Teaching and Learning in Communication Sciences & Disorders

Volume 7 | Issue 2 Article 3

2023

A Survey of Communication Sciences and Disorders Graduate Students' Perceptions of Critical Appraisal Skills

Amanda S. Mahoney
University of Pittsburgh, asm100@pitt.edu

Kendrea L. Garand
University of Pittsburgh, kgarand@pitt.edu

Erin G. Lundblom
University of Pittsburgh, lundblom@pitt.edu

A Survey of Communication Sciences and Disorders Graduate Students' Perceptions of Critical Appraisal Skills

Abstract

Research shows that prerequisite courses prepare students for participation in more challenging coursework and more advanced future learning. Despite being a field that heavily relies on research evidence to inform clinical decisions as part of evidence-based practice, many undergraduate Communication Sciences and Disorder (CSD) programs do not include prerequisite undergraduate coursework dedicated to research methods. The purpose of the present study was to explore speech-language pathology and audiology graduate students' experiences with and opinions about critical appraisal of research articles. A total of 201 graduate students from institutions nationwide completed an online survey with questions related to exposure to research appraisal, use of an appraisal tool, and perspectives on the importance of research appraisal and confidence in appraisal skills. Results indicated that nearly one-third of the respondents did not learn or could not remember learning about article appraisal in their undergraduate CSD programs, though almost all survey respondents reported that they had learned about article appraisal in their graduate classes. Over half of the students used an article appraisal tool to bolster their learning of article critiques, almost all of whom found it helpful. Most of the respondents recognized the importance of article appraisal knowledge prior to graduate school but suggested that many of their undergraduate instructors did not place importance on the skill. Respondents' confidence in their article appraisal skills ranged from "least confident" to "most confident". This study supports early and ongoing practice with article appraisal, which will provide these future clinicians with the confidence to communicate their knowledge and understanding when making evidence-informed clinical decisions. Additionally, instructors who teach article appraisal may consider using a hands-on appraisal tool since almost all students with experience using them believe they are helpful.

Keywords

appraisal, critique, prerequisite, research methods, students

Research in human cognition has demonstrated that prior knowledge is the key variable to successful learning and serves as the foundation for how to provide instruction and guidance for learners (Braasch & Goldman, 2010; Chew & Cerbin, 2021; Simonsmeier et al., 2021). The integrity of a learner's foundational knowledge base influences their ability to acquire and apply new information via problem-solving skills (Dochy et al., 2002). To develop an understanding of novel concepts, learners check new information against their existing understanding, broad knowledge becomes more focused and sophisticated, and the learner gains an appreciation for more nuanced concepts (Entwistle & Peterson, 2004; Loyens et al., 2009). The importance of a strong knowledge base for future learning supports the use of prerequisite courses to adequately prepare students for participation in more challenging coursework and more advanced future learning (Donovan & Wheland, 2009; Halberstam & Redstone, 2005; McCall et al., 2006; Sylvan et al., 2020).

Clinicians in the fields of speech-language pathology (SLP) and audiology rely on the integration of clinical expertise, client values, and the best current evidence to make clinical decisions (i.e., evidence-based practice [EBP]; American Speech-Language-Hearing Association [ASHA], 2004). Clinical expertise is an ever-evolving, high-quality, multifaceted source of clinical evidence that is intrinsic to the clinician and develops over time, and the consideration for clients' values, needs, and choices arise from time spent working with clients (Fissel Brannick et al., 2022). Although these two components of EBP are likely to develop in a clinical setting, evaluating the validity, reliability, and relevance of current research to determine the "best" evidence can be taught in the classroom. ASHA specifies that students should exit Communication Sciences and Disorders (CSD) undergraduate programs with at least a general understanding of how to use evidence to support clinical decision making. In fact, ASHA reports that exposure to contemporary issues in health care and education through evidence-based decision making is a formative part of the experience in obtaining an undergraduate CSD degree (American Speech-Language-Hearing Association [ASHA], n.d.-b).

