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Abstract

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Keywords

Metacognition, Metacognitive Awareness Inventory, occupational therapy students, learning strategies

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Metacognition of First-Year Occupational Therapy Students: A Comparison of Entry-Level Degrees

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ABSTRACT

The purpose of this study was to compare the metacognitive awareness among first year students in entry-level occupational therapy programs. The study investigated the similarities and differences in awareness of cognition and strategies used to regulate cognition in occupational therapy assistant (OTA), Master of Occupational Therapy (MOT), and Occupational Therapy Doctorate (OTD) programs to inform teaching practices for the different educational demands and expected outcomes of each program. Thirty occupational therapy students (11 OTA, 10 MOT, and 9 OTD) completed the Metacognitive Awareness Inventory (MAI) during their first semester of occupational therapy courses at two universities. Overall, the results indicated the student reported use of metacognitive strategies was more similar than dissimilar among the three entry-level programs. Additionally, MAI responses were not predictive of course grades. Instructors can design educational experiences to tap into the metacognition of the student, promoting effective and efficient learning to meet the high educational standards required for our profession. Students who are effective and efficient learners will be more prepared to meet the demands of a complex healthcare environment in their respective practitioner roles.

INTRODUCTION

Occupational therapy students are required to master the skills specified in the Accreditation Council for Occupational Therapy Education (ACOTE®) Standards (ACOTE, 2018) in preparation to meet the demands of today's healthcare environment. These skills include using clinical reasoning and evidence-based practice in leadership roles to meet the client's needs and to survive the complex healthcare environment (Brown, Crabtree, Mu, & Wells, 2015). As students gain occupational therapy knowledge and skills, they must be able to apply that knowledge during fieldwork.

With three degree-level programs to enter the occupational therapy profession through obtaining an associate's degree to become an occupational therapy assistant (OTA), or through two graduate degree options (Master of Occupational Therapy [MOT] and Occupational Therapy Doctorate [OTD]), it is expected that the outcomes of each program are significantly different. A review of the ACOTE (2018) required standards indicated the foundational skills and knowledge required for clinical practice across all three entry routes. The focus of the OTA program is to equip students with the technical skills required for the delivery of client care. Advanced knowledge of theory and research were noted as additional requirements for the MOT and OTD graduate degrees, with further knowledge and skills of leadership and advocacy required explicitly for the OTD degree (ACOTE, 2018).

Academic performance has been positively associated with educational program outcomes of fieldwork success (Bathje & Ozelie, 2014; Thew & Harkness, 2018) as well as National Board Certification for Occupational Therapy (NBCOT) exam pass rates (Novalis & Cyranowski, 2017). Many students who are academically successful exhibit well-developed metacognitive knowledge and metacognitive regulatory skills (Young & Fry, 2008). Metacognition (the awareness of one's learning processes) has long been considered a core element of academic success because higher metacognitive ability allows individuals to be more efficient learners (Kelly & Donaldson, 2016). The proposed move to an entry-level clinical doctorate will result in higher educational demands to prepare students for a more complex scope of practice (Brown et al., 2015), and thus, will likely necessitate a higher level of metacognition.

The three different levels of occupational therapy educational programs prepare students for specific roles within the profession. The OTA program is responsible for preparing professionals to provide direct client care. While MOT education is responsible for producing occupational therapists with advanced clinical reasoning and evidence-based practice knowledge, the OTD program is responsible for producing future leaders who will be at the forefront of the profession in the additional roles of advocates and researchers. Considering the expectations of the three avenues leading to professional practice, an educator could expect levels of cognition and academic performance to be commensurate with the expected outcomes of each respective program. To date, research has not been conducted on the differences in the metacognition of students across the three entry-level occupational therapy programs. Because the role of educators is to facilitate learning, they have an opportunity to aid students in the development of metacognitive self-regulation to positively impact the

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development of occupational therapy knowledge and skills. The purpose of this study was to compare the metacognitive awareness of OTA, MOT, and OTD students to determine the similarities or differences in awareness of cognition and strategies used to regulate cognition, to further inform teaching practice.

