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## Peer Learning in Virtual Schools

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### **Abstract**

This article examines peer-to-peer learning—in virtual schools—among the most vulnerable of students. As a description of a comprehensive case study focused on three different students with disabilities, their parents, their teachers, and their school administrators, this article examines the effects of three kinds of variables on the prevalence and quality of peer-to-peer learning among the students: these variables include 1) student aptitude for and ability to take part in peer-to-peer learning, 2) design of the virtual learning environment and its affordances for interpersonal interactions, and 3) the social and pedagogical contexts in which learning is targeted. The findings show that variation in these areas influenced whether or not peer-to-peer learning occurred.

### **Résumé**

Cet article examine l'apprentissage entre pairs – dans les écoles virtuelles – parmi les étudiants les plus vulnérables. Comme une description d'une étude de cas complète axée sur trois différents étudiants avec déficiences, leurs parents, leurs enseignants et leurs administrateurs scolaires, cet article examine les effets des trois types de variables sur la prévalence et la qualité de l'apprentissage entre pairs parmi les étudiants. Ces variables comprennent 1) l'aptitude pour et la capacité de l'étudiant à participer à l'apprentissage entre pairs, 2) la conception de l'environnement d'apprentissage virtuel et ses capacités de suggestion pour les interactions interpersonnelles, et 3) les contextes sociaux et pédagogiques où l'apprentissage est visé. Les résultats montrent que la variation dans ces domaines a influencé à savoir si l'apprentissage entre pairs s'est produit.

## INTRODUCTION

In the United States, the new Common Core State Standards (CCSS) emphasize the importance of, and the increasing requirements for, peer-to-peer learning. For example, the English Language Arts (ELA) speaking and listening standards require “academic discussion in one-on-one, small-group, and whole-class settings. Formal presentations are one important way such talk occurs, but so is the more informal discussion that takes place as students collaborate to answer questions, build understanding, and solve problems” (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010). This new requirement for peer-to-peer learning is significant because the CCSS, a set of educational standards for kindergarten through 12th grade (K–12) in mathematics and ELA, have been voluntarily adopted by 45 American states (Common Core State Standards Initiative, 2012).

Other pedagogical approaches used nationally also have new requirements for K–12 students to actively participate in the learning process and to engage in learning activities with peers. For example, inquiry-based science instruction is not conducted through completion of solitary work pursued separately by individual students; instead, it is a constructivist, collaborative, discourse-based process rich with opportunities for students to learn from and engage with the experiences of their classmates (National Research Council, 2012).

As in many other domains of pedagogy and educational practice, the technologies for online learning are potentially disruptive for traditional peer-to-peer learning (Christensen, Horn, & Johnson, 2008). In this regard, no population is more susceptible—both positively and negatively—to changes in the patterns of peer-to-peer learning than students with disabilities. Students with disabilities, in fact, have often been enrolled in online learning precisely because of their difficulties with peer relations in the social learning environment of traditional schools (Edge Research, 2013; Reiner, 2012; Rose, Monda-Amaya, & Espelage, 2011). The study discussed in this paper—part of a much larger body of research examining the benefits and liabilities of online learning for students with disabilities (conducted through the national Center on Online Learning and Students with Disabilities [COLSD])—is among the first to examine the effects of online learning on peer-to-peer learning per se. The case study method (Yin, 2008) described here was designed to provide the first “close reading” of what peer-to-peer learning looks like in these environments and for these socially vulnerable students.

A paucity of research in this area is of considerable concern in light of two new policy requirements. The first pertains to the requirements for peer-to-peer learning that exist in curriculum frameworks being implemented nationally in the United States (e.g., the Common Core State Standards, National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010) and The Board of Science Education’s 2012 framework for science education (National Research Council, 2012). The second policy area involves the increasing requirements for all schools to provide a Free Appropriate Public Education (FAPE) for students with disabilities (a requirement under Section 504 of the Rehabilitation Act of 1973). Federal and state government agencies, legislators, and school districts are in the process of determining what an FAPE entails in a virtual public school (Martin, 2011; Rhim & Kowal, 2008). To ensure an FAPE, administrators and teachers in virtual schools will need to understand how students with disabilities can meet new curricular requirements for peer-to-peer learning.

The shortage of research on peer-to-peer learning in virtual schooling (Cavanaugh, Barbour & Clark, 2009), especially as it relates to students with disabilities, is concerning for other reasons as well. Research on learning in a broader sense consistently points to the importance of peer interactions for the generation of new knowledge (Hildreth & Kimble, 2002; Lave & Wenger, 1991). Borup (2013), in a study of the nature of students’ interactions in a virtual high school, found a significant positive correlation ( $r = 0.257$ ,  $P = 0.020$ ) between students’ course grades and time spent on learner-learner interactions. However, there was no significant correlation between course grades and time spent on learner-instructor interactions. Further, qualities and beliefs that are essential when learning becomes challenging, such as self-efficacy and motivation, develop socially through access to a range of models that can demonstrate that there are multiple pathways to a goal (Bandura, 1977; Ford, 1992). Self-

regulatory behavior also begins within social processes through which learners follow a sequential pattern of observation, imitation, demonstration of self-controlled behavior, and mastery of self-regulation (Ryan & Deci, 2000; Schunk & Zimmerman, 1997; Zimmerman & Tsikalas, 2005).