Many undergraduate CSD programs do not include prerequisite coursework dedicated to research methods (Sylvan et al., 2020). Although research evidence may be presented throughout foundational CSD courses, many students have not acquired the skills to critically evaluate this type of evidence. By thoroughly and methodically evaluating scholarly research with consideration for its methodological rigor, the reader of the research can be more confident about the relevance and trustworthiness of reported findings (Tod et al., 2022). SLPs and audiologists rely on research evidence to inform clinical decisions as part of EBP (ASHA, 2020a; ASHA, 2020b). Initial development of this skill is needed before graduate program entry where clinical practicum experiences often start concurrently with academic coursework. One of the standards for SLP and audiology graduate programs is the ability of students to "access and critically evaluation information sources" (Council on Academic Accreditation [CAA], 2023). Prior knowledge is an excellent predictor of successful future learning (Braasch & Goldman, 2010). A foundational research course in the CSD undergraduate program could prepare learners for continued refinement of knowledge and skill, including application to clinical practice settings at the graduate level and beyond. The earlier students engage in evidence appraisal, the more likely they are to apply the skill confidently and consistently throughout their careers (Kajermo et al., 2000).

Purpose

The ability to critically appraise a research article to determine its methodological rigor and potential for bias is an essential skill for all clinicians (ASHA, n.d.-a). Given that many undergraduate CSD programs do not include prerequisite coursework dedicated to research methods (Sylvan et al., 2020), the purpose of the present study was to survey graduate students in SLP and audiology programs to understand their experience with critical appraisal of research articles during their undergraduate CSD programs. We suspected that most students would have learned this skill in their graduate programs, given the standards for these graduate programs to teach critical evaluation of research; however, we hypothesized that the majority of CSD graduate student respondents would not have learned how to critically appraise a research article in their undergraduate CSD programs.

Along with discovering *if* these students learned article appraisal skills, we also sought to discover *how* they learned those skills; specifically, whether they used a hands-on learning approach, such as an article appraisal tool (e.g., chart, checklist). Reading and evaluating research articles is difficult and time consuming for those without the skill and practice. Critical appraisal tools provide consumers of research with structured questions and/or checklists to evaluate the quality of published evidence and to determine sources of bias, which is an essential skill for clinicians (ASHA, n.d.-a; Buccheri & Sharifi, 2017). Using such a tool to teach article appraisal would facilitate the students' organization of information according to the structure and components of research articles and provide an objective, evaluative process for appraising research evidence. Research suggests that student performance is enhanced when given the opportunity to integrate knowledge with practice (Harvey-Northrop & Vinney, 2019; Martin et al., 2014), and that concrete, practical situations are more effective for learning than conceptually abstract methods (Dochy et al., 2002; Shuell, 1986). Consequently, we surmised that students who were introduced to article appraisal through a structured article appraisal tool would be more familiar and comfortable with reading research and be more efficient at retrieving information from the text. Since we hypothesized that most students did not learn how to appraise an article in their undergraduate education, and thus would not have experienced using an article appraisal tool, we also asked respondents about their article appraisal instruction and use of article appraisal tools in graduate school.

Lastly, we were interested in various perspectives from students related to article appraisal, including the perceived importance of appraisal skills, the perceived adequacy in obtaining these skills during their undergraduate program, and their confidence in using appraisal skills.

Methods

This cross-sectional survey study was approved by the University of Pittsburgh's Institutional Review Board. The reporting of this survey study was guided by the Consensus-Based Checklist for Reporting of Survey Studies (CROSS) (Sharma et al., 2021). SLP and audiology graduate students attending accredited graduate programs nationwide were recruited to participate in an anonymous, voluntary electronic survey developed using Qualtrics © (https://www.qualtrics.com). To create a sample of convenience, the link to the survey was distributed to potential respondents

via email and through various social media platforms (e.g., Facebook groups dedicated to SLP services, ASHA Special Interest Groups discussion boards). The survey was open for students to participate from the beginning of February 2021 to the beginning of March 2021. Participants provided consent prior to beginning the survey.

The 23 item-survey gathered the following closed-ended demographic information: current graduate focus (SLP or audiology), graduate university, year in the program, and the undergraduate and/or post-baccalaureate university attended. The remaining closed-ended questions were related to exposure to research appraisal, use of an appraisal tool, and perspectives on the importance of research appraisal and confidence in appraisal skills. One free-text box with no specific question prompt was provided where students could offer additional feedback (although not necessary). Time to completion was estimated to be fewer than 10 minutes. The complete survey can be found in Appendix A, while free-text responses to the survey can be found in Appendix B.

A total of 258 respondents initiated the survey, with 201 complete responses. Most respondents were enrolled in SLP graduate programs (n = 184, 92%), with the remaining respondents in audiology graduate programs (n = 17, 8%). Respondents represented 71% of the CSD graduate programs nationwide (South, n = 72, 36%; Northeast, n = 65, 32%; West, n = 34, 17%; Central, n = 30, 15%). Most respondents were in their first (n = 97, 48%) or second (n = 95, 47%) year of graduate school.