LITERATURE REVIEW

Whether the program is at the associate, master's, or doctoral level, students must work to fulfill high educational expectations. All entry-level occupational therapy students must learn information presented in a variety of methods including traditional lectures, hands-on labs, projects, simulations, and group discussions. After presenting the educational demands of entry-level occupational therapy programs, this literature review will present the research on the use of metacognitive strategies in higher education.

Not only are there rigorous admission and progression criteria in occupational therapy education, but also course objectives are often scaffolded according to Bloom's taxonomy. Bloom's Taxonomy of Classification of Learning Objectives (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) is often used in education to demonstrate the progression of learning, by illuminating the cognitive skills necessary for students to assimilate the material presented. Bloom's taxonomy contains six categories of cognitive abilities ranging from lower-order skills that require less cognitive processing to higher-order skills that necessitate deeper learning and a greater degree of cognitive processing (Adams, 2015). Bloom's Revised Taxonomy uses verbs and gerunds to label categories and subcategories, and to describe the cognitive processes by which thinkers encounter and work with knowledge (Anderson, Krathwohl, & Bloom, 2001). A review of the ACOTE standards revealed commonalities with Bloom's Taxonomy. All entry level (OTA, MOT, OTD) degree standards utilize the foundational levels of Bloom's Revised Taxonomy, focused on the understanding and application of knowledge, and graduate (MOT & OTD) entry-level degrees have standards within the advanced levels of application and synthesis of knowledge.

Each entry-level occupational therapy educational program presents unique academic challenges. Academic challenges, as well as life stressors, have impacted students to the point of reporting diagnoses of anxiety (22%), depression (18%), or anxiety plus depression (14%; American College Health Association [ACHA], 2018). Additionally, 27% of students responding to the ACHA survey indicated their anxiety affected their academic performance. Interestingly, low cognitive confidence places the student at risk for developing anxiety (Yilmaz, Gençöz, & Wells, 2011). Furthermore, rigorous admission and progression criteria embedded in each entry-level program present an additional level of stressors for occupational therapy students. Stress negatively impacts metacognitive function and affects academic performance (Reyes, Silva, Jaramillo, Rehbein, & Sackur, 2015).

Metacognition

Metacognition, defined as awareness or analysis of one's learning or thinking processes (Flavell, 1987), has long been considered a fundamental element of academic success because higher metacognitive ability allows individuals to be efficient learners (Kelly &

Donaldson, 2016). Use of metacognitive strategies may help students meet the increased higher educational demands across each entry-level program. Metacognitively-aware learners are more strategic and perform better than those who are not, allowing them to plan, sequence, and monitor their learning in a way that directly improves performance (Harford Community College Learning Center, 2014). Higher levels of metacognition are associated with better grades across a range of subjects, ages, and types of academic tests (Kelly & Donaldson, 2016). Metacognitively aware students also tend to exhibit less test anxiety and improved examination performance (Zhang & Henderson, 2017).

Metacognitive strategies relate to students' knowledge of their cognitive processes. These strategies typically fall into the categories of planning, monitoring, and evaluation (Flavell, 1987), enabling students to evaluate their thinking and learning processes (Yilmaz & Baydas, 2017). Planning includes selecting appropriate methods, determining effective ways of thinking, and deciding on the allocation of resources before a learning episode (Ku & Ho, 2010; Yilmaz & Baydas, 2017). The use of monitoring strategies such as awareness and evaluation of comprehension allows students to filter information and prioritize ideas for attention. Evaluation strategies include examination and correction of one's thinking and revisions as necessary after a learning episode (Ku & Ho, 2010; Yilmaz & Baydas, 2017). These strategies allow students to self-manage their learning. When students can self-manage, they can develop unique, customized study strategies incorporating their own cognitive and affective characteristics, monitor their learning, and modify their approach to learn and retain material (Aydemir 2014; Yilmaz & Baydas, 2017).

Furthermore, Yilmaz and Baydas (2017) suggested that metacognition is an essential 21st-century skill such as lifelong learning, digital literacy, creativity, and critical thinking. The university environment offers a suitable context for using these strategies because university students have a personal responsibility to manage time and educational demands (Hu, 2007; Yilmaz & Baydas, 2017). Academically unsuccessful students exhibit commonalities in metacognitive shortcomings such as inadequate planning, monitoring or evaluation and typically do not recognize whether their study strategies were effective until after receiving a graded assignment or examination (Garrett, Alman, Gardner, & Born, 2007).