This article examines peer-to-peer learning in online education through a case study of a virtual public school in the United States. The study participants were three students with disabilities enrolled in a virtual school as well as their parents, teachers, and administrators. Findings indicate that a greater effort to support and train teachers and parents to explicitly identify and foster peer-to-peer learning could increase opportunities for all students to learn from one another. However, to help students meet the new requirements for peer-to-peer learning, administrators and teachers in virtual schools must understand three sources of variability that are present in all learning environments. First, students will vary in their capacities to engage with peers and in their motivation to do so. Second, there will be variability in the design of online learning environments and what these environments afford for peer-to-peer learning. Third, there will be variability in the context of implementation of a more social model of learning where peers are expected to learn from and with one another.

#### REVIEW OF THE LITERATURE

##### *Peer-to-Peer Learning in the Online Setting*

Early distance education theorists emphasized individualized learning using technologies that supported one-to-one communication between a teacher and student (Holmberg, 2005). Historically, student-to-student interaction was not a key component of distance education (Anderson, 2004; Holmberg). As online learning emerged as a vehicle for teacher-led education with content and instruction delivered primarily over the Internet (Watson & Kalmon, 2005), it also became a mechanism for peer-to-peer learning (Holmberg, 2005). For example, a community of practice (Lave & Wenger, 1991) is a learning partnership among people who find it useful to consider each other's experiences of practice as a means of making sense addressing the challenges they face individually and collectively (Wenger, 2010). Many communities of practice rely on the Internet to support peer-to-peer learning among adult learners who find themselves separated by time and space (Wenger, White, & Smith, 2009). Communities of practice can make learners responsible for bringing together the resources, people, information, and strategies they need to enhance their knowledge in a domain that is meaningful to them (Lave & Wenger; Stoll, Bolam, Wallace, & Thomas, 2006; Wenger, 1998; Wenger, McDermott, & Snyder, 2002). Key strategies in the facilitation of active involvement in communities of practice include organizing discussions, acknowledging other perspectives, and challenging assumptions (Davis, 2006).

One could reason that, for communities of practice to be an effective vehicle for peer-to-peer learning among students in the K–12 virtual schooling context, teachers and administrators will need to be involved in the development and facilitation of them. A mixed methods study of a virtual high school focusing on students' and teachers' perceptions of social presence as achieved online found that a greater focus on interactions and social presence should be part of teacher professional development as well as student preparation for learning in a virtual high school (Dickers, Whiteside & Lewis, 2013). A

challenge to bringing communities of practice into K–12 virtual education is that there is no consistency in how they are operationalized or implemented and, subsequently, they vary widely in the outcomes they support (Davis, 2006; Riel & Polin, 2004). Educators may be more likely to develop communities of practice that generate similar outcomes for all students, including those with disabilities, if they understand and can plan for sources of variability in the learning environment.

### *Variability in Learners*

Research indicates that, when learners in online courses have an active social presence, or affective social communication, they are more likely to engage in higher order critical thinking with other learners (Garrison, Anderson, & Archer, 2000; Gunawardena & Zittle, 1997; Rifkind, 1992; Rourke, Anderson, Garrison, & Archer, 2001). At the same time, social presence differs among individual learners based in large part on the values, beliefs, and emotions students have around communication; their commitment level to engaging in group processes; and their skills in interacting in ways that support social relationships (Mykota & Duncan, 2007).

Social perspective taking (SPT) is another ability associated with interpersonal interactions that has been examined in middle and high school (Gehlbach et al., 2008; Gehlbach & Brinkworth, 2012; Gehlbach, Brinkworth, & Wang, 2012). In the literature, it has been reported that SPT can be successfully developed through virtual simulations (Gehlbach et al.) and that it includes one's ability and motivation to understand the thoughts, feelings, and motivations of other people (Gehlbach, 2004). It plays an important role in the classroom experience because it is associated with engaging in interpersonal interactions. It is also positively associated with important academic and social outcomes in school such as greater gains in learning (Bernieri, 1991), more favorable ratings from teachers (Halberstadt & Hall, 1980), higher grade point averages (Gehlbach, 2004), greater capability to provide social support to others (Verhofstadt, Buysse, Ickes, Davis, & Devoldre, 2008), and more effective communication (Nickerson, 1999).