Of the total sample, 184 (92%) had completed an undergraduate or post-baccalaureate program in CSD in the United States, representing 67% of the programs across the nation (South, n = 70, 38%; Northwest, n = 63, 34%; West, n = 29, 6%; Central, n = 22, 12%). Graduation years ranged from 2013 to 2020, with the majority of respondents having graduated from an undergraduate or post-baccalaureate program between 2018 to 2020 (n = 166, 90%). Complete demographic information is provided in Table 1.

Survey questions were designed by the authors to address the aims of the study. Descriptive statistics were used to present the quantitative data from the surveys, and thematic analysis was used to analyze the free-text responses. Thematic analysis is a method of analyzing qualitative data to identify common themes or topics that appear frequently in participants' responses. The first and last authors (A.M. and E.L.) used concepts from Graneheim and Lundman (2004) to create consensus codes and themes for the free-text responses. The first author read the full responses in their entirety several times to get a sense of the overall content, and then conducted the initial analyses and coding before presenting them to the last author for review. All authors reviewed and agreed upon final categories and themes.

Table 1

Respondent Demographics

	n = 201	
	n	%
Graduate program		
Speech-language pathology	184	91.5
Audiology	17	8.5
Year in program		
1st	98	48.8
2nd	95	47.3
3rd	4	2
4th	3	1.5
5th or above	1	0.5
Geographic regions of graduate programs		
Northeast	65	32.3
South	72	35.8
Central	30	14.9
West	34	16.9
Undergraduate program		
Communication-Science and Disorders (CSD)	160	79.6
Post-Baccalaureate in CSD	24	11.9
Other undergraduate but minor in CSD	5	2.5
Undergraduate other than CSD	12	6
Geographic regions of undergraduate/post-baccalaureate programs		
Northeast	66	32.8
South	80	39.8
Central	25	12.4
West	30	14.9
Graduate year from undergraduate/post-baccalaureate program		
2020	72	35.8
2019	81	40.3
Before 2019	48	23.9

Results

Survey Responses.

CSD Undergraduate/Post-Baccalaureate Experience with Article Appraisal. Of those respondents who graduated with a CSD undergraduate or post-baccalaureate education, approximately two-thirds (*n* = 122, 66%) learned about article appraisal in their programs, while the remaining one-third did not (*n* = 49, 27%) or could not remember (*n* = 12, 7%). Over half (*n* = 69, 53%) of those who learned about article appraisal in their undergraduate or post-baccalaureate programs used an article appraisal tool; almost all (*n* = 66, 97%) of the respondents who used an article appraisal tool considered it to be at least a little helpful, with almost half (*n* = 33, 48%) rating it "very helpful."

On a scale of 1-5 (1 = least; 5 = most), the majority of respondents (*n* = 64, 34%) rated their CSD undergraduate and post-baccalaureate instructors with a "3" as to how much importance they placed on article appraisal, while a third rated a 1 or 2 (*n* = 59, 32%) and the other third rated a 4 or 5 (*n* = 62, 34%). Over half of the respondents who attended a CSD undergraduate, or post-baccalaureate program agreed they had adequate instruction in article appraisal in their programs (*n* = 118, 59%), and fewer than one third of the respondents disagreed (*n* = 59, 29%). Table 2 provides further detailed descriptive results.

CSD Graduate Experience with Article Appraisal. Of those responding to the survey, most respondents (*n* = 187, 93%) learned about article appraisal in their graduate program, while 8% (*n* = 14) had not. Of those who reported learning about article appraisal in their graduate program, approximately two-thirds of these respondents (*n* = 128, 68%) were provided with an article appraisal tool. Almost all respondents (*n* = 119, 94%) considered an article appraisal tool to be at least a little helpful and half of the respondents (*n* = 64, 50%) considered it very helpful, while 7% (*n* = 9) did not think it was helpful at all or did not have an opinion. Over half of the respondents rated their graduate instructors with the highest rating (i.e., "5") for importance placed on article appraisal (*n* = 103, 54%), with 5% (*n* = 10) rating a 1 or 2. Table 3 provides further detailed descriptive results.

