delivery method; the students view a virtual lab and then can complete a lab activity via the computer. The lab is one way to incorporate different activities encompassing the learning of science as recommended by the NSTA.

Sampling Strategy

Criterion, purposive sampling with an emphasis on variation was chosen for this study. According to Creswell (2013) criterion sampling allows for rich and deep data to be collected because the participants selected will have the experiences necessary to elucidate their understandings. Variation is important because the goal in phenomenography is to have multiple outcome spaces in the data analysis phase so that all of the possible collective ways of relating between the world and one’s own ideas will be exemplified (Akerlind, 2005). The criteria for inclusion are that the participants have been enrolled in Tullahoma for at least half a semester and that they have an assignment completion rate of 80% in their science class. Once students meet these criteria, further criteria of geographic diversity and past experience in different school environments will be preferred, but not necessary. Four students agreed to be interviewed for this study. Two of the students are not in the same site as the teacher, one works from home, and one splits their time between the teacher’s site and being home. They are all in biology class and regularly participate in virtual labs.
Data Collection

In phenomenography, the main source for data collection is open-ended interviews (Larsson & Holmstrom, 2007). The theme for the interviews was to have some preformed questions to get the students talking about and reflecting on their experience with the virtual labs. The questions should be grounded in what the students are saying about their experience to truly see what this is like for a particular student.

I conducted four hours of observation to gather a sense of the structure of the course and how students interact and also to introduce myself. I conducted one interview with each of them over the course of two weeks. It has been shown that 20 participants are enough to discover all of the different ways of understanding the phenomenon (Larsson & Holmstrom, 2007). My four participants are a pilot study for future research with a greater sample. The interviews were semi-structured with guiding questions and lasted between one hour and one hour and fifteen minutes. I conducted these interviews in a private AdobeConnect virtual classroom. Since all of the interviews involved typing, there were grammatical errors from the participants. To maintain accuracy and authenticity to the original interviews, I have not corrected spelling or grammatical errors on the part of the students. These interviews were recorded and a link was created that allowed me to access the recordings for transcription.

Data Analysis

To conduct the analysis I followed the steps recommended by Sandberg (2000). The recommended process is to first familiarizing yourself with the interview notes and transcriptions, then engaging in a back and forth process identifying what occurs in the phenomenon (virtual labs) being studied and the variation in how it is understood by participants (what they focused on in the virtual labs) with the context in mind. This iterative process should first be completed for individual participants and then comparing these understandings with cross-case comparisons to make clearer the similarities and differences across perspectives. The last step in the analysis is to join the what and how into one unit in order to create the hierarchical categories in which full variation and understanding of the phenomenon are derived. Since there are only four participants in this study it is realized that the full variety of understanding will not likely occur. The categories are likely to be rudimentary and would be refined and developed through more analysis and interviews with more participants.

Researcher Positionality

Originally, this study was going to be conducted at a larger cybercharter school in Pennsylvania with a sample size between 10-20 students to align with the recommended criteria for a phenomenographic study to explore the individual perceptions in enough depth to arrive at well-developed collective experiences (Larsson & Holmstrom, 2007). After getting initial approval from the administration of the school and being put in contact with a middle school teacher, it was discovered that the students did not do virtual labs and thus made an inappropriate cohort to study for the purpose of this research. This helped to transition the paper to a pilot study as a baseline for future work.

To locate a new site, I activated my personal network and conducted this research at a former place of employment and thus already had a connection with the science teacher. To come in contact with the students I first let the teacher, Mr. Smith know what my sampling requirements were and to have him announce the research in class to gauge an interest level. Once this was complete I entered the Biology class and introduced myself and the goals of the study. I got the four participants interested from Mr. Smith and told the students what type of research this was, what would be required of them, and gave them my contact information. I realize that the students who know me may answer differently than those who I am meeting for the first time since I already have a rapport established. The first half of one of the interviews was conducted as a two person interview since both of these students were ahead in their work, work from the same site, and shared a room for the interview. This could lead to an ethical issue were there answers may have been influenced by the other student and thus a full variety of understanding may not be understood. However, the second half of the interview was conducted separately and the main theme and type of responses I was getting from each student were not different from those in the first half of the interview.