Identification of the metacognitive and study strategies used by students could allow occupational therapy educators to create and enhance learning opportunities appropriate for each entry level educational program. This study was conducted to compare the metacognitive strategies used by first-year occupational therapy students in the OTA, MOT, and OTD degree programs. The Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994) was chosen as it measures the constructs of interest potentially answering the research questions of:

- What metacognitive strategies do first-year occupational therapy students employ while studying to learn and retain information presented by instructors?
- Is there a difference in the metacognitive strategies used by first year associate, master's, and doctoral degree occupational therapy students?

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METHODOLOGY

The purpose of this study was to explore the metacognitive strategies used by first semester occupational therapy students in three entry-level programs. An online survey combining the MAI (Schraw & Dennison, 1994) with demographic questions was administered to students during their first semester of their respective programs to explore their metacognitive knowledge and how they monitor learning. The MAI is a 52 question self-reported measure in true/false format for adults, with "True" indicating the use of a strategy, to evaluate the respondents' awareness of knowledge of cognition and regulation of cognition. It is a reliable and valid initial test of metacognitive awareness in adults (Schraw & Dennison, 1994).

Sample questions from the MAI are included in Table 1. Questions from the MAI (Schraw & Dennison, 1994) are formulated to assess a student's knowledge of cognition. This portion of the test evaluates three types of knowledge including declarative knowledge, procedural knowledge, and conditional knowledge. Declarative knowledge focuses on facts, and procedural knowledge focuses on processes or procedures. Conditional knowledge consists of the cognition needed to determine when to use declarative and procedural knowledge. Additional questions focus on the student's strategies used to regulate their cognition. Questions in this area assess five areas which include (1) Planning (planning, goal setting, and allocating resources prior to learning), (2) Information Management Strategies (skills and strategy sequences used to process information more efficiently), (3) Comprehension Monitoring (assessment of one's learning or strategy use), (4) Debugging Strategies (strategies used to correct comprehension and performance errors), and (5) Evaluation (analysis of performance and strategy effectiveness after a learning episode).

Table 1

Examples of Questions from the MAI and Alignment with Type and Regulation of Knowledge

Type of Knowledge	MAI Question
Declarative	Q5: I understand my intellectual strengths and weaknesses Q10: I know what kind of information is most important to learn
Conditional	Q18: I use different learning strategies depending on the situation Q29: I use my intellectual strengths to compensate for my weaknesses
Procedural	Q3: I try to use strategies that have worked in the past Q27: I am aware of what strategies I use when I study

Regulation of Knowledge	MAI Question
Planning	Q6: I think about what I really need to learn before I begin a task
Information Management Strategies	Q48: I focus on overall meaning rather than specifics
Comprehension Monitoring	Q34: I find myself pausing regularly to check my comprehension
Debugging Strategies	Q40: I change strategies when I fail to understand
Evaluation	Q24: I summarize what I've learned after I finish

Demographic questions included the highest level of education obtained, occupational therapy education program, gender, age, race/ethnicity, and marital status. Following exempt status from the Institutional Review Boards (IRB) of both universities, the online survey was embedded in the courses via the universities' learning management systems. Course grades were also considered as part of these analyses after grades were submitted to the registrar upon conclusion of the semester.

Participants were recruited from the OTA and OTD programs at a southern public university, and the MOT program from a mid-western private university. A total of 30 students completed the survey, yielding a response rate of 30%. All students indicated having at least some college experience, with 86.7% of students reporting an earned bachelor's degree. All but one respondent reported their race as White/European American. A summary of participant demographics is shown in Table 2.

