Teaching and Learning in Communication Sciences & Disorders

Volume 8
Issue 2 *Special Issue: SoTL Fellows*

Article 4

2024

Speech-Language Pathology Graduate Students' Experiences with the Use of Case-Based Learning to Develop Skills for Evidence-Based Practice

Aleah S. Brock
University of West Georgia, abrock@westga.edu

DOI: 10.61403/2689-6443.1315

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Abstract

The American Speech-Language Hearing Association (ASHA) states that practitioners should use the principles of evidence-based practice (EBP) for clinical decision making. However, speech-language pathologists (SLPs) often report a lack of understanding, time, and resources to implement EBP. Clinicians who were exposed to EBP training during their graduate program or clinical fellowship are more likely to use EBP in their clinical practice; therefore, graduate programs in SLP must provide explicit EBP training to upcoming clinicians. At present, no consensus exists on the best way to train students in the principles of EBP. The present study sought to investigate student experiences and perceptions of a case-based learning (CBL) approach to training EBP. Thirty-two graduate SLP students completed a semester-long CBL activity which required them to create a PICO question, complete a literature review and annotated bibliography, and write a plan of care for a hypothetical clinical case. At the end of the semester, students were asked to write reflections on their use and learning of EBP during the course of the project. Those reflections were analyzed to understand the students' experiences with CBL as a method to learn the principles of EBP.

Keywords

case-based learning; evidence-based practice; aural (re)habilitation; SoTL

Cover Page Footnote

This project was supported by the SoTL Fellows program, an initiative of Teaching and Learning in Communication Sciences and Disorders: http://tlcsdjournal.com/ and supported in part by resources from the University of Pittsburgh.

Evidence-based practice (EBP) is "an approach in which current, high-quality research evidence is integrated with practitioner expertise and client preferences and values into the process of making clinical decisions" (ASHA, 2005, para. 1). In clinical fields such as speech-language pathology (SLP), EBP is the expected standard upon which clinicians should base their services. Despite this expectation, many speech-language pathologists report a lack of knowledge about EBP (Greenwell & Walsh, 2021) and a lack of time and resources needed to effectively implement it (Greenwell & Walsh, 2021; Thome et al., 2020). Despite positive attitudes toward research and the concept of EBP, clinicians may rely more heavily on clinical experience and the recommendations of others than on research for clinical decision making (Hart & Kleinhans, 2014; Togher et al., 2011; Zipoli & Kennedy, 2005). Clinicians who receive training on EBP during their graduate program and/or clinical fellowship are more likely to use EBP principles in their clinical service delivery (Greenwell & Walsh, 2021; Zipoli & Kennedy, 2005). Therefore, it is important that SLP students receive clear and explicit training in EBP during their graduate programs. An assessment of EBP knowledge and self-efficacy administered across three levels of undergraduate SLP students in the Netherlands indicated that as students progressed in the program, their knowledge of EBP increased, but their perceived ability to implement it did not, indicating that simply learning the principles of EBP is insufficient for students to feel competent to use it (Spek et al., 2013).

Training programs in speech-language pathology are tasked with providing students with adequate preparation in both the principles and application of EBP; however, no consensus exists as to how these skills are best taught. Some proposed methods for teaching EBP include a triadic model including the student, academic faculty, and clinical faculty (Rangamani et al., 2016), infusion of common EBP components across the curriculum (Apel & Scudder, 2005), hybrid models including didactic and applied clinical components (Hall-Mills & Apel, 2007), problem-based learning (Visconti, 2010), and workshops or coursework on EBP (Cobus-Kuo & Waller, 2016; Doble et al., 2019). One pedagogical method that has been suggested for training EBP skills is case-based learning (CBL), an active learning strategy that allows students to learn in a way that is meaningful and practical by having students apply knowledge to scenarios that simulate clinical practice (McCabe et al., 2009). CBL has been employed in many clinical fields to transfer academic knowledge to clinical practice including physical therapy, nursing, psychology, social work, and medicine (e.g., Edwards et al., 2004; Goldberg et al., 2014; Harman et al., 2015; Loghmani et al., 2011; Marriner, 2003; Olsen et al., 2014; Shlonsky & Gibbs, 2004; Thistlethwaite et al., 2012; Yoo & Park, 2014). Within the field of communication sciences and disorders, CBL has been used to develop students' interprofessional teamwork skills (Goldberg et al., 2014; Lieberman-Betz et al., 2023; Trommelen et al., 2014; Wallace & Benson, 2018), facilitate integration of student skills across courses (Friberg & Harbers, 2016), develop student knowledge of specific content in the field (Vinney & Harvey, 2017), improve student metacognitive skills (Vinney et al., 2018), supplement clinical education (McAllister et al., 2022; Meilijson & Katzenberger, 2014), and develop student clinical decision-making skills (Brackenbury et al., 2013; Werfel & Reynolds, 2020).