Research reflexivity in interpretive work is necessary for addressing the subjectivity and biases that are brought to the process (Creswell, 2013; Sin, 2010). Before starting this paper I wrote an autobiography that detailed my history and concern with this phenomena and why I decided to study virtual labs. I also kept a journal along with my field notes and interviews that commented on my thoughts and reflections on the interviews and observations. This helped me to clarify the conceptions of the students and ensure that I had accuracy in my interpretation of their meaning.
Data Findings and Connections

The driving force behind the interview questions was to see how constructivist the class environment was through the eyes of the students and the strategies that students used to attempt and understand the content. By constructivist I mean how much the students were expected to form their own knowledge, how metacognitive and reflective they viewed their learning, and how authentic and interactive they saw the virtual labs. The community of inquiry framework developed earlier helps to shape the understandings of the student into varied conceptual levels. The other focus of the data analysis was on the strategies students used to understand the content. As recommended by Creswell (2013) and Schramm (2006) the focus in the interviews was on in-depth information from each participant to form rich and meaningful operations.

The final phenomenographic categories formed “are treated as the final description and not part of the whole or essential description of the phenomenon” (Sjostrom & Dahlgreen, 2002, p. 341). The categories are arbitrary and imposed on the system by the researchers to help understand the phenomenon in detail (Sjostrom & Dahlgreen, 2002). The students’ alignment with one category or another was often dependent on the lab they were conducting. If the student had an interest in the lab they were more likely to view it in a positive light which aligns with the three approaches to interest research which includes the characteristics of the learner, the characteristics of the context, and the situational interest within the person (Renninger, Hidi, & Krapp, 1992). The phenomenographic categories formed are as follows:

a. The general preference for physical labs over virtual labs and the blocking aspect this has on learning

All of the students showed a preference for physical labs over the virtual labs and this is in contrast to many previous studies which showed no preference or advantage for virtual labs (Klahr, Triona & Williams, 2006; Pyatt & Sims, 2011). The excerpt below is from a dual interview with Cole and Samantha, students who were together at the remote site away from their science teacher.

Victoria Raish: so how are these labs similar to the hands on labs you have done
Victoria Raish: and how would you say they are different
Samantha: one is real life stuff and one is on the computer
Victoria Raish: why would you say the one on the computer is not real life stuff
Victora Raish: and cole how would you say these virtual labs are similar to the hands on labs you did before
Samantha: cuz its all like non touchable
Victoria Raish: okay so do you think it loses some of the meaning because it is all virtual
Samantha: yes
Cole: you can interact with the labs but you can't with the virtual labs
Victoria Raish: so why would you say you can't interact with the virtual labs
Samantha: cuz u cant get hands on with the stuff on the computer (AdobeConnect Room, 2013-04-16).

Emily, a student who was at the same site with the teacher, but due to scheduling conflicts was actually enrolled in biology in a room full of students taking chemistry shares this block on learning.

Victoria Raish: so that is the one you did not like
Emily: yes
Victoria Raish: why not?
Emily: i hated them
Emily: and because they are so hard to learn and just do in a lab on the computer
Victoria Raish: okay
Victoria Raish: do you think doing the lab virtually lost some of the understanding
Emily: yes, because i am actually a hands on person (AdobeConnect Room, 2013-04-23)

These students do not feel that the virtual labs are interactive and can be manipulated in the same way that a physical lab could. These findings seem to contradict an earlier study done by Pyatt and Sims (2011) that show that “the instructional medium (physical or virtual), may have little or no effect on the learner’s ability to describe casual relations in inquiry settings” (p. 134). The conception shows that the students do in fact feel that the instructional medium affects their understanding of the content.
b. The preference for physical labs over virtual labs with the ability to see the value in virtual labs

Engagement in authentic tasks is important for student learning which helps the learning process by investing students more in their academic work. A community of inquiry includes components of culture and enhancing understanding. Within the social presence there is affective expression and the culture of the environment which relates to the setting climate of the online classroom (Garrison & Arbaugh, 2007). Anna is clearly affected by this affective component of the lab, but does not let it hinder her learning experience of the lab. The following conversation comes from a prompt asking her what her favorite lab was.

Anna: Probably the one with the bacteria slides because I've done a hands on lab which I felt was more exciting to see the real images under a real microscope.
Victoria: So do you feel like doing it that way kind of lost some of the engagement of the lab.
Victoria: do you think doing that lab virtually lost some of the learning experience
Anna: I learned the same things but I guess I would say that the hands on lab was more exciting.  
(AdobeConnect Room, 2013-04-12)

The relevance of the virtual lab to prior knowledge and authentic learning experiences impacts the engagement of the students with the academic task. An excerpt follows in which Emily is discussing her favorite lab in biology and why she enjoyed it. The lab she is referencing involves the phenotypes and genotypes in a genetics unit.