Respondent Opinions about Article Appraisal. Almost all respondents (*n* = 188, 94%) agreed that article appraisal instruction is necessary during an undergraduate program, with over half strongly agreeing (*n* = 110, 55%). Similarly, the majority of respondents (*n* = 192, 96%) agreed that article appraisal skills are necessary as a clinician, with 79% (*n* = 158) strongly agreeing. On a scale of 1-5 (1 = least confident; 5 = most confident) in their article appraisal skills, approximately half of the respondents rated themselves ≥ 4 (*n* =106, 53%), while the remaining pool of respondents rated themselves < 4 (*n* = 95; 47%). Table 4 provides further detailed descriptive results.

Table 2

CSD Undergraduate/Post-Baccalaureate Experience with Article Appraisal

	n = 184	
	n	%
Learned aspects of appraising a research article during program?		
Yes	123	66.8
No	49	26.6
I can't remember	12	6.5
Perceived importance placed on article appraisal by instructor(s)?		
5 (most)	21	11.4
4	36	19.6
3	59	32.1
2	31	16.8
1 (least)	24	13
No response	13	7.1
Felt that they received adequate instruction in article appraisal?		
Strongly agree	53	28.8
Somewhat agree	56	30.4
Neither agree not disagree	21	11.4
Somewhat disagree	36	19.6
Strongly disagree	18	9.8
Used a hands-on article appraisal tool during program?		
Yes	64	34.8
No	37	20.1
No response	83	45.1
	n = 64	
Felt the hands-on article appraisal tool was helpful?	*n*	%
Very helpful	30	46.9
Somewhat helpful	27	42.2
No opinion	2	3.1
A little helpful	4	6.3
Not helpful at all	1	1.6

Table 3

CSD Graduate Experience with Article Appraisal

	n = 201	
	n	%
Learned aspects of appraising a research article during program?		
Yes	182	90.5
Not taken a research course yet	14	7
No response	5	2.5
Perceived importance placed on article appraisal by instructor(s)?		
5 (most)	103	51.2
4	49	24.4
3	28	13.9
2	8	4
1 (least)	2	1
No response	11	5.5
Used a hands-on article appraisal tool during program?		
Yes	128	63.7
No	54	26.9
Not taken a research course yet	14	7
No response	5	2.5
	n = 128	
	n	%
Felt a hands-on article appraisal tool was helpful?		
Very helpful	64	50
Somewhat helpful	47	36.7
No opinion	7	5.5
A little helpful	8	6.3
Not helpful at all	2	1.6

Table 4

Student Opinions about Article Appraisal

	n = 201	
	n	%
Article appraisal instruction is necessary during undergraduate education.		
Strongly agree	110	54.7
Somewhat agree	75	37.3
Neither agree nor disagree	8	4
Somewhat disagree	3	1.5
Strongly disagree	5	2.5
Article appraisal skills are necessary as a clinician.		
Strongly agree	158	78.6
Somewhat agree	34	16.9
Neither agree nor disagree	5	2.5
Somewhat disagree	1	0.5
Strongly disagree	3	1.5
How confident are you in your article appraisal skills?		
5 – most confident	20	10
4	86	42.8
3	71	35.3
2	12	6.0
1 – least confident	12	6.0

Thematic Analysis of Free-Text Responses to Open-Ended Comment Box. A total of 26 individuals (13%) provided responses to the open-ended free-text prompt: "Please share any additional comments/feedback you have related to the survey questions or about learning how to appraise research." The 26 responses were broken down into 46 initial meaning units, which are groups of words or statements that have a central meaning. The meaning units were then given short labels called codes (Graneheim & Lundman, 2004). From these codes, two overall themes emerged related to instruction on article appraisal and opinions about article appraisal.

Theme 1: Instruction on Article Appraisal. Over half (61%, *n* = 28) of the 46 free response meaning unit statements referenced article appraisal instruction, either regarding graduate or undergraduate school. All statements about article appraisal in graduate school (*n* = 8) indicated that the respondents did have article appraisal instruction in their programs, and, in fact, one respondent wrote that article appraisal in graduate school "was an everyday thing!" The remaining 20 responses focused on article appraisal instruction in undergraduate programs. While three statements indicated that the respondents did learn how to appraise articles in their CSD

undergraduate programs (or at least "the importance of EBP"), seven statements indicated that the respondent's did not receive any article appraisal instruction in their CSD undergraduate program. The 10 remaining responses indicated that respondents learned article appraisal skills before graduate school, but not from their CSD undergraduate courses. For example, one respondent wrote, "While I did learn how to appraise articles [in undergrad], it was not in a classroom setting or during a course. I was active in research projects outside of the classroom and that is where I learned appraisal skills."