Students who attend virtual schools also need to be competent as online learners to engage effectively with their peers. Executive functioning has been identified as a core competency of adept learning within a virtual learning environment (Bol & Garner, 2011; Dabbagh & Kitsantas, 2004; Greene & Azevedo, 2007). Bol and Garner describe executive functions as a set of neurocognitive processes that promote higher level cognitive and metacognitive functioning that is closely linked to the constructs of student motivation and self-regulation (Garner, 2009). Motivational beliefs are considered critical to students' ability to regulate cognition (Pintrich, 1988; Pintrich, 1999). Deficits in executive functioning and low motivational beliefs can impede various self-regulatory behaviors, including sustaining effort, making appropriate learning plans, remembering goals, and regulating emotions (Parker & Benedict, 2002; Quinn & McCormick, 1998). Self-regulation and executive functioning skill deficits have been found to be significant predictors of online course drop-out rates (Youngju, Jaeho, & Taehyun, 2013). In a success prediction study of over 4,000 students in virtual high school courses, Roblyer, Davis, Mills, Marshall, and Pape (2008) found that preparing students to organize themselves and work in a virtual classroom would be particularly useful for students at risk of dropping out. Dikkers et al. (2013), in their

study of K–12 virtual school teacher and student perceptions of online social presence, indicated that specific preparation of students regarding time management could increase motivation, satisfaction, and persistence.

It may be particularly important for students with disabilities to develop abilities associated with interpersonal interactions and virtual learning. Students with disabilities struggle with social learning generally (Bauminger & Kasari, 2000; Guralnick, 1997; Guralnick, 1999; Williams & Asher, 1992) and peer-to-peer learning specifically (Guralnick, 2006; Leffert, Siperstein, & Millikan, 2000; Siperstein & Leffert, 1997). In addition, social perspective taking has been found to be weak in students with intellectual and developmental disabilities (Guralnick, 1999) and with autism spectrum disorders (ASDs) (Trepagnier, 1996). Autism spectrum disorders are characterized by difficulty with theory of mind (i.e., understanding the mental state of self and others) and flexibility in thinking and behavior (Trepagnier,). Children with ASDs struggle with the social competencies conducive to peer-to-peer learning such as showing interest in engaging with peers and demonstrating appropriate behaviors and emotions in peer-to-peer interactions (Kahana-Kalman & Goldman, 2007). Students with disabilities, despite average or above-average intelligence, also have difficulty with executive functioning and self-regulation (Barkley, 1997; Fossati, Amar, Raoux, Ergis, & Allilaire, 1999; Katz, 1998; McCloskey, Perkins, & Van Divner, 2009; Parker & Boutelle, 2009; Reid, Trout, & Schartz, 2005; Shmulsky & Gobbo, 2013; Ylvisaker & DeBonis, 2000).

#### *Variability in Design*

One of the central promises of online learning proponent is its apparent capacity for individualization and personalization of learning (Bray & McClaskey, 2013). In many online environments, students have many choices: through a single log-in, a learner can access educational software that can respond in different ways to user behavior, choose from a vast amount of networked information, visit social media and other web sites, and use multiple communication technologies. In principle, this variability in options enables peer-to-peer learning and highly individualized self-study (Holmberg, 2005)—and, importantly, the combination of the two.

While individualization and personalization sound the same, subtle and important differences exist between them. Individualization involves adapting curriculum to meet the specific needs of an individual student: it is an approach where students with disabilities are reliant on their para-professionals or teachers for instruction (Bray & McClaskey, 2013). The purpose of personalization is to provide more direct student control over learning than otherwise. In a personalized learning context, learners have choices in what they learn and the resources they access to help them learn including drawing on peers as a resource (Bray & McClaskey).

The most important question, then, regarding personalization and a peer-to-peer learning is not whether an existing learning environment design provides options that allow peer-to-peer learning but whether the features and functions of the environment encourage and develop it. Students with disabilities provide a unique test case of this question: can such environments enable optimal learning

for students with disabilities? If so, does optimal learning occur for all or some students? While there have been great strides made in online learning, design of virtual learning environments to support peer-to-peer learning among all students is still an emerging phenomenon.

Take, for example, software systems that respond to learners' behaviors in the online environment known as adaptive learning platforms (Education Growth Advisors, 2013; Fischman, 2011). Adaptive learning platforms use real-time data about a learner's actions within an online environment and the learner's performance on formative assessments embedded in the platform. This real-time data is used to adapt content, learning supports, and, later, formative assessments to meet the specific learning needs of a learner at a specific point in time (Education Growth Advisors,).

Adaptive learning platforms are devised to meet the need of individualized study. However, some education technology providers and educational institutions are beginning to use the capacity of virtual learning systems to gather student data to examine processes and behaviors that are tied to social learning (Buckingham Shum & Ferguson, 2012). This sub-domain of learning analytics, known as social learning analytics, focuses on "the group processes of knowledge construction" (Buckingham Shum & Ferguson, 6) rather than on assessment of past performance or the behaviors of individuals in relation to pre-defined tasks. (Social learning data needs to be linked to individual student demographic data including disability status and achievement data. This association will enable educators to see how individual students, including students with disabilities, engage in peer-to-peer learning activities and how such involvement is correlated with achievement.

Another effort that could be made to advance peer-to-peer learning is provision of options within the design of the online system to ensure that all learners can participate effectively in virtual learning environments. Distribution of the demands and benefits of virtual learning among all students is also recommended. For example, students with autism have very different communication difficulties than students with Down's syndrome and those with learning disabilities (Boser, Goodwin, & Wayland, 2014; Meyer, Rose, & Gordon, 2014). Therefore, greater attention must be paid to issues of the variability in design and design features which best support students across the full spectrum.

