EDUCATIONAL RESOURCES ABOUT UNIVERSAL DESIGN FOR LEARNING

DEVELOPMENT AND PRELIMINARY EVALUATION OF EDUCATIONAL

RESOURCES ABOUT UNIVERSAL DESIGN FOR LEARNING FOR SPEECH-

LANGUAGE PATHOLOGY STUDENTS

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A Thesis Submitted to the School of Graduate Students in Partial Fulfilment of the

Requirements for the Degree Master of Science

McMaster University MASTER OF SCIENCE (2019) Hamilton, Ontario

TITLE: Development and Preliminary Evaluation of Educational Resources About

Universal Design for Learning for Speech-Language Pathology Graduate Students

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Campbell, Ph.D. NUMBER OF PAGES: xiii; 113

Lay Abstract

Inclusive education in which students with diverse abilities learn together is an expectation within Canadian schools. People who work in schools, like Speech-Language Pathologists (SLPs), need to know about frameworks such as Universal Design for Learning (UDL) that identify specific strategies for supporting inclusive education. However, many SLPs do not know about UDL or how to apply this framework when they work with teachers. In this thesis, I used a new resource development process involving a rigorous resource design method with a theory that helps people use new ideas, to make educational resources about UDL for SLP graduate students. Next, I implemented and evaluated the resources with 19 SLP students at McMaster University. Students felt the resources were suitable and taught them new information about UDL. This thesis provides new teaching resources for SLP students to increase their knowledge about UDL and better prepare them for working in schools.

Abstract

BACKGROUND: The mandate to provide inclusive education in Canadian schools means that Speech-Language Pathologists (SLPs) need to be well-versed in frameworks such as Universal Design for Learning (UDL) that support learning among students with diverse backgrounds and abilities. To be responsive, professional graduate programs need resources that support teaching SLP students about UDL.

PURPOSE: 1) To use an instructional design model and Knowledge Translation (KT) theory to develop educational resources about UDL for SLP graduate students; and 2) to assess feasibility of the resources and SLP students' perceived and actual UDL knowledge change after resource implementation.

METHODS: First, educational resources about UDL were created for SLP students using a process in which the first three phases of the Analysis, Design, Development, Implementation, Evaluation (ADDIE) instructional design model were combined with the Diffusion of Innovations (DOI) KT theory and supported by engagement of key SLP stakeholders. Stakeholder feedback about their involvement in the resource development process was assessed through a focus group and analyzed using conventional content analysis. Next, the last two phases of the ADDIE model were conducted in which the developed resources were implemented and evaluated with 19 SLP students over a three-hour session; resource feasibility and UDL knowledge were measured before and after the session using anonymous, web-based questionnaires.

RESULTS: The novel process for developing resources was deemed suitable for creating high-quality theory-informed resources tailored to SLP students. SLP students perceived

the resources to be practical and acceptable. There was a statistically significant improvement in students' perceived UDL knowledge as well as improvements in actual UDL knowledge.

CONCLUSION: Health educators could consider the described methodology when developing content-specific resources for health professional students. This thesis introduces a new set of resources that could be used to address an important gap in SLP training.

Acknowledgements

This thesis would not have been possible without the tremendous support I have received throughout the duration of my Master's thesis. The School of Rehabilitation Science at McMaster University has provided me with a safe space to grow and develop as a researcher, providing me with extensive opportunities that have challenged me and contributed to my academic and research success.

I have been so fortunate to work under the supervision of Dr. Wenonah Campbell. She has been the utmost important contributor to my success at McMaster University, providing me with limitless support and kindness throughout completing my thesis. She has provided incredible feedback throughout this process, helping me develop my research and academic writing skills. Dr. Campbell always encouraged my ideas and suggestions and ensured we had optimal time to meet, discuss, and collaborate ideas. Dr. Campbell embodies the traits and skills that every supervisor should have and has inspired me to continue my education in hopes of one day also becoming a researcher and Professor. An immense thank you goes to Dr. Campbell for providing me countless opportunities at McMaster University and supporting me throughout my Master's thesis journey.

Another thank you goes out to my committee members Dr. Patty Solomon and Professor Justine Hamilton. They have provided wonderful feedback for each thesis chapter, enhancing the overall quality of my work. They were always available to answer questions and provide me with honest and supportive feedback that helped enhance my academic writing skills. Specifically, when working through the Phase one paper of my

thesis, Dr. Solomon and Professor Hamilton spent a lot of additional time assisting in helping structure and guide the flow of this manuscript. Both of these women are brilliant and intelligent individuals that provided me with so much support and kindness, for which I am eternally grateful.

I would also like to thank my mentor throughout my duration at McMaster University, Dr. Andrea Cross. I first began working with Dr. Cross during the International Classification of Functioning Disability and Health (ICF) framework course (RS 722). She was my mentor during this course, assisting me with my final course project and encouraging me to think critically and creatively. After completion of this course, she has consistently provided me with endless opportunities that have helped enhance my research skills. I am eternally grateful for all of the support and assistance Dr. Cross has provided throughout my Master's degree. I hope one day to be as kind, intelligent, and dedicated as her to making a life-changing impact for children with disabilities.

I would like to thank various researchers and staff from *CanChild* who helped throughout various components of my thesis. Specifically, assisting in taking Working Group meeting minutes, leading and transcribing the Focus Group, assisting with setting up a REDCap account, and providing support and kindness in preparing for my thesis defense.

Finally, I would like to thank all of my friends, family, and other staff at McMaster University, for example, Jennifer Kennedy, who supported me throughout the duration of my Master's thesis and helped me prepare for my final defense. All of these

individuals provided me with so much encouragement and positivity when I felt

frustrated, stressed or overwhelmed. Without these people, I would not have made it

through with such success and strength! In particular, my tremendous family and friends,

I am truly so fortunate to have so many loving people in my life.

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Declaration of Academic Achievement

The following is a declaration that the content of the research in this document has been completed by Vanessa Tomas and recognizes the contributions of Dr. Wenonah Campbell, Dr. Patty Solomon and Professor Justine Hamilton in components of the research process and the completion of this thesis. Vanessa Tomas contributed to the conceptualization of the study, the study design, completed and submitted the ethics application, created the questionnaires on REDCap, and was responsible for data collection, data analysis and writing the content of this thesis. Vanessa Tomas is the first author on both manuscripts included in this thesis. Dr. Wenonah Campbell contributed to the study design and conceptualization, reviewed all ethics applications, and assisted in writing and editing. Dr. Patty Solomon and Professor Justine Hamilton contributed to the study design and provided thorough review and feedback on all chapters in this thesis.

Chapter One: Introduction

Universal Design for Learning (UDL) is an inclusive education framework that is increasing in interest and implementation efforts across Ontario schools (MEDU, 2005; MEDU, 2013; OHRC, 2018). UDL embraces student diversity and leverages this to create a flexible and accessible curriculum so that all students in the classroom can learn, thrive, and succeed (Meyer et al., 2014; Rose, Meyer, Strangman & Rappolt, 2002; Daley & Rose, 2018). In this Master's thesis, I use a Knowledge Translation (KT) theory and instructional design model to develop educational resources about UDL for Speech-Language Pathology (SLP) students. I later implement these resources to determine resource acceptability and practicality as well as SLP students' change in UDL knowledge. In the current chapter, I review relevant literature and introduce key topics pertinent to my thesis. I conclude by summarizing the two major research phases that comprise this thesis. In the second chapter, I focus on systematically describing the first phase of my work in which I integrated a KT theory, Diffusion of Innovations (DOI), into the Analysis, Design, Development, Implementation, Evaluation (ADDIE) instructional design model to develop a novel process for creating theory-informed educational resources. The third chapter describes a pilot study in which I implemented and evaluated the developed educational resources with SLP students at McMaster University. Finally, in the concluding chapter, I integrate the findings across the two thesis phases and describe the implications of my work and contributions to the literature.

Setting the Context: Inclusive Education in Canada and Ontario

Inclusive education involves welcoming and accepting all students into neighbourhood schools and classrooms with their same-age peers, while providing supports required for full participation in the physical, social, and academic components of school life (Sokal & Katz, 2015; Operrti, Brady & Duncombe, 2009). Although inclusive practices increasingly are recognized and applied in Canadian schools (Towle, 2015; Inclusive Education Canada, 2017; Archibald, 2017; MEDU, 2013), reports indicate that Canada is not meeting expectations (Timmons & Wagner, 2008; Towle, 2015). Most special education policies across Canada are over ten years old and do not meet current standards on supporting children with disabilities (Towle, 2015). For example, a recent Ontario research report on inclusive education indicated that students with intellectual disabilities are not receiving the supports required to make the curriculum accessible (Reid et al., 2018). As well, students with intellectual disabilities are often excluded from classroom activities, limiting social engagement with peers (Reid et al., 2018). The latest Ontario Human Rights Commission (OHRC) policy on accessible education indicates that there are insufficient resources and supports to accommodate students with disabilities (OHRC, 2018). One concern is that current curricula are not designed and implemented in ways that meet the needs of diverse students (OHRC, 2018). Additionally, there is a need for better training for school service providers on specific needs for students with disabilities and accommodations to help these students access the curriculum and achieve learning goals (OHRC, 2018). The policy provides recommendations and guidelines for promoting an inclusive education environment and

enhancing learning for students with disabilities (OHRC, 2018), including adoption of a

framework called Universal Design for Learning (UDL) (CAST, 2018; Meyer et al.,

2014).

Universal Design for Learning (UDL)

UDL is an educational framework developed by researchers from the Center for

Applied Special Technologies (CAST) (Meyer, Rose, & Gordon, 2014; Rose et al., 2002;

Daley & Rose, 2018) using ideas from Universal Design, educational research, and

neuroscience (Meyer et al., 2014). With respect to Universal Design, CAST researchers

noted that when architects began designing buildings and physical spaces for users who

had a range of physical and sensory abilities, there was no longer a need to make ad-hoc

structural changes after-the-fact (Rose et al., 2002; Meyer et al., 2014). Moreover,

structural features of the built environment that were intended to increase accessibility for

some users, ended up benefiting a multitude of individuals (Rose et al., 2002). For

example, curb cuts were designed for individuals in wheelchairs to navigate curbs;

however, these also benefit parents pushing strollers, an individual who has a cane, and

someone pushing a grocery cart (Rose et al., 2002). UDL takes the same principles from

Universal Design and applies them to development of educational curricula. Curricula are

proactively designed to be flexible from the outset, thereby reducing the need for

individual student accommodations after-the-fact (Meyer et al., 2014; Rose et al., 2002).

In addition to embracing the concept of Universal Design, the specific elements of

the UDL framework were informed by research in education and advancements in

neuroscience (Meyer et al., 2014). Educational researchers identified that students with

exceptionalities were not the only ones facing barriers and challenges in their learning

abilities; historically, curricula and instruction have been designed to fit an "average"

student, making it unsuitable for the diverse range of learners in most classrooms (Meyer

et al., 2014). A typical classroom includes students with a wide range of learnings needs,

for example, students who have English as a second language; students who are from

varied cultural and linguistic backgrounds; students who are considered gifted; and

students who are identified as having a disability (Rose et al., 2002). If curricula are

designed with the belief that everyone learns information in the same way, then

opportunities to differentiate curricula to the specific strengths and needs of individuals

are lost (Rose et al., 2002).

CAST turned to advancements in neuroscience to understand why current

curricula are not effective for many students (Meyer et al., 2014; Rose et al., 2002). The

researchers sought ways to make neuroscience research applicable to educators and

identified three major learning networks to help them understand learning differences

(Meyer et al., 2014). CAST researchers asserted that there are three learning networks of

the brain that parallel the three prerequisites of learning as described by psychologist Lev

Vygotsky (1962): the affective, recognition, and strategic learning networks (Meyer et al.,

2014). Vygotsky stated that for children to learn, they need to engage with a new learning

task, recognize the new information, and apply strategies to understand the new

information (Vygotsky, 1962). CAST's interpretation is that the affective networks are

the "why" of learning and determine individuals' motivation to learn; these affective

networks correspond to regions of the brain associated with the limbic system (Meyer et

al., 2014; Lane & Nadel, 2000; Carels et al., 1999; LeDoux, 2003). The recognition

networks are the "what" of learning and determine how individuals categorize and

recognize information; these networks correspond to the sensory regions of the brain

(Meyer et al., 2014; Kandel, Schwartz & Jessell, 1991; Gazzaniga, 1995; Mountcastle,

1998). The strategic networks are the "how" of learning and correspond to executive

functions associated with the frontal brain region that are critical in planning, organizing,

managing, and problem-solving tasks (Meyer et al., 2014; Gopher, 1996; Burbaud et al.,

2000; Stuss &Knight, 2002). These three learning networks were used by CAST as the

basis for identifying the core principles that underlie the UDL framework (Meyer et al.,

2014; Rose et al., 2002).

