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Use of Metacognitive Techniques in Occupational Therapy Education: A Scoping Review

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Abstract

Efficient and effective occupational therapy curricular and course design is essential to develop competent and reflective practitioners. The intentional use of metacognitive strategies could improve the development of higher-order thinking and learning outcomes. The study explored the use of metacognitive strategies to improve learning and higher-order thinking in students within occupational therapy higher education. A targeted search for occupational therapy journals only was the primary method to identify studies. Arskey and O'Malley's (2005) five-stage framework guided this scoping review. All studies demonstrated some aspects of metacognition, this included thinking about their learning, reflection, self-assessment, or sense-making. Through the PRISMA process, the initial search yielded 260 studies; 27 duplicates were removed for a remaining total of 233 studies. Thirteen articles were included in the final study. The identification of the studies' purpose, pedagogy, metacognitive strategies, and the level of Bloom's taxonomy for the strategies was included in the analysis. Written reflection, peer-to-peer debate, self-directed learning, critical thinking, self-assessment, and reflection observation were the metacognitive strategies described in the articles. The metacognitive strategies were not specific to a pedagogy. Rather the strategies varied in use; however, all focused on learning outcomes to develop higher-order thinking skills and life-long learners. The selected studies reported improved learning outcomes and described metacognitive strategies. Transparency and intentionality in occupational therapy higher education related to metacognition may improve learning outcomes leading to practitioners whose self-reflection and critical thinking improve client and system outcomes.

Keywords

Metacognition, higher order thinking, occupational therapy, reflective learning

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ABSTRACT

Efficient and effective occupational therapy curricular and course design is essential to develop competent and reflective practitioners. The intentional use of metacognitive strategies could improve the development of higher-order thinking and learning outcomes. The study explored the use of metacognitive strategies to improve learning and higher-order thinking in students within occupational therapy higher education. A targeted search for occupational therapy journals only was the primary method to identify studies. Arskey and O'Malley's (2005) five-stage framework guided this scoping review. All studies demonstrated some aspects of metacognition, this included thinking about their learning, reflection, self-assessment, or sense-making. Through the PRISMA process, the initial search yielded 260 studies; 27 duplicates were removed for a remaining total of 233 studies. Thirteen articles were included in the final study. The identification of the studies' purpose, pedagogy, metacognitive strategies, and the level of Bloom's taxonomy for the strategies was included in the analysis. Written reflection, peer-to-peer debate, self-directed learning, critical thinking, self-assessment, and reflection observation were the metacognitive strategies described in the articles. The metacognitive strategies were not specific to a pedagogy. Rather the strategies varied in use; however, all focused on learning outcomes to develop higher-order thinking skills and life-long learners. The selected studies reported improved learning outcomes and described metacognitive strategies. Transparency and intentionality in occupational therapy higher education related to metacognition may improve learning outcomes leading to practitioners whose self-reflection and critical thinking improve client and system outcomes.

Introduction

Metacognition, in its simplest definition, is thinking about one's thinking. Initially coined by John H. Flavell in 1976, the term further involves awareness of one's mental processing in the context of monitoring, planning, and problem-solving in addition to the ability to accurately judge one's level of learning (McGuire, 2015). At its core, metacognition is a process of self-assessment and self-reflection, allowing learners to recognize what they know and do not know (Sandall et al., 2014). Knowledge of strategy, task, and self are three aspects of metacognition (Ku & Ho, 2010). In the development of a learner's metacognitive abilities, two integral components include the learner's current level of learning and the educator's or institution's *expectations* of the learner's level of learning. Expectations for learning are often communicated through objectives and the Bloom's Taxonomy provides a framework to communicate those objectives.

In addition to uses for course design, Bloom's Taxonomy allows students to assess their current level of learning as they progress from surface-level to deep learning (Dong, 2014; Fallahi & LaMonaca, 2009). From simple to complex, Bloom's Taxonomy consists of remembering, understanding, applying, analyzing, evaluating, and creating (Krathwohl, 2002). Surface-level learning occurs within the lower tiers of Bloom's Taxonomy (knowledge/remembering, comprehension/understanding) and is a prerequisite for achieving deep learning at the higher levels that align with metacognition (analysis, synthesis, evaluation, creativity; Bernauer & Fuller, 2017).

