

2023

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Recommended Citation

Cowan, A. C., Ratcliff, K., & Li, C. (2023). Using a Flipped Classroom to Teach Evidence-Based Practice to Entry-Level Occupational Therapy Students. *Journal of Occupational Therapy Education*, 7 (2). <https://doi.org/10.26681/jote.2023.070217>

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Abstract

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Keywords

Evidence based practice, constructivism, flipped classroom, team-based learning

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JOTE

Journal of Occupational
Therapy Education

Volume 7, Issue 2

Using a Flipped Classroom to Teach Evidence-Based Practice to Entry-Level Occupational Therapy Students

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ABSTRACT

Constructivist teaching approaches rely on students to be active participants in their learning. A flipped classroom is a constructivist approach that requires the students to complete pre-learning activities outside of class. Thus, in class the students can practice and engage in team-based discussions and teacher guided learning. We delivered evidence-based practice (EBP) concepts to entry level occupational therapy (OT) students in a doctoral program using a constructivist approach, that included a flipped classroom model and reliance on team-based strategies. We used the Evidence Based Practice Confidence (EPIC) Scale to assess the change in students' confidence in EBP. Students demonstrated statistically significant differences in their confidence for EBP after the course. Evaluation of the changes in EPIC Scale scores indicates that a flipped classroom and team-based activities are effective approaches to teach EBP for entry level OT doctoral students.

Introduction

Evidence-Based Practice

Evidence-based practice (EBP) means a clinician uses the best available evidence, considers the client's needs, and incorporates clinical expertise to guide interventions (Klaic et al., 2019). According to the American Occupational Therapy Association (AOTA, 2021), EBP is considered a vital element for quality, cost-effective occupational therapy (OT) services. Klaic and colleagues (2019) also found that clinicians without post-graduate education lose confidence in EBP skills as time progresses but that clinicians with post-graduate training tended to retain higher levels of confidence. This finding illustrates the need for education in OT programs to ensure that students graduate with strong skills and deep knowledge in EBP that will be retained as they transition into clinical settings.

Teaching Evidence-Based Practice

Evidence-based practice involves determining the best intervention based on client characteristics and desires, the clinician's OT knowledge and critical thinking, and known evidence or research (Cohn et al., 2014; Stube & Jedlicka, 2007). Teaching EBP requires that the student develop both skills and habits to sustain and continue EBP as an everyday norm (Cohn et al., 2014). To develop these skills and habits, six steps were outlined as necessary for EBP (Cohn et al., 2014; Lin et al., 2010). Students must be taught how to engage in the steps of EBP, requiring reinforcement with continued practice throughout the curriculum. The EBP process encourages students to reflect on the applicability of the available evidence to the presenting problem.

Constructivist Educational Theory

In contrast to traditional teacher directed educational methods, constructivist learning is based on student-centered, interactive learning, and the active pursuit of answers. From this perspective, learners actively generate knowledge using their individual experiences, prior knowledge, and information presented in the classroom (Mogashoa, 2014). In the process of learning, the learner develops mental schemas that are changed through the process of assimilation and accommodation of new knowledge into evolved and more fully developed schemas (Eppard & Rochdi, 2017). The focus of instruction is not on the dissemination of knowledge by the teacher but in the generation of knowledge through learner problem solving, questioning, collaborating in teams, and forming ideas (Mogashoa, 2014).

In constructivist classrooms, instructors dialogue with students to identify what the students know and facilitate what students need to learn through questioning and inquiry, building up students' self-knowledge. The instructor's role is interactive, while the students work cooperatively in teams to complete assignments. Constructivist learning provides many benefits to the learner including providing an active mechanism for learning, it focuses on thinking and understanding, it more readily generalizes to other settings, provides understanding to problems experienced in the real world, and it enhances social and communication skills (Bada, 2015).

