



## **Supporting students with diverse learning needs using UDL in online learning: Voice of the students**

Diane P. Montgomery  
*University of Prince Edward Island*

Kathy Snow  
*University of Prince Edward Island*

### **Abstract**

During the Covid-19 pandemic, online learning became the predominant mode of learning for 33-54% of students in Canada's three largest school boards. As inclusive practices continue to grow and online learning is now part of the Ontario curriculum, educators need guidance on how to support K-12 students with diverse learning needs in both online and in-person inclusive classrooms. This case study attends to the voice of elementary and high school students, with and without learning disabilities who shared their experiences of online learning during the pandemic. It explored the impacts of integrating universal design for learning (UDL) and technology to accommodate diverse learning needs. Results indicated limited opportunity for engagement was a key factor impacting the students' motivation and ability to learn in the online environment and age was a determining factor in technology use preferences.

### **Introduction**

The abrupt switch to online learning within the province of Ontario due to the Covid-19 pandemic significantly impacted approaches to learning for students with disabilities (MacKay et al., 2021). Students, caregivers and teachers were in vastly different stages of readiness to begin online learning and online teaching. Gallagher-Mackay et al. (2021) reported that the first in-person school closures in Ontario during March-June 2020 led to increased absenteeism, and disproportionately impacted students from lower socioeconomic

backgrounds, racialized children, newcomers and students with disabilities<sup>1</sup> across the province.

In the fall of 2020, due to the ongoing concerns of the pandemic, families were provided with the option of continuing to learn online or return to the physical classroom (Ford, 2020). Despite the promise of safety adaptations in the classrooms, the demand for online learning surged among the three largest school boards in Ontario; Toronto (TDSB, 2020), Peel (PDSB, 2020) and York Region (YRDSB, 2020) school boards, with registrations ranging from 33%-54% of the student population. Within the TDSB, approximately 14,000 (17% of online learners) required special education support (TDSB, 2020). Therefore, online teachers needed to be prepared to offer the same support for a diverse student population online as those supports offered in person. However, at the outset, teachers were not readily equipped with the skills and resources to develop inclusive teaching techniques online (Charlesworth, 2020).

Noting the challenges for students with diverse learning needs in particular, we conducted this exploratory case study to give an account of the students' experiences during this significant moment in time, and to contribute to the growing body of evidence examining approaches in inclusive<sup>2</sup> practice in online learning; and by extension the potential for these innovations to support future in-person learning post pandemic. These experiences may also benefit future teaching practices in online inclusive environments since online learning options continue for K-12 students in Ontario post-pandemic, and high school students in Ontario are now required to complete two online courses prior to graduation (People for Education, 2022).

Keeping in mind the lessons learned from the COVID-19 pandemic and the future state of online and inclusive education in Ontario, we began our examination of students' experiences with a review of the literature related to the critical questions which emerged within boards related to teaching and learning in inclusive online environments. This included the question of balancing varying types of online learning environments, then shifts to outlining what was known about online learning experience for children with disabilities. We adopted the Universal Design for Learning (UDL) framework, as the theoretical frame for our analysis, because this is the dominant paradigm adopted for inclusive practice in Ontario. Through this lens we evaluate student experience; the degree to which UDL practice was adopted successfully in online learning, and discuss in the context of current literature which practices show promise for moving forward post-pandemic.

## **Literature review**

Prior to the pandemic, online learning literature was dominated by post-secondary, which may or may not offer insight into learning with younger K-12 students (Do, 2018; Bower et al., 2015). Since the pandemic, COVID-19 online K-12 teaching literature has emerged, but very few

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<sup>1</sup> The Ontario Human Rights Code term “disability” refers to a person with any degree of physical disability, mental impairment, developmental disability or learning disability (OHRC, n.d.).

<sup>2</sup> According to the Canadian Research Center on Inclusive Education (2021), inclusive education is when “All students actively participate and learn with their peers in the same classroom and adaptations and accommodations are made for all to succeed” (par. 1 )

authors have attempted to examine online inclusive education to support students with diverse learning needs (Dahlstrom-Haki et al., 2020). Therefore in grounding our research, we brought together what was known about the blend of varying modes of online learning and student learning diversity online using universal design for learning (UDL) teaching practices.

### ***Balancing Varying Online Learning Environments***

One of the critical factors that appeared to rise to the top of discussions in the newly emerging K-12 online teaching literature, was the impact of varying modes of online teaching on students' learning and engagement (Erümit, 2021; Herman, 2020; Hersh, 2020).

