Engaging Clinicians and Graduate Students in the Design and Evaluation of Educational Resources About Universal Design for Learning

Impliquer des cliniciens et des étudiants de cycles supérieurs dans la conception et l'évaluation de ressources pédagogiques portant sur la Conception universelle de l'apprentissage

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Abstract

The mandate to provide inclusive education in Canadian schools means that speech-language pathologists need to be well-versed in frameworks, such as Universal Design for Learning, that support learning among students with diverse abilities. To be responsive, professional graduate programs need resources that support teaching speech-language pathology students about Universal Design for Learning. The purpose of this article was to demonstrate (a) how we applied an instructional design model and knowledge translation theory to develop educational resources about Universal Design for Learning for speech-language pathology graduate students and (b) how we assessed the feasibility of these resources and students' perceived and actual knowledge change about Universal Design for Learning. We created the educational resources using the first three phases of the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design model together with a knowledge translation theory, Diffusion of Innovations, and through engagement of experienced school speech-language pathologists. Next, we applied the last two phases of ADDIE by delivering our resources to 19 speech-language pathology students during an educational session. We assessed the feasibility of resources and students' knowledge of Universal Design for Learning through pre–post web-based questionnaires. Preliminary findings indicated that students perceived the resources to be practical and acceptable and there was improvement in students' perceived knowledge of Universal Design for Learning. Resources should be implemented in a larger student cohort to reassess feasibility and knowledge change. We believe that this novel resource development methodology could serve useful to educators, researchers, and clinicians to develop high-quality, theory-informed educational resources.

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Abrégé

L'obligation d'adopter des pratiques d'enseignement inclusives au sein des écoles canadiennes se traduit notamment par le fait que les orthophonistes doivent maîtriser différentes approches pédagogiques, telles que la Conception universelle de l'apprentissage, afin de favoriser l'apprentissage chez les élèves ayant des habiletés et des besoins variés. Afin de répondre aux besoins de la profession, les programmes de formation professionnelle de cycles supérieurs en orthophonie doivent avoir accès à des ressources destinées à l'enseignement de la Conception universelle de l'apprentissage. L'objectif de cet article était de présenter (a) la façon dont nous avons eu recours à un modèle d'ingénierie pédagogique et à une théorie de transfert des connaissances afin de mettre au point des ressources pédagogiques portant sur la Conception universelle de l'apprentissage destinées à des étudiants de cycles supérieurs en orthophonie; et (b) la façon dont nous avons évalué s'il était faisable d'utiliser ces ressources pour enseigner la Conception universelle de l'apprentissage et si les connaissances réelles et perçues des étudiants sur cette approche avaient augmenté. Nous avons conçu des ressources pédagogiques en nous appuyant sur les trois premières étapes du modèle d'ingénierie pédagogique ADDIE (analyse, design, développement, implantation, évaluation), sur une théorie de transfert des connaissances (appelée la diffusion de l'innovation) et sur les suggestions effectuées par des orthophonistes expérimentés travaillant en milieu scolaire. Les deux dernières étapes du modèle ADDIE se sont concrétisées par la présentation de nos ressources à 19 étudiants en orthophonie lors d'un cours de leur cursus universitaire. Nous avons évalué s'il était faisable d'utiliser les ressources et si les connaissances des étudiants au sujet de la Conception universelle de l'apprentissage avaient augmenté à l'aide de questionnaires en ligne distribués avant et après la présentation de ces ressources. Les résultats préliminaires indiquent que les ressources ont été perçues comme étant pratiques et acceptables par les étudiants et que ceux-ci ont noté une amélioration de leurs connaissances sur la Conception universelle de l'apprentissage. Ces ressources devraient être présentées à un groupe d'étudiants plus important afin de réévaluer la faisabilité de leur mise en application, ainsi que leur impact sur l'acquisition des connaissances reliées à la Conception universelle de l'apprentissage. Il est de notre avis que la nouvelle méthodologie présentée dans le présent article pourrait s'avérer utile pour le personnel enseignant, les chercheurs et les cliniciens lors de la conception de ressources pédagogiques de qualité s'appuyant sur la théorie.