In 2002, Krathwohl provided an overview of the revised Bloom's Taxonomy. The revised version of Bloom's Taxonomy added metacognition to the categories of knowledge in addition to factual, conceptual, and procedural knowledge. Metacognitive knowledge recognizes the importance of strategic knowledge, self-knowledge, and knowledge about cognitive tasks, including appropriate contextual and conditional knowledge (Krathwohl, 2002). Metacognitive knowledge brings awareness to the student about their cognitive process and how to leverage and adapt this to learn.

Health professional students, while noted to be high academic achievers, are generally not trained to be critical thinkers as it is a discipline seldom taught in schools and colleges (Eichbaum, 2014). This deficit in critical thinking can impact adaptability and flexibility, the incidence of medical error, effective practice of medicine, clinical reasoning, and decision making (Colbert et al., 2015; Eichbaum, 2014; Hong et al., 2015). While critical thinking is a fundamental skill for health professionals, students may not develop this skill without explicit instruction (Brown, 2017; Hoffmann & McGuire, 2010; Huang et al., 2014; Huang et al., 2016; Medina et al., 2017; Moukperian & Woloshyn, 2013; Tanner, 2012). Livingston (2003) posited that the most effective instructional approach includes both the knowledge of cognitive processes and experience in using cognitive and metacognitive strategies, followed by an evaluation of the outcomes. Thus, Livingston echoed the Everson and Tobias (1998) recommendation, which stated that educators should target instruction to develop key learning strategies.

The need for self-directed and reflective health professionals continues to grow as the pace and demand of modern healthcare increases. In a typical curriculum, faculty make the majority of choices regarding what and how to study (e.g., read a chapter), offering students little opportunity to reflect on those choices' relevance and, therefore, limiting their overall awareness of the learning expectations (Nilsson & Silen, 2010). As such, educators need to include metacognition and strategies to acquire higher-order thinking within their core curriculum, regardless of discipline (Huang et al., 2014). Therefore, this study aimed to identify to what extent published academic-related studies in occupational therapy explicitly describe the use of metacognition.

Methodology

Due to the broad nature of this aim, a scoping review was the selected methodology. According to Tricco and colleagues, scoping reviews are “a systematic approach to map evidence on a topic and identify main concepts, theories, sources, and knowledge gaps” (Tricco et al., 2018, p. 1). Arksey and O’Malley (2005) described the scoping review as an iterative process, where researchers methodically review and reexamine literature to ensure an accurate representation of the existing evidence. This study’s protocol was established a priori and refined iteratively to provide specificity to the search process and more precision to the inclusion and exclusion criteria. Protocol for this study is not registered. Arksey and O’Malley’s (2005) five-stage framework informed the methodology to answer this scoping review's aim. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) format (Moher et al., 2009), two investigators performed the search and review of the evidence. Cochrane technology platform, *Covidence,* was used to manage the selection process of the studies.

Stage 1: Identifying the Research Question

This scoping review aimed to examine occupational therapy literature and identify whether research exists discussing occupational therapy curricular/course design and the use of metacognition. The overarching aim was to answer the following question: “To what extent is metacognition or metacognitive strategies used in occupational therapy curricula course design.”

Stage 2: Identifying Relevant Studies

The research question was specific to occupational therapy; in keeping with previous occupational therapy-specific scoping review research (Juckett & Robinson, 2018), a targeted search for occupational therapy journals only was the primary method to identify studies. Journals were not considered if they had a population focus, e.g., pediatrics. The following journals were selected: the *American Journal of Occupational Therapy,* the *Australian Journal of Occupational Therapy, Occupational Therapy in Health Care, British Journal of Occupational Therapy, Canadian Journal of Occupational Therapy,* and the *Occupational Therapy Journal of Research*.

The search terms included: [“metacog*” OR “higher-order thinking” OR “learning strategies” OR “Bloom's Taxonomy” OR “metamemory”] AND [“higher education” OR “course design” OR “pedagogy"]. Due to the targeted journal search strategy, it was not necessary to include occupational therapy as a search term.