In an example from Turkey, Erümit (2021) reported an increase in student motivation associated with increasing synchronous interaction. Herman (2020) suggested that the human connectedness in platforms such as Zoom (a synchronous meeting tool using both voice and video) may contribute to engagement because it more closely mirrors classroom experience. Additionally Hersh (2020) posits the use of small group sessions in Zoom breakout rooms as an important learning tool to increase student voice in online learning.

Despite the aforementioned advantages of synchronous sessions, they could quickly be sidelined when students/caregivers or teachers were not confident in using technology adequately or when students had learning preferences/needs which made synchronous activities difficult (Do, 2018; Hogan & Sathy, 2020). Hence, Hogan and Sathy (2020) outlined the importance of student's access to recordings of lessons in addition to synchronous learning. Do (2018) evidenced, learning tasks established using text based group tools, such as Google documents or slides could be an effective middle ground in supporting concurrently asynchronous/synchronous learning though text based discussions. A balance of online learning modes may better support the unique learning needs of students with disabilities.

### ***The Impact on Students with Disabilities***

Although the effectiveness of online learning for students with disabilities has not been fully explored (Dahlstrom-Haki et al., 2020), the challenges faced by this population must consider individuals' unique learning needs and accommodations, which when not addressed significantly impact engagement and motivation to learn (Carver & Rowe, 2020; Erümit, 2021; Ferdig & Pytash, 2021; GAO, 2020; Smith, 2016; Tindle et al., 2017).

Within Ontario, individual needs of students who require special education support are addressed through the development of an Individual Education Plan (IEP) which can be more difficult to implement in online than bricks and mortar settings (GAO, 2020; Tindle et al., 2017). Ferdig and Pytash (2021) also recognized the inconsistencies in the way students interacted with online learning, with some students excelling and others deprived of engagement between teachers and students. When provided with appropriate support, students with disabilities were more engaged using technology than traditional approaches; and these students also chose to participate in online courses at higher rates than students without disabilities (Thompson et al., 2012). This demonstrated the importance for educators to continue providing high quality online learning experiences to address the varying needs of these students. However, supporting students with disabilities in online learning required that students and teachers were comfortable and capable with the technology used. Carver and Rowe (2020) evidenced student challenges using technology during school closures required parental support which frustrated both student and parent (Carver & Rowe, 2020). Alternatively, GAO (2020) reported technology increased

student engagement in online learning environments for some students with identified social anxiety and other mental conditions.

Bjekic et al. (2014) conveys that students may become more engaged in the use of technology when teachers utilize multiple methods to represent instruction and confirm students' understanding of the material. Hence, online learning combined with the Universal Design for Learning (UDL) Framework "may allow educators to address both disability and learner variability" (Smith, 2016. p.16).

### ***Universal Design for Learning (UDL) as the Theoretical Frame***

UDL is currently the dominant model for diverse learner support in Canadian K-12 schools. The three foundational principles of UDL are providing students with opportunities of: multiple means of engagement, multiple means of representation and multiple means of action and expression (Cast, 2018). Engagement impacts a student's motivation to learn by enabling learners to engage with the material in a variety of ways since there is more than one way of engagement for all learners. Representation refers to the way learners perceive and understand material using different means of representation to align with different learning preferences. Action and expression enables learners to express what they know in alternative ways that work best for them (CAST, 2018).

Some research suggests this theory is an oversimplified hypothesis instead of a fact (Boysen, 2021; Murphy, 2021). There have also been mixed views about the effectiveness of UDL on student's achievement with some studies reporting success (Rappolt-Schlichtmann, 2013; Smith Canter, et al., 2017), and others indicating limited evidence in this area (Boysen, 2021; Lowrey, 2014). However, since UDL has also been shown to increase educational access, by offering more choice of learning to all types of diverse learners, there seems to be more proponents supporting the expansion of UDL (Lowrey, 2014; Nelson & Basham, 2014).

The integration of UDL with online learning was especially critical in supporting the needs of students with disabilities by accounting for both learner variability and student engagement (Basham et al., 2020). Coy's et al. (2014) preCOVID study evidenced how educators adopted a variety of online interactive tools; audio, video, webcam, chat room, whiteboards, PowerPoint presentations and websites to apply the UDL principles. The teachers and students in Sharpe (2019) study on Google classroom also outlined the benefits of combining UDL and technology so students could access features to help them with reading, writing, group work, organization, and engagement. Some of these features included text-to-speech, speech-to-text, word prediction software, collaborative word documents (Google Docs) and presentation slides (Google Slides).

Regardless of the features in online learning platforms, Coy et al. (2014) found that some features aligned to the UDL principles were used by teachers more than others. For example, the principles of providing multiple means of representation and multiple means of action and expression were used more often (80% of the time) than the principles of multiple means of engagement which were applied 40-60% of the time. Basham et al. (2020) also noted that during the pandemic when teachers were unprepared for the emergency shift to online learning, teachers were focused more on the technology than learner needs. They proposed that a combination of UDL with technology would ensure a wide range of learner variability was addressed.

