Universal Design for Learning and Multimedia Supports the Inclusion of Diverse Learners with Digital Learning Tools

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Contents

Abstract

When I began teaching, the learning design was a “one size fits all” model. Today’s classroom of diverse learners requires a different model of learning design. It has become essential to allow students to use the media of their choice with the structured guidance of the Universal Design for Learning (UDL) framework so they can better communicate and express their understanding of curricular competencies. My literature review reveals that a curriculum imbued with educational media can allow alternatives to using specific learning tools that let learners better articulate what they know. The study and implementation of educational media are critical because it has become the norm for 21st-century learning and can provide an equal opportunity for everyone to learn. The amount of screen time is essential so the students do not experience adverse health effects. The implications are that students learn differently when they are allowed to read, watch, or listen to information multiple times. I advocate that students have access to media tools to support their learning. I notice that students in my classroom are more engaged and feel more successful when they have a choice of multimedia to learn and work with. Implications include teachers having the skills and tools to create lessons embedded with multimedia, how the digital divide affects equal access to multimedia, and the continuing evolution of technology.

Keywords: multimedia, interactive whiteboard, digital learning tools, diverse learners, universal design for learning framework, screen time

Chapter One: Introduction

How I Became Interested in Multimedia

Newspapers were the first medium to employ a combination of text, graphics, and images and can therefore be considered the first form of multimedia (Marshall, 2001).

Educational multimedia tools are vastly different today compared to when I was a grade school student. I used a typewriter. I drew graphics by hand. Videos were only accessible by television and the eight-mm home movie camera. The video cassette was introduced. Creating audio was done on the cassette tape. My teachers used very little multimedia to teach, and students had to express an understanding of curricular content in traditional forms by writing tests and essays.

Today, multimedia is used for different learning purposes compared to my experiences as a student. For example, choosing which tool to use for instruction is essential. It is much easier to create personalized audio for lessons. I can use a computer or a portable phone with various tools to create high-quality text, images, audio, and video. I will connect these experiences to my interest in educational multimedia developed as I journeyed through my Master of Education studies.

Origin Story: Beginning my Academic Journey

My life changed in 2015. My spouse decided to end our marriage. In 2016, she and my children moved into another home. The house was suddenly empty and quiet. My time was freed because my family was no longer a focal point. I had always wanted to complete a Master of Education (M. Ed.) degree and decided that now was a good time to update my teaching skills. It had been almost 30 years since I completed my Bachelor of Education Studies. So, in 2019, I began my M. Ed. Studies. My first realization when I started was how much the learning content of the courses would connect me to how learning is done today. Today's pedagogy and learning

tools are different from 30 years ago. My teaching skills were apparently outdated, and the M. Ed. program would bring me into the 21st century.

Starting the Learning Journey

I began my studies with no declared major. I decided to complete the core courses before engaging in the electives. I did not know it then, but I already had an interest. The courses led me to discover it**.** The philosophy course introduced me to the philosophies that impact education. I learned that these philosophies influence the pedagogies to learn. It helped me develop my philosophy on how we should learn. The diversity course taught me the value of including diversity and equity to provide an inclusive education. The curriculum course taught me about developing subject units through various lenses and contexts.

All these themes I was introduced to were relevant to providing my students with quality instruction. There was one missing piece. How can I promote inclusive learning to diverse learners within the context of my educational philosophy? How skilled was I at using the multimedia I wanted my students to use in their learning journeys? The M. Ed. courses answered my questions.

Using Multimedia as a Graduate Student

All courses I took required using multimedia for communication and assignments. Several tools were available: Microsoft Word, PowerPoint, video, and audio software, to name a few. I was familiar with some of these and explored other formats I had not used before. I gained experience creating video and audio and found this enhanced my work. Another first I experienced was working in groups when creating assignments, even though group members lived in different cities. We could collaborate in real time. I experienced a transformational learning experience in the diversity course when I learned that the diverse learners in my

classroom include students from different social and ethnic backgrounds and of different genders and sexual orientations. The tools I use impact their level of engagement in their learning, and that multimedia is a way to increase their inclusion.

Technology Courses

I found the answer as I began deciding which electives to choose. I found a series of courses that focus on technology. I developed an interest in multimedia when an interactive whiteboard was installed in my classroom, and I received some training. I was aware that the Universal Design for Learning (UDL) framework uses various teaching methods so all students can learn in the way they learn best, giving them equal opportunities to succeed. I was also aware that using multimedia with UDL gives students options in how they learn. I decided this was the path to take in my education that would benefit my students in the greatest possible way. Multimedia and UDL would connect the key learning outcomes I took from my courses.