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 (Ontario Ministry of Education, 2009). Speech-language pathologists (S-LPs) 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). Speech-language pathology students would benefit from learning about UDL to enhance their preparation for school-based practice (Campbell, Selkirk, & Gaines, 2016).

Universal Design for Learning

UDL is an inclusive education framework that emerged from the universal design movement in architecture, where it has long been recognized that designing for physical accessibility from the outset is much better than retrofitting after the fact (Campbell et al., 2016). Developed by researchers at the Center for Applied Special Technology, UDL takes those lessons and applies them to education: Instead of retroactively making one-off changes to the curriculum for individual children, the UDL framework promotes the proactive design of inclusive learning environments that support every child (Center for Applied Special Technology, 2019).

As Meyer et al. (2014) explained, UDL has three principles to guide development of a flexible and accessible curriculum: (a) provide multiple means of engagement by implementing strategies that motivate and engage students in their learning, (b) provide multiple means of representation by conveying content in various ways to increase student recognition and comprehension, and (c) provide multiple means of action and expression by providing options for students to express their knowledge and develop skills. Each UDL principle has three corresponding guidelines to support implementation; for example, the principle *multiple means of engagement* includes guidelines for recruiting students' interests, sustaining effort and persistence, and supporting self-regulation. Further, each guideline includes checkpoints that provide specific strategies for implementing that guideline. For example, students' interest can be recruited by optimizing choice and autonomy.

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 for all students regarding academic performance (Ok et al., 2017). Despite this uncertainty, the UDL framework currently is utilized or recommended for use in multiple jurisdictions (e.g., Alberta Ministry of Education, 2015; British Columbia Ministry of Education, 2011; Ontario Human Rights Commission, 2018; Ontario Ministry of Education, 2005, 2013).

S-LPs' Knowledge about UDL

Although UDL figures prominently in education research and policy, many S-LPs are not familiar with this framework (Campbell et al., 2016). In a 2016 survey of 91 Canadian school-based S-LPs, 30% of respondents had never heard of UDL, and among those who had, a majority were not confident that they could describe UDL in relation to the S-LP profession or implement UDL-based strategies in a classroom setting (Campbell et al., 2016). More recently, researchers reported that school S-LPs rarely use UDL terminology 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). 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, McFarlane, Pollock, Schneider, & Leroy, 2013). Speech-language pathology students are one group that could be targeted to increase UDL knowledge before they enter the workforce (Ralabate, Currie-Rubin, Boucher, & Bartecchi, 2014; Suleman et al., 2013; Zurawski, 2014).

Purpose

With the aim of increasing UDL knowledge among the speech-language pathology student population, the purpose of this article is twofold: (a) to illustrate a theory-informed process of developing educational resources about UDL using a theory from the field of knowledge translation (KT) called Diffusion of Innovations (DOI) theory, combined with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional design model and the involvement of practising school S-LPs and (b) to describe implementation of these newly developed resources with speech-language pathology students and evaluate their perceptions of resource feasibility as well as the impact of the resources on their perceived and actual knowledge of UDL.

Using KT to Increase UDL Knowledge Among Speech-Language Pathology Students

KT describes 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). One component of KT is called knowledge dissemination, which involves the communication of research findings to a target audience by tailoring information to that specific group (Canadian Institutes of Health Research, 2016), such as through educational resources like written materials or presentation slides (Farmer et al., 2008; Gagnon, 2011; Medves et al., 2010). Knowledge dissemination is critical to ensure that important information is available and understandable to the specific target audience. Use of KT theory is recommended to develop effective high-quality dissemination strategies such as educational resources (Eccles, Grimshaw, Walker, Johnston, & Pitts, 2005; Estabrooks, Thompson, Lovely, & Hofmeyer, 2006; Tabak, Khoong, Chambers, & Brownson, 2012). Yet, many authors do not apply KT theory during resource development, nor do they 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 et al., 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).