The online learning experiences during the pandemic of students with diverse needs and the ongoing need for online learning post pandemic, as well as the dearth of literature in UDL applications online, made it clear far more research is needed in this area to support learning for

students with disabilities. There was also limited research that considered the perspectives of students with diverse learning needs in elementary and high schools, on the quality of education they were receiving in online schools in comparison to their peers in physical classrooms (TDSB, 2020; PDSB, 2020; YRDSB, 2020). Therefore we designed this study to examine the UDL strategies used to support all students in online learning platforms which led to the research questions:

1. What are the experiences of elementary and high school students with diverse learning needs in varying online learning environments?
2. How does the implementation of each of the Universal Design for Learning (UDL) principles impact students with diverse learning needs in online school settings?

## **Methodology**

We adopted an exploratory case study (Yin, 2018) to examine individual students' experiences within Ontario K-12 online learning over the period of April-December 2020. After ethical review and approval, the participants were invited through an online learning social network. The criteria for participant selection included students: enrolled in K-12 online or hybrid (combination of online and in-person learning), with or without disabilities. Caregivers were included in the study because online learning was observed to require both students and their caregiver's engagement.

Data collection consisted of semi-structured interviews (Merriam & Tisdell, 2016) and online observations of learning in scheduled classes. Two interviews were conducted with each participant: one at the outset of the project, and one at the conclusion of the observation period. Interview questions focused on student/caregiver perceptions of the type of instruction received, communication with peers and instructors, as well as self evaluation of engagement and achievement levels. Three online observations were completed with each elementary student while only two observations with each high school student given the difference in age and class length. The learning observations recorded the level of engagement and comprehension of the student in relation to instructional approach from the researcher's perspective through the use of frequency tallies on a standardized tracking sheet. Observational data was member checked with students and the caregivers of the younger students at the end of each observation, to aid interpretation. Descriptive coding was used to organize data from the observational field notes allowing for a clear outline of what occurred in each lesson and students corresponding response in relation to the categories: understanding, motivation or engagement. Thematic analysis (Miles et al., 2014) of interviews was conducted to identify themes which emerged in students' responses to online learning.

Anonymity, confidentiality, and the voluntary nature of participation were addressed at the time of recruitment and included parental consent and youth assent.

## **Findings**

The purpose of our research was to explore the online learning experiences of students with diverse learning needs in elementary and secondary school settings. Specifically, we aimed to understand the successes and challenges of these experiences and the impact of integrating the UDL principles of: multiple means of engagement, representation and action and expression. Given the unique needs of each student and the importance of context in case study analysis, our

findings first introduce the learning profiles of each participant, and then detail the themes revealed within each of the three UDL principles.

### ***Participant profiles: Strengths, needs and disabilities***

Our participant group consisted of three male and four female students with and without learning disabilities from grades 1-12. One caregiver of each student also contributed to the interviews. A brief profile of each individual derived from initial observations and interviews with the student and their caregiver was created.

Leah (grade 1, F) was observed to be highly engaged in online learning but required constant supervision and one-on-one support. Leah was diagnosed with a neurovisual disorder and ADHD which impacts her ability in all aspects of learning. For a variety of reasons, Leah's needs could not be met in the online learning classroom so she returned to the physical classroom at the conclusion of our research.

Claire, (grade 1, F) was observed to be able to work independently for short periods of time without distractions but sought affirmation of her achievements and parental support to stay on task for lengthy assignments. Claire's mother indicated that Claire does not have any disabilities and was motivated to enrol in the online learning school to support her social network.

Owen (grade 5, M) was diagnosed with high functioning autism. Owen told us he enjoyed learning but was easily bored with topics he found uninteresting or when explanations were lengthy. Owen's mother indicated that he was able to focus well within a structured schedule in the presence of a teacher, but needed supervision in the absence of a teacher during asynchronous periods. Owen returned to the physical classroom at the end of our research because his mother felt online learning did not adequately address his needs.

Jacob (grade 5, M) was observed to be engaged in learning when he was able to hear and comprehend the lesson. His mother shared with us that Jacob has a complex processing disorder which makes it difficult for him to attend to and manage multiple pieces of information. This impacted his ability to initiate and follow through on tasks without an inordinate amount of external support.

Madison (grade 10, F) expressed that she exhibits ADHD, anxiety and specific learning disorders. Madison stated that she experienced many challenges in the way instruction was delivered in the spring but she was content with the adapted model of in-person and online learning she received in the fall.