I took three technology courses to become familiar with the use of current multimedia to teach, communicate, and let students express their understanding of curriculum competencies with multimedia tools. New tools I was introduced to and worked with included using the Html-5-Package interactive media plugin (H5P) to create interactive text and graphics. I found this to be a fascinating experience. I learned that digital pedagogies such as TPACK are essential to providing quality instruction. I hope that the developing technologies of virtual reality and augmented reality will enter the classroom before I retire from my teaching career.

The course on managing my technology classroom showed me how multimedia, technological pedagogies, and learning methods are essential in today's classroom of diverse learners. I have a Smart interactive whiteboard (IWB) in my classroom, a popular educational technology (De Vita et al., 2018). The course showed me that using the Universal Design for Learning framework with the Smart IWB is an effective teaching tool for diverse learners

(Benton-Borghi, 2013). The technology allows all students with or without disabilities for inclusion within the framework of UDL (Perras, n.d.). I also learned about TPACK, a learning framework that combines three types of knowledge: technological (T), pedagogical (P), and content knowledge (CT). Cabus et al. (2017) state that when using the TPACK method, "teaching with the SMARTboard is an effective method to increase students' math proficiency: (p. 155).

In the course on using educational technology for learning, I learned about synchronous, asynchronous, and blended learning and teaching tools. With this knowledge, I am using a blended learning system in my grade eight math class using the IWB, UDL, and digital math lessons developed with audio, video, and digital learning activities. I notice that students are more engaged in their learning as they can learn at their own pace. I can also support more students individually than teach all students from the front. Understanding how the tools that I use, specifically related to multimedia, impact student understanding, communication, and expression, was a transformational learning experience for me. I was convinced that multimedia and UDL were the paths to all my students improving their learning success.

The Significance of Multimedia in the Classroom

The study and implementation of educational multimedia are essential because it has become the standard for 21st-century learning and can provide an equal opportunity for everyone to learn. The link between the classroom application of multimedia and enhanced student learning, communication, and expression is significant because studies show a connection between diverse learners and multimedia. Lin, Chen, & Liu (2017) conclude that digital learning tools increase student engagement in discussion and communication. Laskin and Avena (2015) state that "Mobile media can enable students to get access to classmates and instructors,

communicate with them, ask for assistance, and build relationships—thus, addressing a real need and, as a result, enhance the learning experience" (da Mota Matos, Festas, and Seixos, 2016, p. 283). The Universal Design for Learning Framework (2018) states that various multimedia tools allow students to learn and demonstrate what they know. Haleem, Javaid, Qadri, and Suman (2022) state that by using digital technologies in the classroom, students develop work-related skills, such as problem-solving, thinking structure creation, and process comprehension.

The Argument: Improving Learning, Communication, and Expression

I claim that students with diversities are more successful in learning, communicating, and expressing their understanding of curricular competencies when using digital multimedia to engage in multiple means of representation, action, and expression. Different tools for expression are suited for diverse learners because a curriculum imbued with educational media will allow alternatives to using specific learning tools that let learners better articulate what they know. Since media is part of the learner's daily life, using it in the classroom will help prepare them to be successful when competing in the global economy.

The Counterargument: Too Much Multimedia

Research shows that multimedia applications for diverse learners can have adverse effects. A study by Guangyang, Li, Zhangmei, and Haiyan (2019) makes several claims. These claims include that multimedia weaken emotional communication, limits students' imagination and emotional experience, and forms terrible habits. Da Mota Matos, Festas, and Seixos state that a protectionist approach focusing on limiting digital media has many disadvantages.

Overview

In the following sections, I will explain my argument and the counterargument. In the literature review, I will present a written report of the existing research and debates relevant to my

argument and the counterargument. In the application, I will show how my argument and the counterargument can be applied to my work in the classroom, citing a specific unit in the British Columbia grade eight science curriculum. In conclusion, I will state how my argument and application are intended to display the benefits of using multimedia for today's classroom of diverse learners. Finally, I will state the implication of future technology development, providing evidence with examples regarding the development of virtual reality and augmented reality.

Chapter Two: Review of the Literature

Introduction

Digital tools have become more prominent in the 21st-century classroom. Today's students have a high digital and technological literacy (Hashim, 2018). Technology is a way of life for them, and they are eager to learn using digital media (Buzzard, Crittenden, Crittenden, & McCarty, 2011). Hashim (2018) identifies today's learners as "kinesthetic, experiential, hands-on learners who prefer to learn by doing rather than being told what to do or by reading text. They prefer graphics and connected activities" (p. 2). There is a great deal of research on using multimedia for diverse students to learn and communicate, but very little on how students can use it to express their understanding of curricular competencies. This literature review will focus on how the Universal Design for Learning Framework provides a structured guide on using multimedia and some multimedia tools available for students. It will also focus on a counterargument that too much exposure to multimedia, also called screen time, can have adverse health effects.