Theme 2: Opinions about Article Appraisal. The remaining 39 (n = 18) of the 46 free-text meaning unit response statements offered opinions about article appraisal instruction. Three responses mentioned the expectation of article appraisal skills in graduate school with comments such as, "They just expect us to have these skills" and "We were expected to be able to do critical appraisal." Ten responses centered around a desire to have had more instruction. Four responses wished for more article appraisal instruction in their undergraduate programs (e.g., "I feel like my undergrad could have def prepared us better," and "At least some exposure would have better prepared me for my graduate program where we have gone in depth in terms of research appraisal"), and six wished for more in-depth instruction in their graduate programs, as evidenced by responses such as, "The skill should be incorporated in more courses rather than just the one research course." The remaining seven responses noted that article appraisal requires instruction, as expressed in the quote, "If you weren't given adequate background and knowledge of how to read articles and appraise them, these assignments are extremely hard and frustrating."

Discussion

As clinical professionals, SLPs and audiologists use evidence-based approaches to support clinical decisions with the use of external research as part of the EBP framework. This study examined SLP and audiology graduate students' experiences with and opinions of critically appraising research articles including instruction at the undergraduate and graduate levels. SLPs and audiologists are expected to use EBP; accreditation expectations of CSD programs and certification requirements for persons entering the field require instruction on how to use evidence-based frameworks including external research to make clinical decisions. While almost all survey respondents reported that they had learned about article appraisal in their graduate classes, nearly one-third reported that they did not learn or could not remember learning about article appraisal in their undergraduate CSD programs. While no curricular requirements exist for undergraduate or post-baccalaureate programs related to research-based coursework, this is critical knowledge needed at graduate program entry for the implementation of evidence-based clinical decision making. Many CSD graduate students begin clinical experiences in the first semester of their graduate program, and the graduate curriculum may not provide instruction on the use and appraisal of external research before students enter clinical practice settings; as a result, instruction on how to appraise external research is foundational knowledge needed at the outset of graduate school. Responses such as, "They just expect us to have these skills," and "We were expected to be able to do critical appraisal," add support.

Halberstam and Redstone (2005) found that strong CSD prerequisite grade point averages (GPAs), more so than a strong overall undergraduate GPA, was a predictor of success for SLP graduate school students, including better academic and clinical performance (Halberstam & Redstone,

2005), underscoring the importance of educating undergraduate students in content that will be used in their graduate programs. Graduate students would benefit from having learned and becoming comfortable with appraisal skills during their undergraduate education, allowing them to focus on applying evidence to clinical decision making during their graduate studies.

Educational research indicates that students' conceptions of knowledge and learning develop through educational experiences, and students benefit from exposure to learning and practicing realistic problem solving comparable to the types of situations they will encounter in their future careers (Entwistle & Peterson, 2004; Loyens et al., 2009). Early and ongoing practice appraising evidence will provide these future clinicians with the confidence to communicate their knowledge and understanding when making evidence informed clinical decisions (Jakubec & Astle, 2013); thus, it follows that a prerequisite undergraduate CSD research course would benefit SLP and audiology graduate students who will continue to use scientific appraisal throughout their schooling and careers.

Most of our respondents recognized the importance of article appraisal knowledge prior to graduate school. The majority believed that article appraisal is important in undergraduate CSD programs, and almost all considered it an essential skill for a clinician. Likewise, of those who used an article appraisal tool during their undergraduate and graduate education, almost all considered it helpful. About half of the student respondents were in their 2nd year of graduate education, or higher, and the 1st year respondents completed the survey in the middle of the second semester. Students' conceptions of learning activities change between their first and second years in their academic program (Loyens et al., 2009), which may have influenced the high ratings for these two questions. With more experience in their program, students are likely to see the benefit of practical activities that build on prior knowledge and will benefit them in their future profession.

Students are more likely to find meaning in concepts if they have prior exposure, participate in practical activities that build on prior knowledge, and practice realistic problem solving like situations they will encounter in their future. Meaningfulness can be further strengthened through the importance placed on content by the instructor. Research shows that students are more interested in a topic and more motivated to learn based on experiences with their teachers, such as the instructor being knowledgeable about content, making content meaningful, and having a positive attitude (Brewer & Burgess, 2005; Siegle et al., 2014). While well over half of our survey respondents reported that their instructors placed importance on article appraisal in graduate school, less than half agreed with this statement for their undergraduate CSD instructors. We can surmise that undergraduate instructors are not placing importance on article appraisal equal to that of graduate instructors because it is not a required area of content knowledge in undergraduate programs, despite its importance in graduate school and beyond.