Stage 3: Study Selection

The PRISMA and the meta-analyses process were applied to guide articles' selection (Moher et al., 2009). The authors agreed to a set of inclusion and exclusion criteria before the selection of relevant studies. Inclusion criteria included published range 1990 – 2018, English language, all types of research design, and the use, consideration and/or application of metacognition. Articles were excluded if they did not discuss course design, if they were primarily focused on fieldwork, and did not include any metacognitive strategies. As Arksey and O’Malley (2005) described, additional criteria were developed post hoc as the reviewers became more familiar with the literature. For example, the authors agreed to include both courses and curricular design if metacognition or metacognitive strategies were discussed so to capture a broad breath of the literature. The search criteria specifically became an iterative process when the reviewers needed more refinement on what constituted metacognition or metacognitive strategies. The authors agreed that, for this scoping review, all included studies demonstrated some aspects of metacognition. Aspects of metacognition could include “thinking about their learning,” reflection, self-assessment, or “sense-making.” These defining criteria are consistent with the description of metacognition provided by The National Academy of Sciences’ Committee on Learning Research and Educational Practice publication “How People Learn” (National Research Council, 2000). Additionally, the authors searched the references of the full-text review articles for additional studies that might meet the inclusion criteria. The additional articles, found as a result of the hand searching, were reviewed against the inclusion and exclusion criteria by both reviewers.

Stage 4: Charting the Data

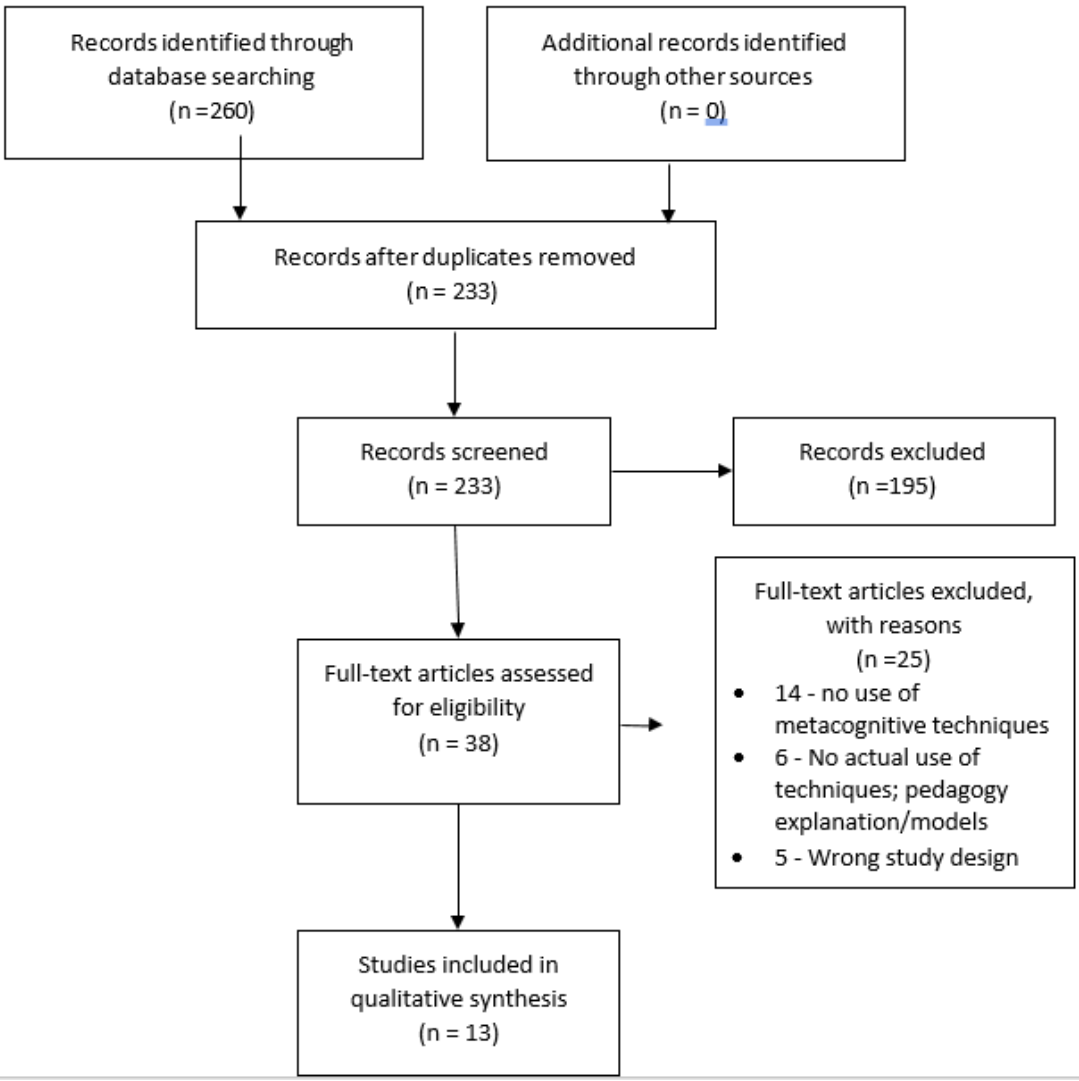
A descriptive-analytic method was used to extract information from the articles. The initial extraction table included the article’s aim, the pedagogy, metacognitive strategies, and study findings. The table was then modified to improve the data representation of the answer to this scoping review's research question. The authors’ revised table focused on the study’s aim, related metacognitive relationships, and Bloom’s Taxonomy themes (see Appendix).

