INTERPROFESSIONAL EDUCATION

# 3D printing applications through peer-assisted learning and interprofessional education approaches

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## Abstract

***Introduction:*** Although 3D printing offers customised assistive technology devices at relatively low costs to address the access needs of individuals with disabilities, implementation barriers exist to achieve widespread technology adoption. To improve 3D technology acceptance and to better prepare future clinicians, peer-assisted learning (PAL) was undertaken between occupational therapy (OT) students and students with expertise in 3D printing to work to address real-life patient functional problems.

***Methods:*** 3D printing technology acceptance was measured between cohorts of OT students (Cohort Year 2020, n = 31; Cohort Year 2021, n = 32) without and with PAL integration approaches, respectively, at the conclusion of the 15-week term at project completion.

***Results:*** After the structured interprofessional PAL modules, Cohort Year 2021 improved in perception of *Usefulness* ($p = 0.023$) as compared to Cohort Year 2020, while the *Ease of Use* ($p = 0.095$), *Attitude Toward Using* ($p = 0.313$) and *Intention to Use* ($p = 0.271$) categories did not significantly differ between cohort years.

***Conclusions:*** PAL modules may improve perceptions of 3D printing *Usefulness* among OT students, however *Ease of Use* should continue to be explored as both 2020 and 2021 cohort average perceptions were neutral related to 3D printing technology. Identifying ideal training and mentoring approaches may alleviate the *Ease of Use* barriers to integration of this technology within both the classroom and practice settings and benefit patients.

***Keywords:*** interprofessional education; 3D printing; peer-assisted learning; occupational therapy

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## Introduction

Globally, there are 1 billion individuals with disabilities who need one or more assistive technology devices, and it is projected that 2 billion people will need at least one assistive device by 2030 (Gupta et al., 2011). In more recent years, technological advancements have unfolded new prospects for assistive device service delivery, especially through the use of three-dimensional (3D) printing, which offers individualised and reproducible products at relatively low costs (Hunzeker & Ozelie, 2021). This emerging technology has been implemented in healthcare settings, for example, within occupational therapy (OT) practice to print customised pillboxes and assistive hand tools to open beverage bottles, access doors and facilitate handwriting (Buehler et al., 2016; Janson et al., 2020; Schwartz et al., 2020). Despite the benefits, the 3D printing process has not been fully adopted within rehabilitation service delivery settings, with noted barriers including lack of awareness and experience of service providers as well as the time required to learn computer-aided design (CAD) and operate 3D printers (Patterson et al., 2020). Among physical and occupational therapists, the most important factors determining the adoption of new technologies are the support of internal technical expertise to implement usage and the perception that a novel technology will benefit both their work and the patient (Liu et al., 2015). As healthcare technologies continuously evolve, their limited use and adoption have been studied by applying the Technology Acceptance Model (TAM). The TAM is the most well-accepted model to explain and predict acceptance, for example, of electronic health record information technologies, telemonitoring and telehealth (Gagnon et al., 2012; Ketikidis et al., 2012; Tsai et al., 2019). The TAM considers the importance of user perceptions of *Usefulness* and *Ease of Use* to predict future use of new technologies in workplace settings (Venkatesh, & Davis, 2000). According to the TAM, more exposure to, and experiences with, the technology increases the likelihood that one will use it, with reports that more experience with 3D printing leads to more positive perceptions of the technology (Benham & San, 2020). Current research already supports that the TAM may also predict usage intentions (Gagnon et al., 2012; Ketikidis et al., 2012), however pedagogical approaches to training in the use of the technology and whether these approaches affect user acceptance and predict usage and adoption has not been extensively studied in relation to OT-based technology applications.