Diffusion of Innovations: A Theory for Supporting Dissemination

One theory that helps guide dissemination research is the DOI theory (Rogers, 1995). As Rogers (1995) described, DOI theory attempts to explain why some ideas are more likely to be adopted than others and comprises four elements. First, characteristics of the innovation will influence why some innovations are more likely to be adopted than others. For example, the characteristic of *complexity* refers to how easy or difficult it may be for an individual to apply or use the innovation. 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. Third, the communication channel by which messages are delivered can impact uptake of an innovation. 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. 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 (Britto, Schoettker, Pandzik, Weiland, & Mandel, 2007; Cunningham, Rosenbaum, & Hidecker, 2016).

When used in the development of educational resources, DOI theory can inform how to select and tailor the resource content to encourage widespread adoption of the innovation; however, it does not provide an actual stepwise methodology or process on how to develop dissemination strategies like educational resources. Depending on the chosen dissemination strategy, other models can be used to provide a methodology for development. In this case, given that we aimed to develop educational resources, we looked towards instructional design models that could provide guidance and a stepwise methodological process to inform development of high-quality resources (Levac et al., 2015; Peterson, 2003).

ADDIE: A Model for Supporting Instructional Design

ADDIE is a five-phase instructional design model (Allen, 2006; Dick, Carey, & Carey, 2009; Peterson, 2003). First, the Analysis phase involves background research—examining the literature to determine a target audience's learning needs on a topic (Reinbold, 2013). Second, in the Design phase, information gained from the Analysis phase is used to design learning activities and draft educational resources (Reinbold, 2013; Wang & Hsu, 2009). Third, the Development phase involves assembling and validating resources before implementation (Allen, 2006; Peterson, 2003; Reinbold, 2013; Wang & Hsu, 2009). Fourth, the Implementation phase involves the delivery of educational resources to the target audience (Reinbold, 2013; Wang & Hsu, 2009). Fifth, the Evaluation phase measures desired outcomes to ensure educational 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, South, Yanchar, Wilson, & Allen, 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).

ADDIE has proven effective in educational resource design and is recommended to guide resource development (Battles, 2006; Park & Song, 2017; Reinbold, 2013; Shibley, Amaral, Shank, & Shibley, 2011; Wang & Hsu, 2009). Within educational curriculum development, ADDIE provides a model that guides student-centered resource development and improves learning potential (Battles, 2006; Robinson & Dearmon, 2013). For example, ADDIE was successfully used to design effective educational resources about bedside best-practice for undergraduate nurses (Robinson & Dearmon, 2013) and to develop modules that disseminated knowledge on supported employment for

community behavioural health treatment programs (Patel, Margolies, Covell, Lipscomb, & Dixon, 2018).
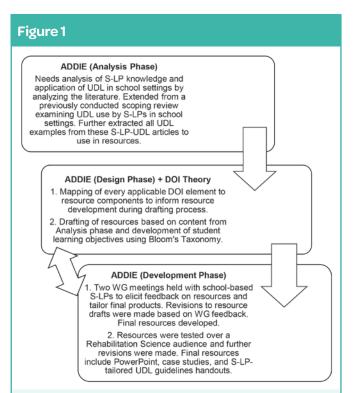
ADDIE is now being recognized for educational resource design within the field of rehabilitation science (Levac et al., 2015). Levac et al. (2005) provided best-practice recommendations regarding development of educational resources informed by KT theories and the ADDIE model in rehabilitation science. 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 and evaluate high-quality, effective educational resources in rehabilitation science (Levac et al., 2015). Consistent with the dual purpose of our study, we will report our study as comprising two major sections: (1) the resource development process and (2) a pilot study involving resource implementation and evaluation.

Section One: A Process for Developing Educational Resources

This study received ethics approval from the Hamilton Integrated Research Ethics Board (HiREB #3963). To achieve our first aim, we drew upon the first three phases of the ADDIE model—Analysis, Design, and Development—and integrated DOI theory into the Design phase (**Figure 1**).