Results

The final stage of Arksey and O’Malley’s (2005) scoping review framework is Stage 5, which includes collating, summarizing, and reporting the results. Stage 5 comprises a numeric representation of the findings in addition to a thematic discussion. The initial search yielded 260 studies following the PRISMA study selection process and 13 articles were included into this scoping review (see Figure 1). The authors were in agreement for all included articles; therefore, the third reviewer was not required.

Figure 1

PRISMA Flow Diagram



Scoping reviews do not seek to assess the rigor of evidence or bias, but rather provide a narrative account of the findings (Arksey & O'Malley, 2005). Bloom's Taxonomy categories represented in the studies were primarily higher-order thinking categories: creating (12 studies), evaluating (9 studies), planning (1 study), and analyzing (4 studies). Distinct themes of the use of metacognitive strategies were identified: written reflection (7 studies), peer to peer/debate (2 studies), peer-led interactions (4 studies), self-directed learning (4 studies), critical thinking (5 studies), self-assessment tool (2 studies), and reflective observation (1 study). Nine studies included two or more themes, with the Chung (2001) study having the most with four themes. Revised Bloom's Course type represented in the review included foundational courses (interpersonal relationships, groups, and task analysis), clinical classes (geriatric and pediatrics), fieldwork preparation, research, and interdisciplinary medical humanities. The year range was 1995 – 2017, with most studies from the early 2000s (see Table 1).

Table 1

List of Study Articles

Author (s)	Year	Aim of Study
Chung	2001	Assessed the development of student capacity for active learning and problem solving to promote clinical practice, self-directed learning and lifelong learners through inquiry-based learning and reflective journaling.
Faulk-Kessler & Ciaravino	2006	Assessment development of advanced interpersonal dynamics through journaling and creative writing.
Gifford	2001	Assessed use of gaming in a course, specifically a game designed for sexual expression interventions.
Griswold	1999	Assessed the use of debate in an OT course to promote professional development.
Marterella & Aldrich	2015	Assessed professional habit formation through qualitative inquiry research courses [two-course sequence]. Students used critical thinking to analyze professional knowledge and critical habit development.
McCannon et al.	2005	Evaluated the effectiveness of problem-based learning case study course in meeting faculty generated learning objectives.
Mickan	1995	Use of qualitative action research and grounded theory to assess the effectiveness of a self-directed learning pack [of reading] to prepare students for pediatric fieldwork, after completion of the pediatric placement.
Murry et al.	2000	Assessed the effectiveness of a medical humanities course in developing reflective practice and lifelong learning among occupational therapy students.
Perlman et al.	2005	Assessed the effectiveness of web-based instruction to teach activity analysis. Compared traditional Analysis Framework to using the Model of Human Occupation.
Scaffa & Wooster	2004	Assessed the effectiveness of an intensive, problem-based learning course on the development of clinical reasoning skill in OT students with peer-to-peer teaching.
Schaber	2005	Assessment of the effectiveness of video technology and problem-based learning to teach group dynamics.

Smits & Ferguson	2000	Evaluated the effectiveness of Integration Tutorial and Seminarto improved student application of theoretical knowledge during fieldwork using self-directed learning as part of the tutorial.
Zimmerman et al.	2007	Described the value of self-reflection in the evaluation processto develop reflective practitioners through assessment of guided self-reflections and peer/advisor feedback.