A final consideration for including research in CSD undergraduate programs is that many SLP and audiology students are interested in pursuing a master's thesis or PhD but require more education about research methods to cultivate their interests (Willis, et al., 2018). In 2013, ASHA's Academic Affairs Board laid out a strategic plan that introduced initiatives to alleviate the shortage of PhDs in CSD (ASHA, 2019). One of these initiatives was for the Academic Affairs Board to develop guidance for the undergraduate curricula. By 2015 ASHA's Academic Affairs Board disseminated a report about the role of undergraduate education in CSD, with the goal of fostering

research careers. The report asserted that CSD departments should be a university's central point for "… faculty and students interested in advancing the science of human communication and disorders through *research*, management, technology, and advocacy," (Crais et al., 2015, p. 2). The board presented three domains of knowledge and skills associated with the CSD undergraduate education, each including an aspect of research (i.e., exposure to the scientific method, research opportunities, exposure to research from the field; cocurricular research experience; and knowledge of research careers and research within their department; Sylvan et al., 2020). Although our survey respondents did not specify whether they were presented with the domains of knowledge recommended by the Academic Affairs Board, we do know that one third of them did not learn how to critique a research article and without such a skill, one cannot be a responsible consumer of research.

Considerations for Implementation. Research indicates that prior knowledge is an excellent predictor of future achievement in learning (Braasch & Goldman, 2010); therefore, it is likely that incorporating critical appraisal skill instruction into the CSD undergraduate education will benefit CSD students as they continue to graduate school and into the clinic where these skills are necessary. Using an article appraisal tool, such as a list of well-defined questions or a checklist, offers a systematic guide for students to become familiar with article structure and to recognize methodological bias. Numerous critical appraisal tools exist and are typically considered research-design specific (e.g., systematic reviews, randomized controlled trials) or generic, to address a range of study designs (Katrak et al., 2003). Critical appraisal tools are available on websites such as the Critical Appraisal Skills Programme (CASP) Checklists (https://casp-uk.net/casp-tools-checklists/), Joanna Briggs Institute's (JBI) Critical Appraisal Tools (https://jbi.global/critical-appraisal-tools), Centre for Evidence Based Medicine's Critical Appraisal Tools (https://www.cebm.ox.ac.uk/resources/ebm-tools/critical-appraisal-tools), or ASHA's suggested appraisal tools (https://www.asha.org/Research/EBP/Bias-Appraisal-Tools-and-Levels-of-Evidence/). Additionally, Buccheri & Sharifi (2017) offer descriptions for frequently used critical appraisal tools used in EBP. Finally, educators could consider creating their own appraisal instrument by incorporating aspects from various tools, which they believe would be most helpful for their students.

It is important to consider that undergraduates in CSD might not realize the importance and relevance of article appraisal skills if they are not putting the skills into practice. Cognitive theories of motivation indicate that students who perceive course content to be meaningful and important for future goals are more motivated to learn and are more persistent in school than those with short-term goals (Creten et al., 2001; Husman & Lens, 1999; Siegle, et al., 2014; Van Calster et al., 1987; Zaleski, 1994). Although most of our respondents appreciated the importance of learning article appraisal skills, Martin et al. (2014) suggested that students in SLP graduate programs may not see the relevance of material taught in courses; they see pieces individually and not the integrated way they come together in clinical practice (Martin et al., 2014). Harvey-Northrop & Vinney (2019) introduced the concept of implementing an integrated curriculum in the field of CSD, specifically integrating content about disorders with clinical case studies, to provide students with a better understanding of the content within the scope of clinical application (Harvey-Northrop & Vinney, 2019). It seems, then, that integrating CSD coursework with disorder content and research critiquing could provide students with a more advanced understanding of disorders and how to incorporate research into clinical practice. Preparing CSD students with scientific

application skills prior to such a graduate curriculum would avoid a steep learning curve and create a richer experience with more depth of understanding.

Limitations. This study was not without limitations. Although students were recruited to participate from a variety of institutions from across the country, though admittedly fewer from the Central and Western parts of the country, it is possible that only students with strong feelings about the topic participated in the survey. This type of convenience sample could have introduced bias, which lessens the generalizability of the data. Additionally, far fewer audiology students participated in the survey than SLP students. Since audiology and SLP graduate programs differ, it is possible that overall responses would be different if there was a more even sample. Finally, the validity of this survey was not established before it's use, which may have affected the data.