For students, educators and health professionals, the preferred methods of professional healthcare education have shifted from the traditional lecture-based model to active learning approaches that prepare students for the critical thinking and communication skills required for team-based healthcare environments. Traditional approaches to teaching often view learning as the responsibility of the instructor, while the active and meaningful “learning by doing” approaches shift the responsibility to the learner by engaging students as partners in their learning and dissuading passive participation (Gleason et al., 2011; McKeachie & Svinicki, 2013). Within entry-level OT educational programs, active approaches such as team-based learning have produced conflicting evidence. For example, Zachry et al. (2017) reported that OT students prefer lecture-based methods to team-based learning, while in a separate study, OT student accountability was associated with academic performance after the completion of team-based learning modules (B. Tan et al., 2021). Suggestions have been posed to improve team-based learning models to enhance clinical reasoning and to meet the dynamic content delivery needs from course to course, the diverse needs of students and accreditation standards among healthcare professions (Abdelkhalek et al., 2010; Dolmans et al., 2015). Peer-assisted learning (PAL) methods, which implement the teamwork principles of working together collaboratively among peers of varying expertise levels to share knowledge, may be an applicable framework to improve the active learning experience (Topping & Ehly, 1998; Whitman & Fife, 1988). Key components of PAL include assisting others to learn, peer modelling and mentoring and peer assessment (Topping, 1998; Topping & Ehly, 1998). Given the benefits of interprofessional case-based learning to solve problems, including changes in learners' skills and attitudes (Keijsers et al., 2016), implementing the PAL framework to bring together peers from two different expertise backgrounds (e.g., from technology-focused backgrounds and from OT) may be beneficial.

Within allied health professions, PAL has improved student satisfaction outcomes for rehabilitation, social work and nutrition students, however its integration has been limited within clinical education settings and in sharing intra-professional knowledge (i.e., within own profession) (Sevenhuysen et al., 2017). Within the fields of engineering and computer science, the degree programs with skills often needed for 3D printing expertise, working as a team and with clients has long been established as an important skill (Connors, 1982); indeed, the average engineer spends more than half of their work time communicating either in written or oral form (Passow & Passow, 2017). However, communication is a major skill lacking in recent graduates (Ford et al., 2021). Joint Task Force on Computing Curricula, Association for Computing Machinery and IEEE Computer Society (2013) curriculum guidelines suggest that collaboration with actual clients is helpful but is not required due to the complex process of solidifying partnerships, which may be difficult for some academic institutes. The absence of outside collaborations results in the limited practice of communication skills at a non-technical level, as an intra-professional audience will always be familiar with core technical concepts. Allowing technology-focused students to work with real clients may have an impact on their transition into the working world (Bednar, 2021; Ford et al., 2021), and authors have suggested that service learning would be a positive solution to incorporate actual clients or patients while also providing students with a sense of purpose (Brooks, 2008; Duffy et al., 2000; Linos et al., 2003; J. Tan & Phillips, 2005).

In view of the PAL key components of peer education, peer modelling and mentoring, and peer assessment, we planned a course project to address a patient problem collaboratively between undergraduate 3D printing students and OT students, with instructor supervision. We identified PAL as the most relevant framework to investigate interprofessional learning within a service-learning project to design an assistive device using 3D printing. In order to address the barriers of lack of awareness and experience operating 3D printers and CAD programs, as identified by Patterson et al. (2020), perceptions of 3D printing must be examined to project future technology adoption and to promote allied health collaborations with the technology expert on the team. In this study, we aimed to explore the impact of using PAL methods on OT students' ability to optimally learn about and implement 3D printed assistive devices when collaborating with undergraduate students who had technology expertise. Specifically, our research question was: Does OT students' acceptance of 3D printing improve after the integration of PAL modules with technology students?

## Methods

This study utilised a two-group, observational quasi-experimental design at a private university based in the United States. The 3D printing project is assigned to all students enrolled in a required graduate, entry-level OT course that focuses on adaptations and environmental modifications. The course is offered annually in the spring term (January–April). The two cohorts' (Year 2020 and Year 2021) perceptions were sampled by retrieval of a required Qualtrics survey questionnaire completed as part of a reflection assignment on 3D printing experiences to understand if the changes to the 2021 course, which included structured PAL integration, improved technology acceptance as measured by perceptions of 3D printing. The Moravian University Human Subjects Institutional Review Board (HSIRB) approved this study (#21-0033) and determined that it qualified as exempt from the HSIRB review as it involved research conducted in an educational setting focusing on normal educational practices.