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Table 2

Participant Demographics across Programs

	OTA (*n*=11)		MOT (*n*=10)		OTD (*n*=9)		Total (*n*=30)	
	n	%	*n*	%	*n*	%	*n*	%
<u>Gender</u>								
Female	9	82%	10	77%	6	67%	32	83.33%
Male	2	18%	-	-	3	33%	5	1.67%
Prefer not to answer	-	-	3	23%	-	-	4	2.33%
<u>Age</u>								
21-25	7	64%	10	77%	8	89%	25	83.33%
26-30	3	27%	-	-	1	11%	4	1.33%
31-35	-	-	-	-	-	-	-	-
36-40	-	-	-	-	-	-	-	-
40-45	1	9%	-	-	-	-	1	3.00%
46+	-	-	-	-	-	-	-	-
Prefer not to answer	-	-	3	23%	-	-	4	10%
<u>Marital status</u>								
Never married	5	45.5%	13	100	8	89%	29	86.67%
Married	5	45.5%	-	%	1	11%	6	20.00%
Divorced	1	9%		-	-	-	-	3.00%
Prefer not to answer	-	-	-	- -	-	-	-	-

RESULTS

Grades for the course in which students were enrolled and recruited for the study were considered. Average course grades were 94.85 (*n* = 6; *R* 86.10-95.24) for the OTA students; 91.92 (*n* =10; *R 84.63-94.88*) for the MOT students; and 92.54 (*n* = 10; R 91.36-96.45) for the OTD students. The proportion of "True" responses for the declarative knowledge factor was a significant predictor of course grade. On the other hand, for all other factors, there was insufficient evidence to conclude that the proportion of true responses was a significant predictor of course grade.

MAI Responses across Programs

The proportion of subjects who answered "True" and "False" to the MAI questions across programs for each domain and factor can be seen in Table 3. Chi-square tests of independence (Pearson, 1900) were utilized to determine if significant associations exist between how the participants responded (true or false) and the program type (OTA, MOT, or OTD) for all subcategories of the domains and factors. These tests and all additional analyses were conducted in *R* (*R* Core Team, 2018). All expected counts for each chi-square test were sufficiently large (i.e., $\geq$ 5 in at least 80% of the cells), except in the "debugging strategies" group. Thus, Fisher's exact test was used instead by calling the "fisher.test" function. Table 4 provides a summary of the results. Included in Table 3 is Cramer's *V* (Cramer, 1946), which provides a measure of association between the two nominal variables of interest (i.e., response type versus program type) for each domain and factor and was calculated using the “cramerV" function from the “rcompanion" package (Mangiafico, 2018).

Table 3

The Proportion of Subjects Who Answered “True” And “False” to the MAI Questions Across Programs

Program	OTA		MOT		OTD	
	True	(False)	True	(False)	True	(False)
Domains						
Knowledge of Cognition (KC)	0.7892	(0.2108)	0.7471	(0.2529)	0.7843	(0.2157)
Regulation of Cognition (RC)	0.7506	(0.2494)	0.7081	(0.2919)	0.7524	(0.2476)
Factors of Knowledge of Cognition						
Declarative Knowledge (DK)	0.7614	(0.2386)	0.7375	(0.2625)	0.8333	(0.1667)
Procedural Knowledge (PK)	0.7955	(0.2045)	0.8250	(0.1750)	0.7778	(0.2222)
Conditional Knowledge (CK)	0.8302	(0.1698)	0.7000	(0.3000)	0.7111	(0.2889)
Factors of Regulation of Cognition						
Planning Strategies (PS)	0.7143	(0.2857)	0.6714	(0.3286)	0.6667	(0.3333)
Information Management (IM)	0.7182	(0.2818)	0.7400	(0.2600)	0.8333	(0.1667)
Comprehension Monitoring (CM)	0.8312	(0.1688)	0.7429	(0.2571)	0.7049	(0.2951)
Debugging Strategies (DS)	0.8727	(0.1273)	0.9149	(0.0851)	0.9535	(0.0465)
Evaluation (EV)	0.6515	(0.3485)	0.4915	(0.5085)	0.6111	(0.3889)

Association between MAI Factors and Program Type

Table 4 displays the results of the tests for association between response type (true/false) and program type (OTA/MOT/OTD) for the 10 domains. Of these 10 tests, 9 were performed using the Chi-square test of independence and one test (for the debugging group) was performed using Fisher's exact test (because of small cell sizes).

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The Chi-square statistic for each test (minus Fisher's) is reported along with the corresponding *p*-value. In addition, Table 4 also provides Cramer's *V*. This statistic measures the association between the two variables within each domain. As seen in this table, all 10 tests (large *p*-values) showed there was no evidence of a significant association between response type and program type. Thus, put plainly, within each domain, there was insufficient evidence to conclude that one group was responding “True” at a higher rate compared to the other groups. Furthermore, within each domain, students appeared to be responding “True” on the MAI at the same rate across the three program types.

