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**EVALUATING THE EFFECTIVENESS OF AN OCCUPATION-BASED
UNIVERSAL DESIGN TOOLKIT AMONG OCCUPATIONAL THERAPY STUDENTS**

by

Ella Atkinson

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Abstract

While specialized design approaches are increasingly gaining popularity in the realm of home design and modification, there is less of an emphasis being placed on universally-designed environments or, alternatively, these terms are mistakenly being used synonymously. There is not only a gap in the literature surrounding universal design, but also a lack of educational resources, which may hinder understanding and application. Thus, there is an evident need to further promote the understanding and implementation of universal design within occupational therapy. This capstone project seeks to address this by developing and disseminating a universal design toolkit intended for occupational therapy student use. 34 occupational therapy students reviewed and utilized the universal design toolkit during a case study exercise and provided both quantitative and qualitative feedback regarding the toolkit's usability, usefulness, and knowledge acquisition. Findings reveal that participants demonstrated statistically significant gains in knowledge. Additionally, significantly more participants yielded positive perceptions of the toolkit's usability and usefulness, compared to those with neutral to negative perceptions. This illuminates the fact that many occupational therapy students are demonstrating an emerging

understanding and application of universal design, which can be enhanced through targeted educational resources.

Introduction

The home environment is crucial for promoting individuals' occupational engagement, wellbeing, and overall health (Carr et al., 2013; Joines, 2009; Struckmeyer et al., 2021). However, unfortunately there is often a disconnect between individuals' abilities and their residential environment (Stark et al., 2017; Struckmeyer et al., 2021), resulting in excess disability and difficulty in performing both activities of daily living (ADLs) and instrumental activities of daily living (IADLs) (Stark et al., 2017). To overcome activity limitations that result from the mismatch between the individual and the physical environment of the home, specialized design approaches, including home modifications for aging-in-place, accessible design, and assistive technologies, have been championed in the design, rehabilitation, and gerontological literature. In contrast, while the concept of universal design has received increased attention within the field of occupational therapy, it is largely absent from the body of evidence in occupational therapy (Hitch et al., 2012) and has yet to be widely adopted into practice (Egilson et al., 2023; Sanford 2012; Watchorn et al., 2021).

A major reason for the lack of universal design examples in both the literature and in practice is the misperception that it is synonymous with specialized design (Hitch et al., 2012; Larkin et al., 2015). Specialized design is a disability-specific approach that is typically added to everyday products and building features to overcome the mismatch between individuals' abilities and the demands of the physical environment (Sanford, 2012). However, the reactive nature of specialized design often results in giving the home an institutional appearance that tends to

exacerbate stigmatization and segregation of individuals with disabilities (Carr et al., 2013; Sanford, 2012). To overcome the functional shortcomings of accessible design, universal design seeks to ensure that environments are “usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” (Mace et al., 1991; Sanford, 2012). Conceptually, universal design does not view disability as a single point requiring specialized intervention, but a continuum of ability that would benefit from everyday designs that accommodate the widest possible range of body shapes, dimensions and movements (Imrie, 2004) through contextually appropriate solutions (Sanford, 2012). As a result, universal design enables occupational participation and engagement for all individuals of a home across the life-cycles of those individuals as well as the lifespan of the home through an approach to accessibility that is “built-in and undetectable” (Sanford, 2012).

To define the performance goals and guidelines of universal design, the 7 Principles of Universal Design, which are frequently referred to in research literature, were developed by a team of designers and engineers at the Center for Universal Design, NC State University (Connell et al., 1997). The principles aim to foster the environmental evaluation and design processes, as well as provide insight into the characteristics that enhance the usability of environments and products (Larkin et al., 2015; Young et al., 2019). Whereas both specialized and universal design address activity performance, specialized design seeks to overcome activity limitations through access requirements that ameliorate environmental barriers for people with disabilities. In contrast, universal design promotes performance through the inherent usability of the environment, as evidenced by the seven principles of universal design (See Table 1).

Table 1. Universal Design Principles Defined

<i>Universal Design Principle</i>	<i>Definition</i>
P1. Equitable Use	The design is useful and marketable to people with diverse abilities
P2. Flexibility in Use	The design accommodates a wide range of individual preferences and abilities
P3. Simple & Intuitive Use	Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level
P4. Perceptible Information	The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities
P5. Tolerance for Error	The design minimizes hazards and the adverse consequences of accidental or unintended actions
P6. Low Physical Effort	The design can be used efficiently and comfortably and with minimum fatigue
P7. Size & Space for Approach & Use	Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility

Although incorporation of universal design aligns with occupational therapy theory, the principles have yet to be widely translated into practice (Egilson, et al., 2023; Hitch et al., 2012; Sanford 2012; Watchorn, et al., 2021). To identify the barriers and facilitators associated with the successful implementation of the principles, a survey of 38 occupational therapists with experience in home modifications found that almost half (47%) reported being familiar with universal design. Most participants had a good understanding of all universal design principles, with Simple and Intuitive Use being significantly better understood than Perceptible Information ($p=0.001$) and Tolerance for Error ($p=0.003$). In addition, respondents reported that they consistently applied the principles in their work with Simple & Intuitive Use being used most often and Perceptible Information being used the least ($p=0.004$). There were no statistically

significant differences between any other principles regarding understanding or application frequency.