Specifically, the UDL guidelines framework has three main principles, each of

which corresponds to one of the three learning networks. The UDL principles are as

follows: 1) **provide multiple means of engagement** by implementing strategies that

motivate and engage students in their learning (thereby activating affective learning

networks); 2) **provide multiple means of representation** by representing content in

various ways to increase student recognition and identification (thereby activating

recognition learning networks); and 3) **provide multiple means of action and**

expression by providing options for students to express their knowledge and develop

skills (thereby activating strategic learning networks) (Meyer et al., 2014; Rose et al.,

2002; CAST, 2018; Rapp & Arndt, 2012). Each UDL principle has three corresponding

'guidelines' that provide broad strategies for enacting that principle (Meyer et al., 2014;

CAST, 2018). Each guideline has several 'checkpoints', which are specific strategies for

implementation (Meyer et al., 2014; CAST, 2018). The UDL guidelines framework can be found in Figure 1.

Applying the UDL Principles

To foster the first UDL principle, to provide multiple means of engagement, educators and school service providers can refer to the UDL guidelines and checkpoints, which provide suggestions on how to recruit student interest, sustain student interest, and provide students options for self-regulation (Meyer et al., 2014; CAST, 2018; Rose et al., 2002) (Figure 1). Implementation of the second UDL principle, to provide multiple means of representation, can be achieved through applying the guidelines and checkpoints, for example, by displaying content in visual and auditory formats, displaying language and symbols in various formats, and assisting in comprehension by activating background knowledge to assist with recognition (Meyer et al., 2014; CAST, 2018) (Figure 1)**.** The third UDL principle, to provide multiple means of action and expression, can be applied through its guidelines and checkpoints, for example, offering students options for physical expression, allowing students different ways to communicate their knowledge, and to assist in developing executive functioning skills (Rapp & Arndt, 2012; Meyer et al., 2014; CAST, 2018) (Figure 1).

Evidence Supporting the UDL Checkpoints

Each UDL checkpoint in the UDL guidelines framework is based on empirical evidence (CAST, 2019). For example, consider the first UDL principle of engagement, specifically, checkpoint 7.1, which is to optimize individual choice and autonomy; researchers have demonstrated that providing students with choice and autonomy in the

classroom (e.g., options in materials, content, and format) increases student engagement and motivation (Amabile & Gitomer, 1984; Assor, Kaplan & Roth, 2002; Cavazos-Kottke, 2006). Regarding the second UDL principle of representation, specifically, checkpoint 3.3, which is to guide information processing and visualization, findings from multiple studies show the importance of using cognitive strategies and skills to ensure students can process new information (CAST, 2019). For example, using strategies that allow for selection and manipulation of information (e.g., graphic organizers, prompts, and concept maps) lead to increased understanding of new information and increased student achievement (Atkinson, 2002; Boon, Burke, Fore & Spencer, 2006; Idol & Croll, 1987). With respect to the third UDL principle of action and expression, checkpoint 5.2, using multiple tools for construction and composition, CAST identified the benefits of using technology and media to provide accessible tools to augment student learning (CAST, 2019). For example, some students may not communicate optimally using traditional tools such as pencil and paper (Dalton & Hannafin, 1987; Graham & Perin, 2007), but are more successful when provided with tools to express their knowledge in flexible ways (e.g., speech recognition software, calculators, and word prediction programs) (Dalton & Hannafin, 1987; Ellington, 2003; Higgins & Raskind, 1995).

Although examples of research supporting just three of the UDL checkpoints is provided here, CAST provides similar summaries of evidence for every checkpoint in the UDL guidelines framework (CAST, 2019). Thus, the individual strategies that make up the UDL framework are empirically supported; however, evidence demonstrating the impact of applying UDL as an entire framework is still emerging (Ok et al., 2017).

UDL: A Review of Current Research

In a recent systematic review, Ok and colleagues (2017) examined educators'
application of UDL during curriculum design and classroom instruction as well as the
impact of UDL application on student outcomes in pre-Kindergarten to grade 12
classrooms. The authors sought peer-reviewed empirical studies (qualitative, quantitative,
single-case or mixed-method research methods) that implemented and evaluated UDL
interventions and reported students' academic or social outcomes (e.g., engagement,
motivation). Overall, 58 studies were identified with 13 qualifying for inclusion (Ok et
al., 2017). Outcomes were evaluated through author-reported effect sizes (ES) in the 13
identified studies. If ES were not provided, they were computed using the studies'
statistical results (Ok et al., 2017). Among included studies, seven were quantitative
group designs, three were mixed-method designs, two were qualitative designs, and one
was a single-case design (Ok et al., 2017). None of the quantitative studies had initial
randomized selection of participants (Ok et al., 2017). For studies that did use random
assignment, the entire class or teachers of classes were randomly assigned to UDL vs.
non-UDL interventions (Ok et al., 2017). All 13 studies in the systematic review applied
the UDL principles through use of technology-based instructional materials that had built-
in UDL strategies or through UDL-based instructional methods as defined by the UDL
principles (Ok et al., 2017). For example, Hall and colleagues implemented the "Strategic
Reader Tool", which is a digital environment that incorporates a variety of accessible
reading strategies, e-books, text-to-speech software, highlighting, bookmarking, and
many other universally designed features (Hall, Cohen, Vue & Ganley, 2015).

Ok et al. (2017) summarized several key findings about the effectiveness of UDL that emerged from their systematic review. First, multiple studies using different research methodologies have reported that UDL is associated with improvements in students' classroom engagement and motivation (e.g., social outcomes). For example, Dymond and colleagues (2006) conducted a one-year qualitative case study assessing 101 high school students with severe cognitive disabilities (SCD) taking an inclusive science course in a general education classroom based on the three UDL principles (Dymond et al., 2006). As reported by the teachers, most students, including those with SCD, improved in their classroom social skills, engagement and motivation when taught in the UDL-based science course (Dymond et al., 2006). Marino et al. (2014) used a quasi-experimental design with repeated measures to compare student engagement when using UDL-based video games versus a textbook for fifth and seventh-grade students completing a science course. They found students to be more engaged in learning about science when using the UDL-based tools (Marino et al., 2014). The methodologically strongest study was by Rappolt-Schlichtmann et al. (2013), who conducted a randomized-control trial (RCT) where pairs of matched teachers were randomly assigned to specific schools, with one teacher from each pair assigned either to implement UDL strategies or to be in the control group. Teachers in the implementation group used a web-based science notebook that was developed with reference to the three UDL principles (Rappolt-Schlichtmann et al., 2013). The control group used traditional paper and pencil notebooks (Rappolt-Schlichtmann et al., 2013). Students reported the UDL-based science notebook to have a

positive impact on classroom engagement and teachers reported an increase in student

confidence and motivation when using this tool (Rappolt-Schlichtmann et al., 2013).

    In contrast to findings for students' social outcomes, the impact of UDL on

students' academic outcomes was less clear, with effect sizes varying across studies (Ok

et al., 2017). This may be because UDL can be applied in such a variety of ways that it is

challenging to measure its specific impact on academic performance (Ok et al., 2017). For

example, UDL can be applied through providing options of visual information or can be

applied by supporting executive functioning and goal-setting (CAST, 2018). Many of the

existing studies reviewed by Ok et al. (2017) are problematic methodologically, with only

one study using an RCT design (Rappolt-Schlichtmann et al., 2013). In Rappolt-

Schlichtmann et al.'s (2013) RCT, students taught with the UDL-science notebook scored

significantly higher on the Assessment of Science Knowledge (ASK) post-test survey

compared to peers who used traditional pencil-and-paper notebooks; however, the

components of UDL that contributed to this increase in science knowledge were unclear.

It also is important to note that many of these studies use standardized tests to assess

students' knowledge (Coyne et al., 2012; Dalton et al., 2011; Hall et al., 2015; Kennedy

et al., 2014; Rappolt-Schlictmann et al., 2013). This could lead to problematic and

inconsistent results as there is no guarantee that the curriculum content taught using the

UDL strategies will appear on the standardized test. If questions asked through

standardized tests involve dissimilar content then what was taught with UDL strategies,

this would not be an accurate assessment of UDL's potential impact on students'

academic outcomes. In fact, there are many disputes regarding standardized testing as a

means of measuring student knowledge (Kohn, 2000). Standardized tests have been said to only measure isolated skills and specific facts that are not true indicators of student knowledge (Kohn, 2000).

Ok et al. (2017) acknowledged that UDL needs a stronger research base. Empirical evidence is lacking in causally connecting application of UDL and the specific strategies that positively impact student learning (Ok et al., 2017). Researchers need to continue building evidence by utilizing rigorous approaches (e.g., controlled randomization) and enhancing methods of measuring student knowledge to establish ways UDL can be applied to consistently measure impact on student outcomes.

Increasing UDL's Evidence Base

CAST is currently working to increase the evidence base for UDL (Daley & Rose, 2018). CAST has been developing a UDL-informed digital literacy environment called Udio, which has the goals of increasing middle-school students' reading motivation and comprehension (Daley & Rose, 2018). CAST researchers applied the three UDL principles during the development of Udio (Daley & Rose, 2018). For example, the first UDL principle of engagement was applied by providing students with the option to design their learning environment and included prompts of emotional check-ins to document how students feel about specific readings (e.g., bored or intrigued) (Daley & Rose, 2018). The second UDL principle of representation was applied by providing students options of reading formats; for example, students can have text read aloud, use highlighting, or access dictionary resources and language translations (Daley & Rose, 2018). The third UDL principle of action and expression was applied through supports

such as prompts for students to identify the main ideas of a reading, labeling features, and discussions with peers online (Daley & Rose, 2018). CAST researchers recently implemented Udio with over 600 students and assessed students' motivation and academic outcomes (Daley & Rose, 2018). Data are currently being analyzed and publications will be forthcoming (Daley & Rose, 2018).

Although current evidence supporting UDL has limitations, available findings suggest that UDL has a positive impact on students' social outcomes, such as engagement and motivation, with impacts on academic achievement to be determined (Daley & Rose, 2018). While lack of evidence regarding students' academic outcomes is an important and definite gap, it is not the only dimension that is relevant. With current mandates supporting inclusive education, positive changes in students' social outcomes (e.g., engagement, participation, and motivation) are also important reasons to consider implementation of UDL.

UDL Application in Ontario

In Ontario, the Ministry of Education supports application of UDL in the classroom (MEDU, 2013; MEDU, 2005). MEDU discusses UDL as one of three effective approaches to "instruction that both responds to characteristics of a diverse group of students and is precisely tailored to the unique strengths and needs of each student" (MEDU, 2013, p.12). As well, the OHRC's 2018 policy on accessible education recognizes that the rights of children with disabilities are still not fully acknowledged within the education system (OHRC, 2018). Within this policy, UDL is encouraged and recommended as an approach to achieve equal education opportunities for all students

(OHRC, 2018). The United Nations' Committee on the Rights of Persons with

Disabilities also supports UDL implementation in classrooms as an effective inclusive

education approach (OHRC, 2018). However, despite these policies and the MEDU's

recommendations to use UDL, children with disabilities are still being excluded in the

Ontario education system and these inclusive practices are not being followed by all

school-based professionals (OHRC, 2018; Reid et al., 2018).

The Role of the Health Care Professional in Universal Design for Learning

Health care professionals (HCPs) who work in Canadian schools need to become

well-versed in inclusive education practices like UDL to help reduce exclusion of

students in the classroom (Tomas, Cross & Campbell, 2018). HCPs, including Speech-

Language Pathologists (SLPs), are vital members of the education system and possess

knowledge about how to support students with communication and language needs

(Causton & Tracy-Bronson, 2014; Staskowski, Hardon, Klein, & Wozniak, 2012;

Archibald, 2017). SLPs also have the necessary skillset to help students develop oral

language skills, which are critical to students' reading and writing abilities (Ontario

Association of Speech-Language Pathologists and Audiologists, 2014). SLPs play a

pivotal role in the education system by supporting students' language-based learning

needs; therefore, it is essential that school-based SLPs are well-informed about current

inclusive education practices like UDL.

Despite mandates to use UDL (MEDU, 2003; MEDU, 2013; OHRC, 2018) and

the need to enhance inclusive education practice (Reid et al., 2018; OHRC, 2018), many

Canadian SLPs are unfamiliar with UDL and how to apply it (Campbell, Selkirk &

Gaines, 2016; Ralabate et al., 2014; Suleman et al., 2013; Zurawaski, 2014). A 2016

survey of 91 Canadian school-based SLPs reported that 30% had never heard of UDL

and, of those who were aware of this framework, a majority did not feel confident that

they could explain UDL or apply the guidelines (Campbell et al., 2016). Respondents also

reported a need for increased training and support related to how to apply UDL in

collaboration with educators (Campbell et al., 2016).