Sofia (grade 11, F) said that she excelled academically in the spring 2020 with fully online learning but struggled in the fall when the method of instruction rotated between in person at school and online at home. Sofia had an IEP, but all of the accommodations had not yet been implemented for the school year at the time of the research.

Dylan (grade 12, M) told us he was determined to excel in this final year of secondary school. Dylan indicated that in the fall, his course load was only two courses within a 2.5 month period in the new quadmester<sup>3</sup> system but delivered at a speed of four times the pace of his regular pre-pandemic course load of eight courses taken over the entire 10 month school year. Dylan expressed that he did not have any disabilities and was learning to manage the workload challenges.

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<sup>3</sup> Quadmester refers to a 2.5 month period or half of a semester.

## ***The application of UDL in online learning***

We have combined all grade/age ranges in the thematic discussion of students' experiences with online learning. Where differences arose between the elementary and secondary students within a theme, they have been noted. The results have been organized using the theoretical frame of UDL to guide analysis with the emergent themes related to the UDL principle discussed.

### ***Means of engagement***

Supporting multiple means of engagement appeared to be the most problematic UDL support to transfer into the online environment. As a reminder, multiple means of engagement refers to optimizing individual choice of learning and opportunity for collaboration (Cast, 2018). Emerging from observations, two main challenges to engagement appeared: students limited collaboration and social connection and reduced focus and enjoyment during online learning events. From the interviews, three specific factors that contributed to students' engagement both positively and negatively were: learning needs, curriculum offered, and opportunities to interact with webcams.

***Online learning limited student's sense of connection and collaboration in learning.*** The instructional experiences observed at the time of research limited students' ability to connect and collaborate with their peers. Regardless of age, social isolation in the students' spring and fall learning was expressed as one of the most important factors negatively impacting online learning experiences.

*Elementary school students.* The participating elementary school students were fully online. Facing the shut down or limiting of other social pathways at this time, students identified connecting with others in online school as important. When describing Claire's desperate need for social connection through a teacher directed chat room, Claire's mother stated, "The kids open the chat fast, as soon as they log on, saying hi ... before the chat box is closed off to them." Leah attempted to connect with the teacher by raising her hand constantly while sometimes forgetting she needed to share turns with the others. Turn taking was managed well in Jacob's class as the teacher encouraged all students to use a portable white board to write and display their answers all together on screen, essentially giving everyone a turn at the same time. Although peer connection was generally limited, Owen recalled a memorable day in the spring when his teacher allowed the students to stay connected with one another after class in the meeting platform.

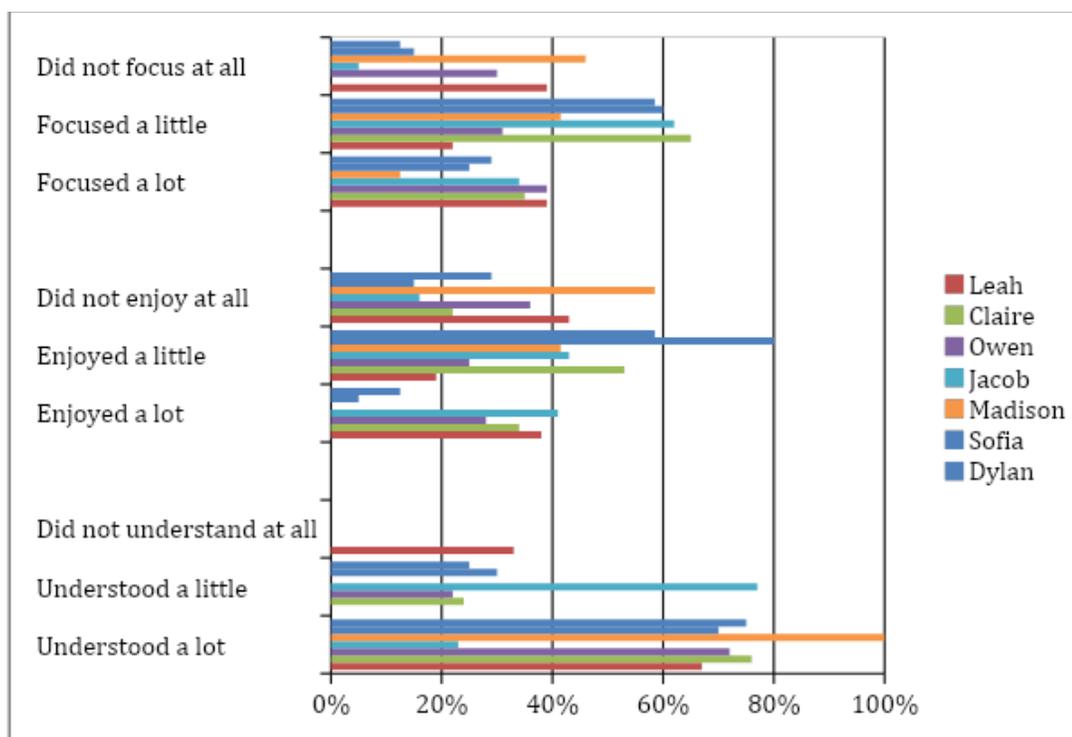
*High school students.* The participating high school students in our study experienced a hybrid model of online learning half the time, and learning in the physical classroom the remainder of time. During their synchronous online learning, high school students communicated primarily using the chat box to ask questions about the course. To encourage participation within the class, Sofia's teacher awarded extra marks for completing a series of questions through the chat box. However, since direct connections between peers were limited, Sofia and her classmates used personal text messaging instead of school/teacher driven tools to connect with one another. Sofia said she would be receptive to small group discussions in the online breakout rooms.