Digital Learning Tools

Hashim (2018) calls today's learners Generation Z and is experiencing the digital age unlike any generation before. They are growing up with mobile devices such as smartphones and cloud computing such as OneDrive. They are tech-savvy, use social media to communicate, and

live in a world where the Internet has always been available. Because of these characteristics, Hashim (2018) states that diverse learners are kinesthetic and experiential hands-on learners who learn best with graphics and related activities. To help them learn in the multimedia environment, text, visuals, audio, and video can be combined in alternative ways compared to traditional forms of representation and expression (Rao, 2015). A digital classroom equipped with digital tools can meet those needs. The following section will use Embry's (2019) description that lists some current tools and apps in her thesis on classroom technology.

E-books

One device that supports diverse learners is the E-book. Embry (2019, p. 14) describes them as a modern print book form converted to digital format. They are accessible to more students and are accessed on digital readers or computers. Using E-books benefits diverse learners because they provide audio and definitions in the book (Embry, 2019, p.15).

iPads/Chromebooks

Another device is the iPad or Chromebook. They can be used for various learning activities. They are accessible by making information readily available (Embry, 2019, p. 15). Students can create video and audio and express their learning with cloud-based apps.

Educational Game-Creators

Educational game-creators are popular apps that motivate students to learn while playing (Embry, 2019, p. 19). Quizzes and games are created by teachers and can be shared and edited. Examples of popular game-creator apps are *Kahoot*, *Gimkit*, *Blooket,* and *Quizizz*.

Google Apps for Education

Google Apps for Education (GAFE) is a cloud-based package of apps (Brown & Hocutt, 2015). Teachers and students use it to create word documents, presentations, spreadsheets,

websites, and other applications. Students can create projects using any app and work together in the cloud (Embry, 2019).

Hashim (2018) mentions some advantages of mobile technology that make it an essential digital tool for teaching and learning:

- Students can learn wherever they are.
- Students can learn whenever they want.
- Students can create video and audio wherever they are.

Web-Based Presentation Tools

Web-based presentation tools, or presentation software, are an alternative app to Microsoft PowerPoint. They have visual appeal, flexible delivery, and can be co-presented (Sietz & Sintkinson, 2014). Presentations can contain visual and interactive elements that enhance student engagement (Sietz & Sintkinson, 2014).

An example of a web-based presentation tool is Prezi. Strasser (2014) describes some of the Prezi features:

- It allows the creator to see the entire presentation at once.
- It can be linear or non-linear.
- Students can collaborate on creating presentations.
- Video, audio, text, graphics, and backgrounds can be used to create engaging presentations.

Summary

Diverse learners have an array of multimedia to choose from for communication and expression. The tools I discussed allow them to showcase their abilities as strong digital learners. The

following section reviews a framework that provides a guided structure for teachers and diverse learners.

The Universal Design for Learning Framework

The Universal Design for Learning (UDL) is an educational framework that meets the needs of diverse learners, including ability, learning style, language, culture, economic status, race, ethnicity, age, gender, socioeconomic status, and gifted students (Jimenez, Graf, & Rose, 2007; Evmenova, 2018)). Evmenova (2018) states that "meaningfully-integrated technology makes learning environments more accessible to diverse learners" (p. 149). This supports my claim that UDL is essential in structuring multimedia in learning, communicating, and expression of understanding.

As student diversity increases, UDL provides guidelines that can be used for instructional design and expression (Rao & Eden-Smith, 2015). The Center for Applied Special Technology (CAST) has a set of guidelines for implementing UDL. These guidelines include ways to include multimedia to support the three design principles. These designs are multiple means of engagement, multiple means of action and expression, and multiple means of representation (CAST 2018). The UDL guidelines from CAST (2018) state that providing alternative media for expression is essential. Such alternatives reduce media-specific barriers to expression among learners with a variety of special needs but also increase the opportunities for all learners to develop a broader range of expression in a media-rich world.

Some suggestions from CAST (2018) that use multimedia for communication are composing with film or video and using social media and interactive web tools such as discussion forums, chats, web design, and animation presentations.