Nonetheless, despite having a sound understanding of universal design principles, participants noted persistent challenges pertaining to universal design awareness among clients and design-build professionals. Participants also expressed how working within budget constraints can pose difficulties, whether it be due to limited insurance coverage, lower income, or reluctance to invest in universal design solutions stemming from lack of awareness surrounding universal design and its benefits. Thus, occupational therapists discussed the need for increased education on universal design, regarding aspects such as definition and application clarification, provision of real-world visual examples to shift public perception, and emphasis on client-centered solutions that offer unique benefits to clients.

Based on this feedback, a study was undertaken to develop and evaluate the usability, usefulness, and knowledge acquisition of a toolkit to increase occupational therapy students' knowledge about the breadth of universal design solutions available across multiple price points, thereby aiding cost-conscious clinical decision-making to mitigate budget concerns. The toolkit also provides an in-depth background into the principles of universal design, how it varies from specialized design, and the inherent client-centered nature of universal design.

The primary outcome for this toolkit is enhanced knowledge of universal design and the variety of potential solutions across multiple price points among future occupational therapists. In turn, a better understanding among clinicians is expected to translate a greater acceptance and application of universal design solutions among occupational therapists' clients and residential design/build professionals that they work with. In the longer term, implementation of universal

design has the potential to increase clients' quality of life, wellbeing, and participation in their daily lives (Struckmeyer et al., 2021; Carr et al., 2013).

Methods

The toolkit consists of a universal design infographic, specialized versus universal design comparison reference, and an occupational analyses and universal design solutions reference. A mixed-methods design was used to evaluate the usability, usefulness, and knowledge acquisition of this toolkit by occupational therapy students. Inclusion criteria required that participants were currently enrolled in either a master's or doctoral accredited occupational therapy program in the United States. To recruit participants, students in all cohorts in the investigator's current program were contacted directly via GroupMe, and directors of occupational therapy programs throughout the U.S. were contacted via email and asked to share the toolkit and survey with their students. The project was approved by the university's Institutional Review Board.

Toolkit. This toolkit includes a universal design infographic that provides users with a concise, visually-appealing educational resource about the concept of universal design. The infographic includes the standardized universal design definition to provide users with a clear, objective understanding of what qualifies a product or environment as being truly universal (i.e., does not require adaptation or specialized design). After introducing the concept of specialized design, the infographic also features a comparison table depicting the differences between specialized design (e.g., accessible design, design that solely abides by ADA standards) and universal design. Due to the fact that these terms are often used synonymously, despite their key differences, this table aims to clarify such dissimilarities and emphasize the value of the more

inclusive universal design approach. This infographic also introduces the seven principles of universal design and the critical information that constitutes each principle.

The toolkit also includes a quick-reference visual guide highlighting bathroom products that are categorized as adaptive equipment or specialized design, as well as universally-designed alternative solutions that meet the same ADL-specific needs, while facilitating a bathroom environment that is designed with all users in mind, without stigmatizing older adults or individuals with disabilities.

This toolkit includes a resource that breaks down each of the bathroom-related activities of daily living (i.e., toileting, bathing/showering, grooming). The resource includes a table key reference page at the beginning of the document to promote clarity and ease of use of the resource. The keys consist of an impairment key (e.g., brain icon symbolizes cognitive impairment), universal design principles key (e.g., P1 stands for Principle 1: Equitable Use), commonly used abbreviations key (e.g., UE stands for upper extremity), and an investment key (e.g., \$ symbolizes investment in universal design solution of less than \$100). The resource is separated by each specific bathroom ADL. Each resource consists of an occupational analysis for that specific bathroom ADL (e.g., bathing), which breaks down each step of the ADL in a color-coded flow chart diagram. In addition to the ADL-specific occupational analysis, there is a table that provides extensive information regarding universal design solutions at varying price points, what universal design principles most align with the universal design solutions, what steps of the occupational analysis are most supported by the universal design solutions, what clinical impairments are most supported by the universal design solutions, and additional clinical rationale and considerations based on clients' needs and environmental contexts. Within the

universal design solutions column, there are also respective real-world image examples of aesthetic bathroom products and environments that are universally-designed.

Instruments and Measures. A mixed-methods Qualtrics survey was used to evaluate usability, usefulness, and knowledge acquisition. The quantitative components included Likert-scale questions for usability and usefulness and a pre-post design, also with Likert-scale questions, for knowledge acquisition. Usability was measured using a modified version of the System Usability Scale (SUS), focusing on the dimensions of effectiveness, efficiency, and satisfaction (Brooke, n.d.). The three questions that were derived from the SUS addressed how well-integrated the functions of the toolkit were, ease of use of the toolkit, and overall confidence with using the toolkit. Usefulness was measured using a modified version of the USE (Usefulness, Satisfaction, and Ease of Use) Questionnaire. Three questions were derived from this questionnaire, which focused on the dimensions of usefulness, satisfaction, and ease of use of the toolkit (Gao et al., 2018). Additionally, the Likert-scale was adapted from 1-7 to 1-5 to facilitate consistency across answer choices in this survey.