A few reports have described the use of CBL to teach EBP in communication sciences. Meilijson and Katzenberger (2014) described the implementation of case-based learning into a clinical education program. Graduate students in the program learned to apply EBP through direct instruction during academic coursework followed by presentation of a clinical question based on

a client they treated during their practicum. Bloom (2010) described a group CBL activity focused on the application of EBP to hypothetical cases in a graduate motor speech disorders course. Students completed the assignment using five steps, including developing a clinical question based on the provided case, locating evidence, critically appraising the evidence, integrating evidence with individual client needs and perspectives, and evaluating the EBP process. Students produced a written report and oral presentation including case history, evaluation, resources, a treatment plan, and documentation of how the EBP process was applied. Students were able to demonstrate sound clinical decision making using available evidence. Each of these reports contained a description of the process used to deliver EBP content to the students but did not contain data related to outcomes or student experiences.

To date, two papers have reported students' experiences with courses that used CBL to teach EBP. Durieux et al. (2018) examined the impact of a module which included both direct instruction in EBP principles and a guided case-based project on undergraduate SLP students' EBP competence. Students were administered assessments before and after the module to assess their competence in applying principles of EBP to clinical scenarios. As a control, a group of undergraduate psychology students also took the pre- and post-assessment but did not complete the EBP module. Students in the experimental group, but not the control group, demonstrated a significant increase in EBP competence from pre- to post-test. Additionally, most students indicated that they felt they developed knowledge and skills in EBP as a result of the module. Students completed an open-ended survey to report their experiences with the project. Student comments indicated that they enjoyed that the experience "simulated professional conditions" (p. 221) and felt that what they learned was applicable to their future as professionals. In another study, a graduate SLP program in Australia implemented a case-based approach to teaching the EBP process, utilizing cases for both training and assessment. Researchers reported student and instructor perceptions of the program that used CBL to teach the EBP process. Many students reported that the case-based approach was effective in helping them learn and retain content as well as helping them understand the application to the field. Comments indicated that the interactive and hands-on nature of the CBL approach helped them to learn more than they would from a lecture alone. Some students, however, felt that the cases needed to be balanced with theory for a more grounded experience. Instructors in the program felt that the students' level of involvement was increased with CBL, which they reported to be engaging and dynamic (McCabe et al., 2009).

To date, there is little in the literature reporting graduate students' experiences with the use of CBL to train them to implement the EBP process. The present study examined students' perceptions of a case-based approach to applying course materials using the principles of EBP and sought to answer the following research question: What are graduate SLP students' perceptions of CBL as a method for learning the principles and application of EBP in Aural Rehabilitation?

Methods

The present study extends a preliminary investigation which used CBL to teach second-semester graduate SLP students to apply the principles of EBP to an article review assignment (Brock, 2023). In the current study, the same cohort of students who participated in Brock (2023; now in their fourth semester of the graduate program), completed a semester-long CBL project which required them to create a PICO question, complete a literature review, evaluate the evidence, and

write a plan of care for a hypothetical client. Ethical approval was obtained from the institutional review board (IRB) of the supporting university prior to beginning the study.

Background. Students in the current study also participated in a pilot project two semesters prior in a course called Auditory Disorders which focuses on the anatomy and physiology of the hearing mechanism, types and causes of hearing loss, and the impact of auditory disorders on language. Prior to beginning the assignment, students participated in a 1-hour session focused on EBP, search strategies, and academic writing. Then, working in self-selected groups of 3-4, students were provided with a case-based prompt and were asked to locate and review an article to help them approach the clinical problem. The assignment included both a written critical review paper and an in-class presentation of the group's findings and recommendations (Brock, 2023).