Flipped Classroom and Team-Based Learning

The flipped classroom and team-based learning are two ways to implement the constructivist theory in the OT classroom. A flipped classroom provides opportunity for students to engage in collaboration during the learning process to solve real world problems (Park & Park, 2021). A flipped classroom offers a learning environment where students are introduced to content at home and practice working through problems and practice skills in class (Dong et al., 2021; Hussain et al., 2020; Leigh et al., 2021). In the flipped classroom model, students practice under the guidance of the instructor, while accessing content on their own and within their groups. A flipped classroom approach can increase student access to the instructor and allows opportunity for personalized learning.

Studies reported that students had a positive perception of flipped classroom approach (Lewis et al., 2018; Uskoković, 2018; Varthis & Anderson, 2018) and demonstrated deeper learning (Almutairi et al., 2020; Lewis et al., 2018). In a study looking at students' perceptions of a flipped classroom, they appreciated the use of video, the flexibility it offered, and that they could go at their own pace. In the study, those students with positive experiences statistically had increased motivation, more effective learning, and increased learning compared to students without positive experiences (Nouri, 2016). In a critical appraisal, Kraut and colleagues (2019) found that flipped classrooms were effective for classes that taught procedural tasks, and students may learn more in flipped classrooms than students in traditional learning classes. They also found the flipped classroom was more effective to teach higher cognitive tasks at the higher-order level of Bloom's Taxonomy (Morton & Colbert-Getz, 2017), and learners were more engaged.

The literature indicates that a constructivist flipped classroom and team-based learning approaches could be effective to teach EBP within an entry level doctoral program's curriculum. This approach was selected as the foundation to teach beginning skills in the first semester that would be built upon as the curriculum progressed. We selected a flipped classroom approach because its concept aligned well with the process of EBP, including relying on the students learning to ask relevant questions, searching the literature, practicing evidence appraisal, integrating evidence into a clinical example, and evaluating the use of evidence. These processes needed for EBP seemed to fit a learner directed approach that would facilitate questioning and discussion rather than taking a lecture, teacher-based approach to learning. A review of the available literature validated the thought that OT students learn about EBP in many ways; however, the best, most memorable learning occurs in an active engagement context with clinically relevant situations (Stube & Jedlicka, 2007). For that reason, a flipped classroom model reliant upon team-based learning via problem-based case studies was employed. The students are encouraged to share their energies and skills to work collaboratively toward the incorporation of evidence into OT scenarios (Stube & Jedlicka, 2007). Ideally, OT programs need a curriculum that prepares students to be evidence-based practitioners, including the knowledge and reasoning habits necessary to provide collaborative, client-centered, and evidence-based interventions (Cohn et al., 2014).

Planned Application of Learning Theory

Occupational therapy educators who teach EBP need to think carefully about their use of learning theory when designing the course, should clearly communicate the course structure to the students, and use a holistic set of teaching-learning activities that connect theory to practice (Stern, 2005). The faculty chose to use constructivist educational theory, a flipped classroom model, and team-based learning. The focus was on offering OT education in a manner that allowed OT students to synthesize the clinical content to a level that is sufficient for the students to become clinical leaders in the use of EBP (Stern, 2005). We sought to evaluate if using a constructivist and flipped classroom approach was feasible for teaching EBP. The objective was to examine if the flipped classroom method would be effective in changing the students' perception of their confidence for EBP in clinical practice.

Description

Course Expectations

Using a constructivist, flipped classroom and team-based design, the students were expected to prepare for class meetings by reviewing course materials, completing readings, participating in online discussions, and performing independent study to guide their own learning. During class meetings, the students completed weekly readiness assurance checks over readings, participated in question-and-answer sessions, engaged in peer discussions, and practiced evidence-based skills with instructor input to complete team assignments. Week by week content addressed the definition of EBP, finding and reading the literature, appraising the evidence, various research study designs (descriptive, predictive, randomized controlled trials, systematic reviews/meta-analyses, clinical practice guidelines, and qualitative research), understanding statistics, internal and external validity, selecting outcome measures and interventions, and collaborative decision-making.