Discussion

The included studies had commonalities, and all seemed energized by the desire to develop students' skills and characteristics that would improve learning outcomes and ongoing professionalism. We further examined these studies specific to Bloom's Taxonomy higher-order thinking categories, pedagogies in the study that applied metacognitive strategies, and educational purposes.

Higher-order Thinking

The top three levels of Bloom's taxonomy include creating, evaluating, and analyzing; the top three levels include skills such as self-directed learning, critical thinking, and reflection/reflective thinking; all of which are higher-order thinking skills (Irvine, 2017). The appendix describes the articles included in the study across several dimensions, where we discuss the aspect of metacognition and Bloom's Taxonomy level reflected in their interventions and the relative Bloom's level of learning. The appendix also describes the learning activities in each study related to a specific aspect of metacognition and the related Bloom's Taxonomy level of learning. The analysis of the articles in this study revealed the ways in which students participate in metacognitive activities aligned with higher order thinking including written reflections, peer-led interactions, self-directed learning, critical thinking, debate, peer-to-peer feedback, self-assessment (personal reflection), and reflective observation.

Self-directed learning seeks to develop skills wherein the student/practitioner can take a topic of interest and find resources and knowledge, critique the value of the knowledge, assess how the credible knowledge could apply to current training or practice, and create a way to apply that knowledge that is reasonable and helpful (Murad et al., 2010). While the studies tended to use several learning activities to achieve their educational aims, four studies used self-directed learning through problem-based learning strategies, fieldwork preparatory courses, or as part of an inquiry-based learning pedagogy (Chung, 2001; McCannon et al., 2005; Mickan, 1995; Smits & Ferguson, 2000). Mickan proposed that self-directed learning packets would improve upon generic knowledge for fieldwork to prepare students for a specialty fieldwork placement. Similarly, Smits and Ferguson (2000) found that using a course between fieldwork placements helped integrate knowledge learned in fieldwork with theory by using self-directed learning and allowing for the incorporation of theory into practice, as reported

by both students and fieldwork educators. Chung (2001) and McCannon et al. (2005) were intentional in their use of self-directed learning, having students plan, collaborate, and direct activities using inquiry-based and problem-based learning pedagogies, respectively.

Five articles were specific about having critical thinking in their courses (see Appendix). Critical thinking is part of assessing and analyzing a problem or situation to apply knowledge in a manner that provides evidence in decision-making. Perlman and colleagues (2005) used critical thinking to elevate learning in an online module designed to teach activity analysis through tutorials and immediate feedback. Students had to create feedback, reflect on their performance, and apply feedback provided (Perlman et al., 2005). The studies used Bloom's Level of evaluation (reflection, critique) and creation (writing), applied through student assignments and activities requiring writing and critical collaborations.

Reflection, reflective thinking, or reflection-in-action is a process of looking back at what occurred in learning or practice and evaluating and judging what went well, what was not desirable to continue, and what could possibly change to improve a situation (Fleming, 1991). Eight studies used a variety of forms of reflection (see Table 1). The reflection process becomes deeper as more time is devoted to thinking (assessing), analyzing, and writing about the learning process and knowledge gained. Practitioners may reflect as they work, based on observations of the client's reactions and the environment's effect, known as reflection-in-action (Falk-Kessler & Ciaravino, 2006). The process of reflection-in-action, while beneficial, does not allow for thorough assessment or reflection over time as with written reflections, called reflection-on-action. Chung (2001) used reflective journals to promote learning through student reflection on their learning. However, all reflection is beneficial because it provides a space for thinking about chosen actions, analyzing for needed changes, and improving outcomes both in learning as a student and as a practitioner. One study specifically used reflections on peer observations through lab work to elevate the learning to the level of creating and evaluating instead of normal lab work where a student might receive feedback from an instructor only (Smits & Ferguson, 2000).

The intentional use of higher-order thinking activities elevates the students' learning in a way that does not naturally occur. Self-directed learning, critical thinking, and reflecting are foundational ways of learning for adult learners and professionals seeking to improve their practice. Developing higher-order thinking is thus a skill set that benefits students in educational programs, in the transition to practice, and as a practitioner (Chung, 2001).