There are contemporary tools that diverse learners can use to articulate their knowledge (CAST, 2018) successfully. Some examples are:

- Spell checkers, grammar checkers, and word prediction software
- Text-to-speech software
- Calculators
- Music notation and mathematical notation software
- Web applications such as wikis

Another valuable tool for successful UDL practices is the interactive whiteboard (IWB). IWB technology allows all students with or without disabilities for inclusion within the framework of UDL by letting educators present information with graphics, audio, video, and text. (Perras, n.d.). Students with nuanced motor challenges can use the IWB pen or their finger on the board.

Video

Video can improve student learning and engagement (Brame, 2016). Brame (2016) states that “effective use of video as an educational tool is enhanced when instructors consider three elements: how to manage the cognitive load of the video; how to maximize student engagement with the video; and how to promote active learning from the video” (p.1). Students can use video for expression to demonstrate their understanding of a curricular competency (UDL on Campus, n.d.)

Adverse Effects from the Amount of Screen Time

Students today are digital natives and are growing up with electronic media as a central part of their lives and being entertained on screens (Stilgic & Viner, 2018; Lissak, 2018). Many

studies present evidence that excessive screen time adversely affects children's health. A literature review by Lissak (2018) and other evidence links excessive screen time with obesity resulting from a sedentary lifestyle, mood disorders, increased stress, and posture problems. Screens emit blue light, which affects sleep, vision, and brain activity, and causes inattention in children (Munsamy, Chetty, and Ramlall, 2022; Bharadwaj, 2021).

A definition of screen time is "time spent engaging with visual screen-based technologies such as televisions, computers/laptops, videogames, smartphones, tablets/iPads, and handheld electronic or gaming devices" (Oswald, Rumbold, Kedzior, & Moore, 2020). Using the Internet, social media, or communicating via text are all included as screen time activities (Oswald et al., 2020). Diverse learners require screen time when using devices such as a computer or a tablet to access multimedia. In this section, I will review research that argues the adverse effects of excessive screen time.

The studies list recommendations to limit the potential adverse effects of excessive screen time. Suggestions include limiting the amount of daily screen time (Munsamy et al., 2018), promoting positive digital habits and use of digital technology (Pandya & Lodha, 2021), increasing recreational time outdoors, spending more time with families, and finding new hobbies (Rumbold et al., 2020).

Summary

The evidence for the argument and counterargument must be taken into consideration. Student digital media use occurs in the classroom and on their time. Multimedia use during learning could contribute to adverse health effects. Therefore, a teacher should consider how much screen time a student is exposed to during school hours. In the next chapter, I will apply the evidence from the literature review to a grade eight science unit I teach. I will consider the

amount of screen time and hands-on learning in the lesson planning to apply moderate multimedia use.

It is important to note that several studies cited in this review were conducted in locations with different cultural situations than North America. Political, philosophical, and cultural views influencing lifestyle in those geographical locations were considered when comparing the study outcomes to North American students. The studies that were considered relevant were chosen with the consideration that students' digital media habits were similar in North America.

Chapter Three: Applying the Literature to My Practical Context

My Practical Context

When I began teaching in 1996, I was unaware of the differences among learners and that the differences impacted their success in learning. I was aware of students with learning disabilities and made some adaptations to their learning and assessments. I developed lessons with the 'one size fits all model" and assessed students equally. Today, the classroom is more diverse than ever to provide equal access to all learners. Most significant about this is that students should have a choice on how they will learn, communicate, and express their understanding of curricular competencies. My journey through the M. Ed. program has shown me how to provide that choice.

In this chapter, I will apply the literature from chapter two to support my argument that multimedia improves student success in learning, communicating, and expression. I will use my classroom as a practical context to support my argument and how I apply it. I teach math and science at the grade eight level and French at the grades six to eight level. The grades six and seven students are divided into multi-age classes. I have been teaching at the same middle school

on Vancouver Island my whole career. I have been using multimedia in these subject areas already.

Diversity and My Classroom

The British Columbia Ministry of Education (2017) defines diversity as "the different beliefs, customs, practices, languages, behaviours, sexual orientation, gender identity and expression, and physical differences of individuals and cultural groups." Using this definition, I interpret a group of diverse learners to include black, Indigenous, *students* of color, LGBTQ, *gender, housing status (own, rent, or homeless), religion, income, language, family status, and abilities*. There are students in my classroom that meet this definition as diverse learners. I will demonstrate how using multimedia benefits my students' abilities to learn, communicate, and express themselves to meet their diverse needs.