Students were expected to complete reading an assigned textbook chapter (Brown, 2017) and listening to a pre-recorded lecture by the instructor over the planned topic before coming to class and then were given readiness assurance checks to ensure pre-class activities were completed. In-class activities included team reviews of the readiness assurance checks, student questions and answers from the instructor, and a written in class assignment completed in groups of five to six students over a range of one to six class meetings. Larger assignments were allowed longer time to completion. The students were taught and practiced search strategies for finding evidence, were provided opportunities to appraise the evidence and then apply the best available evidence to clinical cases and diagnoses.

Course Content

The specific course content was developed with guidance from the OT literature on how to teach EBP. The structure mirrored the work of Tickle-Degnen (1998) as far as the development of clinical questions to guide literature retrieval, retrieving relevant research in a timely manner, interpreting study results, and communicating with clients for collaborative treatment planning. In the same article, Tickle-Degnen recommended focusing on research literature as a valid source for determining the potential usefulness of treatment interventions, and this idea was reinforced within the EBP course. The authors further followed the advice of Tickle-Degnen (2000), for the organization of the EBP course, the posted syllabus, and by using a variety of formats for the delivery of EBP education. Tickle-Degnen and Bedell (2003) proposed teaching an EBP method that includes all relevant, valid, and available research evidence for making clinical decisions and that thought was perpetuated in the classroom by allowing students to use evidence from different disciplines as appropriate.

Course Competencies

Occupational therapists also need information on the evolving definitions and concepts of EBP, encouragement to develop and adopt EBP models that link to OT's professional values, and methods that translate evidence into answers for clinical questions (Marr, 2017). The course structure and content aimed to provide this. The competencies addressed by the academic coursework considered the work of Myers et al. (2019) who outlined 56 EBP competencies in nine domains for occupational therapists (OTs): understanding evidence-based practice, demonstrating knowledge and skills, asking clinical questions, acquiring knowledge, appraising evidence, applying evidence, integrating patient values, assessing practice outcomes, and implementing evidence-based practices. It is important to facilitate the learning strategies of EBP skills and demonstrate how students can practice this competency during clinical placements (Johnson et al., 2020). The course offered multiple opportunities to practice EBP competencies when solving clinical issues through OT interventions.

Course Objectives

A problem-based approach was used as one of the learning vehicles to mirror the real-world complexity of OT clinical practice and the acquisition of relevant skills were framed as small group undertakings where each student contributed to the process (Wyer, 2019). In keeping with the AOTA's (2018) philosophy on OT education, the instructor sought to facilitate the development of a sound reasoning process that is client-centered, occupation-based, and theory-driven while encouraging the use of evidence and client outcomes to inform the teaching–learning experience.

The Steps to Evidence-based Practice

Research evidence is likely to be underutilized by students because of difficulties in retrieving relevant information in a timely manner and in translating the information into a useful, client-centered approach (Tickle-Degnen, 1998). The course structure was designed to address six steps for the application of EBP: formulate a clinical question, search efficiently for the best available evidence, determine evidence validity and usefulness, integration of external evidence, clinical expertise, and client preference, evaluate performance or outcomes of actions taken, and dissemination of information to other stakeholders (Cohn et al., 2014; Lin et al., 2010). In-class activities were not announced until the day the assignment started to target student focus on readings and lectures as pre-class activities. As such, the in-class assignments were built to allow completion of each of the six steps in a logical sequential order.

Assignments

Assignment #1 – What is EBP?

The first assignment facilitated student reflection on their definition of EBP before any instruction was given. Students were asked to individually define EBP off the top of their head and then meet in their small groups to formulate a formal definition of EBP. The group definition was posted to a discussion board within the learning management system for sharing across the cohort. Student replies to postings were encouraged but not required. The assignment spanned one class meeting and provided a lead-in to the second assignment.

Assignment #2 – What are the Steps for EBP?

The second assignment involved the process of EBP overall. The students were asked to identify the steps of EBP and to construct a mnemonic or other unique method for remembering the steps which was shared to a discussion board. Then the students were provided with a clinical case for which to develop a clinical search question, followed by a detailed search strategy and an executed search query. The best available evidence for the clinical case was highlighted by the instructor and the students were asked to identify the research variables (independent and dependent), the specific study design, as well as the level of evidence-based and clinical implications for OT interventions. At the end, the students reported how the information could be shared with clients, co-workers, and other healthcare providers. The second assignment was allotted four class sessions for completion and introduced the process used in the third assignment.