Victoria Raish: why did you like it
Emily: i likd it because you are crossing them and i actually did like my fake baby type thing on a worksheet
Victoria Raish: okay...you liked to see what they would look like?
Emily: to see what color the eyes are, the hair, and like the thumb etc... and yes a lot (AdobeConnect Room, 2013-04-23)

Learning in school is differentiated from learning outside of school by the fact that learning in school is not reliant on tools for help in understanding the content (Resnick, 1987). However, one of the students in this study found an advantage to the online classroom that allows tools for understanding. Anna is referencing being able to use the lab as a guide to understand the content of the class.

Victoria Raish: so when he asks you a question in class outside of the lab you go back into the lab to look at it
Anna: Yes we can always refer back to the lab.
Victoria Raish: that is super helpful to always have it there
Anna: Yeah it's a lot more helpful.
Victoria Raish: do you think it is more helpful in a virtual lab because you can always go back to a concept that you are working on in class
Anna: The fact that I can always go back to the lab is really helpful if I'm preparing for a quiz or test.
Anna: Yes or you can look at it the other way and say that you can always go back to it at a later time. So time really isn't much of a factor with virtual labs.  (AdobeConnect Room, 2013-04-12).

c. Communication and sense-making via class mechanisms

The community of inquiry emphasizes that in the absence of direct contact with the teacher, participants must attempt to “recreate the social and knowledge building processes that occur via moment by moment integration” (Shea et al., 2010). Communication is recognized as an important goal in science and one that in this context necessarily involves using the computer. In the following excerpts, Emily and Anna conceptualize using communication as the class platform was designed for. Emily is in a different class trying to complete the labs and shows the communication roadblock she encountered:
Victoria Raish: just because of having to do everything with the computer?
Emily: well that and if they are the situation i am in, say if they have bio but have to be in a chem class, the teacher may not have the time t help them and i mean i had trouble the first couple times on them some of the labs are hard being new (AdobeConnect Room, 2013-04-23).

Anna discusses being more comfortable participating in the virtual lab due to the design of the classroom. She reflected that she participated more in this setting than in her previous physical labs. The chat feature of the class was heavily used to ask questions and that is the platform she is referencing.

Victoria Raish: why do you think you are more comfortable doing it that way
Anna: Since the class sizes are smaller mr. smith is able to answer all our questions right away rather than being to busy to answer of forgetting about it. (AdobeConnect Room, 2013-04-12).

d. Communication and sense-making using the internet and other information resources

In an online courseroom, the students have access to the tools that are not typical for those in traditional brick-and-mortar schools (Collins & Halverson, 2009). These tools take some of the control of the classroom away from the teacher because they are able to use the computer to find information. 21st century skills highlight the need to use resources effectively and engage in ICT literacy (Griffin, Bui, & Care, 2013). The following excerpts represent information retrieval strategies and communication techniques that were not necessarily designed to be a part of the course. Samantha and Cole recognize using Google as a strategy for learning about the content.

Victoria Raish: how would you say you communicate while doing the labs
cole: we dont,we just do them, thats it.
Victoria Raish: what do you consider googling for answers
Samantha: that depends on the question
Victoria Raish: so if you have a question how do you get it answered
Samantha: google
cole: figured it out on your own or google it
Victoria Raish: okay so you both have googled it before (AdobeConnect Room, 2013-04-16).

Anna recognized that she does not use this strategy but realized the potential value of searching for the information. The excerpt followed a discussion of communication and how she finds information for the labs.

Victoria Raish: do you think you would be comfortable with doing that on your own - using a search engine and finding a web page
Anna: Yeah I think google would be a great alternate resource. (AdobeConnect Room, 2013-04-12).