      Within Canada and internationally, SLPs use UDL terminology inconsistently

and, in some instances, UDL terminology is completely absent (Kennedy et al., 2018).

For example, SLPs are using UDL-based strategies but are not calling the strategies UDL;

instead, SLPs are using terms like 'differentiated instruction,' 'classroom-based

collaboration' and 'integrated service' (Kennedy et al., 2018). Kennedy and colleagues

(2018) found that school based SLPs inconsistently describe and implement UDL, and

often do not provide a formal definition of UDL or refer to the strategies they use as

related to the UDL framework. Nonetheless, many SLPs are executing strategies that are

comparable to those provided in the UDL guidelines (Kennedy et al., 2018). For example,

in one article identified by Kennedy et al. (2018), SLPs were using visual images and

symbols to assist students with understanding word meanings (Starling, Munro, Togher,

& Arciuli, 2012). This strategy was not referred to as a UDL-based strategy, but falls

under UDL checkpoint 2.1, to clarify vocabulary and symbols (CAST, 2018).

      There is a need to increase knowledge and application of UDL by school-based

SLPs (Campbell et al., 2016; Kennedy et al., 2018; Suleman et al., 2013) and to ensure

consistent terminology and implementation efforts of UDL across practice settings.

Particularly in Ontario, there are inclusive education mandates regarding UDL application (MEDU, 2013; OHRC, 2018); therefore, SLPs who are unfamiliar with UDL will face challenges when entering the Ontario school system. Researchers have highlighted the importance of beginning training about educational frameworks and collaboration with educators at the student level to ensure readiness when these pre-professionals enter the school system (Suleman et al., 2013). SLP students are one group that could be targeted to increase UDL knowledge before they enter the workforce (Suleman et al., 2013; Ralabate et al., 2014; Zurawaski et al., 2014).

Increasing UDL Knowledge Among SLP Students: What is Knowledge Translation?

Knowledge Translation is a complex and iterative process involving "getting the right information, to the right people, at the right time, in a format they can use" to assist in decision making (Knowledge Translation Australia, 2016, p.1; Canadian Institutes of Health Research, 2016; Tetroe, 2007). The primary purpose of KT is to address knowledge gaps between what is mandated through policy and what is implemented in practice (Graham et al., 2006; CIHR, 2016; National Center for the Dissemination of Disability Research, 2005; Curran et al., 2011). One aspect of KT is 'dissemination' or the process of identifying a target audience and tailoring research evidence to that audience (CIHR, 2016; Tetroe, 2007). Dissemination efforts aim to increase awareness and begin shifting attitudes and perceptions regarding specific topics, for example, through using journal publications, presentations, and posters (Cramm, White, Krupa & 2013; Straus, Tetroe & Graham, 2009).

KT activities are identified as complex and methodologically challenging (Tabak, Khoong, Chambers, & Brownson, 2012; Curran et al., 2011), requiring application of KT theories to assist in optimal planning, development, and delivery to the intended audience (Tabak et al., 2012; Eccles et al., 2005; Estabrooks, Thompson, Lovely & Hofmeyer, 2006). Theories provide a means of understanding behaviours and events by providing reasons, definitions, and suggestions that help enhance knowledge or prediction (Tabak et al., 2012; Eccles et al., 2005; Estabrooks et al., 2006). Theories have a multitude of benefits in health research, increasing quality, validity, and overall research and implementation success (Tabak et al., 2012; Eccles et al., 2005; Coloquhoun et al., 2010).

Dissemination strategies can increase knowledge about a specific topic to a target population, for example, by using educational resources and educational meetings (Farmer et al., 2008; Medves et al., 2009). Educational resources are materials that are tailored to a target population to enhance knowledge about a topic, such as through websites, videos, or research presentations (Farmer et al., 2008; Stacey & Hill, 2013). Educational meetings are interactive gatherings of the target audience allowing participation in learning about the specific topic, for example, through implementation of lectures or workshops (Arnold & Straus, 2005; EPOC, 2002; Johnson & May, 2015). Application of educational materials and resources have proven effective in targeting knowledge when used individually (Johnson & May, 2015); however, preliminary evidence regarding utilization of both educational materials and meetings together through a multi-faceted approach has shown to be more effective (Medves et al., 2009; Scott et al., 2012).

Theoretical Background: Diffusion of Innovations Theory

One theory that helps guide dissemination research is the Diffusion of Innovations (DOI) theory (Rogers, 1995). Developed by Everett M. Rogers in 1962 (Rogers, 1995; LaMorte, 2016), DOI theory explains the logic behind adoption or rejection of new projects, innovations, concepts, or ideas throughout populations and social systems (LaMorte, 2016). Rogers' theory contains four major elements: the innovation itself, communication channels, time, and the social system (Rogers, 1995). The four elements of DOI theory work in tandem to determine whether an innovation will be adopted by a target population (Rogers, 1995).

The first element of DOI theory, the innovation itself, is any new idea or product that has the potential to be adopted by a group of individuals (Rogers, 1995). The second DOI theory element, communication channels, brings attention towards communication strategies that create awareness about the innovation within a target population. The third element of DOI theory is time, which involves the time it takes for specific groups of people to form an opinion about and potentially adopt an innovation (Rogers, 1995). The last element of DOI theory is the social system. Every social system consists of different values that shape people's behaviour and beliefs (Rogers, 1995). As identified by Tabak et al. (2012), DOI theory is recognized for its relevance to dissemination in health care and is known to effectively enhance dissemination efforts (Pennington et al., 2005; Britto et al., 2007; Cunningham, Rosenbaum, & Hidecker, 2016). For example, Cunningham et al. (2016) applied DOI theory to developing and successfully disseminating a web-based

intervention for SLPs. DOI theory can be applied to accelerate the rate of adoption of innovations within a target population (Dearing, 2004; Dearing, 2009).

Although DOI theory can help guide KT research, it does not provide an actual stepwise methodology or process on how to develop KT strategies like educational resources. Depending on the specific KT element being addressed and the chosen KT strategy, other models can be used to provide a methodology for development. For example, instructional design (ID) models (Levac et al., 2015) can provide guidance and a stepwise methodological process to inform development of high-quality and effective KT educational resources (Levac et al., 2015; Peterson, 2003). The ADDIE is an ID model that has been effective in educational resource design and is now being more widely recognized for its usage in the field of rehabilitation science (Levac et al., 2015).

The Analysis, Design, Development, Implementation, Evaluation (ADDIE)

Instructional Design Model

The ADDIE model is widely used in the development of educational resources and training programs across the fields of healthcare, systems acquisition, and education (Peterson, 2003; Allen, 2006; Kurt, 2018; Hsu, Lee-Hsieh, Turton & Cheng, 2014). ADDIE has been adapted from systems engineering, behavioural and cognitive psychology, and instructional technology advancements (Allen, 2006). ADDIE provides its users with five clearly defined phases and steps for effective development and implementation of instruction (Peterson, 2003).

The five phases of the ADDIE model include: Analysis, Design, Development, Implementation and Evaluation (Peterson, 2003; Allen, 2006; Hsu, Lee-Hsieh, Turton &

Cheng, 2014; Kurt, 2018; Dick, Carey, & Carey, 2009). The Analysis phase involves examining the literature to determine target audience needs and what they know about the specific topic (Peterson, 2003; Allen, 2006). The Design phase consists of drafting and planning of the resources, development of learning objectives, determining how objectives will be met, and the specific instructional activities (Peterson, 2003; Reinbold, 2013). The Development phase of ADDIE involves assembly, final revisions, and production of the resources (Peterson, 2003; Reinbold, 2013; Wang & Hsu, 2009). Key stakeholders can be involved within the Development phase to ensure final products are tailored to the target audience (Williams et al., 2011). The Implementation phase involves application and delivery of the final resource product to the target audience (Peterson, 2003; Reinbold, 2013). The Evaluation phase determines if resource objectives and learning goals were met through utilization of the developed resources (Peterson, 2003; Kurt, 2018; Reinbold, 2013). Although the ADDIE model may seem like a linear methodology, it is quite an iterative process (Allen, 2006; Reinbold, 2013). The phases overlap with each other and are constantly revisited to further enhance and tailor the instructional resources (Reinbold, 2013; Allen, 2006).

ADDIE has proven effective in educational resource design and is recommended to guide resource development (Shibley, Amaral, Shank & Shibley, 2011; Wang & Hsu, 2009; Reinbold, 2013; Park & Song, 2017; Battles, 2006). ADDIE provides a consistent and evidence-based process that reduces the developer's uncertainty when creating educational resources (Mayfield, 2011). As well, due to ADDIE's iterative nature, each phase can inform improvements in earlier phases to ensure resources are of highest

quality (Mayfield, 2011). Within educational curriculum development, ADDIE provides a model that guides student-centered resource development and improves learning potential (Robinson & Dearmon, 2013; Battles, 2006). For example, ADDIE was successfully used to design effective educational resources for graduate nurses (Robinson & Dearmon, 2013) and to develop modules that disseminated knowledge on supported employment for community behavioural health treatment programs in New York (Patel et al., 2018).

ADDIE is now being recognized for potential utilization for educational resource design within the field of rehabilitation science (Levac et al., 2015). Best practice recommendations were provided by Levac and colleagues regarding development of educational resources informed by KT theories and the ADDIE model in rehabilitation science (Levac et al., 2015). KT theories help provide the theoretical foundation of how to frame the resources and the specific content to include, while the ADDIE model provides systematic guidance and the methodology needed to develop high-quality, effective educational resources in rehabilitation science (Levac et al., 2015).

Levac and colleagues suggested that when developing educational resources, various steps should occur: 1) assess target audience needs and knowledge; 2) summarize the evidence surrounding audience needs; 3) apply a KT theory, framework or model in the development process; 4) select a KT format; 5) develop learning objectives; and, 6) include multimedia content that engages the audience (Levac et al., 2015). By utilizing KT theory and the ADDIE model, these best practice recommendations for developing evidence-based, user-centered educational resources are achievable (Levac et al., 2015).

Master's Thesis Overview

As outlined in my literature review, SLPs are unfamiliar with the UDL guidelines framework and how to apply it when collaborating with educators (Campbell, Selkirk & Gaines, 2016). This is problematic because inclusive education policy in Ontario recommends that educators implement UDL when designing curricula and providing instruction (MEDU, 2003; MEDU, 2013; Tomas, Cross & Campbell, 2018). Therefore, to successfully collaborate with educators and support broader inclusive education mandates, SLPs need to know about and understand how to apply UDL in their practice within schools. My Master's thesis will begin to close this knowledge gap in two ways: 1) through using and systematically describing a novel methodological process of using DOI theory, the ADDIE model, and key stakeholders to develop educational resources about UDL for SLP students; and 2) by evaluating feasibility of the resources with SLP students and the association between exposure to resources and UDL knowledge change. In addition to closing a knowledge gap among SLPs, I also anticipate that other health educators who need to develop content specific resources for health professional students in areas of emerging practice might also learn from the novel resource development process that I am using in my thesis research.