Assignment #3 – Choosing Outcome Measures

The third assignment revolved around looking for evidence-based outcome measures for use in clinical practice. The students were expected to write a clinical search question for an outcome measure of interest. Then the small group developed and executed a targeted search strategy which was summarized in an annotated bibliography. Based on the information found, the students were to identify and interpret commonly encountered statistics, choose the best available evidence, and communicate a take-home message for clients, peers, and other providers. The third assignment spanned six class sessions and facilitated studying for a written mid-term examination.

Assignment #4 – Types of Research Designs

After the knowledge-based mid-term exam, the fourth assignment focused on the use of descriptive evidence for a condition of interest, predictive evidence for an outcome of interest, and qualitative evidence for the exploration of individual experiences or cultural phenomena. For this exercise, the students wrote three clinical questions and executed three targeted literature searches to locate descriptive, predictive, and qualitative evidence. The chosen evidence was described in detail including quantitative statistical analysis or qualitative data analysis, communication of the evidence to all involved parties, and how the evidence could be implemented by an occupational therapist in clinical practice. The assignment also included in-text citations and reference lists in the American Psychological Association (APA) style. The fourth assignment was completed over six class sessions. While the third assignment targeted choosing assessment tools, the fourth assignment looked at other types of evidence that might be encountered by OTs looking for answers. The selection of clinical interventions was addressed in the fifth and final assignment.

Assignment #5 – Choosing OT Interventions

The last assignment was centered around how to locate, select, and implement clinical interventions. The instructor provided three high-level pieces of research evidence for the students to appraise. The students discussed and made decisions about the study designs, research notations, and levels of evidence. The chosen articles were

appraised using a systematic approach (using the Physiotherapy Evidence Database [PEDro] Scale, the Critical Appraisal Skills Programme [CASP] Systematic Review Checklist, or the Appraisal of Guidelines for Research & Evaluation Instrument [AGREE] II-Global Rating Scale depending upon the study design) and any threats to internal and/or external validity were identified. Statistical methods were reviewed, and issues discussed or explained as needed. All information was summarized in a decision aid shared during in-class presentations. Finally, the assignment ended with a brief statement of how all the evidence could be implemented in each clinical scenario. The last assignment was also completed over six class sessions.

Assessment of Learning

The final exam was knowledge-based and included a clinical case scenario that required replication and implementation of the EBP process within a reasonable time akin to what might be encountered in clinical practice.

Methods

Student Participants

The student cohort included 60 entry-level graduate students who were in the first semester of an OT doctoral program. The EBP course utilized constructivist theory and a flipped classroom model. At the beginning of the semester and end of semester, the Evidence-Based Practice Confidence (EPIC) scale, an EBP self-efficacy scale, was used to assess changes in students' perceived level of confidence in EBP (Salbach & Jaglal, 2011; Salbach et al., 2013; Clyde et al., 2016).

Outcome Measure

The EPIC Scale was used before any education to find the areas of educational need and to help development of targeted classroom materials. See Table 1 for the questions on the EPIC Scale and the skill targeted in the classroom. The post-education application of the EPIC Scale was used to assess students' self-efficacy and confidence levels for EBP after completing the course. The developer of the EPIC scale gave written permission for use of the tool in the educational project (N. Salbach, personal communication, September 30, 2020). The EPIC Scale has been implemented to evaluate self-ability in implementing EBP among healthcare providers (Salbach & Jaglal, 2011). The EPIC Scale has excellent test-retest reliability, acceptable construct validity, and minimal measurement error on repeated administration in evaluating EBP self-efficacy among physical therapists and occupational therapists (Clyde et al., 2016; Salbach et al., 2013). The EPIC Scale has 11 items, and the instruction is to ask the respondent to show "how confident you are in your current level of ability by choosing the corresponding number on the rating scale". Each item scores the confidence level ranging from 0% (no confidence) to 100% (completely confident) with an interval of 10% (i.e., 0%, 10%, 20%... 100%). The total scores are divided by 11 items to generate the average % of confidence level (ranging from average 0% to 100%).