Knowledge acquisition was evaluated through students' self-assessment of their understanding and confidence of applying universal design solutions prior to and after using the toolkit. Topics for these questions consisted of general understanding of universal design, confidence discussing home modifications through a universal design-lens with others, familiarity with universal design solutions available at a wide range of price points, understanding of how universal design solutions can benefit individuals with a wide variety of functional impairments, confidence performing occupational analyses and identifying what aspects of an occupation are most challenging for a client, and confidence recommending universal design solutions that best support clients' occupational performance.

Qualitative Measures. Participants who selected a Likert score of 3 or below were prompted to provide additional explanation as to why they gave this neutral or negative rating. At the conclusion of the survey, participants were asked to provide open-ended feedback in regards to what they believed to be the most valuable aspects of the toolkit, the toolkit's usefulness in educational and clinical contexts, and areas of improvement for the toolkit to further enhance understanding and application of universal design.

Procedures. Students were first presented with a case study about a client who is seeking to make modifications to their current bathroom environment. Based on the case study, participants were asked to make their initial design recommendations for the client. Participants were then provided with additional context about the client's needs and asked to review the universal design toolkit to help guide their clinical decision-making process. After reviewing and utilizing the toolkit, participants were presented with the post-knowledge acquisition questions, as well as the usability and usefulness portions of the survey.

Data Analysis. Data were securely stored on the Qualtrics website, a university-approved tool that protects one's confidentiality. Data analysis documents were securely stored in a OneDrive folder that only the principal investigators had access to. Survey results were both quantitatively and qualitatively analyzed. Quantitative data was analyzed utilizing Qualtrics' embedded StatsIQ data analysis tool. This tool was utilized to gather descriptive statistics, such as means, frequencies, and standard deviations. Quantitative data was also further analyzed using the IBM SPSS Software platform. Statistical analyses consisted of the Wilcoxon signed-rank test (i.e., changes from pre- to post- for knowledge acquisition), Friedman test with Bonferroni-adjusted post-hoc comparisons (i.e., differences across knowledge acquisition questions), and chi-square tests (i.e., strength of agreement versus non-agreement). Qualitative

data were analyzed using the NVivo software. All survey responses were read through several times to ensure full understanding and identified themes that were consistently mentioned by participants (i.e., more than 2 participants addressed the theme).

Results

Demographics. Participants in this study consisted of 34 occupational therapy students. However, it is worth noting that one participant was lost to attrition during the final question block of the survey (i.e., ‘Overall Feedback’ qualitative section). Participants derived from 14 occupational therapy programs, with the most represented programs being Georgia State University (n=5), Huntington University (n=5), University of South Alabama (n=4), Belmont University (n=3), Kettering University (n=3), and Cleveland State University (n=3). 100% (n=34) of participants were enrolled in a doctorate level occupational therapy program.

Quantitative Data

Usability. Overall, usability ratings indicate that the majority of participants were in agreement or strong agreement that the universal design toolkit was shown to be usable (See Figure 1). The mean usability score across all domains was 4.40 ± 0.62 out of 5, ranging from ease of use (mean = 4.44 ± 0.69) to integratedness of the toolkit (mean = 4.41 ± 0.69) to confidence in using the toolkit (mean = 4.35 ± 0.72). There were no significant differences among the 3 questions. In fact, almost 9 out of 10 participants ($p < 0.001$) agreed or strongly agreed that the toolkit was well integrated (n=30, 88%), easy to use (n=30, 88%), and had confidence using it (n=29, 85%). No participants reported negative ratings, with the remaining responses being neutral.