Analysis Phase

In this phase, we sought to determine S-LPs' knowledge about UDL and its current application in school settings. Our work was informed by a scoping review that explored how S-LPs 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 S-LPs 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 S-LPs can implement UDL by collating practical strategies that S-LPs 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 exemplifies the second UDL principle—provide multiple means of representation—specifically, checkpoint 2.2, which is to clarify syntax and structure (Center for Applied Special Technology, 2018). Through this first step, resource content could be framed within the UDL framework by utilizing information gained from Kennedy et al. (2018).

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 working group 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.

S-LP = speech-language pathologist; UDL = Universal Design for Learning; DOI = Diffusion of Innovations; WG = Working group.

Design Phase Supplemented with DOI Theory

We incorporated DOI theory in the Design phase to inform resource learning activities and content before beginning the drafting process. The DOI elements (i.e., innovation characteristics, time, communication channel, and social system) were used to identify likely barriers of knowledge uptake. We mapped each element of DOI theory to ways these potential barriers could be addressed through our resources.

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 incorporated into our educational resources. For example, *trialability* is an innovation characteristic that refers to the ability of the target audience to apply the innovation (Rogers,1995). We determined that our resources would need to provide an opportunity for speech-language pathology students to apply UDL knowledge to meet the requirement of trialability.

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 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 S-LP'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 S-LP 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.
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 S-LPs successfully using UDL (e.g., include quotations from school-based S-LPs and examples of S-LPs using UDL from the literature).

Note. UDL = Universal Design for Learning; S-LP = speech-language pathologist. Information for innovation characteristics adapted from Rogers (1995), for incorporations in educational resources from Kennedy, Missiuna, Pollock, Wu, Yost, and Campbell (2018); Lieberman, Lytle, and Clarcq (2008); and the Ontario Ministry of Education (2013).

DOI theory also includes five adopter categories describing those individuals who are likely to adopt an innovation over time (Rogers, 1995). **Table 2** describes these adopter categories and provides examples of considerations 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. Thus, we included evidence, policy documents, and examples of S-LPs applying UDL to tailor our resources to the adopter categories.

DOI theory also considers the time it takes for an individual to form an opinion of an innovation, called the innovation-decision process, which comprises five steps (Rogers, 1995). We focused on the first two steps of this process, knowledge and persuasion, to identify strategies to influence the decision process. 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 (Rogers, 1995), we asked practising school S-LPs to prepare messages about the innovation as they are individuals who likely have similar qualities, beliefs, and education as the speech-language pathology students. In so doing, we also addressed the social system in which speech-language pathology students are being inculcated. Rogers (1995) suggested 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 documents that situate UDL as a framework to support all students' learning. Change agents were represented by including supportive quotations from school S-LPs.

Drafting of educational resources. Three types of educational resources were drafted: a PowerPoint presentation, two case studies, and two S-LP-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

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 willing to take risks.	• Innovators are the school-based S-LP working group members who assisted with resource development. • Quotes from working group members show students that there are S-LPs 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 speech-language pathology students who have worked or completed placements within the schoolboard and have an interest in becoming a school-based S-LP. Promote sharing of stories and enthusiasm for UDL by inviting students who have been exposed to UDL to share their experiences.
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 S-LPs are using UDL, emphasizing UDL adoption by Ministry of Education, providing opportunity to apply UDL in class, and having a longer version of the S-LP-tailored UDL guidelines handout that provides an extensive list of practical examples.
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 speech-language pathology students may have regarding UDL.

Note. S-LP = speech-language pathologist; UDL = Universal Design for Learning. Information for adopter categories adapted from Rogers (1995) and Borough (2017).

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 (Center for Applied Special Technology, 2018). With the late majority adopters in mind, one handout was extensive and included all strategies extracted from the literature, while the other handout was abbreviated and included salient examples for the earlier adopter categories (see **Table 2**).

Development Phase

In this phase, we recruited school S-LP stakeholders to form a working group that would assist in resource development. We specifically sought S-LPs who were practising in a school setting, were geographically close to

McMaster University, and had an interest in UDL. Potential working group members were identified and contacted by a third party using a secure database that housed contact information of local S-LPs. The final working group included three school S-LPs who had familiarity with UDL. Among 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). They received compensation for parking fees and a $100 gift certificate for their participation.