Long term goals for higher-order thinking includes developing life-long learners. Life-long learners continue to intentionally develop professionally, maintain reflection as a practitioner using evidence to improve their clinical reasoning, and always seek best practice. The goal of developing life-long learners within occupational therapy education was explicit in three of the studies: Chung (2001), Murray et al. (2000), and Zimmerman et al. (2007). Life-long learning involves a continued process of seeking new skills and

knowledge. As life-long learners, practitioners may develop professionally if they pursue an intentional path of discovery. Promoting professional development within a student/practitioner's career takes focus; in an educational program, the curriculum identifies the path and focus.

Clinical reasoning allows practitioners to apply skills, experience, knowledge, and best evidence to each client (Fleming, 1991). Two studies, Falk-Kessler and Ciaravino (2006) and Scaffa and Wooster (2004), specifically identified clinical reasoning as a foundational and lifelong skill. The outcome, developing clinical reasoning, would allow the translation of this skill from class to fieldwork, to practice. Learning theory in higher education does not need to be different than how practitioners learn and update their practice. Greber et al. (2007b) developed the four-quadrant model of facilitated learning and spoke to the relationship between how occupational therapy practitioners facilitate client learning and adult learning theory. Additionally, Zimmerman and colleagues (2007) noted that higher education must evolve to keep up with employers' changing needs who value soft skills related to clinical reasoning, such as reflection.

Pedagogy

As the occupational therapy profession evolves, likewise, there are trends in education. In the late 1990s to the 2000s, there was a surge of studies examining the implementation of problem-based learning (PBL) in occupational therapy education. The trends identified in this study came from many of these articles and are therefore worth discussing. Problem-based learning is a student-centered pedagogy that allows students to work through problems that do not have a defined solution; thus, students must find evidence and think through the problem to create a solution or a way to address the problem. These are often related to real practice scenarios or application (Vroman & MacRae, 1999). This adoption of PBL appears based on the need for improving student outcomes related to the higher-order thinking skills previously mentioned. One study in this scoping review applied PBL (McCannon et al., 2005). It is worth noting that some excluded studies used PBL; however, these studies did not explicitly use metacognitive strategies or higher-order thinking approaches. Overall, we found a wide variation in the implementation and application of PBL in occupational therapy curriculum and courses.

Problem-based learning done well includes critical thinking and self-directed learning. However, some of the studies in this review focus on curriculum goals and/or course objectives and may not embrace the full extent of active learning within PBL. Active learning pedagogies, including PBL, are not all implemented in the same manner and may include varying levels of self-directed learning or critical thinking and may or may not emphasize reflection as a key part of learning. Purposeful implementation is key to developing the metacognitive skills of reflection, self-directed learning, and critical thinking. Vroman and MacRae (1999) concluded that developing clinical reasoning and critical reflection in students was the impetus for PBL use in occupational therapy

education. Many strengths of PBL relate to developing skills, such as ongoing learning and translation of learning. However, some educators are concerned that the more traditional lecture-based course is still necessary to prevent the loss of learning factual and basic science information.

Educational Purpose of the Study

The appendix shows the examination of the educational purpose of the courses in the studies. Eleven of the thirteen studies included metacognition related design and were unique to a specific course or course series (e.g., evidence-based practice, activity analysis, pediatrics) and not intended for an overarching program curricular design. One of the studies that took a program curricular approach was Marterella and Aldrich (2015). They examined the rationale for teaching qualitative inquiry across the curriculum. Their findings suggested that qualitative inquiry can build the habits of reflection and reflexivity, criticality, and active engagement that parallels both practice and research. In contrast, Zimmerman and colleagues (2007) added a guided reflection process in faculty-student advising. Through this guided reflective process, they found students were better able to assess their learning and make adjustments, especially in preparation for fieldwork experiences.

There were various reasons the aforementioned eleven courses add metacognitive design elements or strategies to a course. The reasons for a change in course design emerged in two subthemes: a philosophical approach or an active- learning and teaching strategy. As stated previously, much of the philosophical design was based on PBL (McCannon et al., 2005; Scaffa & Wooster, 2004; Schaber, 2005). All philosophical approaches had in common the goal for student behavioral change and to foster higher-order thinking. The second subtheme identified was active-learning and teaching strategies. Some of the strategies included gameplay (Gifford, 2002), medical humanities (Murray et al., 2000), debate (Griswold, 2000), autopathographies and disability training videos (Falk-Kessler & Ciaravino, 2006), guided-reflection with feedback, and web-based tutorials paired with active learning strategies and immediate feedback (Perlman et al., 2005).