### *Participants*

In Cohort Year 2020, a total of 32 OT students were enrolled in the OT course, and 31 students completed the questionnaire. In Cohort Year 2021, 33 OT students were enrolled in the course, and 32 students completed the questionnaire.

### *Procedure*

The spring term is held over 15 weeks. The sequential timelines of the project assignment tasks in 2020 and in 2021, January through April in both years, are described in Table 1. The OT students in 2020 were assigned in groups of two (i.e., partners), and the OT students in 2021 were organised in groups of three or four. The university partnered with a local rehabilitation network that provides OT services to patients to identify patients seeking a 3D printed assistive device within the rehabilitation network's long-term care facility that specialises in the 24–7 nursing care of adults living with severe neurological diagnoses, such as multiple sclerosis and spinal cord injury. The patients and the staff requested specific 3D printed assistive devices to aid a real-life functional problem related to the limitations of the disability. In both years, the OT student groups were matched with a patient's functional problem and also matched with students who had background technology expertise who were either currently taking a 3D printing elective course or had completed the 3D printing elective course in a previous semester. See Figure 1 for examples of the devices that were produced, including a deodorant application extended holder for an individual with severe shoulder arthritis and limited active shoulder range of motion and a communication board pointer for an individual with cerebral palsy and severe dysarthria, who uses a communication board but was unable to reach all of the letters on the board due to upper limb hypertonicity. Other examples of devices included a television remote keyguard, a playing-card holder and a custom drink holder for a wheelchair. There were 16 3D prints designed in 2020 and 12 prints designed in 2021. Due to pandemic visitation restrictions and the time constraints of the spring term, the students did not receive formal feedback from the patients in either year as would have usually been obtained.

**Table 1**

*3D printing Project Timelines for the Spring 2020 and Spring 2021 Terms*

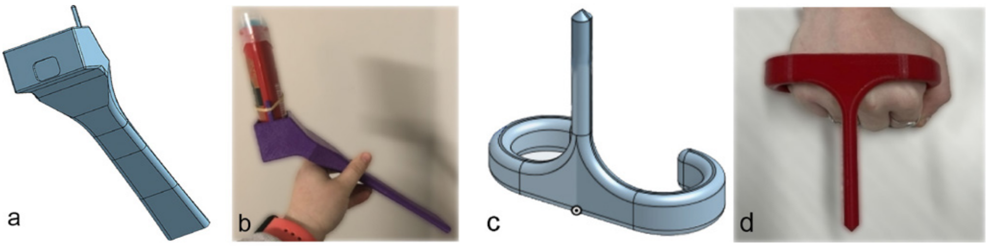
| | Spring 2020 | Spring 2021 |
|---|---|---|
| Weeks 1–3 | 3D printing students learned the 3D printing design and process. 3D printers were available for student use in the Computer Science building at all times throughout the 15-week term. | *Both* OT and 3D printing students learned the 3D printing process; 3D printing students learned the design process. 3D printers were available for student use in both the Computer Science and the OT buildings at all times throughout the 15-week term. |
| Week 4 | | *Structured PAL Module #1:* 3D printing students taught the OT students basic CAD design, about different 3D filaments and 3D printing limitations. |
| Week 5 | OT students receive information regarding the patient's condition and functional problem that could potentially be solved with a custom 3D print. | |
| Week 6 | First meeting between 3D printing students and OT students, which included the 3D printing students teaching the basics of 3D printing to OT students and the OT students describing the proposed item to be designed and printed. | *Structured PAL Module #2:* OT students taught the 3D printing students about the condition of the patient, the functional problem and the proposed item to design and print to solve the problem. |
| Weeks 7–11 | 3D printing students designed the print within a CAD program with OT student input. 3D printing students printed the first drafts of the print. | |
| Weeks 12–14 | 3D printing students printed the final draft of models. | *Structured PAL Module #3:* The OT students printed the final draft of models, with 3D printer access and availability in both the Computer Science and the OT buildings and mentoring assistance from 3D printing students or from the OT instructor. |
| Week 15 | OT students presented the final copy of the 3D print to the OT class. | |