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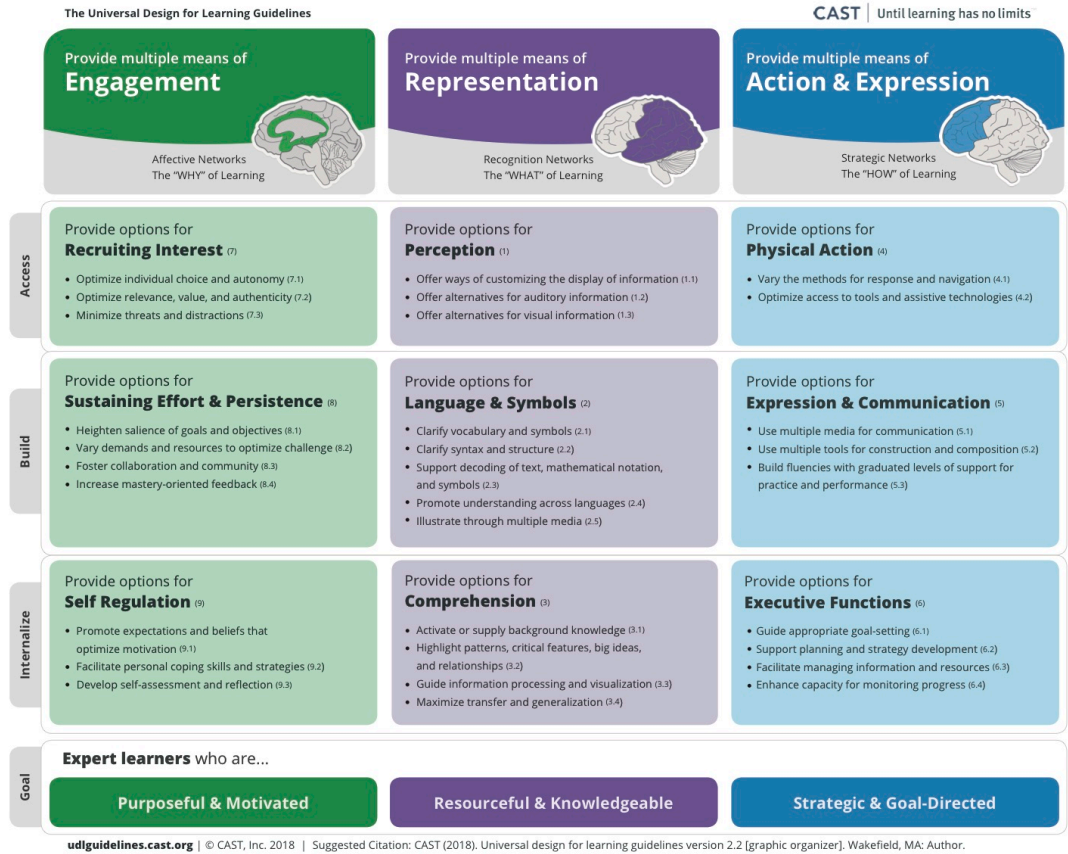
Figure 1. The UDL guidelines framework. From "Universal design for learning guidelines version 2.2 [graphic organizer]," by CAST, 2018, Wakefield, MA. Copyright 2018 by CAST.

Chapter Two: Manuscript #1

Using Knowledge Translation and Instructional Design to Develop Educational Resources for Health Professional Students

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Submitted to: Journal of Allied Health

Abstract

BACKGROUND: A key aspect of knowledge translation (KT) is ensuring that information is packaged and delivered to stakeholders in ways that enhance knowledge and practice. To achieve this aim, developers of KT resources are advised to use theory to guide educational resource content and development. Currently, there are few papers that systematically describe the theory and methodology used when developing educational resources, especially for those who educate and train health professionals. PROCESS: We describe how we applied a KT theory, Diffusion of Innovations (DOI), with an instructional design model, Analysis, Design, Development, Implementation and Evaluation (ADDIE), to develop educational resources for Speech-Language Pathology (SLP) students on the topic of Universal Design for Learning (UDL) and its application in school-based practice. We also explain how we engaged school-based SLPs as stakeholders in the development process and elicited their feedback on their experience. FINDINGS: Stakeholders indicated that their experience was positive. They viewed the approach as valuable, realistic, and one that could be considered by others looking to develop resources for health professional students. DISCUSSION: We consider the benefits, potential limitations, and implications of using theory-driven approaches to develop resources for professional graduate programs. Suggestions are offered for future research and practice.

Using Knowledge Translation and Instructional Design to Develop Educational Resources for Health Professional Students: An Example from Speech-Language Pathology

Knowledge Translation (KT) is a health care term used to describe the iterative process of "getting the right information, to the right people, at the right time, in a format they can use, so as to influence decision making" (Knowledge Translation Australia, 2016, p.1). The process of KT consists of three major components, one being 'knowledge dissemination' (Canadian Institutes of Health Research, 2016). Knowledge dissemination involves communication of research findings to a target audience by tailoring information to that specific group, such as through educational resources like written materials or presentation slides (Canadian Institutes of Health Research, 2016; Cramm, White & Krupa, 2013; Gagnon, 2011; Farmer et al., 2008; Stacy & Hill, 2013; Medves et al., 2010). Use of KT theory is highly recommended to develop effective and high-quality resources (Eccles et al., 2005; Estabrooks, Thompson, Lovely & Hofmeyer, 2006; Tabak, Khoong, Chambers, & Brownson, 2012); yet many authors do not apply KT theory during resource development, nor systematically explain its application in the development process (Davies, Walker & Grimshaw, 2010; Levac, Glegg, Camden, Rivard & Missiuna, 2015; Scott et al., 2012; Squires, Sullivan, Eccles, Worswick & Grimshaw, 2014). As a result, theory-driven approaches for developing resources are lacking (Curran, Grimshaw, Hayden, & Campbell, 2011; Eccles, Grimshaw, Walker, Johnston & Pitts, 2005; Tabak et al., 2012). Studies are needed that better describe the

theory and methods underpinning the resource development process (Scott et al., 2012; Squires et al., 2014).

In this paper, we describe a novel process for combining a KT theory, *Diffusion of Innovations* (DOI), with an instructional design (ID) model, *Analysis, Design, Development, Implementation, Evaluation* (ADDIE), to develop educational resources for training health professional students. It is our contention that both DOI and ADDIE add uniquely to the resource development process. Specifically, DOI guides selection and framing of educational resource content such as what information will address end users' needs (Levac et al., 2015), while ADDIE offers a step-by-step method detailing how educational resources are developed (Levac et al., 2015).

Diffusion of Innovations: A Theory for Supporting Dissemination

DOI theory explains why some ideas are more likely to be adopted than others and comprises four elements. (LaMorte, 2016; Rogers, 1995). First, specific *characteristics of the innovation* will influence why some innovations are more likely to be adopted than others (Rogers, 1995). Second, the element of *time* considers two components: the innovation-decision process, which focuses on how people's changing perceptions of an innovation influences adoption, and adopter categories, which refers to groups of people who vary in how slowly or quickly they take up an innovation (Rogers, 1995). Third, the *communication channel* by which messages are delivered can impact uptake of an innovation (Rogers, 1995). The final element, the *social system*, addresses the structure of societal members, and which members hold the most influence in changing behaviour towards an innovation (Rogers, 1995). When used in the development of educational

resources, DOI theory can inform how to select and tailor content to encourage

widespread adoption of the innovation. For example, DOI theory can suggest effective

strategies for conveying the relevance of the innovation for people in various adopter

categories. However, since DOI theory does not suggest a step-by-step process to guide

resource development, ID models can fill this gap (Levac et al., 2015).

ADDIE: A Model for Supporting Instructional Design

The ADDIE model consists of five phases (Analysis, Design, Development,

Implementation and Evaluation) for developing educational resources (Allen, 2006; Dick,

Carey, & Carey, 2009; Peterson, 2003). The Analysis phase involves background

research: examining the literature to determine a target audience's learning needs on a

topic (Reinbold, 2013). In the Design phase, information gained from the Analysis phase

is used to design learning activities and draft the educational resources (Reinbold, 2013;

Wang & Hsu, 2009). The Development phase involves assembling and validating

resources before implementation (Allen, 2006; Peterson, 2003; Reinbold, 2013; Wang &

Hsu, 2009). The Implementation phase involves the delivery of the educational resources

to the target audience (Reinbold, 2013; Wang & Hsu, 2009). The Evaluation phase

measures desired outcomes to ensure educational resource goals are met (Kurt, 2018;

Reinbold, 2013). Although descriptively linear, the ADDIE model is iterative and cyclical

(Reinbold, 2013). Involvement of key stakeholders within ADDIE is an important

component in shaping the final product of the educational resources (Williams et al.,

2011). Instructional designers who work with stakeholders and modify resources based on

their feedback have a higher likelihood of producing high-quality resources suitable for the intended audience (Williams et al., 2011).

Setting the Context: An Example from Speech-Language Pathology

In Canada, inclusive education has shifted from segregation of children with disabilities to policies and practices supporting inclusion of all children in general education classrooms (Inclusive Education Canada, 2017; Ontario Human Rights Code, 1990; MEDU, 2005; Towle, 2015). With an increase in inclusive practices, health professionals who work in schools, such as Speech-Language Pathologists (SLPs), need to be prepared to support inclusive education strategies (Tomas, Cross, & Campbell, 2018). Universal Design for Learning (UDL) is an inclusive education framework that is relevant for those working in school systems (Daley & Rose, 2018; Meyer, Rose, & Gordon, 2014; Rose, Meyer, Strangman & Rappolt, 2002). UDL provides strategies for creating a flexible curriculum that optimizes learning for all students (Meyer et al., 2014). However, many SLPs are unaware of UDL and do not know how to apply it in the classroom setting (Campbell, Selkirk & Gaines, 2016). Developing educational resources for pre-licensure SLP students could address this knowledge gap.

Purpose

The purpose of this paper is to: (1) describe a novel theory-informed process of developing educational resources using DOI theory combined with the ADDIE model to increase SLP students' knowledge of UDL; and (2) elicit and analyze the experiences of stakeholders who were engaged in the novel development process.

A Process for Developing Educational Resources

Following ethics approval from Hamilton Integrated Research Ethics Board (HiREB #3963), in order to achieve our aims, we drew upon the first three phases of the ADDIE model (Analysis, Design, and Development) and integrated DOI theory into the Design phase (see Figure 1).

Step 1: Analysis Phase

In this step, we sought to determine SLPs' knowledge about UDL and its current application in school settings. Our work was informed by a recent scoping review that explored how SLPs define and use UDL in school practice (Kennedy et al., 2018). Through the review, we identified articles that provided inclusive education strategies and techniques similar to UDL that SLPs currently use to support students in the classroom. We then matched each of these techniques to specific concepts within the UDL framework. This analysis provided a means of addressing a gap in knowledge about how SLPs can implement UDL by collating practical strategies that SLPs already use and reframing them using the terminology associated with UDL. For example, in a study conducted by Hadley, Simmerman, Long, and Luna (2000), rhythm sticks and clapping techniques were used to emphasize rhythm of words and syllables for students. The authors did not explicitly refer to this as UDL, but the strategy fits under the second UDL Principle, to provide **multiple means of representation**, specifically, checkpoint 2.2, which is to clarify syntax and structure (CAST, 2018). Through this first step, resource content could be framed around utilizing information gained from Kennedy et al. (2018).

While providing extensive knowledge of the UDL framework is beyond the scope of this paper, interested readers may learn more about UDL by consulting Kennedy et al. (2018).

Step 2: Design Phase Supplemented with DOI Theory

DOI theory was introduced in the Design Phase to inform resource learning activities and content before beginning the drafting process. We mapped each element of DOI theory (innovation characteristics, time, communication channel, and social system) to ways these could be addressed by the SLP students.

DOI theory mapping to guide resource content. DOI theory's five innovation characteristics are described in Table 1 along with examples of how each was mapped for this project. For example, one characteristic is 'trialability', which is when the target audience applies the innovation (Rogers,1995). We determined that the resources would need to provide an opportunity for SLP students to apply UDL knowledge to meet the requirement of 'trialability'.

DOI theory also considers time taken to adopt the innovation through five adopter categories describing those who are more or less likely to adopt a new innovation over time (Rogers, 1995). Table 2 describes each of these adopter categories and provides examples of considerations we made for each. For example, the late majority and laggard categories are groups that require more persuasion through evidence and examples of the innovation's success (Rogers, 1995). Thus, we included evidence, policy documents, and examples of SLPs applying UDL to tailor to these adopter categories in our resources.

DOI theory also considers the time it takes for an individual to form an opinion of an innovation, called the innovation-decision process (Rogers, 1995). We applied the first

two steps of the innovation-decision process, knowledge and persuasion. We determined

that knowledge would be addressed through provision of basic UDL definitions and

explanations through text, diagrams, and videos in the resources. Persuasion was

addressed through portraying evidence supporting UDL and UDL's compatibility within

the education system in Ontario, Canada.

To incorporate the communication channel element of DOI theory, we asked

practicing school-based SLPs to prepare messages about the innovation as they are

individuals who have similar qualities, beliefs, and education as the SLP students

(Rogers, 1995). In so doing, we also addressed the social system in which SLP students

are being inculcated. Rogers (1995) suggests that adoption is supported by incorporation

of opinion leaders and change agents, who are viewed as having the power to shift beliefs

regarding an innovation. Opinion leaders were represented by describing Ontario

Ministry of Education (MEDU) documents that situate UDL as a framework to support

all students' learning. Change agents were represented by including supportive quotations

from school-based SLPs.