Conclusion

Prior knowledge is a significant variable in a learner's ability to acquire and apply new information via problem-solving skills. Graduate students in SLP and audiology learn how to access research and relate it to clinical practice because SLPs and audiologists are required to use EBP throughout their careers. Employing EBP, however, requires ongoing reading and consuming of scientific literature to stay current in the field, which can be a difficult skill for many to master. Instruction in how to appraise and critique external evidence should begin at the earliest opportunity in the CSD education to arm students with the skills and knowledge they need before graduating and becoming independent clinicians and consumers of research. This study revealed that many graduate students in SLP and audiology programs did not learn how to critically appraise a scientific article in their undergraduate programs, and many said that their instructors did not place much importance on this skill at the time. Most students, however, indicated that article appraisal skills should be taught during undergraduate education and that such a skill is essential for a clinician. Instructors planning to teach article appraisal may consider using a hands-on appraisal tool since almost all students with experience using them deemed them helpful.

Author Disclosures

The authors have no relevant financial or nonfinancial disclosures.

References

American Speech-Language-Hearing Association. (n.d.-a). *Bias, appraisal tools, and levels of evidence*. https://www.asha.org/Research/EBP/Bias-Appraisal-Tools-and-Levels-of-Evidence/

American Speech-Language-Hearing Association. (n.d.-b) *The value of the undergraduate degree in Communication Sciences and Disorders (CSD* https://www.asha.org/siteassets/uploadedfiles/value-of-the-undergraduate-degree.pdf

American Speech-Language-Hearing Association. (2004). *Report of the joint coordinating committee on evidence-based practice*. https://www.asha.org/siteassets/uploadedfiles/jccebpreport04.pdf

American Speech-Language-Hearing Association. (2020a). *2020 standards and implementation procedures for the Certificate of Clinical Competency in Audiology*. https://www.asha.org/certification/2020-Audiology-Certification-Standards/

American Speech-Language-Hearing Association. (2020b). *2020 standards and implementation procedures for the Certificate of Clinical Competency in Speech Language Pathology*. https://www.asha.org/academic/value-of-the-undergraduate-degree-in-csd/

American Speech-Language-Hearing Association Acadmeic Affairs Board. (2019). *Report of the 2013-2018 Academic Affairs Board (AAB) strategic plan to increase the student pipeline and workforce for PhD researchers and faculty-researchers*. https://www.asha.org/siteassets/reports/academic-affairs-board-report-of-phd-shortage-plan-2013-2018.pdf

Braasch, J. L. G., & Goldman, S. R. (2010). The role of prior knowledge in learning from analogies in science texts. *Discourse Processes: A Multidisciplinary Journal, 47*(6), 447–479. https://doi.org/10.1080/01638530903420960

Brewer, E. W., & Burgess, D. N. (2005). Professor's role in motivating students to attend class. *Journal of STEM Teacher Education, 42*(3), 23-47.

Buccheri, R.K., & Sharifi, C. (2017). Critical Appraisal Tools and reporting guidelines for Evidence-Based Practice. *Worldviews on Evidence-Based Nursing*, *14*(6), 463–472. https://doi.org/10.1111/wvn.12258

Chew, S. L., & Cerbin, W. J. (2021). The cognitive challenges of effective teaching. *Journal of Economic Education*, *52*(1), 17–40. https://doi.org/10.1080/00220485.2020.1845266

Council on Academic Accreditation (CAA) (Audiology/Speech-Language Pathology). (2023). Standards for accreditation of graduate education programs in audiology and speech-language pathology. https://caa.asha.org/siteassets/files/accreditation-standards-for-graduate-programs.pdf.