Note: OT = occupational therapy, PAL = peer-assisted learning, CAD = computer assisted design

Changes from the 2020 course to the 2021 course were as follows (and described in Table 1): a total of three structured PAL sessions were integrated into the course curriculum to facilitate the acquisition of knowledge, with an emphasis on the aspects of peer education, peer modelling and mentoring, and peer assessment, while working in collaboration to solve an applied problem (Topping & Ehly, 1998). The task of the 3D-printing student for *Structured PAL Module #1* was to teach the OT students 3D printing basics, including plastics and limitations along with basic CAD design. Following this teaching, the OT students evaluated the 3D printing students on the quality of their teaching and provided a grade on their teaching performance. For *Structured PAL Module #2*, each patient was assigned to an OT group. The task was for the OT students to teach the 3D printing students about the patient's condition, the functional problem and the proposed item to design and print to solve the problem. For example, if the patient's condition was cerebral palsy and the request for a device was a deodorant application extended holder, the OT students were tasked with mentoring the 3D printing students to understand the neurological condition and functional consequences of cerebral palsy in a meaningful way, how hypertonicity and hypotonicity affect limb active range of motion of the patient, the daily routines of the patient and how the patient's daily tasks are adapted. The OT students were then graded by the 3D printing students on their teaching performance. The task of *Structured PAL Module #3* was for the 3D printing student and the OT student groups to collaborate during mutually scheduled times during which the 3D printing students modelled and mentored the OT students on how to transfer the designed device within a CAD program (Figures 1a and 1c) so that the OT students could assume the responsibility of printing the final copy of the designed device (Figure 1b and 1d). At the end of the semester, the questionnaire (described below) was completed by the OT students as part of a course assignment to survey their perceptions of 3D printing.

**Figure 1**

*Examples of the Designed 3D Printed Devices*




Note: Images a and c depict examples of the CAD rendering of the assistive technology devices, while images b and d are the 3D printed devices, ready for patient use.

### *Data collection tools*

A validated questionnaire based on the TAM scale (Venkatesh, & Davis, 2000) was modified to relate to 3D printing technology. The measure was selected based on established reliability and validity and its extensive use to predict user acceptance and future use of new technologies. As previously used in OT education research (Benham & San, 2020), the modified TAM scale consisted of 13 questions related to the following TAM scale categories: *Usefulness* (Questions 1–4), *Ease of Use* (Questions 5–9), *Attitude Toward Using* (Questions 10–11) and *Intention to Use* (Questions 12–13), answered on a 7-point Likert scale from 1 = "*totally disagree*" to 7 = "*totally agree*". See Appendix 1 for individual TAM questions.

### *Data analysis*

Data analysis addressed the primary research question regarding whether technology acceptance differed between cohorts of OT students. All data analyses were performed using the statistical software R (R Core Team, 2021). Demographic characteristic comparisons of the cohorts utilised the independent t-test for age and chi-square test for gender. To measure students' perceptions of the four TAM scale categories (*Usefulness*, *Ease of Use*, *Attitude Toward Using* and *Intention to Use*), we calculated students' average scores for each of the TAM categories as the response of interest. Summary statistics describe the distribution of these average scores compared across the groups of our research aim (e.g., across the two cohort years). To assess whether there were differences between groups, we estimated a linear mixed effects model with a random effect for each student (Bates et al., 2015; Roback & Legler, 2021). The model accounted for differences in average scores across the four TAM scale categories and simultaneously estimated differences in groups, all while accounting for the repeated measures within student that result in potential similarities in responses within the same student (e.g., some students may tend to rate higher overall). To ensure unbiased estimates, we implemented restricted maximum likelihood (REML) estimation of parameters. Given the smaller sample sizes and REML estimation, we used the Kenward-Roger approximation to the F-test to test for the effect of year, cohort and TAM categories (Halekoh, & Højsgaard, 2014; Kenward & Roger, 1997; Luke, 2017).