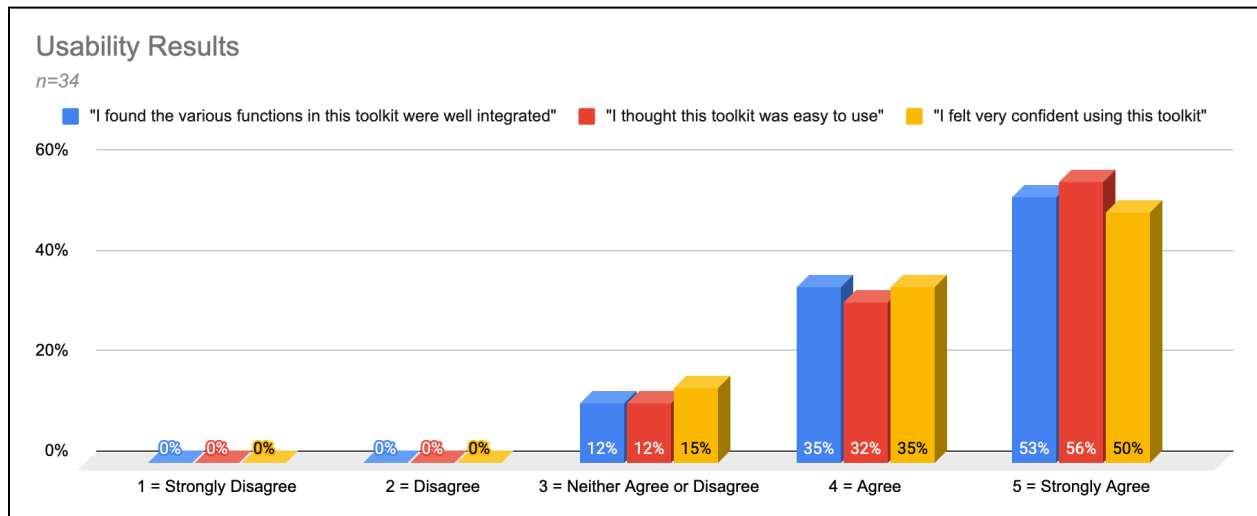


Figure 1. Usability Results

Usefulness. All in all, usefulness ratings indicate that the majority of participants were in agreement or strong agreement that they found the universal design toolkit to be a useful intervention (See Figure 2). The mean usefulness score across all domains was 4.36 ± 0.65 out of 5, ranging from usefulness (mean = 4.47 ± 0.65) to overall satisfaction (mean = 4.35 ± 0.72) to user-friendliness (mean = 4.26 ± 0.78). There were no statistically significant differences among the three questions. Again, about 9 out of 10 participants ($p < 0.001$) agreed or strongly agreed that the toolkit was useful ($n=31$, 91%), they were satisfied with the toolkit ($n=31$, 91%), and that it was user-friendly ($n=29$, 85%). Across all three usefulness domains, two total negative ratings were obtained, as one participant disagreed that the toolkit was user-friendly and that they were satisfied with the toolkit. Additionally, multiple ($n=9$) neutral ratings (i.e., ‘Neither Agree or Disagree’) were collected across the three usefulness domains.

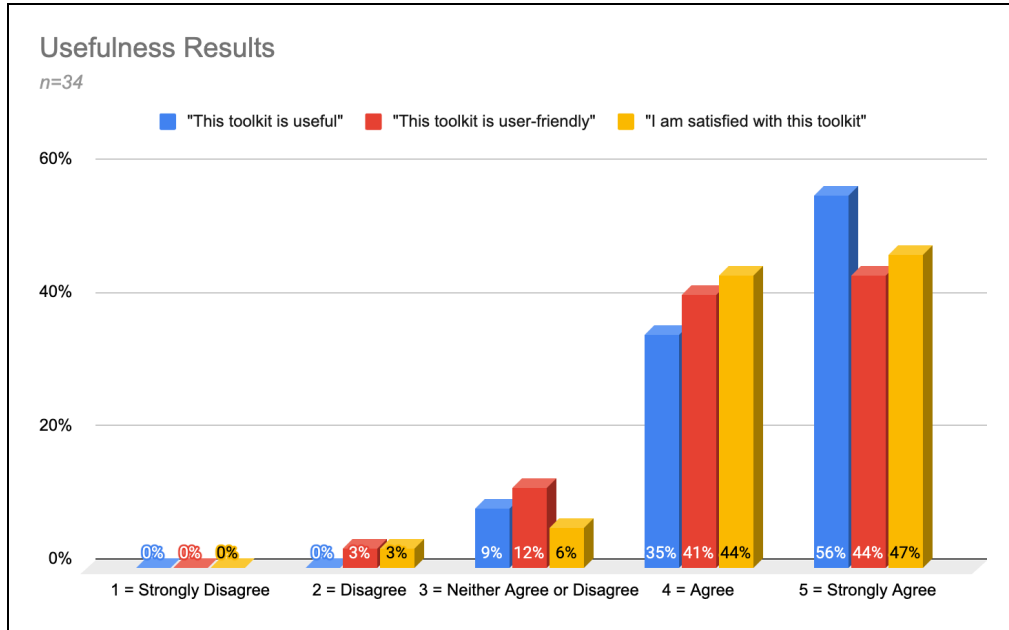


Figure 2. Usefulness Results

Knowledge Acquisition. Participants' responses to the seven knowledge acquisition questions were averaged together to form a cumulative knowledge acquisition score both before and after reviewing and applying the universal design toolkit. Overall, participants' mean knowledge acquisition score increased from 3.77 ± 0.67 (pre) to 4.23 ± 0.51 (post) out of 5 on the Likert scale ($p < 0.001$). A related-samples Wilcoxon signed-rank test found no significant differences between pre- (mean = 4.24) and post- (mean = 4.41) scores in participants' confidence identifying what aspects of an occupation are most challenging for a client, which was the most well understood domain. Conversely, there were significant differences ($p < 0.001$) between pre- (mean = 3.06) and post- (mean = 3.94) in participants' familiarity with universal design solutions available at a wide range of price points, which was the least understood domain. It is also worth noting that this domain had the largest mean knowledge acquisition gain ($+0.88$, $p < 0.001$). This is followed by participants' confidence recommending universal design

solutions that best support clients' occupational performance, and participants' general understanding of universal design, which experienced +0.76 ($p < 0.001$) and +0.47 ($p = 0.004$) improvements, respectively (See Table 2).

Additionally, chi-square tests on each post- question determined that the percentage of participants who agreed or strongly agreed (i.e., 4-5 out of 5) with the statements pertaining to knowledge gain was statistically significant compared to those who gave neutral or negative responses (i.e., 1-3 out of 5) across each of the seven questions. These significant overall findings suggest that the universal design toolkit may be effective at enhancing both foundational knowledge and applied confidence.