**Reduced focus, enjoyment and level of comprehension.** In addition to social connections, the ability to enjoy learning, focus, and understand the material were also key factors emerging from multiple means of engagement. We completed observations of the students’ levels of focusing, enjoyment and understanding using a running record of their behaviours during each observed lesson. Since the high school students had a greater ability to recognize their own engagement, they also completed a supplementary parallel self assessment during their lessons. The summary of their responses is presented in Figure 1 below.

In Figure 2, the category of ‘focused a lot’, ‘enjoyed a lot’ and ‘understood a lot’ was used to signify a high level of engagement. All participants “focused a lot” less than 40% of the lesson with a median of 34%. Of the elementary students, Leah and Owen had the most difficulty focussing, both recording more than 30% of the time as “did not focus at all”, not surprisingly they moved back to the physical classroom. Madison, one of the high school students, also “did not focus at all” 45% of the time. The level of enjoyment for each participant closely matched the focus level with most participants who experienced a high level of focus also reporting high enjoyment.

The results for self reported/observed levels of understanding were quite different from those obtained for the levels of focus and enjoyment. For most participants, the level of understanding was much higher than the levels of focus and enjoyment, with the exception of Jacob where the level of understanding was observed to be lower than the levels of focus and enjoyment. It appeared in describing engagement, participants generally understood their work, but did not enjoy it, nor were they particularly focused on learning tasks.

**Figure 2**  
*Observations and Student Self Reflections*



### ***Factors Contributing to Student's Engagement***

The critical factors we identified that seemed to impact student's engagement were: learning needs, curriculum offered, and opportunities to interact with webcams.

***Learning Needs.*** The ability to focus and enjoy lessons was impacted by the nature and severity of learning disability, as well as age of the participant. In the interviews, the students also expressed a higher level of engagement when teaching addressed their learning needs. Sofia, Madison and Leah admitted their struggles to focus were related to their ADHD diagnoses. In learning observations, Leah (grade 1) also exhibited challenges with response inhibition, and emotional control through her difficulties in turn taking. In interviews, Owen, Madison and Claire said the daily routine was boring or the work was too easy. Owen described it as "busy work", meant to keep him occupied rather than learning.

***Elementary school students.*** Some degree of adult supervision or support was generally required for younger students and those with specific learning disabilities. For example, due to Jacob's (grade 5) processing disorders, his mother established her work area directly next to his so she could support him by partially listening to the lessons in case he missed any key instructions about his assignments. This created some challenges with background noise distractions for both of them. Leah, as one of the youngest participants also needed one of her parents to be consistently beside her to help her sustain attention and engagement.

***High school students.*** At the other end of the age range, Sofia in grade 11, though not requiring constant supervision; struggled with procrastination and became easily distracted. Therefore, Sofia's father initially insisted that Sofia work at the kitchen table in view of parental supervision in order to maintain focus. After unsuccessful attempts, Sofia was motivated to prove to her father she could succeed if given the freedom to select where, when and how she learned best. Sofia proudly reported she had increased her marks from 50- 70% when she was able to move from the kitchen to her bedroom. For Sofia, a choice of learning environment reduced her anxiety. With these considerations of learning environments for each student clarified, we began to examine the impact of instructional methods.