Most of the studies looked at the effect of a specific pedagogy or aspect of active learning or thinking, such as reflective thinking and writing, and the related impact on learning. The articles described metacognitive strategies used to improve learning, understanding, and retention and included the application of knowledge and skills. The metacognitive strategies typically utilized higher-order thinking and learning activities on the level of evaluating and creating on Bloom's Taxonomy (Krathwohl, 2002). However, only one study explicitly mentioned the use of metacognition and metacognitive learning strategies as integral to the course (Perlman et al., 2005).

Implications for Occupational Therapy

Often expert clinicians transition into faculty roles with little to no knowledge of pedagogy or teaching and learning theories, or faculty adjust their teaching and learning through trial and error (Gilbert Hunt, 2017). Greber and colleagues proposed "understanding of the teaching–learning process is critical" for instructing occupational therapy students and their future practice (Greber et al., 2007a, p. S34). Therefore, using specific techniques and strategies designed to actively engage learning and encourage occupational therapy students to use higher-order thinking is desirable and necessary to develop students into reflective practitioners (Barbagallo, 2021). It is essential to purposefully select and implement metacognitive pedagogical approaches and measures for higher-order learning outcomes. In the realm of the scholarship of teaching and learning, occupational therapy education could improve their learning outcomes if they explicitly embedded metacognition and active learning strategies into their curricular threads and throughout their course design. We need targeted research on the explicit use of metacognition to provide discipline-specific evidence of this and other learning strategies' effectiveness. Research assessing the effectiveness of specific metacognitive and higher order thinking activities, assignments, and instructional design specific to occupational therapy courses would assist in guiding instructors in the application and benefits of metacognition in improving instructional and programmatic outcomes.

Although we strictly adhered to the Arksey and O'Malley (2005) framework we acknowledge limitations in our study. Our search strategy to limit our search to only occupational therapy journals may have unexpectedly left out occupational therapy related course design published in education journals. Due to the iterative nature of scoping reviews, we relied upon the National Research Council's (2000) publication *How People Learn* to define more concretely metacognition; in doing so some studies that may have used metacognitive strategies may have been eliminated because the authors did not explicitly use the terms we selected.

Conclusion

The current health care system demands that health care providers practice with critical thinking and critical reflection to improve practice and therapeutic outcomes. For practitioners to perform at this high level, they need training that teaches them how to think critically and self-reflect iteratively. For the occupational therapy profession to meet this demand, curricular and course design and pedagogies in occupational therapy higher education could explicitly use metacognitive techniques within their programs to foster this critical and reflective approach to practice. Further, students may benefit from learning specific metacognitive techniques they can implement independently. Transparency and intentionality in occupational therapy higher education related to metacognition may improve learning outcomes leading to better prepared practitioners.

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Appendix

Metacognitive Strategies: Article Analysis

Authors	Metacognitive Strategy	Title of Course	Aspect of Metacognition	Blooms Taxonomy
Chung (2001)	Written Reflection	Occupational Therapy in Geriatric Rehab & the Ageing Process- incorporated inquiry-based learning	Reflective journals on learning experiences	Creating (writing) Evaluation (reflecting)
	Peer-led interactions	Occupational Therapy in Geriatric Rehab & The Ageing Process- incorporated inquiry-based learning	Small group peer led analysis and peer to peer teaching	Creating (facilitating, leading)
	Self-Directed Learning	Occupational Therapy in Geriatric Rehab & The Ageing Process- incorporated inquiry-based learning	Self-directed learning as part of an inquiry-based learning pedagogy	Planning (directing and planning)
	Critical Thinking	Occupational Therapy in Geriatric Rehab & The Ageing Process- incorporated inquiry-based learning	Critical Thinking as part of an inquire-based learning pedagogy	Evaluating (critiquing, assessing)