Table 4

Chi-square Test of Independence Results and Cramer’s V in Measuring the Association Between Response Type and Program Type for Each Domain and Factor

Domain or Factor Type	χ^2_2	*p*-value	Cramer’s *V*
Knowledge of Cognition	1.0408	0.5943	0.0453
Regulation of Cognition	2.2431	0.3258	0.0464
Declarative Knowledge	2.144	0.3423	0.0945
Procedural Knowledge	0.2730	0.8724	0.0477
Conditional Knowledge	2.8472	0.2408	0.1387
Planning	0.4640	0.7929	0.0470
Information Management	3.9274	0.1403	0.1144
Comprehensive Monitoring	3.2851	0.1935	0.1257
Debugging	NA	0.3869 (Fisher)	0.1159
Evaluating	3.4799	0.1755	0.1394

Relationship between MAI Scores and Course Grades

To determine the relationship, if any, between the proportion of “True” responses and the grades of the participants for each factor, a regression analysis was conducted. In these models, the programs were aggregated together, and the proportion of “True” responses was regressed onto grade. There were four missing course grades out of the 30 participants. A multiple imputation procedure was implemented using the “mice" package (van Buuren & Groothuis-Oudshoorn, 2011). This procedure generated ten imputed datasets using 50 iterations each and the “predictive mean matching" method (Rubin & Schenker, 1986).

A comparison between the non-imputed and imputed results was examined for all factors. In both cases for all factors other than declarative knowledge, the proportion of "True" responses was an insignificant predictor for the course grade. This indicated that there was no significant linear association between these two variables for these factors. For the declarative knowledge factor, the proportion of "True" responses was a significant predictor using the non-imputed data (p=0.0302) and a marginally insignificant predictor using the imputed data (p=0.082). Table 5 summarizes the results of the ten linear models by giving the non-imputed and imputed parameter estimates, standard errors, and *p*-values.

Table 5

Non-imputed and Imputed Parameter Estimates, Standard Errors, and p-values for the 10 Linear Models

Factor		Estimate (Imputed)	Std. Error (Imputed)	*p*-value (Imputed)
DK	Intercept	85.531 (87.271)	3.151 (3.010)	<0.0001 (<0.0001)
	Proportion	9.108 (7.070)	3.953 (3.810)	0.0302 (0.082)
PK	Intercept	91.107 (91.976)	2.775 (2.665)	<0.0001 (<0.0001)
	Proportion	1.910 (1.051)	3.306 (3.195)	0.569 (0.745)
CK	Intercept	88.272 (87.887)	3.012 (2.953)	<0.0001 (0.0001)
	Proportion	5.216 (5.651)	3.500 (3.450)	0.149 (0.114)
PS	Intercept	92.832 (93.124)	2.337 (2.132)	<0.0001 (<0.0001)
	Proportion	-0.230 (-0.502)	3.173 (2.971)	0.943 (0.867)
IM	Intercept	90.677 (90.534)	3.774 (3.799)	<0.0001 (<0.0001)
	Proportion	2.643 (2.932)	4.936 (4.943)	0.597 (0.559)
CM	Intercept	93.306 (92.672)	2.180 (2.345)	<0.0001 (<0.0001)
	Proportion	-0.826 (-0.043)	2.702 (2.863)	0.763 (0.988)

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DISCUSSION

As the metacognitive knowledge and skills of first year occupational therapy students has not been fully investigated to date, this study sought to determine the answers to the following research questions:

1. What metacognitive strategies do first-year occupational therapy students employ while studying to learn and retain information presented by instructors?
2. Is there a difference in the metacognitive strategies used by first year associate, master's, and doctoral degree occupational therapy students?