***Curriculum offerings.*** Students' engagement was negatively impacted by the challenges of offering physical education and visual arts in the online school format. The Ontario Ministry of Education (2020b) stated online learning must address the full Ontario Curriculum highlighting physical education and the arts as important activities to increase opportunities for student engagement, mental health and well being. However, we observed inconsistent delivery of the physical education and arts curriculum. Some students experienced little or no exposure to these subjects. Claire's mother stated that the absence of physical education and the arts resulted in a boring experience for Claire as daily routine of academic subjects quickly became uneventful. Owen explained that although he did have regular physical education class, his teacher repeatedly used the same video daily which became boring very quickly. However, Owen recalled one instance he enjoyed where students could volunteer to turn on their webcams and lead the class in an exercise of their choosing. Jacob was the only elementary school participant who was engaged in both regular arts and physical education. Based on both observational evidence and his interview, it was evident Jacob was highly immersed in these activities and enjoyed this diversion from the purely academic subjects.

***Opportunities to interact with webcams.*** The opportunities to interact with webcams impacted elementary and high school students in different ways.

*Elementary school students.* Elementary classroom students were generally directed to keep cameras on for the duration of the lesson so the teachers could appropriately engage students and provide appropriate support. In one of Leah's observations, when the webcam was malfunctioning, the teacher was unable to see that Leah required additional support to redirect off task activities. Owen identified directly that the main reason for his lack of focus was related to the teacher's choice of not using her webcam nor allowing students to use their webcams. Owen said, "When the cameras are all off, it's hard listening or talking to a wall of black emojis."

*High school students.* Unlike the elementary students in our study, high school students preferred not to turn on their cameras. When asked, high school students reported "teaching style" as the critical factor impacting engagement. In one of Madison's observations where the teacher lectured through the webcam for approximately 30 minutes, Madison appeared to be unfocused on the lesson. She expressed this disengagement was because the teacher "over explains" making it difficult to stay focused. Dylan reported a parallel experience, indicating that when he already understood the material covered in the lesson, he found those sessions a little repetitive or boring.

Overall, means of engagement impacted students in the online setting more than the other two UDL principles. The next UDL principle examined was the impact of multiple means of representation.

### ***Means of representation***

In the UDL guidelines, means of representation refers to the way learners perceive and understand materials. Factors to consider in supporting an equitable inclusive learning environment through multiple means of representation include adaptations of the way information is displayed in auditory and visual formats and illustrated through multimedia (Cast, 2018). We specifically examined the role of technology in providing multiple means of representation as we anticipated different, perhaps greater opportunities for representation alternatives than are used in brick and mortar schools. The teachers used Google Meet to conduct their live synchronous lessons which included voice, text, pre-made images (drawings, diagrams, photos) and collaboratively or teacher generated live images (video discussions, shared drawing). The tools, when used, allowed for receiving and sharing information in different ways.

All students indicated the use of visuals to scaffold learning was their preferred format for receiving and processing information at a comfortable pace. Examples of the visuals identified included screen sharing, and demonstrating the use of a website, writing on the virtual whiteboard or a discussion accompanied with teacher created slides. Features used differently by the elementary and high school students were instructional videos, chat rooms, webcams, and break rooms.

*Elementary school students.* The technology features most experienced by the elementary students were screening sharing, instructional videos, collaborative presentation tools, and gamified applications and websites. Jacob said, "I love screen sharing as I don't like it when the teacher reads a book but doesn't show us the book she is reading. If I can't see what she's seeing, it's hard to understand." Jacob's teacher also used the Google document collaboration tool to demonstrate paragraph writing in real time, which allowed for real time student-shared authoring and feedback. The instructional videos were also a favourite method of presentation for the younger students as evidenced while Leah was watching musician Jack Hartmann to teach her how to create the letter "P".

High quality internet based applications/websites were popular with students when they offered opportunities for direct interaction/feedback and fun through games. Jacob was excited in anticipation of using Knowledgehook, a math interactive website. Claire and Leah both enjoyed the audio features of Tumble Book and Raz Kids literacy sites and Leah particularly liked the gamification aspects of Raz Kids to earn rewards.

The use of breakout rooms was limited by both elementary and high school students. The only participant in the study that experienced breakout rooms was Jacob. Jacob received resource support in break out rooms to align his IEP accommodations.

**High school students.** The technology features most preferred by the high school students were screen sharing, chat rooms and instructional videos. The students particularly enjoyed screen sharing in conjunction with webcams as Sofia says, "It wasn't super helpful if the webcam is all they used without actually showing us anything as I'm a visual learner". The high school students also expressed that instructional videos were helpful but only when they could be viewed independently, because sometimes the internet lag caused delays, disrupting the flow and making it hard to hear. Sofia and Dylan said when the videos were posted on their learning platform; they could view them at their own pace and review the videos as needed for a deeper understanding.

Although the chat room was only used by Owen at the elementary level, it was a primary method of communication at the high school level. The chat room was mostly used to ask the teacher questions, there was little to no student-student chat. Dylan said he preferred to use the chat room to voice communication due to the delay in turning on and off the microphone.