Table 2. Pre-Post Knowledge Acquisition Scores and Within- and Across-Question Comparisons

Question	Pre Mean	Post Mean	Wilcoxon p-value
Q1. How would you rate your understanding of universal design?	3.59	4.06	0.004*
Q2. I feel confident discussing home modifications through a universal design-lens with clients and other professionals.	3.71	4.09	0.009*
Q3. I am familiar with universal design solutions available at a wide range of price points that I can recommend to clients with varying budgets.	3.06	3.94	<0.001*
Q4. I feel confident in my understanding of how universal design solutions can benefit individuals with a wide variety of functional impairments.	4.09	4.38	0.056
Q5. I feel confident performing occupational analyses of various ADLs.	4.15	4.38	0.033*
Q6. I feel confident identifying what steps of an occupation are most challenging for a client.	4.24	4.41	0.175
Q7. I feel confident recommending universal design solutions that best support clients' occupational performance.	3.59	4.35	<0.001*

* Note. $p < 0.05$ (Wilcoxon signed-rank tests for pre-post differences).

Across-question post-hoc comparisons (Friedman with Bonferroni adjustment) indicated that Q3 differed significantly from Q5 ($p = 0.047$) and Q6 ($p = 0.019$). No other statistically significant pairwise differences across questions were found.

Qualitative Data

Usability. Of the 13 responses that yielded neutral usability ratings, several consistent themes emerged in participants' explanations, including: 1) Desire for Enhanced Organization of Toolkit, 2) Desire for Enhanced Exposure to Toolkit, and 3) Influence of Preexisting Knowledge.

Desire for Enhanced Organization of Toolkit. Several respondents (n=5) noted that they found some aspects of the toolkit's layout to be lacking. For instance, one participant explained, "It took a while to narrow everything down and the layout is a little crowded". Similarly, another participant stated, "I loved the information provided on it. Maybe it was just me; the information could have been structured differently". Another participant found it, "Frustrating to have to click link/exit tabs", and lastly one participant explained how they would prefer to defer to other modes of information of this topic, stating, "I think the toolkit is great, but if I'm in a pinch with a client I'll just use the internet rather than pull up specific toolkits for each ADL".

Desire for Enhanced Exposure to Toolkit. Other participants (n=2) explained that they gave a neutral rating of the toolkit's usability due to concerns with needing more time to fully familiarize themselves with the content. For example, one response stated, "I feel like if I spent more time in it I would be able to use it better", and another revealed, "I feel as though if I have more exposure and time to digest the information, I would be more confident in using the toolkit".

Influence of Preexisting Knowledge. One participant stated how they did not feel as though they benefitted from use of the universal design toolkit during the case study exercise of the survey due to sufficient prior knowledge of the topic. This participant expressed, "I honestly didn't really need the extra support that [was] provided. I felt capable of reading and answering

questions”, and later reiterated, “...because of previous education on this topic, I did not need to use the toolkit to help solve the problem”.

Usefulness. While respondents overwhelmingly thought the toolkit would be useful to practitioners, of the 11 responses that yielded neutral and negative usefulness ratings, participants thought that it wouldn't be useful to older adults or individuals who do not have a background in healthcare, mainly due to the format. For instance, two participants addressed concerns with relaying this toolkit to older adults or non-healthcare professionals, stating, “*I feel that this toolkit is user friendly for health professionals, but could possibly be hard to understand for others*” and “*It is easy for me to understand because i am tech-savvy, but may not be for an older adult*”. While it is worth noting that this toolkit was intended to be used specifically by occupational therapy students and practitioners, it is important to ensure that the information can be easily shared with clients and interprofessional collaborators. Others again raised concerns with the overall organization of the toolkit, explaining, “*It can be confusing when looking at the layout*” and “*All of the different icons and steps were a little confusing to keep track of*”.

Knowledge Acquisition. Three main themes emerged from this qualitative data: 1) Limited Understanding of Universal Design, 2) Sufficient Understanding of Universal Design with Limited Application, and 3) Limitations of the Toolkit.

Limited Understanding of Universal Design. Of the 25 open-ended responses obtained across the knowledge acquisition questions, 32% (n=8) of participants still felt that their knowledge of universal design was not fully developed and they still needed further education on the topic to fully understand and apply it in the realm of home modifications. For instance, one

participant stated, *“I think I could give a general explanation but it wouldn’t be that comprehensive”*. Similarly, another participant expressed, *“I know some but would like to know more to feel confident!”*. Lastly, one participant stated, *“I am unaware of all solutions and situations that may come up and therefore withhold from giving a rating of full understanding”*.

Sufficient Understanding of Universal Design with Limited Application. Despite other respondents reporting a sound understanding of universal design, 40% (n=10) still reported they do not feel fully confident in applying it in clinical scenarios due to limited experience. For instance, one participant explained, *“I think I have a general idea of what it is but less about how to apply it”*. Other participants echoed this sentiment, expressing, *“I believe I understand what it is, but do not feel confident enough to give the correct modifications”* and *“I feel that learning and applying this knowledge takes time and practice throughout one's career”*. Another participant reiterated this, stating, *“It’s a concept I understand but have to pause for a moment to reflect on if something is truly universal design”*.