Table 1

Evidence-Based Practice Confidence (EPIC) Scale (adapted from Salbach & Jaglal, 2011)

How confident are you in your ability to...?		Skills targeted in EBP course
Q1	...identify a gap in your knowledge related to a patient or client situation (e.g., history, assessment, treatment)?	Gap recognition
Q2	...formulate a question to guide a literature search based on a gap in your knowledge?	Clinical questions
Q3	...effectively conduct an online literature search to address the question?	PICO (Problem/Population, Intervention, Comparison, Outcome) searches
Q4	...critically appraise the strengths and weaknesses of study methods (e.g., appropriateness of study design, recruitment, data collection and analysis)?	Study designs and research methods
Q5	...critically appraise the measurement properties (e.g., reliability and validity, sensitivity, and specificity) of standardized tests or assessment tools you are considering using in your practice?	Psychometric properties
Q6	...interpret study results obtained using statistical tests such as t-tests or chi-square tests?	Tests of differences
Q7	...interpret study results obtained using statistical procedures such as linear or logistic regression?	Tests of relationships
Q8	...determine if evidence from the research literature applies to your patient's or client's situation?	Relevance and utility
Q9	...ask your patient or client about his/her needs, values, and treatment preferences?	Interview skills
Q10	...decide on an appropriate course of action based on integrating the research evidence, clinical judgment and patient or client preferences?	Implementation of EBP
Q11	...continually evaluate the effect of your course of action on your patient's or client's outcomes?	Planned reassessment

Statistical Analysis

We calculated the average pre- and post-EPIC total scores for students, with descriptive analyses to examine the score distributions, frequency of the responses, averages, and the standard deviations of the change score. We also used paired-sample t-test to analyze the EPIC score change for each student pre- and post- course. All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC, US) and the significance level was set at $\alpha=0.05$.

Assessment

Pre- and post-analysis showed students had significantly higher EPIC scores after the course compared with their scores prior to taking the course (pre: 44.4 [SD=17.2], post: 78.3 [SD=10.8]) ($p < 0.001$). Since we tested each student twice, the probability distributions of pre- and post-scores were exactly as expected. Students improved the most in “deciding on course of action” (Q10), “interpreting results (t-tests/chi square)” (Q6), “evaluating course of action” (Q11) and “appraising measurement properties” (Q5) after the course. Students improved the least in “asking about needs, values, & preferences” (Q9) and “conducting search” (Q3) (see Figure 1). The change score of the EPIC ranged from -2.73 to 82.73 (difference was calculated as post-score minus pre-score). All students in our sample had improved scores showing improved self-efficacy level in EBP skills after the course, except one (1.7%). This student had a negative change score, reporting decreased confidence in EBP after the course (see Figure 2).