Generally, there were varying opportunities provided to all students using the UDL principle, multiple means of representation. The final UDL principle examined was the adoption of multiple means of action and expression.

### ***Means of action and expression***

According to the UDL guidelines, action and expression enables learners to express what they know in alternative ways that work best for them. This can include using multiple media for communication and using multiple tools for composition (Cast, 2018). Elementary and high school students had distinctive preferences of how they expressed their knowledge and were evaluated.

**Elementary school students.** Elementary school students preferred creative outlets to demonstrate their knowledge and understanding. Most preferred to use visual arts, kinaesthetic manipulatives or shared technologies such as Google Slides, Google Doc and the creation of audio and video. When Claire was asked to complete a worksheet she was unable to print, she used play dough to show her work. Leah enjoyed creating videos of herself reading. Although teachers promoted flexibility in the submission of assignments, students expressed a lack of follow-up and feedback received about their completed work. This resulted in a lackadaisical attitude towards work completion for Owen and Claire.

**High school students.** Representation of work was tied to formal assessment for high school students with options delimited by subject specific needs. Tests and quizzes dominated maths and sciences subjects with project based assignments for social science and the arts. Madison experienced a high level of anxiety balancing the workload of her double credit musical theatre course in the spring 2020. Through the support of the school's resource staff, Madison acknowledged this experience helped her to refine her executive functioning skills (organization and planning) in the subsequent fall term.

Although Sofia indicated she thrives on creative outlets, she experienced challenges in the fall with her media arts course due to the volume of independent assignments. She preferred assessments through traditional tests rather than creative approaches because of the large workload in project based assignments. Even though Dylan did not have any specific learning challenges, he found the rapid pace of the quad semester a little challenging and worked with a privately funded academic coach to further develop his executive functioning skills.

## **Discussion**

As can be expected, our results indicated that students in elementary and high school schools had different preferences in the way instruction was presented, and the options for demonstrating their understanding of knowledge. We also found that students with disabilities faced unique challenges; especially with their ability to focus, comprehend information and work on varying online platforms. Regardless of a student's grade level or learning needs, the effective application of each of the three UDL principles positively influenced the outcome of learning of all the students. Therefore, the existence of UDL principles was less relevant than how each of these principles were applied to each type of learner. Elementary and high school students preferred different means of representation and action and expression; and multiple means of engagement were critical to all learners, especially students with disabilities.

### ***Learning Preferences Differed Amongst Elementary and High School Students***

Online learning meant that students had to adapt to different methods of receiving instruction and demonstrating their understanding. The preferred method of learning was dependent on the student's grade levels and how each of their teachers used the online platforms. The number of opportunities for multiple means of representation and action and expression decreased as the grade level increased.

***Elementary Students Preferred More Interactive Representation than High School Students.*** In the Google Meet synchronous platform, screen sharing, which offered multiple means of representation concurrently, such as teacher guidance and demonstration materials, was the method preferred by all students. However, preferences of other approaches varied between elementary and high school students. When interacting with their teachers, high school students preferred posting comments in the chat room with their webcams turned off, while elementary students favored the opportunity for audio visual interaction using their microphone and webcams. These variances may have been related to the need for social interaction and collaboration as expressed through our interviews, since the elementary students had all their learning online whereas the high school students rotated between in-person and online learning.

Elementary students also enjoyed live streamed video based instruction, contrary to the high school students who preferred to watch these videos independently. This paralleled Hogan and Sathy (2020) who also emphasized the benefits of students' access to asynchronous video recording to increase autonomy in learning. Regardless of the similarities or differences in the presentation of instruction, the multiple choices received by the participants supported Bjekic et al. (2014) views that students become more engaged in the use of technology when teachers use multiple methods to represent instruction.

***High School Students Experienced Less Choice of Alternative Assessment.*** In relation to multiple means of action and expression, the elementary students preferred multiple choices in alternative assessment methods and enjoyed creative alternative assessments. In contrast, the

high school students were offered less choice of alternative assessment and preferred traditional tests and exams to large projects. This may be related to the additional expectations of high school students to manage their time in multi-step projects which was difficult for some of the students and resulted in executive functioning challenges.

The limited choice of assessments provided to high school students contrasted Abell's et al., (2017) study where high school students reported to have received more opportunities aligned to the UDL principles than the elementary students. Regardless of the number of UDL opportunities provided, our study found more relevance in the way each principle was applied in conjunction with technology to meet the needs of all learners, especially those with disabilities.