Perceived Limitations of Toolkit. Slightly more than one-quarter (n=7, 28%) of respondents felt as though there were gaps in the toolkit and case study that prevented them from giving positive ratings on the knowledge acquisition questions. For instance, one participant stated, *“The tool kit gave me a better understanding but I wish there were descriptions”* and *“Explanations are helpful to me”*. Additionally, a participant discussed how they wished more context was provided regarding pricing, stating, *“Not sure of pricing specifics. Not sure of Charlie and his wife's budget”*. This feedback is valuable in better understanding how to improve the toolkit in the future to better facilitate users’ knowledge acquisition regarding universal design.

Overall Feedback.

Value. Six key themes arose regarding the value of the toolkit, including: 1) Ease of Use (n=13, 39%), 2) Application to Clients' Functional Impairments (n=9, 27%), 3) Visual Aids & Imagery (n=6, 18%), 4) Financial Considerations (n=4, 12%), 5) Breadth of Options (n=3, 9%), and 6) Comparison of Specialized Design vs Universal Design (n=3, 9%). In terms of ease of use, which was the most common theme, participants discussed how they valued the “*organization*” and “*user-friendly approach*” of the toolkit. As for the second most common theme, participants also discussed how they found it helpful how the toolkit connected functional impairments to certain universal design solutions. The third most common theme focused on how participants valued the imagery of the toolkit, and how it facilitated user-friendliness and maintained “*great information without visual clutter*”.

Educational and Clinical Applicability. Three key themes emerged, including: 1) Clinical Application (n=24, 73%), 2) Overall Referenceability (n=15, 45%), and 3) Educational Application (n=6, 18%). For the clinical application theme, participants discussed how they believed the toolkit would be beneficial for use in a multitude of practice settings, such as “*[inpatient rehabilitation], home health, or outpatient*”, and especially for students during their fieldwork rotations. In terms of the referenceability theme, several participants touched on the value of having the toolkit as a “*quick reference*”, emphasizing how it was very beneficial to have relevant home modification and universal design information all in one place. For the toolkit's educational application, several participants discussed how it might be helpful to integrate this toolkit into occupational therapy academic curriculum, such as through assistive technology coursework.

Areas of Improvement. Three key themes were determined, including, 1) No Identified Areas of Improvement (n=18, 55%), 2) Expand Toolkit (n=10, 30%), and 3) Simplify Toolkit (n=5, 15%). The majority of participants did not have any specific changes to make to the toolkit, stating that it was an “*appropriate and effective*” intervention. However, 10 participants expressed the desire for additional information to be added to the toolkit, such as more universal design solutions, direct links to these solutions, and additional diagnoses and ADLs. Conversely, 5 participants expressed how they found the toolkit to be somewhat overwhelming and wished for it to be simplified. This feedback is valuable in shaping how to best improve the universal design toolkit for future clinical and educational application of occupational therapy students (See Table 3).

Table 3. Overall Feedback

Most Valuable Aspects of Toolkit	
I. Ease of Use	<ul style="list-style-type: none"> - "The organization of it! It is very clearly organized" - "I appreciated the user friendly approach with easy to read information"
II. Application to Clients' Functional Impairments	<ul style="list-style-type: none"> - "I like that it showed the impairment that necessitates the use of various options of universal design" - "The breakdown of what is causing the functional impairment and what design aspect would help"
III. Visual Aids & Imagery	<ul style="list-style-type: none"> - "The table graphics and key kept great information without visual clutter" - "I thought the pictures for impairments was easy to understand and went well with the clinical rationale"
IV. Financial Considerations	<ul style="list-style-type: none"> - "It was also beneficial to see the financial rating of each solution to ensure solutions are appropriate and realistic for clients" - "The options for modifications, especially having them ranged from low-price to high-price, was incredibly useful and is a great resource for practitioners seeking alternative home options!"
V. Breadth of Options	<ul style="list-style-type: none"> - "It offered a wide range of options and tons of information, helping to make decisions" - "...knowing what options are out there for equipment"
VI. Comparison of Specialized vs Universal Design	<ul style="list-style-type: none"> - "The comparison of universal design ideas compared to the non-universal design options" - "Comparison between specific and universal design"
Educational & Clinical Applicability	
I. Clinical Applicability	<ul style="list-style-type: none"> - "For level 1 and 2 fieldwork assignments, especially those in IPR, home health, or outpatient!" - "I would be more confident and knowledgeable making home modification recommendations to clients during fieldwork if I had access to this toolkit"
II. Overall Referenceability	<ul style="list-style-type: none"> - "Its a great reference sheet for quick reference" - "It could be a good visual to have to show families what options are and a quick reference tool than trying to look online"
III. Educational Application	<ul style="list-style-type: none"> - "...useful for assignments/case studies, and for getting familiar with what devices and their info prior to working in the field" - "If students do not have an assistive technology course this toolkit could help them get a simple way to approach universal design"
Toolkit Areas of Improvement	
I. No Identified Areas of Improvement	<ul style="list-style-type: none"> - "I felt that this tool kit was appropriate and effective for enhancing understanding and application of universal design" - "At this time, I am unsure of what suggestions to provide"
II. Expand Toolkit	<ul style="list-style-type: none"> - "Maybe include some common [diagnoses] you might see use each one more frequently? I thought this was already well designed though!" - "For the lay person, maybe provide more explanation of each item/modification and its purpose"
III. Simplify Toolkit	<ul style="list-style-type: none"> - "The graphics and key, which are fantastic and help those who understand best through images rather than words, could be difficult to apply to the toolkit when having to flip from tab to tab to understand what each key item means - perhaps putting the key on the same document as the Bathroom ADL Occupational Analyses & UD Solutions page could be one way to increase the accessibility" - "Simpler key"