To answer the first research question: first year occupational therapy student responses on the MAI were slightly different in the knowledge of cognition portion of the instrument, yet were similar in their response on items in the regulation of cognition section. Students reported a higher proportion of true responses for the following knowledge of cognition factors: OTA – conditional knowledge; MOT – procedural knowledge; and OTD – declarative knowledge. Yet, the proportion of "True" responses for regulation of cognition factors was consistently higher for debugging strategies for all student groups from the three entry-level programs. Debugging strategies are the review of learning during a studying episode, such as asking for assistance, changing study strategies, and rereading content when the study content is not understood or clear. Perhaps, the differing curricular demands of the three programs could have impacted student responses. Reviewing each program's curriculum, the OTA students were enrolled in basic therapeutic skills courses during the semester of the study. Both the MOT and OTD students were engaged in courses that also focused on therapeutic skills, but also included research courses. Additionally, prior higher education experience could have also impacted the student responses on the MAI. Nearly all respondents reported having earned an associate or bachelor's degree, with one respondent reported having only some college experience.

In response to the second research question, all three entry-level programs (OTA, MOT, OTD) were more similar than dissimilar in the proportion of true responses on the MAI. According to the results, there were no significant differences in the metacognitive strategies reported by first year students in the three entry-level programs, according to the MAI. Although there were no reported differences in metacognitive strategies, the education standards for each entry-level program do differ resulting in different expectations to prepare OTA, MOT, and OTD students for different practitioner roles. Thus, the metacognitive strategies required by each educational program need further investigation.

Furthermore, research has been inconclusive regarding the relationship between metacognition and academic performance, as measured by course grades or GPA. Young and Fry (2008) found significant correlations between the MAI and academic performance measures, while Çetin (2017) found the MAI was not significantly correlated with academic performance as measured by GPA. The results of our study demonstrated that the proportion of "True" responses for the declarative knowledge factor was a significant predictor of course grade. For all other MAI factors, there was insufficient evidence to conclude that the proportion of "True" responses predicted course grade. One possible explanation for these results could be the generally high academic success among the respondents, all earning at least 90% in their respective first year course. Another explanation could be the dichotomous scale used for the MAI, limiting its sensitivity.

Limitations

Generalizability of these results is impacted by limitations inherent in the study design. First, the small sample size from three entry-level programs across two universities limits the generalizability of the results to other entry-level occupational therapy programs. Although the study recruited participants from two universities, respondents included students from each entry level occupational therapy program, including OTA, MOT, and OTD. The two universities represented differed in Carnegie Classification. The size of the universities was dissimilar. The focus of the universities differed as one was considered a Doctoral University with high research initiative, while the other was considered a Master's College and University – Large program (http://carnegieclassifications.iu.edu/). Additionally, institutional funding and consequently student tuition differed as one university was state funded, and the other was a private, not-for-profit institution. Second, the use of the dichotomous true/false scale for the MAI may have limited the sensitivity of the instrument. Furthermore, students were recruited in classes taught by the researchers. Having researchers as instructors could have impacted student responses, as students may have believed their responses could influence their course grade. All of these factors impact the generalizability of the results to other occupational therapy programs.

Implications for Occupational Therapy Education

Despite the different educational demands and outcomes set forth by ACOTE for each entry level program, these results showed no difference in reported metacognitive strategies used by first year occupational therapy students across each entry-level program. Therefore, occupational therapy instructors may focus on the educational demands in preparing students for their future roles as practitioners instead of the metacognitive and study strategies used by students. Yet, instructors may still need to teach metacognitive strategies to increase the efficiency and effectiveness of learning for students.

Future studies on the metacognition of occupational therapy students should utilize a broader study population that represents students from all regions of the United States. Utilizing a version of the MAI with a 5-point Likert scale may allow the researchers to increase the test sensitivity and may obtain more accurate information. Finally, because test anxiety has been found to have a significant impact on performance and on a student's ability to employ metacognitive strategies, future studies should include an assessment of participants' self-reported levels of test anxiety.

CONCLUSION

The most used metacognitive strategy reported by occupational therapy students in the three entry-level programs was the debugging strategy, a more reactive strategy to correct comprehension or performance errors after a learning episode or assessment.

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Although there are different educational demands and outcomes for each entry-level program, the study found there is no difference in reported metacognitive awareness among first-year OTA, MOT, and OTD students. Due to these similarities, educators can approach instruction in proactive metacognitive strategies based on individual student needs and course content to improve efficiency, effectiveness, and retention of student learning in preparation for clinical practice.

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