Drafting of educational resources. Three types of educational resources were

drafted: a PowerPoint presentation, two case studies, and two SLP-tailored handouts

outlining strategies to implement UDL. We developed learning objectives using Bloom's

Taxonomy of Instructional Objectives (Forehand, 2005; University of New Brunswick,

n.d.). We consulted the DOI theory mapping tables when beginning the drafting process

(See Tables 1 and 2). UDL strategies that had been extracted from the articles identified

by Kennedy et al. (2018) were formatted and displayed in two handouts using the UDL

Guidelines template (CAST, 2014): One handout was extensive and included all strategies extracted from the literature, while the other handout was abbreviated and included salient examples. The extensive list was developed to address specific adopter categories identified from DOI theory, the late majority and laggard categories who require further examples (Rogers, 1995), whereas the abbreviated list was designed for practical use by all students.

Step 3: Development phase

In this step, we recruited school-based SLP stakeholders to form a Working Group (WG) that would assist in resource development. We specifically sought SLPs who were practicing in a school setting, were geographically close to McMaster University, and had an interest in UDL. Potential WG members were identified and contacted by a third party using a secured database that housed contact information of local school-based SLPs. The final WG included three school-based SLPs who had familiarity with UDL. Between them, members had a median of 29 years of clinical experience (*range* = 18 to 29 years) and a median of 29 years of experience in the school setting (*range* = 12 to 29 years). WG members were compensated for parking fees and received a $100 gift certificate for their participation.

We held two 90-minute WG meetings 6-8 weeks apart. Prior to each meeting, members received an agenda and a set of resource drafts to review. Meetings provided an opportunity for feedback on the content and format of the resources. WG members provided suggestions, such as: describing Ontario Ministry of Education documents in the PowerPoint, explicitly linking Ministry terminology with the terms used in the UDL

framework and revising case studies to include authentic SLP scenarios based on their

personal experiences working with students and educators. Between WG meetings, the

authors re-entered the Design phase to incorporate the feedback and create new content.

Feedback on the final set of products was provided by a small group of McMaster faculty

and staff who volunteered to attend a 'trial run' of the educational session. The final

educational resources included: a 55-slide PowerPoint presentation, two case studies, and

two SLP-tailored UDL strategy handouts.

Stakeholder Feedback

Since this was a novel resource development process, we conducted a 30-minute

focus group after the second WG meeting to gather perceptions on employing this process

and inclusion of stakeholders: See Appendix A for the complete focus group instructions

and guide. The focus group was audio recorded and transcribed verbatim.

Focus group data analysis. Focus group responses were analyzed using

conventional content analysis (Hsiu-Fang & Shannon, 2005), which is appropriate when

existing theory or literature regarding the phenomenon is limited, as is the case in this

paper (Hsiu-Fang & Shannon, 2005). The transcript was first coded using descriptive

coding (Saldana, 2016). Next, the codes were categorized into topics based on their

similarities (see Table 3).

Focus Group Content Analysis Findings

All three WG members participated in the focus group. Three topics were

identified from the focus group: value and appreciation, enriching and positive meetings,

and overall project importance.

Value and appreciation

Through inclusion of school-based SLPs in this process, members felt that their opinions were valued. As one member stated "…any feedback that we gave was really positively accepted, clarification was asked if they were unsure of what we meant. It seemed like we were really quite involved in the participation, yeah. Quite valued". Members also indicated that researchers involved in the WG meetings were responsive; incorporating stakeholder feedback into the resources, further making them feel appreciated and valued during the development process.

Enriching and positive meetings

Members emphasized the orderly structure of both WG meetings; adhering to pre-determined agenda items and the allocated timelines. Members felt that the collaborative discussions and engagement lead to a positive experience. One member spoke to the nature of the collaborative discussions stating, "it meant we could build on each other's ideas which I think overall enhanced the learning and the suggestions…it was also helpful to have other people who could echo or broaden or deepen some of the comments and understandings". As well, members felt that having the meetings in-person contributed to the productiveness and efficiency of each meeting. Members also felt a sense of comfort due to the familiarity each member had with one another from prior collaboration in their professions.

Overall project importance

Members stated the importance of developing these educational resources and including practicing SLPs in resource development. One WG member recommended this

process for development of future resources saying, "I think so because it's realistic. It's connected to reality – to what people really are experiencing in the field…Talk to the people who are actually in the field and get their responses". There was a consensus among members regarding the importance of engaging stakeholders throughout the development process and how this enhanced the resource quality. Members also mentioned how WG meetings raised their awareness of knowledge gaps involving SLP practice. For example, one member remarked, "I think the other thing it does is it shows what we don't know perhaps. Or helps us to know what we need to brush up on, or perhaps re-visit so that we're really current with our practices and our thinking".

Discussion

Within the field of KT, theory-driven studies are lacking and approaches that enhance dissemination strategies are needed (Curran, Grimshaw, Hayden, & Campbell, 2011; Eccles et al., 2005; Tabak et al., 2012). This paper addresses both gaps. DOI theory provided the theoretical foundation to develop content that targeted our intended audience. In addition, our resources were tailored in ways that responded to different elements of innovation adoption in order to encourage knowledge uptake. ADDIE provided a stepwise approach to developing the educational resources, such as assessing target population needs, synthesizing current literature, and including key stakeholders to iteratively design and develop the resources. Stakeholders indicated that this novel process was realistic and could be considered for future use by others looking to develop educational resources for health professional students.

Levac and colleagues provided recommendations for developing and implementing online KT resources for health professionals (Levac et al., 2015). They suggested that developing resources requires assessment of audience needs, summarizing key evidence, use of KT theory to guide resource development, selection of KT format, and inclusion of multimedia content to enhance visual appeal and engagement (Levac et al., 2015). Our novel process of combining ADDIE and DOI theory followed their recommendations and extended their work by providing a descriptive methodology of the process, including stakeholder involvement. The process of engaging SLP stakeholders throughout the ADDIE Development phase enriched the resource content. These experienced school-based SLPs had practical knowledge and experience regarding the role of SLPs within schools and specific policies and terminology that are valuable for pre-professional SLPs.

Development Process Recommendations

We recommend this novel process for developing educational resources in areas of emerging practice where no materials for a specific audience exist. The first three phases of ADDIE combined with DOI theory provide guidance in navigating literature to conduct a needs analysis and utilizing this information to develop tailored and theoretically-informed resources. Potential users of this process should be aware of the time and labor-intensive process required for mapping and applying the DOI elements; however, through meticulously considering every applicable DOI element, each resource component had a purpose and was grounded in theory. Individuals who are unfamiliar with designing educational resources would benefit from ADDIE as a method to guide

resource development, as it provides a structured and effective approach that is easy to

follow.

Limitations

Feedback on employing this novel development process was limited as there were

only three WG members representing perspectives from two school boards. SLP

stakeholders were also familiar with and invested in UDL. We may have received

different input had UDL knowledge, interest, and experience differed among members.

Regardless, stakeholders provided useful and valuable feedback during WG meetings,

which informed the final products.

Future Research

A forthcoming study will describe our application of the final two phases of the

ADDIE model (Tomas, Hamilton, Solomon & Campbell, 2018 – in preparation) in which

we implemented and evaluated the UDL resources with a group of SLP students. Future

research also could explore how this novel approach combining DOI theory and the

ADDIE model could be applied in the development of other educational resources.

Inclusion of larger and more diverse WGs with other health professionals could evaluate

the usefulness of this methodology for developing educational resources for other

disciplines.

Conclusion

Overall, we recommend the steps of this novel methodology to be used by other

healthcare educators for developing educational resources for health professional

students. Although the process was time consuming, final educational products followed

best-practice recommendations (Levac et al., 2015) and provided quality educational

resources to be used for SLP students. Others looking to develop content-specific

approaches could benefit from a similar methodology and the opportunity to engage their

clinical community. With an increased emphasis on developing theory-driven

dissemination strategies (Scott et al., 2012; Squires et al., 2014), this paper adds to the

literature base by describing and illustrating a novel systematic process for developing

quality educational resources for health professional students.

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Table 1

Framing of the Educational Resources Through the Five Characteristics of Innovations

Innovation Characteristic	Recommendations and Incorporation of Innovation Characteristic into Educational Resources
Relative Advantage: The degree to which an idea or innovation seems superior compared to the idea or innovation that came before it.	• Advantages of adopting UDL and UDL benefits should be portrayed. Examples: UDL tackles curriculum barriers and provides supports; UDL motivates students and increases participation; and UDL benefits all students, not just those who are on an SLP's case load.
Compatibility: The extent to which an idea or innovation is consistent with current beliefs, values, and social norms.	• Compatibility of UDL with SLP practice should be emphasized using examples from the literature; Ontario Ministry of Education supports and encourages usage of UDL as an instructional approach.
Complexity: How easy or difficult it is for individuals to perceive and apply a new idea or innovation.	• Resources should be designed to be administered during students' regular class time. • Resources should include basic definitions, tables, diagrams, and videos.

Table 1 (continued)

Framing of the Educational Resources Through the Five Characteristics of Innovations

Trialability: The ability to try out the innovation or idea.	• Students should have the opportunity to trial and apply UDL. • Students should be provided with a guided practical example of how to apply the UDL Guidelines.
Observability: The ability to visibly see the results of an innovation or idea.	• Resources should include examples of SLPs successfully using UDL (e.g., include quotations from school-based SLPs and examples of SLPs using UDL from the literature).

Note. Information for innovation characteristics adapted from Rogers (1995), for incorporations in educational resources from Kennedy et al. (2018), Lieberman, Lytle & Clarcq (2008) and MEDU (2013).

Table 2

Incorporation of the Five Adopter Categories into Educational Resources

Adopter Category	Examples Used to Target Adopter Category in Educational Resources
Innovators: The individuals who want to be the first to try out an innovation. They are visionaries, imaginative, and are willing to take risks.	- Innovators are the school-based SLP Working Group members who assisted with resource development. - Quotes from WG members show students that there are SLPs using UDL successfully.
Early adopters: These are individuals who influence change and adoption of innovations. They are typically trend setters, enjoy leadership roles, and have money and time to invest in the innovation.	Early adopters are SLP students who have worked or completed placements within the school-board and have an interest in becoming a school-based SLP. Promote sharing of stories and enthusiasm for UDL by inviting students who have been exposed to UDL to share their experiences.

Table 2 (continued)

Incorporation of the Five Adopter Categories into Educational Resources

Early Majority: These individuals are typically not found within leadership roles, but they are faster to adopt innovations than the typical person. These individuals require rationale and proof to adopt the innovation and respond well to simplicity of innovations. They will only adopt an innovation if they feel it has real benefits.	• Demonstrate rationale for using UDL, how to apply UDL, and available evidence about UDL. • Ensure resources are simple and easy to understand.
Late Majority: These individuals are more cautious towards new ideas and innovations. They usually only adopt an innovation after seeing it used by peers. When working with them, it is important to focus on social norms and emphasize the risk of being left behind.	• Highlight social norms by providing examples of how other SLPs are using UDL, emphasizing UDL adoption by Ministry of Education, providing opportunity to apply UDL in class, and having a longer version of the SLP-tailored UDL Guidelines handout that provides an extensive list of practical examples.

Table 2 (continued)

Incorporation of the Five Adopter Categories into Educational Resources

Laggards: These individuals typically will not adopt an innovation. They are very conservative and do not try new things. When working with them, address their criticisms, and show how other laggards have successfully adopted UDL.	• Similar to Late Majority but ensure adequate time is provided to address any questions or criticisms these SLP students may have regarding UDL.

Note. Information for adopter categories adapted from Rogers (1995) and Borough (2017).

Step 1: ADDIE (Analysis Phase)

Needs analysis of SLP knowledge and application of UDL in school settings by analyzing the literature. Extended from a previously conducted scoping review examining UDL use by SLPs in school settings. Further extracted all UDL examples from these SLP-UDL articles to use in resources.

Step 2 : ADDIE (Design Phase) + DOI Theory

1. Mapping of every applicable DOI element to resource components to inform resource development during drafting process.

2. Drafting of resources based on content from Analysis phase and development of student learning objectives using Bloom's Taxonomy.

Step 3: ADDIE (Development Phase)

1. Two WG meetings held with school-based SLPs to elicit feedback on resources and tailor final products. Revisions to resource drafts were made based on WG feedback. Final resources developed.

2. Resources were tested over a Rehabilitation Science audience and further revisions were made. Final resources include: PowerPoint, case studies and SLP-tailored UDL guidelines handouts.

Figure 1. Process of educational resource development using the first three phases of the ADDIE instructional design model combined with DOI theory. Steps 2 and 3 were iterative as resource revisions made to drafts based on WG feedback. To make these revisions and develop new drafts resulted in re-entering the ADDIE Design phase and then moving back into the Development phase to then gain more feedback and test resources to then develop the final resource products.