Statistical significance was set at a Type I error of 5%, with planned one-tailed analyses to compare the improvements from Cohort Year 2020 to Cohort Year 2021. In addition to the full, mixed-effects model, we subset the data and performed an analysis on each of the four TAM scale categories separately using one-sided tests for differences between the mean scores of the groups. We note that by subsetting the data, we no longer have repeated measures within a given student.

## Results

Demographic characteristics of the participants were retrieved from the registrar files of the students, who disclosed this information at the time of their admittance in the OT program. Participant characteristics for both years are listed and compared in Table 2. Both Cohort Year 2020 and Cohort Year 2021 were young adults (24.45 ± 2.53 years and 24.91 ± 2.93 years, respectively) with no statistical differences in age ($p$ = 0.253) and were both mostly female (83.87% and 93.75%, respectively) with no statistical differences ($p$ = 0.212).

**Table 2**

*Demographic Characteristics of Participants*

| | **2020 OT Cohort** (n = 31) **M (SD) or n (%)** | **2021 OT Cohort** (n = 32) **M (SD) or n (%)** | ***t* or *X*²** | ***p*** |
|---|---|---|---|---|
| Age (in years) | 24.45 (2.53) | 24.91 (2.93) | 1.153 | 0.253 |
| *Gender* | | | 1.556 | 0.212 |
| Male | 5 (16.13%) | 2 (6.25%) | | |
| Female | 26 (83.87%) | 30 (93.75%) | | |

Note: M = mean, SD = standard deviation

Our research question examined the relationship between the average scores for the four TAM scale categories compared across the different years of OT students from Cohort Year 2020 to Cohort Year 2021 after the integration of PAL modules, which occurred in 2021. Estimation of a linear mixed model found that a moderately large percent of the variability in TAM scores came from differences between students (intraclass correlation value of 54.6%). After accounting for differences across TAM groups, there was no evidence of a significant difference between the two years in the full model (approximate $F$-statistic of 1.7105, $p$ = 0.1958). However, accounting for differences in the average scores across the TAM categories is important (approximate $F$-statistic of 123.63, $p < 0.001$).

Given the evidence that TAM categories are important in explaining differences in average scores, we performed a one-sided test of the mean for each TAM category separately. In Table 3, we reported the averages and standard deviations along with $t$-test statistics and $p$-values for comparing the means of the two independent cohort years. We found perceptions were significantly higher in Cohort Year 2021 when considering perceptions of *Usefulness* ($p$ = 0.023). However, there was only weak evidence to support a significant change for *Ease of Use* ($p$ = 0.095), with an increase from an average perception of 4.02 ± 1.07 in Cohort Year 2020 to an average of 4.36 ± 0.98 in Cohort Year 2021 and no significant change for *Attitude Toward Using* ($p$ = 0.313) or *Intention to Use* ($p$ = 0.271).

**Table 3**

*Summary Values of Students' Average Score Within a Given TAM Category*

| TAM Category | Mean (SD) | | *t* | *p* |
|---|---|---|---|---|
| | 2020 | 2021 | | |
| *Usefulness* | 5.81 (0.79) | 6.20 (0.71) | 2.05 | 0.023* |
| *Ease of Use* | 4.02 (1.07) | 4.36 (0.98) | 1.33 | 0.095 |
| *Attitude Toward Using* | 5.98 (0.91) | 6.09 (0.88) | 0.49 | 0.313 |
| *Intention to Use* | 5.74 (1.06) | 5.91 (1.07) | 0.62 | 0.271 |

Note: Test statistics and *p*-values are based on one-sided *t*-tests. Values are for n = 31 OT students in 2020 and n = 32 OT students in 2021.