Discussion

Results of this capstone study indicate that most occupational therapy students have an emerging understanding of universal design and its application in their current and future clinical and educational endeavors. This is supported by the fact that students experienced statistically significant gains in knowledge after reviewing and using the universal design toolkit ($p < 0.001$). Most participants also found this toolkit to be both usable and useful ($p < 0.001$). Overall, most participants demonstrated a greater understanding of concepts more directly tied to occupational therapy (i.e., identifying which steps of an occupation are most challenging), with a lower initial understanding of the concept of universal design, and especially how cost pertains to it. However, it is worth noting that the largest gain in mean knowledge score derived from the question discussing comfortability with recommending universal design solutions at a variety of price points. Thus, this toolkit may help support occupational therapy students with making client-centered universal design solution recommendations to clients, specifically as it relates to varying financial parameters. Participants' qualitative feedback also revealed that while they believe that they have gained a better understanding of universal design through this toolkit, they believe they could benefit from continued exposure to the concepts in more real-world scenarios, such as in fieldwork rotations.

This supports the findings from the previously conducted needs assessment for this study, as well as current literature (Carr et al., 2013; Hitch et al., 2012), which denotes that while universal design is becoming increasingly recognized in the literature and practice of occupational therapy, there is still ample room for students and practitioners to enhance their understanding of the concept and how it can successfully be applied. This can be addressed

through the development and dissemination of educational materials on the topic of universal design, such as the toolkit intervention being evaluated in this capstone project.

Limitations. However, it is worth noting that there are some limitations of this study. For instance, there was attrition throughout the survey, which led from the initial sample size decreasing from 60 to 34 participants. The final sample also only consisted of doctoral students, as opposed to including any master's students. Additionally, only students from occupational therapy programs in the United States were recruited. Limited time was also a limitation of this study, which resulted in not all occupational therapy programs in the country being contacted for participant recruitment. Another limitation of this study was that there was only one case study used to assess the applicability of the toolkit. Lastly, the breadth of universal design solutions and ADLs included in the toolkit could be considered a limitation of this study.

Future Research. In terms of future research, it would be advantageous to address all of the aforementioned limitations to enhance the quality of this study. For instance, future research should expand the toolkit to include a more extensive list of ADLs, as opposed to solely being bathroom-specific, and include direct access to more universal design solutions. Additionally, more case studies could be included to increase the client-centered aspect of the toolkit and highlight other functional limitations and budget parameters. Future research should also aim to have increased time for participant recruitment and data collection, as well as consider recruiting occupational therapy students from outside of the United States to assess the generalizability of this study's findings. One might consider administering this survey to current occupational therapists to determine if results significantly varied compared to students' perceptions of the effectiveness of the universal design toolkit. It would also be advantageous to revise the toolkit based on participants' open-ended feedback and reassess its usability, usefulness, and knowledge

acquisition to evaluate if the suggested modifications were impactful. Lastly, future research could involve the conduction of a randomized-clinical trial in which modifications are recommended in real cases by clinicians who used and did not use the toolkit to evaluate the applicability of the toolkit in clinical environments.

Implications for Occupational Therapy Practice

In regards to how this universal design toolkit applies in a clinical sense to the field of occupational therapy, qualitative analysis results revealed that 73% of responses (n=24) discussed how they believed this toolkit could be valuable as a clinical application resource. This toolkit has been regarded by most participants as an effective reference for when working with clients in fieldwork, especially in the acute care, home health, inpatient rehabilitation, and outpatient settings. It may also be beneficial for occupational therapists who have an emerging understanding of universal design and its application across varying functional impairments, budget constraints, and occupations. Additionally, this toolkit may serve as a valuable resource in occupational therapy educational contexts. For instance, it may be used in assistive technology courses to assist with case study assignments. Overall, this toolkit would likely be helpful to future and current occupational therapists in both academic and clinical contexts to facilitate an enhanced understanding and implementation of universal design.

Conclusion

When considering quantitative data, in terms of knowledge acquisition, participants experienced a statistically significant increase in knowledge after having reviewed and utilized the universal design toolkit ($p < 0.001$). When comparing the three main outcome measures of this

study, which consisted of knowledge acquisition ($\mu=4.23$), usability ($\mu=4.40$), and usefulness ($\mu=4.36$), no statistically significant relationships were determined. This indicates that all outcome measures were similarly perceived, as mean scores were closely rated. In terms of knowledge acquisition, participants experienced a statistically significant increase in knowledge after having reviewed and utilized the universal design toolkit. On top of this, chi-square tests determined that across all questions pertaining to usability, usefulness, and knowledge acquisition, there were significantly more participants who yielded positive responses compared to those who yielded neutral to negative responses.