However, there is also a problem with students trying to think outside of the system and design constraints in the number of websites they can access. A recurring theme was the inaccessibility of many websites:

Victoria Raish: and do you ever get blocked from sites you are trying to look at
Victoria Raish: from the school
Emily: yes
Victoria Raish: because it says it is a game
Emily: all the time
Emily: i hate it
Victoria Raish: yea...do you think that frustrates
Victoria Raish: and delays your learning

The above quote referring to the blocking of websites was influenced by my personal knowledge of the school. I experienced this problem myself as a teacher and felt the frustration of the students in being unable to access quality sites that provided knowledge or simulations.
**Discussion**

The data discussed in this paper do not represent the experience of all of the students at Tullahoma or blended schools in general. A clear theme underlying all of the interviews is that the previous conceptions and attitudes that students have toward their formal learning clearly affect their experience with the virtual labs. To ensure trustworthiness in a phenomenographic study it is important that the participants’ conceptions are asking follow-up questions to initial answers and addressing the topic later in the interview for clarification of meaning (Sin, 2010). However, the following context specific answers are not considered generalizable in this small scale study. It is proposed by Larsson (2009) that phenomenographic research can be generalizable if the sample size is large enough and the data analysis stage results in rich and deep information; however this view is not the most ideal for qualitative research. If the sample size is adequate there will be saturation in the variety of conceptions experienced by individuals with the phenomena in question. A limitation of this study is that the sample size is small (n=4) and thus the wide variety of conceptions has likely not been achieved so this study is context-specific. Tullahoma school is also unique in its environment and structure due to the hybrid nature and heavy involvement of the computer. The fact that some students are physically present in the classroom, but still interact with their teacher through the computer and can also have physical conversations with some peers and not others makes the likelihood of generalizable findings smaller. Due to the inexperience of the interviewer, some of the interview questions were leading to address the point I wanted to make in my research questions. An example of a leading interview question is shown below:

*Victoria:* Does he just give you the answers or will he help you develop understanding by questioning you to help you develop the right answer? *Emily:* he does not tell me the answer, he helps develop understanding so that I do understand in the future (AdobeConnect Room, 2013-04-23).

In contrast to what has previously been shown that virtual labs can still be considered interactive and that the models and simulations help to promote an inquiry based, constructivist centered approach by doing (Pyatt & Sims, 2011). The view held by Klahr, Triona, and Williams (2007) that “children's hands remain active and in control of the investigations” (p. 185) was not held by any of the students because they did not view it as the same activity as physical manipulation of materials.

Through this pilot study, the need for an expanded community of inquiry for students in K-12 online learning is necessary. The original community of inquiry framework focused on higher education online learning. While most of the categories are extremely relevant to both situations, from a situative and activity perspective the context and environment necessarily influences the knowledge and learning that occurs and the difference in student characteristics and design of the learning environment should be explored through this framework to evaluate its applicability to the K-12 settings (Barab & Duffy, 2012). In future studies, a think-aloud protocol for the interviews will allow access into the thought processes while people are completing a certain task should be considered as the complexities of the interactions between the individual and their environment shape the experience of the students and can provide a different perspective than retroactive interviewing.

Information literacy is a skill that is considered to be “pivotal in the pursuit for lifelong learning and central to achieving both personal empowerment and economic development” (Bruce, 2004, p. 8). Trefil (2006) sees scientific literacy as important to understanding major issues that are going on in the world. Virtual labs allow students to engage in more self-directed learning and earn practice with multiple 21st century skills through the idea of Just-in time teaching in which students only retrieved the information they need at the time they need it. Jonassen (2013) substantiates the idea by proposing that if students do not have a readily applicable context to apply the knowledge they just learned then it is not meaningful and increases isolated knowledge. Emily sees the main point of doing the virtual labs as helping with computer skills because of the type of school that they attend. Anna mentions that she uses the virtual labs to go back and review information that is discussed in class. This is something that is not possible in a physical lab where the lab is a singular classroom experience and cannot be revisited. Even Cole and Michelle, who were generally critical of the virtual labs, acknowledged that they use Google as a resource and this is a strategy the students are using on their own. If this strategy becomes acknowledged by the formal school environment, than the students can be scaffolded to find and evaluate information appropriately (ACRL Standards, 2000; Garrison & Arbaugh, 2007). For this to occur, the school rules blocking certain websites needs to be revised so students can be self-directed learners and find access to reliable websites that provide important information.

This pilot study has provided a few key insights into students completing their virtual labs in a blended charter school. Even though there is a significant amount of research on virtual labs, none have taken place within
the context of a school where students complete the majority of their curriculum via the computer. A future study would include a larger sample size that would fulfill the saturation of data and maximum variation in conceptions. Ideally, the software being used would also be analyzed for its instructional design principles and focus on a constructivist-based design to help understand the student experience with a particular online lab simulation.

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