We held two 90-minute working group meetings 6–8 weeks apart. Prior to each meeting, members received an agenda and a set of resource drafts to review. Working group members provided suggestions, such as describing Ontario Ministry of Education documents in the PowerPoint, explicitly linking Ministry terminology with the terms

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used in the UDL framework, and revising case studies to include authentic S-LP scenarios based on their personal experiences working with students and educators. Between meetings, the authors re-entered the Design phase to incorporate the feedback and create new content. A small group of McMaster faculty and staff who volunteered to attend a "trial run" of the educational session provided feedback on the final set of products. The final educational resources included a 55-slide PowerPoint presentation, two case studies, and two S-LP-tailored UDL strategy handouts.

Stakeholder Feedback

Since this was a novel resource development process, we conducted a 30-minute focus group after the second working group meeting to gather perceptions on employing this process and inclusion of stakeholders (see Appendix 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, which is used to describe a phenomenon or explain participant reactions (Hsieh & Shannon, 2005). Conventional content analysis is appropriate when existing theory or literature regarding the phenomenon is limited, as is the case in this paper using a novel process of resource development (Hsieh & Shannon, 2005). With this type of analysis, researchers do not use predetermined coding categories, but instead, they identify categories that emerge from the data. The transcript was first coded using descriptive coding by VT (first author) and reviewed by WC (fourth author). Descriptive coding is when the researcher identifies words or short phrases that represent and summarize that portion of the data (Saldaña, 2016). After the process of coding, all codes were categorized into topics based on their similarities determined by VT and WC. First, VT identified the topics, which were then reviewed and agreed upon by WC.

Focus Group Content Analysis Findings

All three working group members participated in the focus group. Three topics were identified from the focus group: value and appreciation, enriching and positive meetings, and importance of the development process.

Value and appreciation. Through inclusion of school S-LPs 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 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 meetings, adhering to pre-determined agenda items and the allocated timelines. Members felt that the collaborative discussions lead to a positive experience. One member spoke to the nature of the 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 mentioned how meetings raised their awareness of knowledge gaps involving S-LP 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."

Importance of the development process. Members stated the importance of including practising S-LPs in the resource development process. One member brought attention to creating resources that are important and relevant to the target population saying, "I think it's really important that the resources that we're giving student clinicians or people who are new to the field reflect what they're actually going to see once they're out working." One 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.

Section Two: Pilot Evaluation with S-LP Students

Implementation and Evaluation Phases

To achieve our aims for section two, we drew upon the final two phases of the ADDIE model: Implementation and Evaluation. Briefly, implementation involved administering the resources to the S-LP students, while evaluation involved assessing resource feasibility and perceived and actual UDL knowledge change among the S-LP student cohort. Together, implementation and evaluation constituted steps three and four in the ADDIE instructional design process.

Participants

Using the same ethics approval from section one of this study, we sought participants from a convenience sample of 28 graduate students completing their pediatric unit in their first year of McMaster University's Speech-Language Pathology 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, eight had matching pre-questionnaires. Only seven of the eight respondents completed the actual UDL knowledge open-ended question.

Materials

Educational resources. Resources included the multi-media PowerPoint presentation, two case studies, and two UDL guideline handouts. 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 acknowledgment of gaps, and examples of UDL strategies implemented by S-LPs. The two case studies illustrated how S-LPs could apply the UDL guideline strategies in a classroom setting. The UDL guideline handouts included strategies specific to S-LPs, which as noted previously, 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 of which are aspects of feasibility (Bowen et al., 2009). 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; Göb, 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: "Please provide a brief description of your current 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 guideline handouts 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 1 week before and to the post-questionnaire for 1 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 .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,

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Lindgren, & Lundman, 2017; Potter & Levine-Donnerstein, 1999). To determine words associated with UDL, VT and WC identified key words used to describe UDL as defined by the Center for Applied Special Technology (2018). VT conducted a manifest approach to content analysis through a frequency count of these key words in students' responses to the open-ended question that asked students to describe UDL in their own words. WC reviewed VT's frequency counts for accuracy.