Figure 1

Pre- and post-EPIC Score by Item

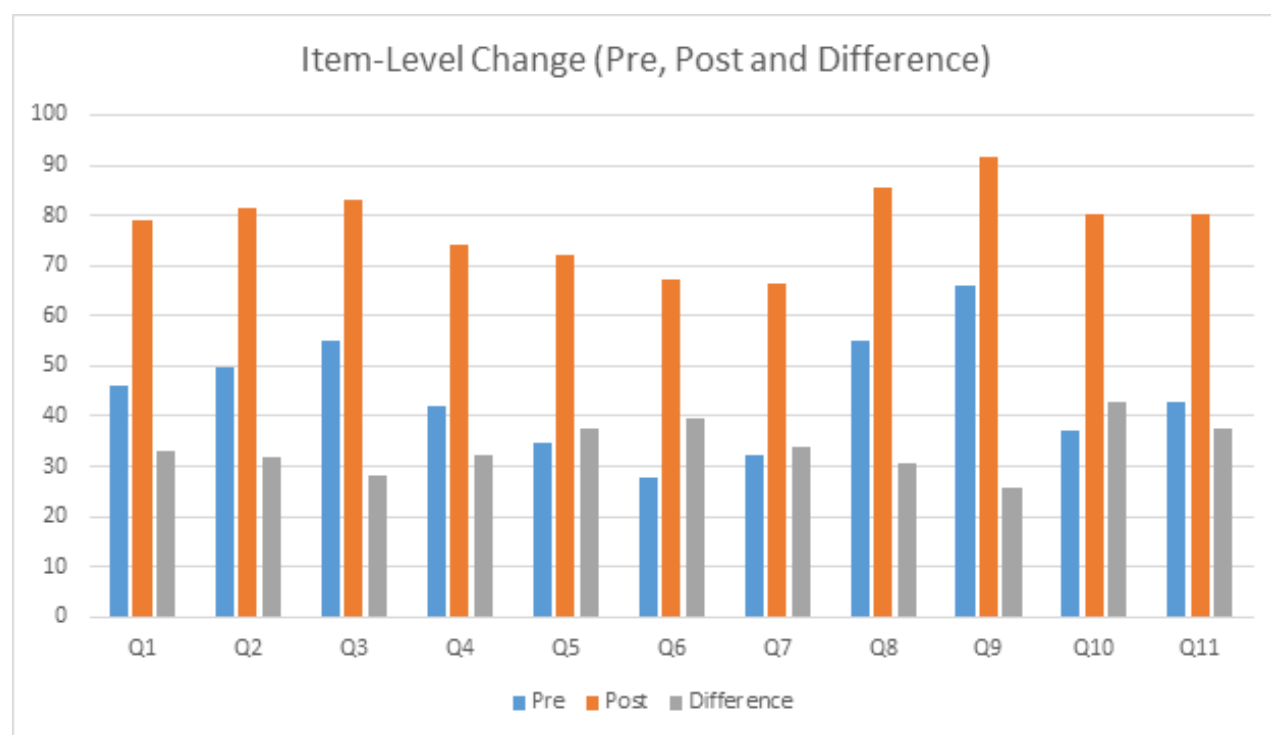
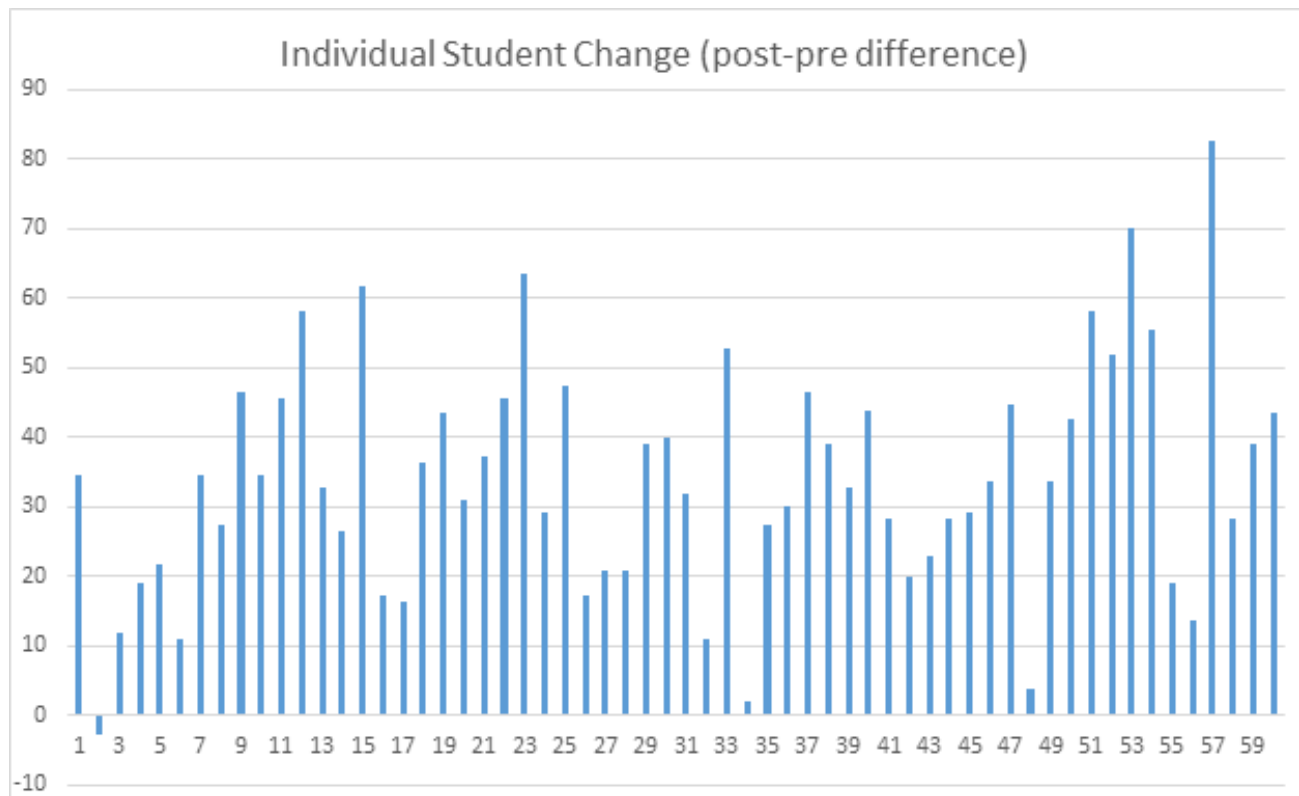