Participants. Participants were 32 students in a graduate program in speech-language pathology. Students were in their fourth semester in the program, which is the final semester of academic coursework prior to entering off-campus clinical placements. Students at this point in their plan of study have completed a course called Methods of Clinical Management, which includes orientation and observation in the on-campus clinic, and two full semesters of clinical practicum providing services in the on-campus clinic as well as in small groups in the university's lab preschool and in local skilled nursing facilities. As part of their practicums, students learn about EBP and complete treatment plans for their clients, which include a description of the evidence-based treatment approach they are using. In the semester of this study, the students were completing their third and final on-campus clinical practicum.

During the last class meeting of the term, students were asked to allow their classwork to be de-identified and used for analysis in the study. The researcher was the instructor in the class; therefore, to reduce undue influence for students to participate, students completed informed consent forms and placed them inside a sealed envelope at the end of the course. The envelope was delivered to the department chair and held there until final grades were posted. All 32 students enrolled in the course consented to participation; however, only 30 submitted the final reflection which was coded for the study. Twenty-nine of the participants who submitted reflections also participated in the pilot study two semesters prior, in which they were asked to review a self-chosen article related to an assigned hypothetical clinical case and analyze the clinical implications of the article to the case. The one student who did not complete that project was taking courses out of sequence and did not take the previous course as scheduled.

Methodology. A phenomenological approach was utilized to explore student's perceptions of a CBL activity as a method to learn about the implementation of EBP. Phenomenology is a qualitative research approach which seeks to describe the experience of a phenomenon as it was lived by a set of individuals (Creswell & Poth, 2018). Phenomenology aims to describe both what was experienced by the participants and how they experienced it (Teherani et al., 2015). Neubauer and colleagues (2019) assert that phenomenology is a valuable tool that provides an opportunity for researchers in health professions education to learn from the experiences of others, a vital task in honing our pedagogical practices. In the present study, student's perceptions were explored by analyzing their prompted, written reflections at the end of the course. Reflections were analyzed by the author using qualitative content analysis (Schreier, 2014). Because the author also served both as the instructor of the course and as the data coder, a statement of reflexivity is provided

here. Reflexivity is an integral part of qualitative research that allows researchers to "critique, appraise, and evaluate how their subjectivity and context influence the research processes" (Olmos-Vega et al., 2023, p.242).

Reflexivity Statement. As a clinician, I take seriously my obligation to provide services to my clients which adhere to the principles of EBP. As an educator, I take seriously my role in guiding students to competence in using EBP in their future clinical practice. As a researcher, I take seriously my responsibility to investigate the methods by which EBP may be most effectively taught. The intersection of these identities may influence my work here. I place great value on EBP as an important piece of clinical service provision. As a researcher, I want to find methods that are effective for teaching EBP, but as an educator, I want to believe that what I am doing in my classes *is* effective. Since I was the instructor for the course from which this data comes, my interpretation of students' reflections are subject to my own bias.

Procedures. The study took place in the context of an 8-week, summer semester, graduate-level SLP course called Aural Habilitation and Rehabilitation. This course focuses on the SLP's role in clinical service delivery to patients who are deaf or hard of hearing (DHH) across the lifespan and includes information on models of intervention including signed and spoken language development and support. In this course, students were required to complete a semester-long case-based EBP project in five guided steps: (a) formulate a PICO question, (b) complete a literature review and annotated bibliography, (c) write a plan of care based on the findings of the literature review, (d) participate in peer review of the plan of care draft, and (e) finalize the written plan of care and present the plan of care orally in class. See Table 1 for the timeline for the steps of the project. Students self-organized into eight groups of four, and each group chose one of four provided hypothetical clinical cases to be the basis of their course project. Thus, two groups completed each case. Each of the cases focused on a different age group: "Lily," an early intervention client with bilateral cochlear implants; "Max," a school-aged child with bilateral hearing aids; "John," an adult with a high-frequency hearing loss and bilateral hearing aids: and "Alice," a geriatric client with a unilateral cochlear implant. Students were provided with resources within the learning management system (LMS) such as ASHA's "Create A PICO Question" worksheet (American Speech Language Hearing Association, n.d.-a) and links to ASHA's 4-step EBP guide (American Speech Language Hearing Association, n.d.-b). They were also given detailed written and verbal instruction on the project expectations, a sample of an annotated bibliography, critical appraisal checklists, a template for the peer review process, and a template for the plan of care.