Universal Design for Learning (UDL) provides a framework for developing flexible learning environments as well as other kinds of learning environments. The principles of UDL call for multiple means of representing information, acting on information, expressing what the learner knows, and engaging in learning (Meyer & Rose, 2002). The basic premise of UDL is that barriers to learning occur during students' interaction with curriculum—barriers are not inherent solely in the capacities of a learner. UDL ensures that curricula—goals, methods, materials, and assessments—are designed to account for systematic human variability without lowered expectations.

*Variability in the Context of Virtual Learning*

No online learning technology or practice can be implemented in a vacuum. Instead, contextual factors such as effective use of teacher and student time so that it focuses on activities of higher order thinking instead of lower level tasks are important. So too is promotion of active learning and personalization that integrate students' interests. Taken together, these elements affect not only the ways by which online environments are implemented but the results of their use (U.S. Department of Education, Office of Educational Technology, 2012). Such factors may also play a critical role in determining whether available features or technologies are used effectively in the support of peer to peer learning.

As a case in point, Haavind (2006) analyzed dialogue from asynchronous discussions in virtual high school courses, looking for evidence of a high level of collaborative dialogue. Haavind found that collaborative dialogue in online instruction requires social engagement among class participants, activity designs conducive to collaboration, explicit teaching of or facilitating of collaboration, and timely evaluation of collaboration. Despite a growing body of research indicating the importance of design for effective peer-to-peer interactions, pre-service teachers primarily learn to use technology to deliver content—not to foster communication and relationships among learners (Egan & Akdere, 2005). As previously noted, Dikkers et al. (2013) found that a greater focus on interactions and social presence should be part of teacher professional development for the virtual high school setting.

Teachers can model effective interpersonal interactions through the relationships they themselves have with students. Thus, the teacher-student relationship itself and the structures and processes that teachers put in place for communication will strongly influence students' own online presence and, ultimately, the quality of critical online discussions (Bangert, 2008). Teacher-student relationships are also critical in contributing to students' level of motivation and academic success in school (Juvonen, 2007). In a study of a virtual high school, Hawkins, Graham, Sudweeks, and Barbour (2012) found that the quality and prevalence of student-teacher interactions increased the probability of student course completion. Understanding and knowledge derived from students' interactions and relationships with their teacher may be transferable to those of their peers.

The rise in use of social media and networked environments has made social learning an expectation for most learners today (Baird & Fisher, 2006). While informal learning environments such as gaming and social networking increasingly meet student expectations for social learning, the formal structures and requirements of schools may fail to meet students' expectations in the digital era. One area of change includes the beliefs and attitudes teachers or parents hold about how students should pay attention. In a participatory ethnographic study of secondary school students, Jones (2005) found that students used computers at home in ways that called for distributed attention among peers, tools, and tasks (i.e., they paid attention socially); yet, when they employed these same strategies during school-based computer time, they were told they were not paying attention by teachers.

If new curriculum standards specify expectations for students to engage in peer-to-peer learning, they must, at a minimum, provide a supportive context for that learning. Further, the implementation of online learning technologies must meet the challenge of new tools and habits of mind as well as updated definitions of student behavior. For example, considering distributed attention to be an appropriate learning style is one practical way to foster collaboration between students as it already includes peer involvement. Teachers, parents, and administrators who may be unfamiliar with social media must learn to facilitate social learning in this relatively novel and unfamiliar environment. This will require, among other things, an approach to professional development that encourages a new role for teachers and parents as facilitators who help students learn from one another, especially in online environments.

#### A CASE STUDY

The literature reviewed in this paper suggests that virtual schools need to be better equipped to meet the new requirements for peer-to-peer learning among students, especially students with disabilities. In addition, a limited yet growing body of research indicates that teachers, parents, and administrators will need to understand sources of learner, design, and contextual variability. They will likewise need to address these components directly in order to improve opportunities for peer-to-peer learning for all learners.

In the following pages, a case study conducted by the national Center on Online Learning for Students with Disabilities (COLSD) is presented. One of the main findings of this case study was the lack of peer-to-peer learning coupled with the growing importance of it. These findings and discussion of them illustrate some of the reasons why there is currently little peer-to-peer learning in virtual schools as well as the potential for increasing its use in this setting.

#### METHODS

Note: Pseudonyms have been used to protect the identity of participants.

Participants from this study were drawn from one virtual school: the West Coast Online School (WOS). Through a purposive sampling strategy, three teachers, three administrators, two data coaches, three caregivers, and three students (n = 14) were selected for participation (Patton, 2002).

#### *Profile of the Students and Their Caregivers*

Three students participated in this investigation: Sam, Gina and Kimberly. Three caregivers, in two instances the student's mother and in one the student's grandmother, served as learning coaches to help the students with all aspects of virtual schooling. Table 1 provides basic demographic information about the students.