Figure 2*Pre- and Post-EPIC Score for Each Student (N=60)***Discussion**

The innovative teaching process was initiated to determine if the delivery method was effective in changing students' self-perception of their EBP skills. The innovation lies in the delivery method driven by constructivist learning theory, application of a flipped classroom model, team-based learning, the use of an established confidence scale as a student self-report measure, and the addition of evidence from the OT knowledge base for designing the EBP course. The faculty planned to review the course delivery methods and the use of a student report outcome tool to decide if the course was, in fact, teaching the foundational skills necessary for confident EBP.

The use of pedagogical theories in a well-structured manner can assist OT educators in achieving intended learning outcomes in the classroom (Heeb et al., 2020). Røe et al. (2019), reported success with the use of a flipped classroom approach in physiotherapy education when compared to traditional teaching methods. The authors specifically investigated the effectiveness of using a constructivist, flipped classroom approach in combination with team-based learning to teach EBP. Based on a review of the EPIC Scale scores, students' perceptions of their confidence in using EBP improved from the beginning of the course to the end. The first scores allowed the instructor to identify the EBP skills the students felt most confident in and those they felt the least confident in. Using that information, the course materials and assignments were tailored to address

the areas of less confidence more intently, while the areas of greatest confidence were covered more superficially. The post-education scores also showed the areas of greatest and least confidence, but in the final instance were taken to show growth in the skills for and understanding of the processes to implement EBP.

While repetitious, the written assignments gave the students multiple opportunities to practice the process of EBP in a safe environment, with minimal time constraints, with unrestricted access to literature, and with the benefit of input from peers and the course instructor. The structured coursework is believed to have contributed to significant improvements in “deciding on a course of action” (Q10), “interpreting results for tests of differences (t-test/chi square) (Q6), “evaluating course of action” (Q11), and “appraising measurement properties” (Q5). The ability to decide on a course of action (Q10) was addressed by offering information on psychometric properties and how to choose assessments and interventions for different conditions with a client-centered perspective. For interpreting the t-test and chi square (Q6), the coursework explored specific statistics used with different study designs and how to interpret statistics when reading a journal article. For evaluating a course of action (Q11), class discussions were led by student questions and always included what if scenarios. What does the OT do if the client does not progress or show improvements in function and participation despite the use of EBP? What does the OT do if evidence is non-existent, not relevant, or not successful when implemented? The other area of maximum improvement in EBP confidence was appraising measurement properties (Q5). To achieve this end an entire written assignment over six class sessions addressed how to select and choose psychometrically sound outcome measures.