First, students created and submitted PICO questions individually based on their chosen case. Then, students discussed their ideas with their group members and either selected one member's PICO question or created a new one as a group to use in the course project. Instructor feedback was given to individual students after the individual PICO submissions and to the group following the group PICO submissions. Second, students gathered literature related to their case and completed an annotated bibliography. The minimum number of sources for the annotated bibliography was five; however, students were encouraged to find as many sources as necessary to answer their clinical question. At this step, students submitted a copy of each article, a critical appraisal worksheet for each article, and an annotated bibliography describing relevant clinical details of each study. Third, students were tasked with writing a plan of care including relevant

background information on their client, long- and short-term goals, and appropriate, evidence-based clinical methods and procedures. Next, students brought a draft of their plan of care to class and participated in a peer review process. For the peer review, student groups were assigned to review each other's written product using a provided template to guide them. Assignments were made such that a group whose case was a pediatric client (Lily or Max) reviewed the plan of care of an adult client (John or Alice) and vice versa. This prevented students from feeling that their reviewing group would "copy" their goals or methods during review and gave students the opportunity to think critically about a different population than they did for their own project. Following peer review, students had one week to revise the plan of care if needed. Finally, the project culminated in the submission of the written product as well as an oral presentation of the findings. At this stage, students had 18-20 minutes to do two things: first, they presented their goals and methods to their peers, and second, they participated in a role-play activity in which they presented the plan of care to group members playing the parts of the patient and family members. This allowed the students an opportunity to practice discussing clinical details both with other professionals and with consumers.

Table 1

Timeline for the Completion of the Case-Based Learning Assignment

Timeline	Description
Week 1	Students submit a PICO question individually
Week 2	Students discuss their individual PICO questions with group members and decide on one question to use as a group.
Week 4	Students submit an annotated bibliography as a product of their review of the literature related to their PICO question.
Week 7	Students submit a draft of their plan of care and participate in peer review of their document.
Week 8	Students present their plan of care to the class. Students submit their written final plan of care.

At the end of the semester, after the project was presented and submitted, students were asked to complete individual written reflections on the course project using the following prompt:

> Reflect on your use of evidence-based practice to complete the course project this semester. How did you identify your clinical question? How did you gather evidence to address that question (both internal and external evidence)? How did you assess the quality, relevance, and validity of the evidence? How did you consider other variables in your decision making? How did this project help you learn to apply the EBP process to clinical scenarios?

Students submitted the reflections to the LMS, and they were downloaded and de-identified for analysis after final grades were posted for the term. Responses were analyzed by the author using qualitative content analysis, a method which systematically describes data by reducing it into units of meaning (Schreier, 2014). Student reflections were extracted to a document for analysis. Consistent with procedures described by Graneheim and Lundman (2004), the reflections were read multiple times in order to immerse the researcher in the data. Meaning units, defined as "words or statements that relate to the same central meaning" (Graneheim & Lundman, 2004, p.

106), were identified and indicated by highlighting within the document, and a code was applied to each meaning unit. The coding process was completed in one pass by the author, and codes were grouped to create categories and subcategories, which are reported here.

Results

Thirty students' reflections were analyzed to understand their perspectives of their learning from the project. In reading the students' reflection submissions, it became evident that the first four prompt questions yielded responses that were procedural in nature or restated project instructions. For example, responses to "How did you identify your clinical question?" included statements like the following: "…we each came up with our own clinical question and then shared them with the group." Responses to "How did you assess the quality, relevance, and validity of the evidence?" included statements like the following: "We utilized the CASP [Critical Appraisal Skills Programme] checklists provided in course content to assess the quality, relevance, and validity of the evidence." Because these responses were reflective only of the prompts, instructions, and/or rubric, they do not provide deep insight to student learning; although these responses did confirm that students followed the prescribed procedures. For this reason, only the final portion of the reflection was analyzed for purposes of this study, which was "How did this project help you learn to apply the EBP process to clinical scenarios?"

Coded meaning units were first sorted relative to three *a priori* categories related to students' use of the components of the EBP process: *Considering Scientific Evidence, Considering Client Perspectives,* and *Considering Clinical Expertise*. This initial analysis provides an understanding of which areas of the EBP triangle students tended to gravitate towards. The coded meaning units were then analyzed in depth to describe students' perspectives of their learning from this CBL project. From this analysis codes were grouped into two main categories: *What Students Learned* and *How Students Learned*.