* = statistically significant using a Type I error of 0.05

## Discussion

Overall, it appears that OT student acceptance of 3D printing technology increased, demonstrated by their scores for the *Usefulness* category, which increased from 5.81 ± 0.79 to 6.20 ± 0.71. The *Usefulness* category aims to examine the quality and performance of work after the integration of PAL modules (Davis, 1989). As the structured PAL modules provided a scaffolded approach for understanding the various applications of 3D printing across disabling conditions, we anticipated this increase in students' perception of its usefulness ($p = 0.023$). On average, OT student perceptions improved from "somewhat agree" in Cohort Year 2020 to "agree" in Cohort Year 2021. Researchers utilise users' TAM responses to predict technology adoption in healthcare. A previous study found that when the TAM was applied to novel telemonitoring usage, perception of *Usefulness* was the only significant predictor of the intention to use the technology (Gagnon et al., 2012). This suggests that the OT students in our study might intend to use the technology upon graduation and as new practitioners, a possibility supported by their TAM responses, which indicate some evidence of their *Intention to Use* (average response of 5.91 ± 1.07). In the absence of follow-up surveys, however, we will not know whether the students, upon graduation, did actually utilise 3D printing in an OT professional practice setting. In telemonitoring adoption literature, researchers have found that the most important variable identified by users when it came to their intention to use technology was their perception of the facilitators (Gagnon et al., 2012). As applied to the PAL methods used in this study, the peer mentors may be analogous to facilitators. Perhaps more training of the peer mentors in how to educate and mentor the novice team member technology users to understand and apply 3D printing technology may improve TAM scores.

In regards to perceptions of *Ease of Use*, it is anticipated that as students gain greater access to a system, they will have more practice with the technology and perceive it as "free from effort" (Davis, 1989, p. 320). However, the average responses for perceptions of *Ease of Use* in this study only weakly improved from 4.02 ± 1.07 to 4.36 ± 0.98 ($p = 0.095$). It should be noted that the average response of both Cohort Year 2020 and Cohort Year 2021 was "neutral", and thus, OT students overall continued to perceive the ease of 3D printing in a neutral way. This is consistent with previous reports of technology adoption in practice settings among surveyed rehabilitation professionals, which indicate that the ease of use of new technologies is perceived either as neutral or not easy to use, with therapists suggesting that barriers include time constraints and the need for more training (Liu et al., 2015; McGrath et al., 2017). In contrast to telemonitoring adoption literature, which found only perceptions of *Usefulness* as a predictor of intention to use (Gagnon et al., 2012), when the TAM was applied to a surveyed healthcare professional sample of health information technology system (i.e., electronic medical record system) users, only perceptions of *Ease of Use*, not *Usefulness*, significantly predicted the technology usage intention (Ketikidis et al., 2012). These authors suggest that users valued being competent using computers and propose the integration of hands-on workshops to enhance familiarity. This suggestion is important to consider for 3D printing adoption as 3D printing relies heavily on computer usage. Therefore, hands-on workshop format PAL modules with an emphasis on computer integration may improve *Ease of Use* scores.

One explanation for the findings on perceptions of *Ease of Use* that is worthy of further examination is the change from two OT students matched with a 3D printing mentor in Cohort Year 2020 to three or four OT students matched with a 3D printing mentor in Cohort Year 2021, which possibly affected the peer mentoring attention received in 2021. Future PAL could be further supplemented with instructor "expert" support throughout the semester to further troubleshoot the technical issues of the printing process and to address the clinically reported technology adoption barriers of dedicated time required for training (Liu et al., 2015).

While our findings showed no notable changes in perceptions in the *Attitudes Toward Using* and the *Intention to Use* categories, it should be noted that responses in Cohort Year 2020 were already favourable, on average (approaching the interpretation of "agree"); thus, they likely did not change due to a ceiling effect of the overall already positive societal perceptions of 3D printing technologies among Millennial and Gen Z learners. In reference to previous literature, not only is perception of *Usefulness* a key predictor of adoption, the anxiety of using computer-based technologies is a main factor influencing its adoption, including health information and telehealth adoptions (Ketikidis et al., 2012; Tsai et al., 2019). PAL in a workshop format may alleviate this factor, as students who participate in PAL activities report less anxiety when working with peers than with clinical instructors (Henning et al., 2006; Zentz et al., 2014). Mentors within PAL are scored highly by learners for social congruence, with learning perceived as occurring with "enjoyment" and mentors perceived as having high "approachability", which reduces anxiety (Loda et al., 2019). PAL integration in 3D printing training may, therefore, improve *Attitudes Toward Using* if stressors are decreased through peer modelling and mentoring. OT students may lack confidence in carrying out the practice of 3D printing for unidentified reasons other than anxiety. In future studies, more structured PAL sessions with more peer mentoring support and outcome measures consistent with other PAL studies, such as perceived learning and satisfaction with the learning, should be examined (Sevenhuysen et al., 2017).