Falk-Kessler & Ciaravino (2006)	Written Reflection	Advanced Interpersonal Dynamics	Reflective journals kept based on reflection in action to illuminate the clinical reasoning skill process	Creating (writing) Evaluating (reflecting)
	Peer-led Interactions	Advanced Interpersonal Dynamics	Small Group Interactions; learning to identify gaps in knowledge	Evaluating (moderating) Creating (facilitating)
Gifford (2001)	Written Reflection	Occupational Therapy Dynamics of Interpersonal Relationships	Problem solving in group and debriefing by instructor; written reflection	Creating (writing) Evaluating (reflecting)
Griswold (1999)	Debate, peer to peer feedback	Occupational Therapy Practice in Public Schools - elective (Senior Level)	Debate with peer to peer and instructor feedback	Evaluating (debating)
	Peer-led interactions	Occupational Therapy Practice in Public Schools - elective (Senior Level)	Peer to peer feedback and interactions during debate	Creating (creating) Evaluating (debating)
Marterella & Aldrich (2015)	Critical Thinking	Qualitative Inquiry Research - two course sequence	Critical thinking used to analyze professional knowledge and practice via "critical habit"	Creating (developing - the critical and active engagement habit) Evaluating (critiquing)

McCannon et al. (2005)	Self-Directed Learning	Occupations and Aging-used problem-based learning & case study learning	Self-directed learning, small group work with instructor facilitation	Creating (planning, collaborating)
Mickan (1995)	Self-Directed Learning	*No course, research on use of advanced readings as preparation for a pediatric fieldwork placement	Self-directed learning, use of provided and discovered resources to develop knowledge and skills simultaneously; supported independent learning	Evaluating and Application (application of skills, analysis of techniques, and self-evaluation)
Murray et al. (2000)	Written Reflection	Occupational Therapy Medical Humanities	Reflective journaling	Creating (writing) Evaluating (reflecting)
	Debate, peer to peer feedback	Occupational Therapy Medical Humanities	Student led debate sessions.	Evaluating (debating) Creating (student led-planning and managing, writing,)
Perlman, Weston, & Gisel (2005)	Critical Thinking	Occupation as Therapy-an online course for teaching activity analysis	Critical Thinking through online tutorials providing immediate feedback	Creating (integrating - feedback) Evaluating (critiquing, reflecting) Applying (implementing feedback)

Scaffa & Wooster (2004)	Peer-led interactions	Occupational therapy course - Development of Clinical Reasoning Skills (intensive)	Peer to peer teaching	Creating (managing, planning. leading)
	Self-Assessment - use of assessment tool	Occupational therapy course - Development of Clinical Reasoning Skills (intensive)	Self-Assessment of Clinical Reflection and Reasoning (SACRR)	Evaluating (assessing, measuring, reflecting)
Schaber (2005)	Written Reflection	Occupational Therapy-Models of Group Dynamics course	Critical reflection of self in group interactions	Creating (writing), Evaluating (assessing, reflecting, critiquing)
	Critical Thinking	Occupational Therapy-Models of Group Dynamics course	Critical thinking as part of critical reflection of self in group interactions	Creating (writing)
	Self-Assessment - use of assessment tool	Occupational Therapy-Models of Group Dynamics course	Self-assessment used through the Myers-Briggs Personality Inventory, and other assessments, used to enhance group analysis	Creating (strategizing) Evaluating (assessing, measuring, reflecting)
Smits & Ferguson (2000)	Peer-led interactions	Occupational therapy course - Development of Clinical Reasoning Skills (intensive)	Peer to peer teaching	Creating (managing, planning. leading)
	Self-Assessment - use of assessment tool	Occupational therapy course - Development of Clinical Reasoning Skills (intensive)	Self-Assessment of Clinical Reflection and Reasoning (SACRR)	Evaluating (assessing, measuring, reflecting)

Smits & Ferguson (2000)	Reflective Observation	Occupational therapy course - Development of Clinical Reasoning Skills (intensive)	Reflection on peer observations in lab	Evaluating (critiquing, reflecting, constructing [feedback])
Zimmerman et al. (2007)	Written Reflection	**Curricular inclusion of self-reflection and feedback; included in student competencies	Self-reflective writing based on guided questions, advisor and peer feedback provided	Creating (writing) Evaluating (critiquing, reflecting)

* Mickan (1995) used action-participatory research to assess an earlier project to assess preparatory learning for fieldwork.

** Zimmerman et al. (2007) Developed a student evaluation process to facilitate development of student personal and professional skills.