The EBP Process. Students frequently commented on specific areas of the EBP process in which they felt the project helped them develop skills. To examine which areas of the EBP triangle students tended to gravitate toward, comments were sorted based on the area(s) of the EBP triangle to which they related. Twenty-one comments (from 16 students) indicated learning about the importance of *Considering Scientific Evidence*. In these comments, students indicated an understanding of the importance of locating and utilizing the best available scientific evidence in treatment planning. For example, one student stated, "In order to find the best treatment route for them to make the most progress, we must find evidence based research." Ten students reported learning about the importance of *Considering Client Perspectives*. Students discussed learning about the importance of considering the client's unique needs, values, and perspectives in treatment planning in comments such as the following: "This project taught me that there should be…a lot of consideration for my client and their personal needs, rather than just picking a therapy method that may apply but might not be the best." Five students reported learning about the importance of *Considering Clinical Expertise*. Students indicated learning about the importance of considering clinical expertise in decision making, including comments such as, "I learned that having great clinical judgment and the best available information is important for guiding our clinical decisions." In the case that a comment contained reference to multiple aspects of EBP, the comment was counted under each category. Of note, only five students discussed learning about

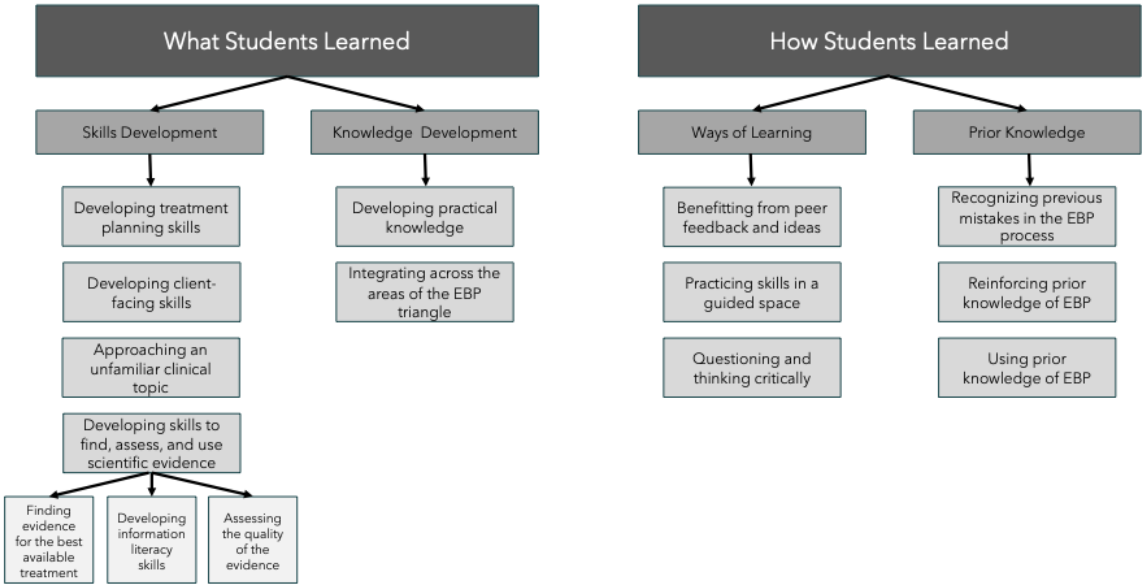
all three facets of EBP (scientific evidence, clinical expertise, and client perspectives) in this project, as demonstrated in comments such as the following:

> Therefore, this was extremely helpful in furthering my learning in the field of speech pathology. I was able to apply prior knowledge, collaborate with other students, research peer-reviewed articles, and also focus on the wants and needs of the client.

Student Perspectives of their Learning. To explore the students' perceptions of how the CBL project supported (or did not support) their learning of the principles and application of EBP to clinical scenarios, coded meaning units were examined and sorted into categories and subcategories. There was some overlap of meaning units across the *a priori* categorization and the Student Perspectives categorization. Comments were included in both analyses if they were found to be applicable to both. Analysis resulted in two main categories, *What Students Learned* and *How Students Learned*, with two levels of subcategories under each. Figure 1 illustrates the categories and subcategories that resulted from the analysis.