### *Limitations*

This study was conducted using an observational design. A controlled study of random allocation was deemed to be unethical as it would involve withholding the PAL modules for part of the OT cohort of 2021. Therefore, attribution of the effect of the changes in technology acceptance due to the PAL modules alone is limited. Both Cohort Year 2020 and Cohort Year 2021 experienced pandemic-related restrictions, however the content of the courses continued to be delivered as originally intended. Although not measured in this current study, which focused on OT student technology acceptance, future studies may include data from the perspective of the 3D printing undergraduate student "mentors".

When examining the demographic characteristics of the students, most were younger adults representative of Millennials or Gen Z, who may be more amenable to the hands-on learning approaches of PAL and more accepting of technology (Phillips & Trainor, 2014) than a more representative sample of practising occupational therapists spanning multiple generations. Future studies should examine the technology acceptance of PAL modules in current practice settings across a greater range of ages. We were also unable to retrieve ethnicity data of the OT students, as the reporting within the registrar was inconsistent, with the majority of Cohort Year 2021 declining to disclose ethnicity. Future studies should aim to recruit rehabilitation team member participants representative of diverse ethnicities.

## Conclusion

Structured PAL modules may improve OT students' perception of 3D printing technology in the TAM category of *Usefulness* and possible adoption in future practice. While *Attitudes Toward Using* and the *Intention to Use* remained the same in our study, they are perceived as positive, on average. OT educators should continue to examine the most effective methods for teaching 3D printing in order to address student perceptions of *Ease of Use*, or how easy technology is to integrate into health professional practice. Within PAL, we recommend integrating more consistent mentoring with the instructor or technology expert and focusing on measuring the relationship between technology anxieties and perceived learning. Future studies should aim to examine if PAL applications have similar results in clinically focused practice settings for rehabilitation professionals to collaborate with the technology experts to solve patient functional problems.

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## Appendix 1

*Individual Questions on the TAM Questionnaire*

| TAM Category | Questions Related to the Category |
|---|---|
| Usefulness | 1. I think that using 3D printers would improve job quality for occupational therapists. |
| | 2. I think that using 3D printers would improve the effectiveness of how occupational therapists deliver services to clients. |
| | 3. I think that the advantages of using 3D printers outweigh the disadvantages. |
| | 4. Overall, I think that using 3D printers is advantageous for occupational therapists. |
| Ease of Use | 5. I think that learning to work with 3D printers is easy. |
| | 6. I think that learning how to use software and printers is clear and understandable. |
| | 7. I think that it is easy for occupational therapists to become skilful at using 3D printers. |
| | 8. I think that it is possible to use 3D printers without expert help. |
| | 9. Overall, I think that using 3D printers is easy for occupational therapists to use. |
| Attitude Toward Using | 10. I think that using 3D printers is a good idea for occupational therapists. |
| | 11. As a future occupational therapist, I like the idea of using 3D printers. |
| Intention to Use | 12. In the future, if 3D printer resources are available to me in my occupational therapy practice setting, it is probable that I will use 3D printers. |
| | 13. I will recommend the use of 3D printers to other occupational therapists. |

Note: Question prompt was "Please indicate your level of agreement with each of the following statements using the scale provided:
1 = *totally disagree*, 2 = *disagree*, 3 = *somewhat disagree*, 4 = *neutral*, 5 = *somewhat agree*, 6 = *agree*, 7 = *totally agree*" (Benham & San, 2020)