Table 1. Demographic Information about the Students

Student	Gender	Age	Grade	Disability diagnosis	Caregiver
Sam	Male	7 years	1	Autism	Candace
Gina	Female	11 years	5	Down's Syndrome	Lisa
Kimberly	Female	12 years	6	Other Health Impairment	Elizabeth

*Teachers, Administrators, and Data Coaches*

Three special education teachers (Emily, Rebecca, and Betty) and three administrators (Karen, Tara, and Michaels) also participated in this investigation: In addition, two data coaches participated in this investigation: Sarah and Kelly. A data coach is a part-time general education teacher, an advocate of virtual learning to district- and state-level officials, and a trainer who educates teachers at WOS about how they can interpret monitoring and assessment results from tools in use at WOS. Table 2 provides a basic profile of these participants in the study. Table 2 provides a basic profile of these participants in the study.

*Setting*

WOS was founded in 2004. The school serves students in kindergarten through eighth grade, including homeschooled students; students who are homebound; students who are gifted; and students who, because of learning or emotional challenges, typically do not find success in traditional public schools. The curriculum used in the school is purchased from a commercial vendor. The vendor provides all online courses for students as well as workbooks and other materials for students to use in their classes. Teachers and students have both synchronous and asynchronous interactions each week through a web conferencing system and a learning management system. Teachers also have regular phone meetings with students and parents. Each learning coach and student pair spends the remaining learning time working through the online course material and workbooks together.

Table 2. Profile of Teachers, Administrators and Data Coaches

Teacher/ Administrator	Role at WOS	Gender	Years at WOS	Role Prior to WOS
Emily	Special Ed teacher grades 3–4	Female	5	11 years as Special Ed teacher
Rebecca	Special Ed teacher grades 6–8	Female	4	5 years as Special Ed teacher
Betty	Special Ed teacher grades K–2	Female	6	8 years as Special Ed teacher Para-educator at school for the deaf prior to becoming a teacher
Karen	Director of Special Education for WOS	Female	6	30 years as Special Ed administrator and university professor in Special Ed
Tara	K-8 Principal	Female	8	13 years as teacher then returned to higher education for administrative credentials
Michael	Head of School for WOS	Male	8	7 years as director of blended charter school
Sarah	Data coach	Female	n/a	15 years as General Ed teacher
Kelly	Data coach	Female	n/a	15 years as General Ed teacher

The school employs 77 teachers, 17 of whom are special education teachers. Special education teachers at WOS work in integrated classrooms that include both general education students and those with special needs. The school also employs a speech and language pathologist. In 2012–2013, there were over 3,000 students enrolled at WOS with approximately 10% of enrolled students diagnosed with a disability. Approximately 27% of elementary and middle school students at WOS are eligible for a free or reduced-price lunch. Students coming from families below the poverty level are eligible for this supplemental nutrition program in public and non-profit schools across the US.

Students in the school tend to perform poorly on the state measurement of student progress (MSP). When compared to overall state performance, WOS math performance on the MSP was significantly lower, although it was similar to overall district performance. Reading MSP scores at WOS were closely matched to state and district scores. Approximately 55% of all students (both elementary and middle school grades) scored at the proficient level on the state's reading test. However, only approximately 35% of students scored at the proficient or above proficient level on the state's MSP math test. This number was notably lower for eighth-grade students, of which only 20% met MSP standards ([Redacted] Office of Superintendent of Public Instruction, 2013).

The researchers were senior personnel at the Center for Online Learning and Students with Disabilities (COLSD). COLSD is a national research center of three organizations, which include the Center for Research on Learning (CRL) at the University of Kansas, Center for Applied Special Technology (CAST), and the National Association of State Directors of Special Education (NASDSE). These three organizations together bring expertise in ways to overcome barriers to learning and achievement, assistive technology and Web-based accessibility and the Universal Design for Learning (UDL) framework, which supports the creation of innovative online tools and new approaches that are effective for students with disabilities (SWDs). The Institutional Review Board (IRB) of the University of Kansas approved the research study and all researchers were IRB certified.

#### *Data Collection and Analysis*

A grounded theory approach was used (Glaser & Strauss, 1967) to analyze the data. On two separate occasions, staff from the COLSD spoke with the study participants. First, each participant completed a semi-structured interview (Maxwell, 1996). The interviews focused on the experiences of students with disabilities in WOS from the perspective of each study subject. For example, learning coaches were asked to describe a typical day for the student and what they felt facilitated their child's learning as well as what hindered it. Students were asked what they liked and did not like about learning at WOS as well as what they thought helped them learn. Administrators were asked to provide information about the enrolment and experiences of students with disabilities in WOS more generally and to describe what was and was not effective about the model for students with disabilities. Teachers were asked about their experiences teaching students with disabilities at WOS and what they thought the strengths and weaknesses were of the school with regards to students with disabilities. All interview subjects were asked whether peer-to-peer learning occurred at WOS among students and if so to describe instances of it.

Next, four separate focus groups (Hennink, 2007) were held in order to review and clarify ideas discussed during individual interviews. Transcripts of all interviews and focus groups were reviewed and independently coded by three independent reviewers. Codes for each participant group were created during analysis of the transcript, with each reviewer participating in the coding. Codes were used to summarize key areas discussed by the participants (Charmaz, 2006).