Figure 1

Categories and Subcategories Resulting from Analysis of Student Reflections



What Students Learned. Comments in the category of *What Students Learned* were related to knowledge and skills that students reported developing during the CBL project. Therefore, codes in this category were subcategorized as either *Skills Development* or *Knowledge Development.*

Skills Development. Comments within the category of *What Students Learned* were subcategorized as *Skills Development* when they reported clinical skills that the student developed or improved by completing the CBL project. Students reported "Developing Skills to Find, Assess, and Use Scientific Evidence," which included comments that indicated development of information literacy skills including search strategies and skills to approach reading articles. For

example, one student stated, "this project helped me to apply EBP by using different search engines, such as PubMED and ASHA resources." Another student commented, "some of the key things I took away were how to search for articles, what to look for in articles, and how to utilize the evidence found." Comments related to "Developing Skills to Find, Assess, and Use Scientific Evidence" also discussed learning to assess the quality of the evidence, as demonstrated in comments such as, "I did learn how to check evidence in order to assess the quality, relevance, and validity." One student noted:

> This taught me how to […] find the best treatment option for the client. I learned how to check off if the article found is useful, reliable, relevant, and of good quality and if it was not how to go back a step and find a better article.

Finally, under "Developing Skills to Find, Assess, and Use Scientific Evidence," students discussed finding and comparing treatment options in the literature to choose the best approach for their client, as demonstrated in this comment: "the project helped us understand that the EBP process involves integrating the best available evidence…" Another student said, "[The project] made us compare both treatments and evaluate which would work best for the client. We eventually decided that we should use both, and had the EBP to support this decision."

Also within *Skills Development,* students discussed "Developing Client-Facing Skills," such as communicating with clients, supporting families through new diagnoses, and applying treatment information to clients as individuals. For example, one student stated, "I feel as if I can now support and educate a family that needs guidance with a new diagnosis." Several students indicated that the portion of the project that required students to role-play reporting the plan of care to their client/family was beneficial, as demonstrated by this student's reflection:

> …presenting this plan to the client's 'family' showed me the entire EBP process that included communicating with the client. I thought this was the most important thing that we did during this project because client values are an important part of EBP, and we interact with clients on an everyday basis.

Another student agreed, stating "I think doing the demonstration helps you explain that to parents and the client because sometimes it can be easy to use jargon or over explain."

Another area of *Skills Development* that students reported was "Developing Treatment Planning Skills." This included clinical skills such as developing a PICO question, creating a plan of care, or writing goals for their client. Students said things like, "this helped me to understand how to take a case/scenario and turn it into an actual PICO question and POC" and, "I also learned a lot about goal writing through this project, as I knew that they needed to be measurable."

Finally, students reported *Skills Development* related to "Approaching an Unfamiliar Clinical Topic." Auditory disorders and aural (re)habilitation are areas in which most students had less background knowledge and clinical experience at the onset of this course. Students indicated that this project helped them to understand how to approach intervention with populations with which they are less familiar. For example, one student noted "…having much less experience with auditory rehabilitation approaches, this project helped me better understand how to find an approach without a ton of background knowledge that I bring to the table." Another said, "it has been helpful to focus specifically on a hearing loss client, as it is something not heavily focused on, and sometimes research can be difficult to find if you don't have the knowledge/information."

Knowledge Development. Comments in the category of *What Students Learned* were subcategorized as *Knowledge Development* if they reported an area in which the student developed knowledge while completing the project. In this subcategory, students discussed "Developing Practical Knowledge," indicating that students found the project useful in helping them to transfer their learning to practical applications and future practice because it allowed them to apply knowledge and skills in a realistic context. Student reflections included comments such as, "I enjoyed this project because I felt like it was a very literal situation. It followed through the entire process that we as SLPs go through in cases like this" and, "this project helped me learn how to apply the EBP process to real clinical scenarios." Other students said, "applying EBP to clinical scenarios is the best way to solidify the importance of all three aspects of EBP," and "learning how to provide effective, caring, evidence based skills and knowledge is going to help me be the best SLP possible and provide the best care that I can for my future clients." Yet another said, "this project helped me learn more about the EBP process in a clinical setting. It was a practical way to apply and practice using EBP in a way that I can apply to my work in the future." Finally, one student expressed their appreciation for the project:

> I appreciate having the opportunity to complete this project, as locating evidence-based research, creating a plan of care, and demonstrating what a session would look like is useful, as this is the process I will complete for each client in the future.