Results

Practicality

As shown in **Table 3**, participants ($n = 10$) perceived the resources to be practical as indicated by median scores of either 6 or 7 for all items. The IQRs 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 S-LP-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 4**, all 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. IQRs were in the upper end of *neutral* and *strongly agree*, indicating minimal response variability. As shown in **Table 5**, participants ($n = 10$) perceived that content tailored using DOI theory was important and relevant, such as including examples and quotes of S-LPs applying UDL. Medians were in the *strongly agree* category with IQRs from *neutral* to *strongly agree*. The exception was an item that asked about the importance of including quotes from school-based S-LPs 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 6**, 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 ($p = .001$; $S = 33.00$).

Actual UDL Knowledge

As shown in **Table 7**, relative to participants' descriptions of UDL on the pre-questionnaire, they increased their use of words associated with how the Center for Applied Special Technology defined UDL on the post-questionnaire, such as "guidelines," "checkpoints," and using terminology that corresponds to the three UDL principles (e.g., multiple

Table 3	
Students' Perceptions of Resource Practicality ($n = 10$)	
Question	Median (IQR)
"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 Universal Design for Learning guidelines handout was appropriate."	6 (5,7)
"Applying the handout to the case study was useful."	6.5 (6,7)

Note. IQR = Interquartile range.

Table 4

Students' Perceptions of Resource Acceptability (*n* = 10)

Question	Median (IQR)
"PowerPoint provided new information on UDL."	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 S-LP examples."	7 (6,7)
"Instructions on how to use the UDL guidelines with the case studies were easy to understand."	7 (6,7)

Note. IQR = Interquartile range; UDL = Universal Design for Learning; S-LP = speech-language pathology.

Table 5

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

Question	Median (IQR)
"It was important to me that…"	
"the presentation included quotes from school-based S-LPs and how they applied UDL."	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."	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)
"the UDL Guidelines handout had practical examples of how S-LPs can use UDL in their clinical practice."	7 (6,7)
"the American Speech-Language-Hearing Association supports a role for S-LPs in using UDL in schools."	6.5 (6,7)

Note. DOI = Diffusion of Innovations; IQR = Interquartile range; S-LP = speech-language pathologist; UDL = Universal Design for Learning.

means of representation). This suggests that participants were more accurate in their description of UDL after attending the class session. It also is important to note that in the pre-questionnaire several participants used general phrases that are associated with UDL, such as "accessible" and "equal/equity." In the post-questionnaire, students' use of these terms decreased and their use of terms specific to UDL increased.

Table 6

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

Question	Before Median (IQR)	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 S-LPs 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 S-LPs."	1 (1,2)	6 (5,6)
"I can explain why there is a need for more evidence about UDL implementation by S-LPs."	3 (2,6)	6.5 (6,7)

Note. IQR = Interquartile range; UDL = Universal Design for Learning; S-LP = speech-language pathologist.

Table 7

Students' Actual Knowledge of Universal Design for Learning

UDL key words	Word count pre-questionnaire (*n* = 15)	Word count post-questionnaire (*n* = 7)
Principle	1	3
Guidelines	0	3
Action and Expression	1	3
Engagement	0	3
Representation	1	3
Accessible	6	3
Equal/equity	6	2
Checkpoint	0	2
Framework	1	1

Note. UDL = Universal Design for Learning.

Discussion

Given the mandate for inclusive education in Canada (Inclusive Education Canada, 2017; Ontario Ministry of Education, 2013; Towle, 2015), S-LPs need to be informed about inclusive education practices and frameworks like UDL (Suleman et al., 2013). S-LPs have identified a need for education and training on the topic of UDL (Campbell et al., 2016), with speech-language pathology students constituting an important audience to target (Suleman et al., 2013). To our knowledge, researchers have yet to develop resources to teach speech-language pathology 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, and that some were able to accurately describe UDL in open-ended question responses, especially given Campbell et al.'s (2016) report that many practising S-LPs did not know this term. This finding may reflect McMaster University's approach to graduate education where faculty implement UDL in their own teaching. Therefore, students' general awareness of the term UDL may be explained by their previous exposure to its use by faculty. Less surprising, 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 speech-language pathology 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. We found that with 3 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. Participants were also able to identify key gaps in the evidence base, such as lack of high-quality research and inconsistent usage of UDL terminology across fields and studies. Thus, our findings suggest that our resources may be able to address a previously unmet need to increase S-LPs' knowledge of UDL (Campbell et al., 2016).