Researchers also conducted two structured observations of each student while they were engaged in online course work (e.g. in their homes). Researchers wrote memos immediately after each observation detailing what they found and these memos were analyzed together with the transcripts from interviews and focus groups.

The three transcript reviewers then came together to collaborate, check first-round coding for accuracy, and re-code transcript areas with coding that did not meet with universal agreement. Based on conceptual codes agreed upon by the reviewers, a master list of conceptual codes was prepared and checked to ensure that conceptual definitions across the list of transcript codes had not shifted (Strauss & Corbin, 1998). This process was repeated across each code cluster for all four participant groups in order to provide a final check.

#### FINDINGS & DISCUSSION

Based on the interviews, focus groups, and observations of the three students and their teachers, parents, data coaches, and administrators' case study, there was little evidence that the students were engaged in peer-to-peer learning. This finding was interesting in that all non-student study participants emphasized the importance of peer interactions for academic and social skills development. The following offers insight into the students' experiences of peer to peer learning according to three sub-categories: learner variability, design variability, and context variability. Findings in relation to each category are presented and then subsequently discussed.

##### *Findings: Learner Variability*

As noted earlier, the three students in the study were Gina, Sam, and Kimberly. Their family members and principal learning supports were Lisa, Candace and Elizabeth.

In the following statement, Lisa, Gina's mother, described various limitations in the design and context of the online learning environment as well as those of her daughter. Considered together, these limitations contributed to the lack of peer-to-peer learning during synchronous class sessions:

“What is missing, though, and I wish would happen is the need to connect the kids in the classroom where the actual learning is going on because we had a moderator and the kids want to chat in the

chat box but when you're younger like Gina, you don't really know what to say... but even there [social group] the moderator is doing most of the talking."

Lisa's statement suggests that the synchronous conferencing technology was set up as a broadcast medium where Gina's teacher was presenting information to passive listeners rather than providing an opportunity for collaborative discussion. Lisa also called attention to a contextual barrier to peer-to-peer learning at WOS: the fact that the teacher was doing most of the talking, even though the students were supposed to be developing social skills during this type of class session. Finally, Lisa identified a challenge at the level of the learner. Gina was not provided the support she needed to interact effectively with her peers given her disability that often includes difficulty with verbal communication (Down's syndrome) (Kumin, 2012).

Lisa described Gina's learning strengths as music, gestures, and kinetic activities. Gina reads fluently, although she is mostly studying second- and third-grade curriculum. Lisa also described Gina as a very social, curious, and friendly child whose biggest learning weakness is retention of information, which makes reading comprehension and math challenging for Gina. In addition to classroom-based Individualized Education Program (IEP) services, Gina also sees a speech therapist.

WOS is a virtual public school where students can be enrolled part-time or full-time. All students enrolled must take the annual state assessment. Lisa has not enrolled Gina full-time because she does not want her to have to take the state assessment. Lisa does not believe that the state assessment is an appropriate method to evaluate the yearly progress of her child who has Down syndrome. Instead, Gina is enrolled as a part-time WOS student and is homeschooled for her remaining courses. Gina does receive standardized testing that has been developed to assess progress for students with developmental disabilities.

Gina was the only one of the three children reported to work independently at times:

"...and sometimes there are areas where she will tell me, "I can do this Mom." She'll say, "Go do something; I'm okay." She'll usually let me know because I'm really hands-on and I have to remove myself because I want her to be independent and she wants to be independent".

At the time of the study, Sam was seven years old and in the first grade. He had also been diagnosed with autism. Candace, his mother, described his learning strengths as history, math, and science and suggested that Sam learns best when subjects are presented to him—preferably read to him—in a story format. Sam struggles with reading, yet he was making progress with the help of a Hooked on Phonics® program and a specialized one-on-one reading class delivered through WOS. Candace described another area of challenge for Sam: switching from one subject to the next in a single day. She remarked that they would often address this situation by completing six lessons in one subject on one day and then tackling another subject the next day. Also relevant is that fact that, in addition to classroom-based IEP services, Sam receives psychotherapy services. Candace indicated that Sam found WOS synchronous sessions that involved the teacher and other WOS students difficult because of his shyness.

Candace disclosed that, in the traditional school Sam had been enrolled in prior to WOS, communication with parents was poor. As well, the staff often disagreed over how to enact disciplinary actions. At this traditional school, Sam had experienced bullying. By contrast, Candace commented that Sam was loving learning at WOS and was willing to try things that were challenging for him such as reading. In the following passage, Sam's participation in a face-to-face social event arranged by WOS is highlighted. While Sam felt bullied by other students in his previous traditional school, he felt supported by other students at WOS:

"My husband's biggest concern was whether [Sam] was still going to get that socialization because he has autism and he needs it, but he's going and he's talking to other kids. He was talking to a girl at the skating rink and they were having a full conversation, and afterward she came up to me and she asked me if he had autism; and when I told her he did, she said, "I do too" and told me not to worry—that he would do really good. It was awesome."