Students also reported *Knowledge Development* related to "Integrating Across the Areas of the EBP Triangle," indicating that students learned about the importance of considering information across the areas of EBP in clinical decision making. A student commented, "it is important that we use our knowledge in combination with current research and the preferences of our client/their families to develop a plan of care that fits their needs and goals." Another said, "as I learned how to integrate evidence from the research with clinical experience it helped me to make well-informed decisions with the given scenario." Further, reflections contained comments such as, "this project ensured that I use the EBP process because of course I have to consider the client's desires as well as my own clinical knowledge, and the other research that is out there" and, "I learned that having great clinical judgment and the best available information is important for guiding our clinical decisions, but it is not enough alone. Without having the client/client's caregivers on board, our efforts are in vain."

How Students Learned. Comments in the category of *How Students Learned* described ways in which the project supported students' learning. Comments were subcategorized as discussing *Ways of Learning* and *Prior Knowledge*.

Ways of Learning. Comments within the category of *How Students Learned* were subcategorized as *Ways of Learning* when they reported ways in which the CBL project supported their learning. First, students indicated "Benefiting from Peer Feedback and Ideas." Students appreciated the opportunity for feedback from their peers, both in the context of peer review of the final draft of their plan of care and in the context of collaboration with peers in their group. Students discussed the importance of their peers in comments like, "with collaboration, there were more ideas presented and more areas to study and consider" and, "being receptive to others' perspectives and/or opinions to guide clinical decision-making is essential." One student noted the benefit of peer-review:

> The peer-review feedback completed in class before the presentation day was beneficial. This allowed specific feedback from another group with a different case study than us. The comments and constructive criticism allowed us to reflect, modify, and make necessary revisions to provide the best possible intervention.

Students also stated that the opportunity for "Practicing Skills in a Guided Space" was helpful for their learning. Comments in this subtheme indicated that students appreciated the opportunity to learn and practice the EBP process within a supportive and low-stakes context with step-by-step guidance. For example, one student stated, "I feel that in other classes we get bits and pieces of treatments and information to apply to patients, but this gave us the opportunity to apply it all in one case in a guided space." Another commented, "it was helpful to be able to walk through this process over the course of a semester, because we have not been given the opportunity to do this yet with a plan of care." Yet another said, "I was nervous in the beginning, but each step of the project helped build my confidence in my abilities and knowledge." One student said about the project:

> I liked how this project was set up because it wasn't all at once and we did one step at a time from the PICO question to finding articles to support it to creating the plan of care. I found it not as overwhelming.

Finally, students discussed how "Questioning and Thinking Critically" about their clinical problem in this project helped them develop knowledge and skills related to EBP. For example, a student said, "we are always going to be asking questions. […] the purpose of EBP is to always find strategies to do the most good unto our clients." Another student said about the project:

> Although we have completed plan of cares and evidence-based practice papers for our clients in the clinic each semester, none were as in-depth as this project. This project taught me that there should be a lot of thought before beginning research.

Prior Knowledge. Comments within the category of *How Students Learned* were subcategorized as *Prior Knowledge* if they related to using, reinforcing, or advancing their existing knowledge base related to EBP. Some students commented on "Using Prior Knowledge of EBP" while working on this project, for example: "I feel like I do have a fairly good understanding of how to use EBP to decide on treatment approaches from my time in clinic." Students also noted that the project helped them by "Reinforcing Prior Knowledge of EBP," as indicated by comments like the following: "doing this project helped to reinforce what I already knew about evidence-based practice, such as how to use evidence to choose treatment methods." One student said:

> This project helped reinforce the importance of evidence based practice in our field and the importance of how it influences treatment plans. As we know from working in the clinic, EBP is a huge part of how we approach new clients.

Finally, students noted that the project led to them "Recognizing Previous Mistakes in the EBP Process," as seen in this comment:

> Previously, I would search for a technique and see if it fit my client. Now, I understand you begin with the client and figure out what you need to work on. You then create your clinical question and then find research based on the clinical question. I realized I had been doing this backwards.

Discussion

The students' written reflections gave insight into their experiences with a five-step, case-based project which required them to apply EBP to produce a plan of care for a hypothetical aural (re)habilitation client. As expected, students reported learning about each of the three pillars of the EBP process. Similar to findings in the pilot study (Brock, 2023), students tended to lean heavily towards scientific evidence. This is likely due to (a) a lack of clinical experience from which to draw their own clinical judgement or expertise, and (b) the artificiality of hypothetical clients that limits students' ability to infer the client's needs or perspectives. Most students (16/30) reported learning about the importance of scientific evidence in clinical decision making, while five students discussed learning about clinical expertise and 10 students discussed learning about client perspectives. Only five of students discussed all three pillars of EBP within their reflections, but of note, all of these reflections spoke of the importance of integrating the three pillars when making clinical decisions.