As for qualitative data, participants mainly discussed the fact that they gained sufficient knowledge from utilizing the toolkit, but feel as though they still need additional real-world application of these concepts in order to fully bolster their understanding of universal design. In terms of usability, participants expressed how they felt as though they needed additional exposure to the toolkit and also desired enhanced organization of the toolkit to facilitate a more usable intervention. Participants also revealed how they found some components of the design of the toolkit to be confusing, which may hinder its usefulness. Lastly, participants offered valuable insight into strengths of the toolkit, as well as ways that the toolkit can be revised to enhance user-experience, and its clinical and educational applicability. Thus, this toolkit successfully addressed the outcomes of this study, as it fostered understanding of universal design amongst future occupational therapists and prioritized cost-effectiveness in universal design, in a larger effort to enhance application of universal design in the home evaluation and modification processes to subsequently improve clients' quality of life, wellbeing, and participation in their daily lives (Struckmeyer et al., 2021; Carr et al., 2013).

References

- Brooke, J. (n.d.). *SUS - A quick and dirty usability scale*.
https://digital.ahrq.gov/sites/default/files/docs/survey/systemusabilityscale%2528sus%2529_comp%255B1%255D.pdf
- Carr, K., Weir, P. L., Azar, D., & Azar, N. R. (2013). Universal Design: A Step toward Successful Aging. *Journal of aging research*, 2013, 324624.
<https://doi.org/10.1155/2013/Fsafe324624>
- Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, E., Story, M., Vandergeiden, G., & Center for Universal Design. (1997). *The principles of universal design*.
<https://design.ncsu.edu/wp-content/uploads/2022/11/principles-of-universal-design.pdf>
- Connell, B. R., & Sanford, J. A. (1999). Research implications of universal Design. In *Measuring enabling environments* (pp. 35–57).
https://doi.org/10.1007/978-1-4615-4841-6_3
- Egilson, S. P., & Jónasdóttir, S. K. (2023). Drawing on critical disability and universal design perspectives within occupational therapy. *Scandinavian journal of occupational therapy*, 30(7), 1102–1112. <https://doi.org/10.1080/11038128.2023.2225755>
- Gao, M., Kortum, P., & Oswald, F. (2018). Psychometric Evaluation of the USE (Usefulness, Satisfaction, and Ease of use) Questionnaire for Reliability and Validity. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 62(1), 1414–1418.
<https://doi.org/10.1177/1541931218621322>

- Hitch, D., Larkin, H., Watchorn, V., & Ang, S. (2012). Community mobility in the context of universal design: inter-professional collaboration and education. *Australian occupational therapy journal*, 59(5), 375–383. <https://doi.org/10.1111/j.1440-1630.2011.00965.x>
- Imrie, R. (2004). From universal design to inclusive design in the built environment. In J. Swain, S. French, C. Barnes, & C. Thomas (Eds.), *Disabling barriers—Enabling environments*. London, UK: Sage Publications.
- Joines, S. (2009). Enhancing quality of life through Universal Design. *Neurorehabilitation*, 25(4), 313–326. <https://doi.org/10.3233/nre-2009-0539>
- Larkin, H., Hitch, D., Watchorn, V., & Ang, S. (2015). Working with Policy and Regulatory Factors to Implement Universal Design in the Built Environment: The Australian Experience. *International journal of environmental research and public health*, 12(7), 8157–8171. <https://doi.org/10.3390/ijerph120708157>
- Mace, R. L., Hardie, G. J., & Place, J. P. (1991). *Accessible Environments: Toward Universal Design*.
- Sanford, J. A. (2012). *Universal Design as a Rehabilitation Strategy: Design for the Ages*. Springer Publishing Company.
- Stark, S., Keglovits, M., Arbesman, M., & Lieberman, D. (2017). Effect of Home Modification Interventions on the Participation of Community-Dwelling Adults With Health Conditions: A Systematic Review. *The American journal of occupational therapy : official publication of the American Occupational Therapy Association*, 71(2), 7102290010p1–7102290010p11. <https://doi.org/10.5014/ajot.2017.018887>
- Struckmeyer, L. R., Campbell, N., Ellison, C., Ahrentzen, S., & Classen, S. (2021). Home modifications and repurposing: perspectives on the accessibility, affordability, and

attractiveness. *Disability and Rehabilitation*, 44(17), 4619–4628.

<https://doi.org/10.1080/09638288.2021.1910866>

Watchorn, V., Hitch, D., Grant, C., Tucker, R., Aedy, K., Ang, S., & Frawley, P. (2021). An integrated literature review of the current discourse around universal design in the built environment - is occupation the missing link?. *Disability and rehabilitation*, 43(1), 1–12.
<https://doi.org/10.1080/09638288.2019.1612471>

Young, D., Wagenfeld, A., & Rucker, H. V. V. (2019). Universal Design and the Built Environment: Occupational Therapy and Interprofessional Design Teams—A Scoping Review. *Annals of International Occupational Therapy*, 2(4), 186–194.
<https://doi.org/10.3928/24761222-20190625-04>