Appendix A

Focus Group Guide

As a part of employing this novel development process, we want to learn about your perspectives as members of this Working Group. We want to better understand your overall experience in helping to design these educational resources. We want to understand your thoughts about the working group meetings, and if you felt following this process and participating in designing the resources was meaningful and useful. We encourage everyone to participate; you might have different opinions and feedback and we are interested in capturing the variety of responses and opinions of all working group members. This is a safe environment and all comments and feedback are welcome.

To ensure confidentiality, we ask that you do not share any information discussed here outside this room. To capture the discussion accurately, we will be recording our discussion. However, the information that you share will be used only for research purposes and will remain confidential. We will provide a written summary of our findings to each one of you, as well as further study results after completion of Phase 2 and utilization of the resources that you all helped to design!

Do you agree to be recorded? □ YES □ NO

This interview will explore three major themes:

1. Your perception of being a part of the design process of these education resources.

2. Your perception in the flow and methodology of each working group meeting.

3. Your suggestions and specific comments regarding pros and cons of the process.

Do you consent to participate in this focus group? □ YES □ NO

Do you have any questions before beginning the interview?

Questions

1. Can you tell me about your overall experience in being a part of this Working Group?

2. What did you especially enjoy during each meeting?

3. What would you have changed or added to each meeting?

4. How did you feel about being a part of designing these educational resources?

5. Did you find the meetings to be an effective way in helping provide feedback to develop these resources?

6. What were the benefits of the process we followed?

7. Were there any drawbacks or challenges in the process that we followed?

8. Would you recommend this as a process for developing instructional resources? Why or why not.

Do you have any additional comments or remarks to add?

Thank you for your collaboration.

Chapter Three: Manuscript #2

Implementing Educational Resources About Universal Design for Learning with

Speech-Language Pathology Students: A Pilot Study to Evaluate Feasibility

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Preparing for submission to: Canadian Journal of Speech-Language Pathology and

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Abstract

BACKGROUND: Although speech-language pathologists (SLPs) who work in schools need to be well-versed in inclusive education frameworks such as Universal Design for Learning (UDL), many are not familiar with UDL and do not know how to apply it. One way to close this gap is to introduce UDL at the pre-professional level. To do so, professional graduate programs need quality educational resources to teach SLP students about UDL.

PURPOSE: To assess SLP students' perceptions of the feasibility (i.e., practicality and acceptability) of educational resources about UDL and to assess the impact of resource implementation on their perceived and actual knowledge of UDL.

METHOD: Nineteen SLP students participated in a three-hour session about UDL. Resource feasibility and UDL knowledge were measured before and after the session using anonymous, web-based questionnaires. Fifteen students completed the pre-questionnaire, 10 completed the post-questionnaire, and eight completed both questionnaires.

RESULTS: SLP students perceived the educational resources to be practical and acceptable. Students' perceived knowledge of UDL was statistically significantly higher after resource implementation. Actual knowledge of UDL also increased as evidenced by more accurate use of UDL terminology after the session.

CONCLUSION: This study introduced a new set of resources that show promise for addressing an important gap in the knowledge and training of student SLPs. Replication

of the study with a larger sample and the addition of a control group would enhance the

strength of this evidence.

Keywords: Universal Design for Learning, Speech-Language Pathology, inclusive

education, health professional education

Implementing Educational Resources About Universal Design for Learning with Speech-

Language Pathology Students: A Pilot Study to Evaluate Feasibility

Inclusive education is the acceptance and meaningful involvement of all students

into neighbourhood classrooms with their same-age peers with any necessary supports

required for success (MEDU, 2009; Porter, 2014). Speech-Language Pathologists (SLPs)

who work in schools need to know how to support inclusive education practices (Tomas,

Cross, & Campbell, 2018). Universal Design for Learning (UDL) is a framework that

educators use to support inclusive education (Meyer, Rose, & Gordon, 2014). SLP

students would benefit from learning about UDL to enhance their preparation for school-

based practice (Campbell, Selkirk & Gaines, 2016).

Universal Design for Learning

UDL has three principles: 1) involve students in their own learning through

multiple means of engagement; 2) deliver information and content through **multiple**

means of representation; and 3) assess learning through **multiple means of action and**

expression (Meyer et al., 2014). Each UDL principle has three corresponding

'guidelines' (Meyer et al., 2014). For example, the principle '**multiple means of**

engagement' includes guidelines for recruiting students' interests, sustaining effort and

persistence, and supporting self-regulation (Meyer et al., 2014). Further, each guideline

includes 'checkpoints' that provide strategies for implementation (Meyer et al., 2014).

For example, students' interest can be recruited by optimizing choice and autonomy

(Meyer et al., 2014). A complete description of the UDL guidelines framework is

available at www.udlguidelines.cast.org.

Whereas researchers consistently report that students who are exposed to UDL feel greater academic confidence, show increased motivation to learn, and are more involved in their learning (Daley & Rose, 2018; Dean, Lee-Post, & Hapke, 2017; Ok, Rao, Bryant, & McDougall, 2017; Rappolt-Schlichtmann et al., 2013; Rose & Strangman, 2007; Smith & Lowrey, 2017), they are less certain about the impact of UDL on students' academic performance (Ok et al., 2017). Challenges with research design, the fidelity with which UDL is implemented, and the use of broad-based standardized assessments to measure content specific outcomes may contribute to gaps in the evidence base (Kennedy et al., 2014; Kohn, 2000; Ok et al., 2017; Rappolt-Schlichtmann et al., 2013). Nevertheless, there is an imperative to move forward with a framework that supports inclusion; thus, the UDL framework currently is utilized or recommended for use in multiple jurisdictions in Canada (MEDU, 2005; 2013; Ontario Human Rights Commission, 2018; BC Ministry of Education, 2011; Alberta Ministry of Education, 2015).

SLPs' Knowledge about UDL

Although UDL figures prominently in education research and policy, many SLPs are not familiar with this framework (Campbell et al., 2016). In a 2016 survey of 91 Canadian school-based SLPs, 30% of respondents had never heard of UDL, and among those who had, a majority were not confident that they could describe the UDL principles in relation to the SLP profession or implement UDL-based strategies in a classroom setting (Campbell et al., 2016). More recently, researchers reported that school-based SLPs rarely use UDL terminology even when recommending or applying inclusive

strategies in the classroom (Kennedy et al., 2018). Initiatives are needed that increase

awareness, knowledge, and a common understanding of UDL (Campbell et al., 2016).

SLP students are one group whose knowledge of UDL could be enhanced

(Ralabate et al., 2014; Suleman et al., 2013; Zurawaski, 2014). Our team developed

educational resources about UDL for SLP students (Tomas, Solomon, Hamilton, &

Campbell, 2018). In brief, we employed a theory called Diffusion of Innovations (DOI),

which suggests how to frame ideas to increase adoption by a target audience (Rogers,

1995), together with an instructional design model called Analysis, Design, Development,

Implementation and Evaluation (ADDIE; Allen, 2006; Peterson, 2003). As part of the

Analysis phase (Allen, 2006; Peterson, 2003), we reviewed literature to identify the

educational needs of our target population (e.g., Kennedy et al., 2018). In the Design

phase, we planned and drafted resources to target these educational needs (Allen, 2006;

Peterson, 2003), drawing on DOI theory to tailor resource content (Rogers, 1995). DOI

theory suggests how to package content in ways that appeal to learners who respond

differently to new ideas. For example, some learners prioritize research evidence or

endorsement by peers while others want to try out new ideas themselves (Rogers, 1995).

In the Development phase, we engaged practicing school-based SLPs to review and refine

our resources (Peterson, 2003; Allen, 2006). A full description of our approach is

available in Tomas et al. (2018). This paper focuses on the implementation and evaluation

phase of the ADDIE model (Peterson, 2003; Allen, 2006; Reinbold, 2013). Our objectives

were to determine if our resources were feasible, meaning practical and acceptable, and to

assess if students' knowledge of UDL changed following resource implementation.

Method

Participants

Following approval from the Hamilton Integrated Research Ethics Board (HiREB #3963), we sought participants from a convenience sample of 28 graduate students completing their pediatric unit in their first year of McMaster University's SLP Program. Of the 28 students eligible to participate, 15 voluntarily completed an anonymous pre-questionnaire prior to implementation of the educational resources. Nineteen students attended the class during which the educational resources were delivered. Following delivery of the educational resources, 10 students voluntarily completed an anonymous post-questionnaire. Of these students, 8 had matching pre-questionnaires. Two of the eight students had completed a school-based practicum, and all indicated they had previously heard of the term UDL.

Materials

Educational Resources. Resources included a multi-media PowerPoint presentation, two case studies, and two UDL guideline handouts (Tomas et al., 2018). The PowerPoint presentation provided a definition of UDL, an overview of the UDL guidelines, Ontario Ministry of Education documents that recommend UDL, evidence that supports UDL with acknowledgement of gaps, and examples of UDL strategies implemented by SLPs. The two case studies illustrated how SLPs could apply the UDL guideline strategies in a classroom setting. The UDL guidelines handouts included strategies specific to SLPs that had been extracted from a published scoping review

(Kennedy et al., 2018). Students received an abbreviated version for use with the case studies and an extensive version for future reference.

Questionnaires. The pre-questionnaire inquired about students' general awareness of the term UDL, experience working in school settings, and knowledge of UDL. The post-questionnaire repeated the questions about knowledge of UDL and probed students' perceptions of the resources as practical and acceptable. Both questionnaires included a mixture of closed- and open-ended items. Closed-ended items were phrased as a statement with students using a 7-point scale to rate their agreement with the statement, where 1 corresponded to strongly disagree and 7 to strongly agree (Dillman, Smyth & Christian, 2014; Gob, McCollin & Ramalhoto, 2007). All questionnaire items were reviewed independently by the authors for face validity (Lavrakas, 2008).

Practicality. Practicality refers to the time, efficiency, and overall usefulness of resources (Bowen et al., 2009). Students responded to three questions about the time allocated to each resource and three questions about the usefulness of content. They also nominated the most and least helpful resources, including the reason for their selection.

Acceptability. Acceptability refers to the overall attractiveness, quality, and suitability of resources (Bowen et al., 2009). Students responded to eight questions about resource quality, visual attractiveness, and understandability of information. They also answered nine questions about the relative importance of content included in the resources based on DOI theory.

Perceived and actual UDL knowledge. Eleven questions asked students about their perceived knowledge of UDL. Actual UDL knowledge was examined using an

open-ended question where participants were asked to describe their understanding of

UDL.

Procedure

The first author delivered the educational resources during a 3-hour class as part

of the students' regular coursework. The PowerPoint presentation was delivered first and

included opportunities for discussion and a guided example of how to apply UDL. Next,

students received the abbreviated UDL guidelines strategy handout and the two case

studies. Working in small groups, students explored the cases and then shared their

responses during a facilitated class discussion.

We administered questionnaires through Research Electronic Data Capture

(REDCap) software housed on a secure network at McMaster University (Harris et al.,

2009). We shared a link to the pre-questionnaire one week before and to the post-

questionnaire for one week after resource implementation. Students received one

reminder for each questionnaire. Students generated their own unique identifier; thus, no

identifying information was collected.

Data Analysis

We used STATA/IC Version 15 to analyze numerical data. Medians and

interquartile ranges (i.e., the difference between the 25th and the 75th percentile; IQR)

estimated central tendency and variability, respectively. We compared students' pre- and

post-ratings of their perceived knowledge of UDL using the Exact Wilcoxon Signed Rank

test (Harris & Hardin, 2013) with two-tailed probability and significance level of 0.05 We

applied a manifest approach to content analysis to determine the frequency with which

students used words associated with UDL in their responses to open-ended questions

(Cash & Snider, 2014; Graneheim, Lindgren, & Lundman, 2017; Potter & Levine-Donnerstein, 1999).

Results

Practicality

As shown in Table 1, participants (*n*=10) perceived the resources to be practical as indicated by median scores of either 6 or 7 for all items. The IQR ranges fell in the upper end of 'neutral' to 'strongly agree' with small IQR differences indicating minimal response variability. When asked to rank order the resources from most to least helpful, six participants rated the SLP-tailored UDL guidelines as most helpful, followed by the case studies (*n*=5), and the PowerPoint presentation (*n*=3). Three participants chose more than one resource as most helpful. Participants stated that the UDL handouts were valued because they addressed application of UDL, included examples, and were a resource for future practice. Participants similarly valued the case studies for their focus on application as well as their stimulation of discussion. Participants described the PowerPoint as visually appealing but repetitive.