My students identify as various diverse learners. Some have individual education plans that are designed to provide adaptations to support learning, including using multimedia. One student has relocated from Ukraine due to the military conflict and speaks little English. Some students are Indigenous. Others have different ethnic backgrounds. Some identify as LGBTQ and use different pronouns. Their family situation is nuclear, extended, or raised by a single parent. Some follow religious cultures that impact their learning time. For example, some students observe the Muslim celebration of Ramadan. They do not attend school on some days. These students learn differently from the same learning programs. They need variety and choice. For the students to have that choice, I am using multimedia in my subjects to teach and assess them.

My Classroom Technology

Various types of technology in my classroom let me teach my diverse learners with multimedia. I am equipped with an interactive whiteboard (IWB) from Smart Technologies. It

allows me to use graphics, audio, video, and text so that all students are included within the framework of UDL (Perras, n.d.). I consider it to be an essential tool for teaching with multimedia. I can include various digital tools in my lesson content with it. I will describe the tools and how I use them when I discuss multimedia in my subjects. Smart uses a program called Smart Notebook. I can input various multimedia, such as video, audio, Smart-created educational games, and graphics. Students can connect to the IWB with a device to engage with the interactive content. Smart Technologies also has a learning management system called Lumio. It is web-based and lets me upload the lessons and add instructional audio to explain the concept. The students can then access them remotely at any time. This will help them retain the curriculum content by being able to repeat the lesson. They can also complete student work in a customizable personal workspace that I can assess for understanding in real time.

There are various devices students can use to engage with my learning management system. The school has class sets of Chromebooks, a class set of Windows Lenovo laptops, iPads, and a computer lab available. Teachers access the devices by reserving them on a central booking webspace. At times, all the devices are reserved. Students can still engage in the learning content with their Smartphones when this occurs. This lets students continue to engage in their learning in the ways they learn best.

Curriculum Planning with Multimedia

Tyler (1949) suggests a rationale for determining and assessing curricular outcomes. While the first step of educational purposes is already decided, I have the autonomy to use the other three steps: 1) planning the educational experiences, 2) organizing them, and 3) planning assessments. Although this study was published many years ago, it can be applied in the modern classroom with current teaching tools. When I started teaching science, math, and French,

multimedia was not as advanced, and I taught more traditionally. I used the one size fits all model and expected all students to learn using the same materials. This model did not work well for diverse learners. As I gained experience, I started adding multimedia tools to teach the unit. This resulted in improved engagement, communication, and understanding. Today, I recognize that educational experiences vary for a classroom of diverse learners, and educational multimedia is an essential tool for teaching and assessing. I use multimedia differently to support the subject area's curriculum content. The figure shows the various multimedia in each subject. The following sections explain how I use them when teaching math, science, and French.

Subject Planning with Multimedia

	Math	Science	French
Tools Used for Teaching	-Videos with closed captioning -Teacher-created audio -Screen videos -Text-to-speech -Graphics -Text -Lumio, a digital learning management system (LMS).	-Videos with closed captioning -Graphics -Text -Text-to-speech -Lumio, a digital learning management system.	-Videos -Audio -Graphics -Text
Tools Used for Learning	-Calculators -Web-based presentational tools -Kahoots for practice - Google Apps for Education (GAFE)	-Web-based presentational tools - Google Apps for Education (GAFE)	- Google Apps for Education (GAFE) -Duolingo computer program -Kahoots and Gimkits

Fig. 1 Subject Planning with Multimedia

Multimedia in Science

The teaching tools I use today in grade eight science are different from how I first taught them. The tools' purpose is to improve the learning needs of diverse learners to support how they learn in their different ways. Evmenova (2018) states that "meaningfully-integrated technology makes learning environments more accessible to diverse learners" (p. 149).

The big idea of one unit is that "life processes are performed at the cellular level" (B.C. Ministry of Education, n.d.). Students are expected to know the characteristics of life, cell theory, the types of cells, and the relationship of microorganisms with living things. I will describe how multimedia is used in a lesson that explains cell structures.

Multimedia as a Teaching Tool

There are various digital tools to improve student understanding of the concept. Videos with closed captioning are used to explain a topic or concept. A video can show the cell structures and how they work. Closed captioning can be turned on to help with understanding. For each screen that describes the organelle, I can record instructional audio. Diagrams of the organelles in the cell can assist with a visual presentation. Students can access a digital version of the lesson remotely at any time. Repeated viewing will help them retain the information presented.

Students can use a text-to-speech app when they are reading text. An urban school district in Southern Vancouver Island has a Google Read&Write subscription for all district staff and students. It is available when logged into the district network and using the Chrome browser. The app reads the text aloud. This assists the reader in understanding the text.