Kimberly is the granddaughter of Elizabeth. At the time of the study, Kimberly was twelve years old and in the sixth grade. Her disability is categorized under other health impairment and involves extreme fatigue and frequent headaches. Elizabeth described Kimberly's learning strengths as learning through art and video; Elizabeth also shared that Kimberly has a very positive relationship with her WOS teachers. Kimberly's learning weaknesses include difficulty maintaining stamina, reading, and writing. Elizabeth indicated that Kimberly often completed only one to two days' worth of lessons in a week, and that Elizabeth and Kimberly were more successful when the information in lessons could be condensed. While Kimberly loves the synchronous online sessions at WOS, she does not like the preparatory software program for the annual state assessment. Elizabeth described the software program as having too many problems that require reading and are too serious for Kimberly.

Like Sam, Kimberly also struggled with peer-to-peer interactions in her previous traditional school. Elizabeth indicated that Kimberly did have friends at her previous school; however, she also got in trouble and hung around with the kids that got in trouble. While Kimberly was making social progress in the synchronous class sessions through very positive interactions with her teachers, her peer-to-peer interaction skills were not improving. Elizabeth identified a need for more support for students to engage in the in-person events that WOS holds monthly:

"When we've gone to them, all of the kids are nervous; and the few that we've gone to, she's just walked home without even talking to anybody. I think what happens is that the kids who are shy and haven't been around have trouble."

Both Candace and Elizabeth indicated that their children felt more supported and more in control of their learning in WOS than they had in their traditional schools.

*Discussion: Learner Variability*

The three students in this study vary in terms of their learning strengths and weaknesses and in the ways in which peer-to-peer learning is challenging for them. Social interactions during the synchronous class sessions were challenging for Sam. To reduce stimulation during class sessions, Sam often required adaptations such as not using the webcam or the microphone. Candace described Sam's interactions in face-to-face activities with other students from WOS as positive, especially given Sam's experience of being bullied in a traditional school setting and his diagnosis of autism. Kimberly's social challenges were different than Sam's. As illustrated in Elizabeth's description of Kimberly's behavior in one of the face-to-face events, students like Kimberly may not participate in social events if they are not welcomed and helped in their interactions with peers by a teacher. While Lisa indicated that Gina needed increased support in order to interact with peers during synchronous sessions, she did not elaborate on the kind of support Gina might need.

The three students in this study also differed in their capacity for self-regulation, which is important for effective virtual learning. While all three learning coaches described their children's sense of self-efficacy as improved since enrolling in WOS, only Gina appeared to be somewhat self-regulated in her learning. She was the student who was able to work independently at points during the day. Self-regulated learning is foundational to effective peer-to-peer learning and begins with social processes through which learners observe, imitate, and demonstrate self-controlled behavior before they master self-regulation (Ryan & Deci, 2000; Schunk & Zimmerman, 1997). Presumably, if Gina had more opportunities to engage in peer-to-peer learning, she could help other students like Kimberly who have poor self-regulation.

*Findings: Design Variability*

Unlike the curriculum in traditional schools, Tara, the K-8 principal described the curriculum at WOS as tailored to each student:

One of the things that we can do, that I think helps kids, is that we might have an 8th grader who's functioning at a 4th grade math level, so we give them the 4th-grade math curriculum and then the Special Ed. teacher provides those additional supports and instruction around the actual goals for the kid. That's the other beauty of online [schooling] is that you have a small group of 10 kids, and we group them together based on their IEP goals, and they work with the same group week in and week out and with the same teachers.

Tara further suggested that this individualized approach helped teachers and parents to identify areas where a student was really struggling and to determine areas requiring re-teaching in order to bring the student to mastery. Once weaknesses are identified and addressed, the student may be able to move quickly through a below-grade-level curriculum.

The parents, teachers, and administrators indicated that individual student weaknesses were less visible to peers in the online setting than they had been in traditional schools. The relative anonymity offered by the online school made it easier for students to try tasks without being embarrassed about what their peers would think.

Kelly, one of the two data coaches, expressed concern about students with disabilities not being exposed to grade-level curriculum and wondered if they were appropriately challenged. As noted earlier, only 20% of WOS' eighth-grade students met MSP standards for math.

*Discussion: Design Variability*

The highly individualized approach of WOS, with its limited emphasis on peer-to-peer learning, may result in parents and teachers being the only people who interact with students around their learning. This situation resembles individualization where a student is reliant on an individual para-professional or teacher for instruction, as opposed to personalization where a student is more self-directed and may call on peers to aid his or her learning (Bray & McClaskey, 2013). Because the students in this study have deficits in the skills they would be expected to have at their age, individualization might be an appropriate means to help them work on recovering and developing skills. However, an appropriate longer-term goal for these students may include a transition towards greater personalization. Implementation of a more personalized curriculum will require school staff and parents to focus on improving learners' self-efficacy, self-determination, and, ultimately, self-regulation.

The practice of Universal Design for Learning (UDL) might assist in the provision of options for supporting executive function and self-regulation. Consistent with UDL, teachers at WOS give students choices around how they communicate (e.g., text chat, audio, video), and all three caregivers in this study indicated that this was helpful in enhancing interactions with teachers and peers. This is a more beneficial approach for students than lowering or eliminating curricular requirements for peer-to-peer interaction for students who are challenged by them.