Analysis of students' reflections revealed insights into *What Students Learned* and *How Students Learned* during the course of this project. In the category of *What Students Learned,* comments indicated that the project supported students' development of a variety of clinical skills, including learning about writing a PICO question, developing a plan of care, and constructing goals for clients. Students discussed the applicability of the project to "real-life" and the development of practical knowledge that they experienced as a result of the project. Several also discussed the applicability of the project to their future practice as clinicians. These findings indicate that students found the CBL project beneficial to support the growth of knowledge and skills that will benefit them in their future careers as clinicians.

Comments in the category of *How Students Learned* give insight into what aspects of the project students found most supported their learning. Students discussed the way that this project interacted with their prior knowledge of EBP. Some students indicated that the project served to reinforce the concepts of EBP, and some mentioned that the project helped them to realize errors that they had been making. For example, one student noted that they had been working "backward" by searching for therapy approaches and then trying to fit them to the client, rather than beginning with the client to create a PICO question and then locate appropriate treatment methods. Analysis further revealed that students appreciated the opportunity to practice clinical decision-making skills within a "guided space." The step-by-step nature of the project provided students with support and feedback along the way and allowed them to practice the EBP process in a realistic, yet low risk, environment. Students noted that the application of classroom knowledge to realistic cases helped them understand the principles of EBP in a more concrete way. These comments indicate that students found the case-based approach valuable in learning to transfer knowledge from academic learning to clinical applications. These findings are consistent with previous reports of student experiences with CBL (Durieux et al., 2018; McCabe et al., 2009), in which students reported that the hands-on and practical nature of the project was helpful for their learning. Specifically, students noted that the simulated cases were beneficial in helping them learn to apply the principles of EBP to aural rehabilitation, an area which students do not routinely encounter in their first-year, on-campus clinical practicums. Additionally, students indicated that peer feedback and the opportunity to collaborate with others provided them with a valuable opportunity to learn from their classmates. These findings support the utility of CBL in creating a co-constructed

learning environment, which encourages active participation and collaborative learning and has been found to support student engagement and skill development (Vespone, 2023).

Limitations and Future Directions. Beneficial as it was, the project was not without challenges. In keeping with precedent for case-based learning assignments (e.g., Bloom, 2010; Friberg & Harbers, 2016; McCabe et al., 2009; Whitworth et al., 2008) and to support the goal of learning to collaborate with others for evidence-based clinical decision making, the project was assigned as a group effort. However, it became obvious that instead of working together, most students approached the assignment as a series of individual projects which they completed independently and then combined. For example, students were instructed to work together to create an annotated bibliography and submit one document per group. Many submissions were divided up with students' names next to the content that they contributed, demonstrating that they had divided the work but had not discussed it and worked it out together prior to submission. Although the division of labor makes sense for students trying to accomplish a goal of completing the assignment, it does not support the collaboration and sharing of ideas that case-based learning encourages. Also of note, the project was completed as part of a course during an 8-week summer term. The accelerated timeline for this course was challenging and led to the project feeling rushed at some stages. Future investigations should examine similar projects in longer semesters or in courses with different subject matter. Finally, this study reveals student perceptions of a case-based learning activity in helping them develop EBP skills; however, it does not demonstrate quantitatively measurable learning outcomes. Future studies should consider quantitative methods to measure student learning about EBP resulting from CBL, such as pre/post measurements or control group experiments as feasible.

Conclusions

Overall, students reported that the practical, guided nature of this case-based approach supported increased knowledge of the EBP process and development of skills necessary to implement EBP in clinical practice. The structure of the project, including the artificial nature of hypothetical clinical scenarios, may have led to students relying more heavily on scientific evidence to the exclusion of the other pillars of EBP. Additionally, some students did not engage in the project as collaboratively as hoped. However, overall the results suggest that case-based learning can be an effective way to train students to apply the principles of EBP to clinical decision making. These findings offer evidence for a pedagogical method that programs may find useful to provide the clear and explicit EBP training that students need to become competent clinicians.

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