Multimedia as a Learning Tool

There are several multimedia tools available that allow the students to choose how to express their understanding of the curriculum. During a lesson, the students' devices are connected to the Smartboard. This lets them engage in interactive review activities I can assess in real time. For a unit assessment, they are given options in how they want to express their understanding. If they choose to write an assessment, they can use the "Read&Write" text-to-speech app to read them the question. They can also use the app to answer questions by speaking into the microphone. The app translates their speech into text. Another choice is an individual or group inquiry project. They can use various web-based presentation tools that let them use video and audio to create an engaging presentation. An example of a presentation tool is Prezi. Users can present information with video, audio, text, graphics, and backgrounds (Strasser, 2014). The project can be shared in a group. This allows a collaborative effort where everyone can work on the project simultaneously. Another option is to use the GAFE apps to create a website. The app is called Google Sites. It is user-friendly and lets individuals or groups create projects, including the same multimedia content as a Prezi. Microsoft Office apps are also an option. Like the previously mentioned tools, students can use video, audio, graphics, and text and share the project for working simultaneously.

Multimedia in Math

My experience with teaching math is similar to teaching science. My journey with researching technology tools and pedagogy in the M. Ed. program has resulted in restructuring how I teach the subject. I have rebranded from the traditional model of synchronous learning. I worked with all students at the same time. For some, it was too fast. For others, it was too slow. This year, I have rolled out a blended learning method. This has moved the lesson from being

teacher-directed to student-focused. Students have become independent learners. This combination of synchronous and asynchronous methods benefits the learners by letting them work at their own pace. My role has changed from instructing everyone in front of the classroom to supporting groups or individuals in their space.

Multimedia as a Teaching Tool

I will use a lesson from the fractions unit I teach as an example of how I engage diverse learners to be successful. The big idea is that "*computational fluency and flexibility extend to operations with fractions" (*B.C. Ministry of Education, n.d.). *One of the lessons teaches how to multiply fractions with fractions.*

Multimedia is relevant for me to teach math using a blended learning model. The multimedia formats are the same as in my science lessons: video, audio, graphics, text, and text-to-speech. I create screen-captured videos to explain a math concept. The benefit of using this model is that students view how to solve a question from the math program we use. Closed captioning can also be used.

Multimedia as a Learning Tool

Students can use various tools to practice their understanding of the math curricular competencies. The traditional format of completing practice questions on paper has been replaced with various options. Students can practice multiplying fractions by engaging in educational games like Kahoot. The practice is teacher-created. I can design and assign homework. Student results can be seen in real-time. I can view which questions a student answered correctly and assess if they are ready to move to practice the concept more or move to a new one. Students also have manipulatives such as calculators and times tables available to help them answer questions.

Students who move through the lessons rapidly can apply what they have learned to a practical situation by completing an individual or group project on a web-based presentational tool. This lets them use various digital tools to design their presentation. For example, a fractions unit project assesses their understanding by creating a menu for a party as a catering company. They use operations with fractions to determine the amount of ingredients for their menu items based on the number of people in the party. They can present this information with the digital tools of their choice.

Multimedia in French

Little technology was available to support diverse learning needs when I started teaching French. Students learned vocabulary pronunciation by repeating audio recordings. Sentences were written on paper to practice spelling and grammar. Students engaged in conversation to practice speaking the language. Technological advances in multimedia have changed how a language is learned.

I will use a unit I teach to a multi-age group that focuses on beginning vocabulary as an example of teaching and learning with multimedia. The learning outcomes are to be able to introduce and describe themselves, how they are feeling, and to count from one to 100.

Multimedia as a Teaching Tool

I use multimedia differently in French than I do in math or science. Videos are presented in various ways. The French language audio is supplemented with closed captioning in English to help students learn the meaning of the vocabulary. Audio is still a traditional format for practicing speaking. Students hear the word and repeat it to improve their pronunciation. Students can also use the Duolingo computer program to practice. Teachers can create a class

and assign units. Students can practice the concepts by listening to, repeating phrases, and writing.

Multimedia as a Learning Tool

Students can use multimedia in various ways for communication and expression. They can create videos to express their understanding of the French language concepts taught. The scene is a talk show, and students interview each other using the vocabulary they learned. Students use an iPad or their phones to record their scenes.

Summary

Diverse learners, and all learners, view technology as a way of life instead of an accessory to life (Hashim. 2018). For this reason, Hashim (2018) claims that teachers must integrate and apply technology in teaching and learning. My experience with integrating multimedia in my lessons and students' use is that they are more engaged and invested in their learning. Embry et al. (2019) state that a technology-filled classroom enables students to work in teams or groups, and teachers can create more personalized lessons for diverse learners. This changed the classroom into a student-centered learning environment. Embry's statement resembles my math program now that it focuses on blended learning. My science and French classes are also more student-centered with multimedia.