The fact that students can conceal their age in virtual schooling may help to promote active participation in learning, especially for those students working below grade level. However, the design of the learning experience needs to include explicit opportunities for collaborative work if peers are to learn from one another through more than passive observation. Ideally, it should be possible to evaluate these learning interactions. To evaluate collaborative learning approaches, social learning analytics embedded with the learning management system could be used to identify patterns of interaction among different students. Patterns of interaction could then be analyzed for correlations with achievement of student outcomes. Findings, in turn, might enable personalization that includes peer-to-peer learning.



*Findings: Context Variability*

Each of the caregivers and teachers interviewed described very positive teacher-student relationships and teachers who were responsive to student needs and preferences. However, Emily, one of the Special Ed. Teachers, described the lack of peer-to-peer learning at WOS as its single biggest weakness:

“But I think the part that they are missing out on the most is that peer work on projects so that they hear feedback from other peers and so they have the dissenting opinions and how you work stuff out.”

Emily talked about how she tried to encourage peer-to-peer learning in her classes:

“I might say, “Well this is how Johnny solved it; would anyone else have solved this differently?” like in math. Because in math, you can solve things 100 different ways, and it might not be how you thought of it; but maybe if he explains it, it might turn a light bulb on for you.”

Betty, the K–2 teacher, described building in a show-and-tell session at the start of every week so her students could get to know one another and work on social skills:

“Every Monday I do a Monday Meeting to help build communities because we are virtual. All of my students are invited to this meeting and we do ‘student of the week’ there and kids can share about their families or their pets or whatever and they send in pictures and a little bit about themselves .... This is a first grader that is on an IEP for speech and social and he read his whole thing, and usually when he gets the microphone he speaks so softly you can’t hear him; but this time he had a big, bold, loud voice and he shared a picture of [himself] and his sister petting their hairless dogs. I was just elated for him. Then the students get turns to ask him questions and they asked him what his dogs’ names were. It was fabulous!”

Rebecca, also a Special Education Teacher, described making significant efforts to build in socialization activities and peer-to-peer learning in her class:

So, I do it a lot just because it’s fun and it is fun for me to lead a class where the kids like to talk to each other ... on Mondays I do a Class Meeting and it’s usually about a topic that’s fun or interesting and so I let the students chat with each other before the class starts and then we just kind of have a conversation with a mini-lesson intertwined.”

*Discussion: Context Variability*

The teachers reported modeling interpersonal interactions and encouraging students to interact with one another, and, in some instances, learn from one another—despite no explicit requirements to do so. All of the teachers interviewed described how valuable it was to their own professional development to

be engaged in peer-to-peer learning through professional learning communities (PLCs) which are similar to communities of practice (Stoll et al., 2006), PLCs are a key strategy used by WOS for the professional development of its general education and special education teachers.

Extrapolating, based on the findings of this study, teachers need to be designers and facilitators of communities of practice in their classrooms for their students. For communities of practice to succeed in K-12, teachers need to model interpersonal interactions. Positively, research indicates that teachers naturally do this (Bangert, 2008). The fact that teachers at WOS have experience in peer-to-peer learning is an advantage in establishing communities of practice in their classrooms.

### *Conclusion*

Compared to other forms of learning, virtual learning is in its adolescence. In order to benefit from a learning framework such as a community of practice, we need to understand the barriers to peer-to-peer learning among the specific learner group which, in this study, was vulnerable younger students. That is, students with disabilities who may have left traditional schooling in part because peer interactions were difficult. In this study, three forms of variability found in all learning environments were considered based on results from a case study focused on one virtual school. These are the variability among learners and their aptitudes that influence how much they can and do engage in peer-to-peer interactions, variability in the design of virtual schools and what they afford for peer-to-peer learning, and variability in the context of implementing a social model of learning where peers are expected to learn from and with one another. Each kind of variability requires explicit attention if virtual schools are to meet new curricular requirements for peer-to-peer learning and ensure that they can provide a FAPE to students with disabilities. While the findings of this study cannot be generalized because of the sample size and study design, the analysis presented here may prove useful for examining the potential for peer-to-peer learning in virtual schooling more broadly.

One area for future research is professional development for administrators, teachers, and parents in relation to peer-to-peer learning: such research could generate insight into and increase peer-to-peer learning opportunities. Another promising direction for research is peer interaction as it includes social perspective taking and social presence among students with disabilities in virtual schools. Another potential area for study is the impact of Universal Design for Learning (UDL) in the development of technology and curricula used in K-12 virtual education. UDL is a framework that has been proven effective for students with and without disabilities across a range of learning environments. Significantly, it holds particular promise for virtual schools.

1"Free Appropriate Public Education (FAPE) means special education and related services that are provided at public expense, under public supervision and direction and without charge; meet the standards of the state, include preschool, elementary school, or secondary school education and are provided in conformity with an individualized education program (IEP)." Morando Rhim, L. and Kowal, J. Demystifying special education in virtual charter schools. 2013. Public Impact.

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