### ***Engagement in Online Learning was Essential for Students with Disabilities***

The UDL principle of providing multiple means of engagement had the greatest impact on students with disabilities, especially those students who had difficulties in the ability to focus, challenges in processing and comprehending information, and social anxiety. GAO (2020) evidenced the importance of engagement for students with social anxiety and other mental health conditions. A lack of engagement was expressed by all participants whether or not they had a disability. This may be related to the limited use of the interactive technology features of the online learning platforms including webcams and breakout rooms for peer collaboration. Teachers may have also been less comfortable using technology, as Coy et al. (2014) study confirmed online features aligned to engagement were only used by teachers 40-60% of time. Herman (2020) and Hersh (2020) found that some synchronous features in zoom, like audio, video and breakout rooms resembled the classroom environment and provided more opportunities to increase student engagement, which was important to increase motivation especially for students with disabilities (Dahlstrom-Haki et al., 2020). In our study, the lack of engagement negatively impacted the students' focus, enjoyment and understanding of the content, resulting in two of the four elementary students opting to return to the bricks and mortar setting. However, Jacob's teacher demonstrated creative ways in which technology could also increase engagement, and provide more opportunities for students with disabilities, including the collaborative use of Google Docs and Google Slides. These strategies aligned with Do's (2018) and Sharpe's (2019) research, which suggested the effectiveness of these Google tools for both asynchronous and synchronous learning.

Although the features within the online learning platform provided numerous opportunities for teachers to implement UDL, keeping the learner's need at the forefront in the integration of UDL and technology increased the effectiveness of the online learning experience for students with and without disabilities. Based on experiences witnessed in our study, Basham et al.(2020) also suggested that the integration of UDL and technology focused primarily on the learner needs may ensure a wider range of learner variability was addressed (Basham et al., 2020).

### ***Limitations***

It is important to acknowledge both the results and conclusions drawn from this paper faced three limitations: sample size, diversity of exceptionalities, and teacher conditions. A larger sample size with a wider range of disabilities may have resulted in more diverse student experiences. Due to the rapid expansion of online learning during the pandemic, technology

training for the teachers was also limited which may have impacted the teacher's comfort level in teaching within an online classroom.

## **Conclusion**

We learned that the online learning experiences of elementary and high school students differed for each student as did the learning preferences between the grade levels for multiple means of engagement, representation and expression. All students identified online learning as more challenging than bricks and mortar settings, but found it was made easier through increased contact to the primary instructor via synchronous sessions and social support from peers. Not unlike students in bricks and mortar schools, throughout online learning lessons students struggled with focus, enjoyment and understanding of the content depending on their learning needs and learning environment. For example, whether a participant was identified with ADHD in elementary school or high school, they were challenged by distractions, need of social interaction and required extra support in their initiation and completion of tasks.

We also learned that the wide range of available technology and online resources made it possible for teachers to use the UDL principles to support students with diverse learning needs, but each teacher adopted these tools in different ways. Although all three guidelines of the UDL principles were important, 'providing multiple means of engagement' appeared to be identified by students and through observations as most critical to supporting students' learning needs, motivation and engagement. For some participants, the lack of engagement was one of the major reasons for abandoning the online learning environment to move back to the bricks and mortar classroom.

In relation to opportunities for multiple means of representation and action and expression, little discrepancy was observed in the online learning environment between students with and without disabilities. In other words, the time and space and modality of online learning potentially offered a more equitable learning experience for all. However, disparity occurred in the tools preferred by and offered to the elementary students and high school students. Both groups of students had opposing preferences to instructional videos and webcams. In relation to chat room function, although high school students depended on this collaborative feature, elementary school students were restricted from its use, reflecting teacher's assumptions of class management and self-efficacy associated with age.

In conclusion, we found that online learning on its own was insufficient to meet the needs of all learners in an inclusive classroom, but when combined with the principles of UDL, a wide range of learner variability could be addressed. In turn, this provided increased opportunities for engagement which benefited students with and without disabilities. Since the UDL framework is relevant in both online and in-person settings, teachers may be able to consider effective strategies shared by the students in our study for their physical classrooms post pandemic, while avoiding those that were detrimental to students' social, emotional and academic needs. The findings related to supporting students with diverse learning needs online may also help school boards keep the needs of all learners in the forefront when designing newly mandated online high school courses as a requirement for graduation.

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### Author Bio

Diane Montgomery is a PhD scholar and a Sessional Instructor at the University of Prince Edward Island. Her research interests focus on inclusive education, assessments for learning, educational technology and teacher education. She has taught students with diverse learning needs specializing in the areas of executive functioning and cognitive skills training.

Kathy Snow is a former k-12 educator and school leader of educational technology. Now a professor at the University of Prince Edward Island, Kathy's research centres on access to education by focusing on systemic bias in formalized educational settings.

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