As shown in my literature review, when the UDL principles and practices are combined with multimedia, diverse learners have more choices in learning, expressing what they know, and being more engaged in their learning. (UDL on Campus, n.d.). I am integrating video, audio, images, and text with UDL pedagogy to enrich the diverse learners in my classroom, satisfying my perspective from research that technology is an integral part of education in the digital era (Hashim, 2018).

Balancing the Amount of Multimedia Use

I have increased the amount of multimedia content in most classes I teach. Studies show that students are exposed to screen time for education and entertainment. It has become a central part of their lives (Stiglic & Viner, 2018; Lissak, 2018).

They are engaged in more screen time in my classroom. Research links increased exposure to adverse health effects, such as obesity, increased anxiety, mood disorders, and posture problems (Lissak, 2018). Combining the increased educational screen time with personal screen time could affect the student's health. As the teacher, I acknowledge the added challenge of considering the type of learning content in my lessons to avoid contributing to potential adverse health effects. How can I engage diverse learners to increase their learning without overexposure to using multimedia to cause adverse health effects?

Various solutions can be considered. I can limit the amount of screen time, as suggested by Munsamy et al. (2018). Hands-on activities can also be used. In science, an inquiry investigation that requires tools to complete can help reduce screen time. For math, practical applications and demonstration of the concepts can be applied practically. I use a cross-curricular inquiry where students build a rocket that flies (science) and use the Pythagorean Theorem (math) to determine the rocket's height. In French, some non-screen time activities can include games. For example, students can play Bingo to improve their understanding of numbers.

Summary

Multimedia can have positive and adverse effects in the classroom (Embry et al., 2019). Positive effects include increased engagement in learning, communication, and expression and a shift to student-centered learning. Adverse effects are related to physical and mental health. Another potential effect is how students use multimedia at their disposal. As demonstrated in my

literature review and this chapter, I am responsible for establishing a counterbalance between both sides of the effects to maximize multimedia to its full educational potential.

Chapter Four: Conclusion

Recap of my Argument

Using multimedia is an effective way for today's tech-savvy diverse learners to increase their engagement in multiple means of representation, action, and expression. Teachers can incorporate multimedia with the UDL framework as structured guidance to improve success among all learners. I would further argue that teachers should be responsible for incorporating UDL with video, audio, graphics, and text when developing their lessons and assessments. This would be beneficial to the diverse learners in the 21st-century classroom. Research by Canter et al. (2017) shows that 21st-century classrooms "need to substantially integrate and utilize advances in technology" (p. 1) to improve the inclusion of UDL in classrooms.

Today's learners consider technology and multimedia as a way of life (Hashim, 2018). The key to including multimedia in my lessons in my classroom relates to using the interactive whiteboard (IWB). IWB technology allows all students for inclusion within the framework of UDL (Perras, n.d.). It positively affects engagement, communication, and achievement (Benoit, 2018). I notice that my diverse learners are increasingly engaged when video, audio, graphics, images, and text are added. It should also give them ideas when they use them in their learning journeys.

Connection of the Chapters

The previous chapters of this paper are interconnected. The first chapter explained my life experience using multimedia, focusing on how I use digital tools in my journey through the M. Ed. Program. The connection between my life experiences and my argument is multimedia. It

is an essential tool for me. It is also an essential tool for digitally connected diverse learners as they progress in their learning journey. It is relevant to my argument.

My literature review has three focuses. The first focus reviews the digital tools available in the classroom for students to learn, communicate, and demonstrate the curriculum competencies. The second focus reviews studies that describe how UDL can be a framework for evaluating which multimedia have the potential to work best for all learning environments. The third focus reviews research that shows the potential adverse effects of being overexposed to multimedia. This is referred to as screen time.

In the application, I describe how I apply a hands-on approach to my capstone argument in the classroom. I have not only been researching, learning, and applying theories to validate the argument. I have been applying my learning by developing lessons that include video, audio, graphics, and text to engage my diverse learners. My diverse learners have manipulatives to support their learning and their practice. These manipulatives include calculators, spell checkers, grammar checkers, text-to-speech (TTS), and web applications. They can choose web-presentation tools, video, audio, text, graphics, GAFE tools, and more, to express their understanding of the curricular competencies. A takeaway from my research that I had not considered before is how I contribute to the amount t of time students are exposed to digital media. I am looking at how I can measure when this occurs, and I am learning how to maintain a healthy balance between hands-on learning and digital tools.