Acceptability

As displayed in Table 2, participants (*n*=10) perceived the resources to be acceptable. Across these eight items, median responses were all 7, which corresponded to 'strongly agree' on the rating scale. IQR ranges were in the upper end of 'neutral' and 'strongly agree;' indicating minimal response variability. As shown in Table 3, participants (*n=*10) perceived that content tailored using DOI theory was important and

relevant. Medians were in the 'strongly' agree category with the IQR ranging from 'neutral' to 'strongly agree.' The exception was an item that asked about the importance of including quotes from school-based SLPs about the value of UDL to school-based practice. For this question, participants endorsed a neutral median value of 4.5.

Perceived UDL knowledge

As shown in Table 4, the 25th and 75th percentiles corresponded to higher values (e.g., neutral and strongly agree) in the post-questionnaire relative to the pre-questionnaire. IQR differences also decreased in post-questionnaire data compared to pre-questionnaire, indicating a decrease in response variability. This suggested that participants felt they were more knowledgeable about UDL after exposure to the educational resources. This observation was verified by the Exact Wilcoxon Signed Rank test, which showed a statistically significant difference in pre- and post-responses (p=0.001; S=33.000).

Actual UDL knowledge

Relative to their description of UDL on the pre-questionnaire, participants increased their use of words associated with UDL on the post-questionnaire, such as 'guidelines', and decreased their use of words like 'accommodate' that are not associated with UDL. This suggests that participants were more accurate in their description of UDL after attending the class session.

Discussion

Given the mandate for inclusive education in Canada (Towle, 2015; Inclusive Education Canada, 2017; MEDU, 2013), SLPs need to be informed about inclusive education practices and frameworks like UDL (Suleman et al., 2013; Zurawaski, 2014). SLPs have identified a need for education and training on the topic of UDL (Campbell et al., 2016), with SLP students constituting an important audience to target (Suleman et al., 2013). To our knowledge, researchers have yet to explore the usefulness of teaching SLP students about UDL nor has anyone evaluated the feasibility of doing so.

With respect to our findings, it may seem unusual that the 15 students who completed the pre-questionnaire had all heard of UDL prior to resource implementation, especially given Campbell et al.'s (2016) report that many practicing SLPs did not know this term. This finding may reflect McMaster University's approach to graduate education where faculty implement UDL in their own teaching (W. Campbell, personal communication, January 18, 2019). Therefore, students' general awareness of the term UDL may be explained by their previous exposure to its use by faculty. Less surprisingly, however, was our finding that most students did not feel confident in their ability to explain UDL or how to apply it to a clinical situation. This may reflect the fact that students had not been exposed to a full explanation of the UDL framework and may not have thought about UDL through the lens of their future clinical practice. In this respect, the SLP students in this study appeared similar to their counterparts in practice, who when surveyed in 2016, had reported lacking confidence in their ability to explain how

UDL was relevant to their role in the schools or in applying it in their collaborations with educators (Campbell et al., 2016).

As enhancing knowledge about UDL was a key reason for conducting this study, it was encouraging that we detected statistically significant change in students' perceived knowledge of UDL. Specifically, we found that with three hours of instruction, students felt more confident in their knowledge of UDL and in their ability to apply UDL in the context of a case study. As well, students used terminology more accurately when describing UDL in their own words. Thus, our findings suggest that our resources may be able to address a previously unmet need to increase SLPs' knowledge of UDL (Campbell et al., 2016).

Another important finding from this study is reflective of our approach to developing educational resources. Students' perception of our resources as practical and acceptable suggests that we were successful in tailoring them to this population. SLP students valued resource content informed by DOI theory (Rogers, 1995), and reported the handout and the case studies to be most helpful. These resources were included because DOI theory emphasizes the importance of trialling new ideas and being able to observe others do the same (Rogers, 1995). This suggests that using theories, like DOI, when developing resources may facilitate knowledge uptake, an observation that is consistent with research in knowledge translation (Tabak et al., 2012; Eccles et al., 2005).

Overall, our study offers an initial step toward closing knowledge gaps among SLPs who work in education settings (Campbell et al., 2016; Kennedy et al., 2018; Suleman et al., 2013). Although our results are promising, given that our study design did

not include a control group, we cannot be certain that changes in students' perceptions of UDL knowledge were causally linked to our resources. Evaluation of our resources would benefit from implementation with a larger sample of SLP students using a control group to determine consistency in results.

Limitations

As this was a pilot study our findings are not be representative of the broader group of SLP students. Although we had hoped to recruit larger numbers, resource implementation occurred just prior to examinations, which may have negatively impacted recruitment. Second, self-selection bias may have contributed to the overall positive response to our educational resources (Lavrakas, 2008). The students who participated may have been those most receptive to UDL or who felt most positive about our session. Finally, participants did not complete the questionnaires in a controlled environment; therefore, students may have consulted resources about UDL during questionnaire completion.

Future Research

Ideally, our educational resources would be implemented with an additional cohort of students to re-assess feasibility. The addition of a control group would help determine the effectiveness of the educational resources as a mechanism to change UDL knowledge. Should effectiveness be established, a longitudinal study could be considered to determine if learning about UDL translates to its application in practice.

Conclusion

This pilot study evaluated the feasibility of newly created educational resources about UDL for SLP students as well as changes to students' knowledge of UDL. With the shift towards inclusive education in Canada (Towle, 2015), future school-based health professionals need to be able to implement inclusive practices, collaborate with educators, and provide the necessary supports for all students to succeed. This study is a step towards decreasing a gap in UDL knowledge among the SLP community (Campbell et al., 2016).

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Table 1

Students' Perceptions of Resource Practicality (n=10)

Question	Median (IQR[a])
"Time allocated to PowerPoint was appropriate"	6 (6,7)
"PowerPoint provided the right amount of information"	6 (5,7)
"Time allocated to completing case studies was appropriate"	6.5 (6,7)
"Case studies provided real-life situations"	7 (6,7)
"Time allocated to exploring UDL guidelines handout was appropriate"	6 (5,7)
"Applying the handout to the case study was useful"	6.5 (6,7)

[a]Interquartile range.

Table 2

Students' Perceptions of Resource Acceptability (n=10)

Question	Median (IQR[a])
"PowerPoint provided new UDL knowledge"	7 (7,7)
"PowerPoint was easy to follow"	7 (6,7)
"Good mixture of visual representation of content"	7 (6,7)
"Case study descriptions provided appropriate detail"	7 (5,7)
"Case studies were easy to follow"	7 (5,7)
"Handout was manageable to use with case studies"	7 (6,7)
"Handout provided sufficient SLP examples"	7 (6,7)
"Instructions on how to use UDL guidelines with case studies were easy to understand"	7 (6,7)

[a]Interquartile range.

Table 3

Students' Perceptions of Content Informed by DOI Theory (n=10)

Question	Median (IQR[a])
<u>"It was important to me that…"</u>	
"the presentation included quotes from school-based SLPs about how they use UDL in daily practice".	4.5 (4,5)
"the presentation included a summary of current research evidence about UDL".	6 (5,7)
"the presentation explained how UDL is compatible with the Ministry of Education's Learning for All document".	6 (5,6)
"the presentation mentioned the potential benefits of UDL".	7 (6,7)
"I had an opportunity to apply the UDL Guidelines to the case studies".	6.5 (6,7)
"I had a longer version of the UDL Guidelines to takeaway as an additional resource".	7 (6,7)
"we had a group discussion about the case studies and UDL Guidelines to observe how my peers would apply UDL".	6 (6,7)

Table 3 (continued)

Students' Perceptions of Content Informed by DOI Theory (n=10)

"the UDL Guidelines handout had practical examples of how SLPs can use UDL in their clinical practice".	7 (6,7)
"the American Speech-Language-Hearing Association supports a role for SLPs in using UDL in schools".	6.5 (6,7)

[a]Interquartile range.

Table 4

Students' Perceived Knowledge of UDL Before and After Resource Implementation (n=8)

Question	Before Median (IQR[a])	After Median (IQR)
"I can name the 3 UDL principles"	2 (1,3)	7 (7,7)
"I can define the first UDL principle"	2 (1,4)	6.5 (6,7)
"I can define the second UDL principle"	2 (1,4)	6.5 (6,7)
"I can define the third UDL principle"	2 (1,2)	6.5 (6,7)
"I can explain the importance of UDL for SLPs who work in schools"	5 (4,5)	7 (6,7)
"I can explain the UDL guidelines"	2 (1,2)	6 (5,6)
"I can apply the UDL guidelines to case studies"	2 (2,2)	6 (5.5,6.5)
"I can choose appropriate UDL strategies to apply in case studies"	3 (1,4)	6 (6,7)
"I can list at least 2 potential benefits of UDL application in the classroom"	5 (4,6)	7 (6,7)
"I can paraphrase current evidence regarding use of UDL by educators and SLPs"	1 (1,2)	6 (5,6)
"I can explain why there is a need for more evidence about UDL implementation by SLPs"	3 (2,6)	6.5 (6,7)

[a]Interquartile range.

Chapter Four: Concluding Chapter

Inclusive education increasingly is mandated within Canadian schools (Archibald, 2017; Inclusive Education Canada, 2017; Towle, 2015). Speech-language pathologists (SLPs) who work in schools need to be knowledgeable about inclusive education frameworks, such as Universal Design for Learning (UDL) (Daley & Rose, 2018; Meyer, Rose & Gordon, 2014; Rose & Strangman, 2007). Indeed, the Ontario Ministry of Education (MEDU) recommends that educators use the UDL framework when designing and differentiating instruction (MEDU, 2005; MEDU, 2013). As well, the latest Ontario Human Rights Commission (OHRC) policy on accessible education recommends UDL as an approach to inclusive education (OHRC, 2018). Given such directives, Ontario school-based SLPs who are familiar with UDL might find this knowledge supports their integration into the education system and their collaborations with educators. However, many school-based SLPs appear to have little knowledge about UDL and are uncertain about how they would apply this framework in their role (Campbell, Selkirk & Gaines, 2016). There is a need to inform the SLP community about inclusive education frameworks like UDL (Campbell et al., 2016; Ralabate et al., 2014; Zurawski, 2014). Researchers have emphasized the importance of teaching SLP students about current practice in the education system and how to collaborate with educators (Ralabate et al., 2014; Suleman et al., 2013). By beginning training at the student level, these pre-professionals can be better prepared to apply UDL and collaborate with educators when entering the workforce.

Master's Thesis

Overview

My Master's thesis addressed the knowledge gap regarding SLPs' unfamiliarity with UDL by developing, implementing, and evaluating educational resources about UDL for SLP students. In Chapter 2, I described the first phase of my thesis in which I integrated a knowledge translation (KT) theory, Diffusion of Innovations (DOI; Rogers, 1995), into the Analysis, Design, Development, Implementation and Evaluation instructional design model (ADDIE; Allen, 2006; Peterson, 2003). Specifically, I carried out the first three steps within the ADDIE model (Analysis, Design, and Development), applying DOI theory during the Design step. As part of the Development step, I also engaged three school-based SLPs as members of a Working Group to help revise and refine my resources for SLP students. Because this aspect of my resource development process was novel, I solicited feedback from the three SLPs about their experience with my project. All felt positively about the development process, recommending its use by others seeking to develop educational resources for health professional students. Through combining DOI theory, the ADDIE instructional design model, and engaging key stakeholders, I developed three types of high-quality theory-informed educational resources to teach SLP students about UDL.

In Chapter 3, I described the second phase of my thesis, in which I executed the last two phases of the ADDIE model (i.e., Implementation and Evaluation; Allen, 2006; Peterson, 2003). Specifically, I delivered the three types of educational resources to SLP students during one three-hour class session and administered questionnaires before and

after my session to assess students' perceptions of the practicality and acceptability of

resources (e.g., feasibility) as well as change in students' perceived and actual UDL

knowledge. Results indicated that students felt the three types of educational resources

were both practical and acceptable in their delivery, content, quality, and usefulness.

Students' perceived and actual knowledge of UDL improved following exposure to the

resources in the class session.

Major Findings and Contributions

   Phase one. To my knowledge, the paper contained in Chapter 2 is the first to use

DOI theory (Rogers, 1995) in conjunction with the ADDIE model (Allen, 2006; Peterson,

2003) to develop educational resources. The inclusion of DOI theory contributed

meaningfully to the innovative resource development methodology and bolsters the view

that KT theory is essential in guiding development of KT strategies (Eccles et al., 2005;

Estabrooks, Thompson, Lovely & Hofmeyer, 2006; Levac et al., 2015; Tabak, Khoong,

Chambers, & Brownson, 2012). Researchers have identified a need for papers that

systematically describe the process of applying KT theory to inform KT strategies

(Davies, Walker & Grimshaw, 2010; Scott et al., 2012; Squires, Sullivan, Eccles,

Worswick & Grimshaw, 2014). This innovative methodology contributes to the fields of

instructional design and KT by illustrating how DOI theory and ADDIE can be used in

tandem to develop high-quality, theory-informed educational resources for health

professional students. We have provided a systematic description of how we navigated

each phase of the ADDIE model and how we integrated DOI theory within this model to

inform resource content.