The OT students improved the least in asking about client needs, values, and preferences (Q9) and conducting electronic literature searches (Q3). Concerning “asking about needs, values, & preferences” (Q9), as first year doctoral students it is unlikely the students would feel completely comfortable with establishing rapport and interviewing to build an occupational profile. It is also easy to focus solely on the strength of the evidence and the client’s occupational needs and less easy to fully consider the client’s values and preferences.

In a similar study of nursing students, Moore et al. (2019) found that students showed increases in attitude scores in conducting literature reviews and writing PICO questions. Although these results were consistent with the findings in nursing students this was an area of lesser change for OT students indicating that writing PICO questions and differences in operations across electronic databases could be an area of higher difficulty. From a review of the EPIC Scale data, one student outlier demonstrated a decrease in EBP confidence, which begs the question what happened in the case of this student? The outlier could potentially be demonstrating the phenomenon that novice learners often overestimate their abilities initially (Bell & Volkman, 2011). The student could have felt confident entering the course but realized the need for base knowledge and more education before being able to uptake the EBP concepts as delivered in a flipped classroom and using team-based learning. In some instances, cultural, social, metacognitive, or motivational factors could influence and impact a

student's perception of their abilities (Bell & Volkman, 2011). Initiating collection of EPIC Scale data at mid-term might have helped to identify the outlier sooner and to take focused action to remedy the lack of confidence in the skills being trained.

The project's strengths include a successful course design that improved student perception of EBP skills. The approaches utilized were based on solid education theory, innovative classroom strategies, use of an established outcome measure to address EBP confidence, and interpretations based upon descriptive statistical analysis. The explicit use of pedagogical theories to guide curricular design, in-class assignments, and learner assessment seems to have facilitated student learning (Heeb et al., 2020). The limitations of the project are important considerations: the project was not a research study per se, the methodology was retrospective in nature, the classroom approaches were not strictly controlled, 60 students were a small sample size, and potential biases exist for both the instructor's lesson planning and student bias when completing the self-report measure of EBP confidence.

Future directions for the information gathered could include validation of the EPIC Scale for use with entry-level OT students. The project could be developed into a controlled study (one group traditional educational approach and one group flipped classroom and compare outcomes). It is also possible that student confidence in EBP skills could be tracked throughout the curriculum at various intervals and before, during, and after fieldwork experiences. The relationship between perceived EBP self-efficacy and the actual use of skills and knowledge for EBP needs to be explored.

Implications for Occupational Therapy Education

1. Constructivist learning theory, use of a flipped classroom model, and team-based learning is possible and shows promise in the transfer of learning for EBP skills.
2. Occupational therapy educators need to consistently model EBP, while reinforcing a three-part definition that includes the use of external evidence, an awareness of the clinician's skillset, and incorporation of client values, needs, and preferences.
3. More evidence from randomized controlled trials linked to student learning beyond student perception is needed to support constructivist teaching methods in OT education.

Conclusion

Promotion of quality entry-level education for OT is imperative and must be supported by academic instructors and clinical educators. To provide quality education, it is necessary to perform ongoing assessment of the delivery strategies used and student outcomes achieved. The OT department considers EBP to be a required competency for students and highlights the importance of the content by offering the EBP course during the first semester and in preparation for two research courses later in the curriculum. In general, the faculty within the OT department strive to be innovative in their delivery of course materials. After changes were implemented to the EBP course to increase student engagement, the authors evaluated the chosen classroom strategies to decide if the methods were effective for teaching EBP.

The course was designed to use Constructivist learning theory and a flipped classroom model that relied on team-based learning. Pre-class activities (recorded lectures and assigned readings), in-class activities (quizzes, written assignments, and student-led discussions), and post-class activities (reflections and discussion forum for asking questions outside of class), all contributed to the learning of evidence-based practice concepts. Upon completing the EBP course, students' confidence levels in EBP skills seem to have increased because of how the education was offered. The students were able to develop a clinical question, conduct a comprehensive literature search, obtain relevant literature from a variety of sources, appraise the quality of the evidence, and describe methods of implementation within the practice of OT.

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