The application chapter also describes how applying multimedia through the structured guidance of the UDL framework has benefited the structure of my lessons and positively contributed to student communication and their understanding of curriculum competencies. As I mentioned, I have been using an IWB for years and have incorporated various digital tools that

support diverse learners. The technology courses in my M. Ed. journey updated my knowledge of educational technology, developing multimedia to effectively deliver the curriculum, and how I can manage the technology in the classroom. My personal multimedia experiences are at the forefront of how I use video, audio, graphics, and text to create a positive learning environment. Finally, I have combined my previous research from the technology courses with the new research I read for this paper to support my argument. The result that I hope is apparent is how the chapters are connected. Multimedia is an ongoing evolution. Therefore, I will continue to read new research and learn about emerging technologies to stay updated on the latest developments in educational technology and pedagogy.

Summary

The three focuses in the literature review describe multiple digital tools available in school, how UDL can guide a teacher to use it to advance learning, and how too much exposure to screen time can lead to adverse effects. This chapter is the main link between my argument and my application. The literature is meant to support my argument. My practical context affirms the three focuses by describing how I apply multimedia with the guidance of the UDL framework in my classroom.

Implications

The Digital Divide

There are implications of my paper to consider. I have seen how multimedia and UDL have benefitted all learners in my classroom. Based on my experiences and reviewing research, I believe it is essential that diverse learners have multimedia and devices available when they are learning. In my classroom environment, students have a variety of multimedia to choose from for learning, communicating, and expressing their learning. Students must also have the appropriate

devices and multimedia available to maximize their learning. A limited number of class sets of devices and the computer lab are available through a reservation system. Sometimes, everything is reserved, and the devices are unavailable for my learners. This system places teachers in competition for access to essential learning tools. When this occurs, my backup plan is to use mobile media. This means that students resort to using personal devices. This includes tablets, laptops, and, most commonly, smartphones. Three adverse effects of this are that the phone screens are small, some multimedia tools are not available as a free resource on the phone, and students are more apt to use their phones for non-learning purposes. A study on cell phone uses in the classroom showed that students use them more than 40% of the time to access social media and play games (Laskin & Avena, 2015). Teachers, therefore, can be reluctant to allow cell phone use in the classroom. I manage this in two ways. I teach the students that classroom cell phone use is for learning purposes, and I spend more time in the back of the class. This lets me view the screens to ensure students use their devices for learning purposes.

Not all students have the tools available to them in an equal manner. This inequity is known as the digital divide. It is defined as a gap between people who do and do not have access to computers and the internet. Students who cannot access technology in my classroom are an example of the digital divide.

I would like to see the digital divide bridged so that all learners have equal access to faster internet, multimedia, and devices. It is essential to have a choice of tools available, so diverse learners can learn in the way they learn best. In my work setting, I believe the best way to cross the digital divide is to have a set of laptops available in every class. I see the laptop as the new textbook.

Teacher Skills with Multimedia

Another implication from my research is that teachers should have the skills to use multimedia effectively. A study by Hashim (2018) concludes that learners have a great deal of digital knowledge, and teachers are digital immigrants. They must be prepared to teach with multimedia. This includes software, hardware, digital, technological, and social media. Researchers suggest that teachers should have professional development opportunities to improve their knowledge about current multimedia and how to use it to teach with the IWB (Shi & Yang, 2012; Eskigioglu & Kopec, 2003).

Evolving Technology

Digital media is constantly evolving. Therefore, a final implication to consider is emerging technologies. Some of these are being used in the classroom. Others are emerging and waiting to be applied in the digital education era (Hashim, 2018). These include cloud computing, Augmented Reality (AR), virtual reality (VT), and 3D printing. One way I hope to use virtual reality is to take students on a field trip to France by using VR glasses. This will simulate being there. I hope I will be able to use VT and AR technology in my lessons before I retire in a few years.

Summary

Eskigioglu & Kopec (2003) state that multimedia "may be the greatest educational revolution since the invention of the printing press" (p. 15). This capstone paper aims to highlight my M—Ed. journey and how I am applying it in my classroom. From my experiences, I must agree with their statement. I have been teaching long enough to see how multimedia is evolving and transforming how students learn and express their learning in my classroom.

There are many considerations when I work with multimedia: digital tools, pedagogies, apps, software, and hardware, to mention some. Plenty of research discusses these themes and how they can impact learners. My development does not stop with this paper. It has only started and must continue so students can be adequately prepared to enter and participate in today's global economy.

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