The educational resource development process used in Phase one of my thesis also extended Levac and colleagues' (2015) best-practice recommendations for resource development in rehabilitation science. Levac and colleagues suggested that development of educational resources requires assessing the target audience's needs, summarizing key evidence, using KT theory to inform and guide resource development, and including multimedia content to enhance visual appeal (Levac et al., 2015). Our novel process of using DOI theory and ADDIE followed these recommendations and extended them in the following ways: 1) by systematically and thoroughly describing our methodology, we have offered a reproducible process that could be tailored and applied to other health professional populations; and 2) by including key stakeholders and soliciting their feedback, we learned that our process was practical, useful, and resulted in the inclusion of important content that we would not have known about otherwise.

It also is important to note that we had only three stakeholders partake in the resource development process. These school-based SLPs may have been more interested in, and knowledgeable about, UDL compared to other school-based SLPs. Reflecting on using this methodology in the future, it would be useful to include additional stakeholders with varying knowledge and expertise of UDL. In doing so, the resource content could be framed around the stakeholders' varying knowledge levels of UDL to better target those students who might have similar or less awareness of UDL. As well, with engaging more stakeholders during the development process, I would gain other perspectives regarding the suitability and usefulness of the resource development process.

Stakeholder engagement during curriculum and course content development is not a new concept and has been linked to enhanced curriculum quality. For example, key stakeholders were involved in developing a new Master of Nursing program in Hong Kong (Tiwari, Chan & Law, 2002). Stakeholder groups included nursing students, nursing faculty, practicing nurses and nurse leaders who participated in focus groups, workshops, and interviews to assist in curriculum development over the span of six months (Tiwari et al., 2002). Through engaging stakeholders, the authors noted that the new nursing curriculum reflected the reality of what these pre-professionals would experience in the field (Tiwari et al., 2002). Chatterji et al. (2016), included key stakeholders in the development of a Health Information Technology (HIT) community college curriculum. The stakeholder groups included college instructors and content experts, who participated in structured reviews to validate and enhance curricular content (Chatterji et al., 2016). Overall, literature that includes stakeholder engagement during graduate level healthcare curriculum development is limited. Also, these articles do not assess the stakeholder experience or gain feedback regarding the curriculum development process. Although the methodology used in my Phase one paper was not to develop an entire curriculum, it is contributing to the literature by including and assessing stakeholder engagement for developing educational resources in graduate healthcare courses.

Authors of the aforementioned studies (Tiwari et al., 2002; Chatterji et al., 2016) emphasized that the stakeholder engagement process was time-consuming and intensive. I also found the methodology used in Phase one of my thesis to be intensive, time-

consuming and mentally fatiguing. This methodology would not be feasible for educators

who do not have the time or resources to conduct each phase of the ADDIE model,

engage key stakeholders, and inform resource content using DOI theory. The duration for

implementing the methodology used in Phase one took around five months, which is not

feasible for educators who have strict deadlines.

Despite being time-consuming, there are areas of practice where this theory-

informed evidence-based methodology could be useful, and in some instances, even

necessary. For example, teaching evidence-based practice (EBP) in graduate level courses

has been a consistent area of challenge for allied health educators (Kamhi, 2006; Newman

et al., 1998; O'Connor & Pettigrew, 2008). Allied professionals, such as SLPs are taught

about EBP in graduate school; however, many practicing SLPs still feel they do not have

the required skillset to locate and analyze evidence-based research once they enter

practice (Kamhi, 2006; O'Connor & Pettigrew, 2008). In a survey conducted by

O'Connor & Pettigrew (2008) on 32 practicing SLPs in Ireland, half of the participants

felt they did not have the skills needed to understand 'statistical results' or critically

analyze the latest research. As well, there is a consensus among allied health

professionals feeling they lack proper appraisal and research skills (Delany &

Bialocerkowski, 2011; McClusky, 2003).

Despite EBP being taught to allied health students (Delany & Vialocerkowski,

2011; Zipoli & Kennedy, 2005), there is a clear need for improved methodologies in

developing resources that will effectively teach these pre-professionals about EBP.

Through using the proposed methodology in Phase one, educators could assess gaps in

knowledge and carefully examine students' needs to help understand why EBP is

challenging for students to learn and apply. Due to our methodology's evidence-based

and theory-informed nature, it would be worth allocating the time and energy to develop

resources that could effectively teach EBP to allied health students.

Phase two. In Chapter 3, I described implementing the educational resources with

SLP students at McMaster University and evaluating resource feasibility (practicality and

acceptability) along with the impact on SLP students' perceived and actual knowledge of

UDL. Phase two results indicated that SLP students felt our educational resources were

practical and acceptable, which suggests that the development process used in Phase one

was effective in creating high-quality resources that students considered pertinent and

suitable for their field. Specifically, use of DOI theory ensured each of the three resource

components had a theory-informed purpose. SLP students rated the handout and case

study resources, which represented the DOI theory components of 'trialability' and

observability', as being most helpful in learning about UDL. Students also indicated that

content included in the resources as suggested by DOI theory (e.g., endorsement by

voices of authority such as the MEDU) was valuable and important for them to know.

Currently, there are no studies involving training of SLP students on the topic of

UDL despite the need to increase SLP student training on educational frameworks

(Suleman et al., 2013). Phase two assisted in closing this gap by demonstrating that there

was a statistically significant increase in students' perceived UDL knowledge from pre- to

post-resource implementation. This suggests that even with only a few hours of resource

implementation, SLP students felt more confident in their knowledge about UDL and

how to apply it in school settings. Students also demonstrated change in their actual UDL

knowledge by using more accurate terminology to describe UDL after exposure to the

resources. Given the pilot nature of the study, implementation of these resources with

other SLP students across other programs is warranted to verify our findings.

     Using UDL to develop the educational resources. Increasing UDL knowledge

among the SLP student population was one goal of my thesis research; however, UDL

played another important role throughout this research. Although I did not formally

integrate UDL into the methodology I used to develop the resources, I did use the

framework in a guiding role when initially creating the resources during the Design

phase. For example, I included videos, images, and diagrams throughout the PowerPoint,

following UDL checkpoint 1.3, offering alternatives for visual information (CAST,

2018). I applied UDL checkpoint 7.2, optimizing relevance, value, and authenticity

(CAST, 2018), by explaining how UDL is relevant to SLPs. I also applied UDL

checkpoint 8.3, fostering collaboration and community (CAST, 2018), by encouraging the

SLP students to work through the case studies in groups and having the opportunity to

discuss case study responses as a class. Therefore, by applying UDL strategies throughout

resource development, I was also designing my resources to be accessible and inclusive.

Levac and colleagues' (2015) also recommended using multi-media and visual images,

which is consistent with UDL checkpoints 1.3, offering alternatives of visual information,

and 2.5, illustrate through multiple media (CAST, 2018).

Limitations

Although results across the two phases of my thesis were promising, there were limitations that need to be acknowledged. First, the SLP stakeholders engaged throughout the resource development process represented perspectives from only two school boards. Stakeholders also were familiar with and enthusiastic about UDL. Input regarding the resources and overall views of the development process may have differed if we had a larger stakeholder group with varied UDL knowledge and experience. Second, when implementing the resources in the Phase two pilot study, we had a small sample size. Therefore, our positive findings regarding acceptability and practicality may not be representative of the broader SLP student population. Third, self-selection bias may have contributed to the positive results (Lavrakas, 2008). The SLP students who participated in the pilot study may have been more interested in UDL or may have felt more positively about the resource implementation process. Finally, for Phase 2, questionnaires were not completed in a controlled environment. It is impossible to know if students consulted other resources when completing the questionnaires, potentially impacting results.

Future Research

The novel resource development process implemented in this thesis using DOI theory, ADDIE, and engagement of key stakeholders could be considered by other health educators needing to develop content-specific resources for health professional students in areas where no materials exist. This methodology was deemed suitable and realistic for developing evidence-based high-quality resources for health professional students. Through further application of this methodology in other health professional fields, more

information can be obtained to determine if the methodology is indeed suitable and

realistic.

The educational resources developed in this thesis could be considered by other

Ontario SLP Programs looking to teach their students about UDL. Feasibility of these

resources should be assessed again to determine if the positive results from this Phase two

pilot study are representative of the general SLP student population. Further evaluation of

these resources should include control-group with a larger sample size to determine

effectiveness in enhancing UDL knowledge. Once effectiveness is established, these

resources could serve beneficial for Ontario school-based SLPs. With the increase in

inclusive education mandates in Ontario (OHRC, 2018; Towle, 2015; MEDU, 2005), and

MEDU's recommendation that educators use UDL (MEDU, 2005; MEDU, 2013), there is

justification to begin teaching these pre-professionals about frameworks they will see

when entering the work-force. Although results are preliminary, this thesis is beginning to

close identified UDL knowledge gaps that should better prepare future SLPs for work in

school settings.

Reflections and Implications

Through conducting my thesis, I observed that the goals of UDL are related to the

field of KT. The field of KT is about delivering information to a target audience in a way

that is suitable to help encourage knowledge change and decision making (Knowledge

Translation Australia, 2016). UDL has similar aims in that the goal is to present curricula

in a format that is accessible and meaningful for all students to optimize learning (Meyer

et al., 2014). At the surface level, these two fields seem different; KT involves health

research and UDL involves education. However, through my thesis work, I believe there is a way to connect these two fields.

When considering the field of KT, UDL strategies could be applied to guide development of KT strategies, such as I did in this thesis when designing the educational resources. Specifically, in Ontario, there are policies regarding accessibility of information and training resources that are used in the workplace and available to the public (e.g., employee training modules, public infographics, public e-modules) (Accessibility for Ontarians with Disabilities Act, 2005). The Accessibility for Ontarians with Disabilities Act (2005) requires that these information and training resources be accessible and inclusive for all Ontarians. For example, KT researchers focus their efforts within the health care sector. These researchers translate health information to the public involving latest research findings in the form of various tools and products like e-resources, videos, or infographics (Brownson, Kreuter, Arrington & True, 2006; Woolf et al., 2015). As well, KT researchers translate health information to various health professionals and policy makers regarding the latest best-practice findings to help influence decision making (Brownson et al., 2006; Woolf et al., 2015). KT researchers and developers need to think about accessibility of their resources and products during the design process, which is when they could integrate concepts of UDL to guide development. The UDL framework provides a means for KT researchers and developers to design resources that are accessible for all potential users, following Ontario provincial mandates (Accessibility for Ontarians with Disabilities Act, 2005).

Alternatively, KT theories, such as DOI, might enhance educator practice in health professional programs and optimize techniques that augment knowledge uptake. For example, including opportunities for students to apply their knowledge regarding a new idea is consistent with DOI theory's element of 'trialability', which emphasizes how important it is for users to test or "try out" innovations (Rogers, 1995). As well, educators could benefit from considering DOI theory's element of adopter categories (Rogers, 1995). Rogers identifies that groups of individuals require varying amounts and types of information before they form an opinion about a specific topic or idea (Rogers, 1995). Educators could consider the various adopter categories to ensure they are reaching all student groups who might have varied interest in the topic. For example, students who fit Roger's 'late majority' or 'laggard' adopter categories may require more information and persuasion to become interested in new ideas (Rogers, 1995). Depending on the student, this might include research evidence supporting the topic, opportunities to hear from practicing clinicians who use the innovation, or information from professional associations such as position statements or guidelines about the innovation. While some educators may include such information in their courses already, it may still be helpful to have a systematic or theory-driven means of considering what information or learning experiences are included in a course and why. Moreover, such considerations might be especially important when educators are introducing new ideas or approaches to practice.

Ultimately, educators not only want to enhance student knowledge, but also impact the way students apply this knowledge beyond the classroom setting. DOI theory is one KT theory that allows educators to support student learning at various levels;

starting with awareness, and eventually developing and enhancing new skillsets and behaviours. By integrating KT theory, like DOI, into the field of education, educators are provided with theoretical information regarding specific strategies and activities that can support and augment student learning.

Conclusion

This thesis not only contributes to the field of rehabilitation science through training SLP students, but contributes to the fields of KT, instructional design, and education. We encourage other health educators to consider use of our innovative resource development process. As well, we hope that with additional testing, our educational resources could become standard resources used to teach SLP students about the topic of UDL. With UDL being a driving force for this thesis, we also encourage those in KT and rehabilitation science to consider the principles of UDL when guiding practice or educating and training others.

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