Another important finding from this study is reflective of our approach to developing the resources. Within the field of KT, theory-driven studies are lacking and approaches that enhance dissemination strategies are needed (Curran et al., 2011; Eccles et al., 2005; Tabak et al., 2012). Students' perception of our resources as practical and acceptable suggests that we were successful in tailoring them to this population. Speech-language pathology 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 (Eccles et al., 2005; Tabak et al., 2012).

Levac et al. (2015) provided recommendations for developing and implementing online KT resources for health professionals. They suggested that developing resources requires assessment of audience needs, summarizing key evidence, use of KT theory, selection of KT format, and inclusion of multimedia content to enhance visual appeal and engagement (Levac et al., 2015). Our 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 S-LP stakeholders throughout the ADDIE Development phase enriched the resource content. These experienced school S-LPs had practical knowledge and experience regarding the role of S-LPs within schools and specific policies and terminology that are valuable for pre-professional S-LPs.

Our study also showcases the value in researcher–clinician collaborations for research, teaching, and training. Researcher–clinician collaborations provide the skillsets and experiences of both the researcher and clinician to enhance evidence-based practice to lead to desired outcomes, as highlighted in KT literature (Glasgow et al., 2012; Goldstein, McKenna, Barker, & Brown, 2019; Olswang & Goldstein, 2017). Olswang and Goldstein (2017) suggested that to make a lasting and impactful change on current practice, researcher–clinician collaborations should be used throughout development of evidence-based protocols. Through collaborating with school S-LPs and including them in the development of the educational resources, we developed evidence-based resources that encompass current school S-LP practice to enhance training and outcomes for future school S-LPs. Other clinicians and researchers looking to develop evidence-based KT products could benefit from these collaborations to ensure developed products are relevant and meaningful to the target population.

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Limitations

Feedback on employing this novel development process was limited as there were only three working group members representing perspectives from two school boards. We also had a homogenous sample of S-LPs who all knew each other well. This could provide an unrealistic expectation that future working groups would be as comfortable and willing to discuss and share ideas as was ours. S-LP 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 working group meetings, which informed the final products. The process to develop the resources was also a time and labor-intensive process that required 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.

As implementing these resources was done through a pilot study, our findings are not generalizable. With only seven students completing the open-ended question about actual UDL knowledge, in only one to two sentences, we cannot infer that resources changed actual knowledge. Although we had hoped to recruit larger numbers, resource implementation occurred just prior to student 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

Engaging stakeholders at the very beginning of the development process, instead of only during resource development, would be useful to help determine the types of educational resources to be developed, and learning objectives and core material to be included. 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 working groups with other health professionals could evaluate the usefulness of this methodology for developing educational resources across disciplines.

Ideally, our educational resources would be implemented with an additional cohort of students to re-assess feasibility. To truly grasp if students retained or learned new information about UDL, a mandatory assignment or in-class quiz could be added to complement existing evaluation methods. The addition of a control group would help determine the effectiveness of the educational resources as a mechanism to change UDL knowledge. Soon, implementation of these resources could also be video-recorded and made easily accessible online for S-LP educators to enhance future use and implementation of the resources.

Conclusion

Overall, we believe the steps of this novel methodology could prove useful to other educators or researchers needing to develop educational resources. Although the process was time consuming, final educational products followed best-practice recommendations (Levac et al., 2015). Those 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 S-LP students.

We also evaluated the feasibility of these newly created educational resources about UDL for speech-language pathology 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 S-LP community (Campbell et al., 2016).

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Appendix
Focus Group Guide

Instructions Given to Participants

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 Asked to Participants

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.

9. Do you have any additional comments or remarks to add?

Thank you for your collaboration.