Crais, E., Nunez, L., Bentler, R., DiLollo, A., Folsom, R., Gillam, R., Hewitt, L., Lister, J., Nittrouer, S., Simpson, J., Chapman, K.L., Honaker, J., Koehnke, J., McNeil, M., Rogers, M., Cone, B., Robinson, S. (2015). *Final report: The role of undergraduate education in communication science and disorders.* American Speech-Language-Hearing Association Academic Affairs Board. https://www.asha.org/siteassets/reports/aab-report-role-undergrad-ed-csd.pdf

Creten, H., Lens, W., & Simons, J. (2001). The role of perceived instrumentality in student motivation. In Efklides, A., Kuhl, J., Sorrentino, R.M. (Eds). *Trends and prospects in motivation research* (pp37-45). Springer. https://doi.org/10.1007/0-306-47676-2_3

Dochy, F., de Rijdt, C., & Dyck, W.. (2002). Cognitive prerequisites and learning: How far have we progressed since Bloom? Implications for educational practice and teaching. *Journal of Active Learning in Higher Education, 3*(3), 265-284. https://doi.org/10.1177/1469787402003003006)

Donovan, W. J., Wheland, E. R. (2009). Comparisons of success and retention in a general chemistry course before and after the adoption of a mathematics prerequisite. *Journal of School Science and Mathematics, 109*(7), 371-382. https://doi.org/10.1111/j.1949-8594.2009.tb17868.x

Entwistle, N. J., & Peterson, E. R. (2004). Conceptions of learning and knowledge in higher education: Relationships with study behaviour and influences of learning environments. *International Journal of Educational Research, 41*(6), 407-428. https://doi.org/10.1016/j.ijer.2005.08.009

Fissel Brannick, S., Wolford, G. W., Wolford, L. L., Effron, K., & Buckler, J. (2022). What is clinical evidence in speech-language pathology? A scoping review. *American Journal of Speech-Language Pathology*, *31*(6), 2943–2958. https://doi.org/10.1044/2022_AJSLP-22-00203

Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*, *24*(2), 105-112. https://doi.org/10.1016/j.nedt.2003.10.001

Halberstam, B., & Redstone, F. (2005). The predictive value of admissions materials on objective and subjective measures of graduate school performance in speech-language pathology. *Journal of Higher Education Policy and Management, 27*(2), 261-272. https://doi.org/10.1080/13600800500120183

Harvey-Northrop, J. M., & Vinney, L. A. (2019). Bridging the gap: An approach to facilitating integrated application of neuroanatomy and neurophysiology in graduate-level speech-language pathology across the semester. *Teaching & Learning in Communication Sciences & Disorders, 3*(2), 6. https://doi.org/10.30707/TLCSD3.2Harvey-Northrup

Husman, J., & Lens, W. (1999). The role of the future in student motivation. *Educational Psychologist, 34*(2), 113-125. https://doi.org/10.1207/s15326985ep3402_4

Jakubec, S. L., & Astle, B. J. (2013). Students connecting critical appraisal to evidence-based practice: A teaching-learning activity for research literacy. *Journal of Nursing Education, 52*(1), 56-58. https://doi.org/10.3928/01484834-20121121-03

Kajermo, K. N., Nordström, G., Krusebrant, Å., & Björvell. (2000). Perceptions of research utilization: Comparisons between health care professionals, nursing students and a reference group of nurse clinicians. *Journal of Advanced Nursing, 31*(1), 99-109. https://doi.org/10.1046/j.1365-2648.2000.01255.x

Katrak, P., Bialocerkowski, A. E., Massy-Westropp, N., Kumar, V. S., & Grimmer, K. A. (2003). A systematic review of the content of critical appraisal tools. *BMC Medical Research Methodology*, *4*, 22. https://doi.org/10.1186/1471-2288-4-22

Loyens, S. M. M., Rikers, R. M. J. P., & Schmidt, H. G. (2009). Students' conceptions of constructivist learning in different programme years and different learning environments. *British Journal of Educational Psychology, 79*(3), 501-514. https://doi.org/10.1348/000709908X378117

Martin, K., Bessell, N. J., & Scholten, I. (2014). The perceived importance of anatomy and neuroanatomy in the practice of speech-language pathology. *Anatomical Sciences Education, 7*(1), 28-37. https://doi.org/10.1002/ase.1377

McCall, K. L., Allen, D. D., & Fike, D. S. (2006). Predictors of academic success in a doctor of pharmacy program. *American Journal of Pharmaceutical Education*, *70*(5), 106.

Sharma A, Minh Duc NT, Luu Lam Thang T, Nam NH, Ng SJ, Abbas KS, Huy NT, Marušić A, Paul CL, Kwok J, Karbwang J, de Waure C, Drummond FJ, Kizawa Y, Taal E, Vermeulen J, Lee GHM, Gyedu A, To KG, Verra ML… Karamouzian M. (2021). A Consensus-Based Checklist for Reporting of Survey Studies (CROSS). *Journal of General Internal Medicine, 36 (10),* 3179-3187. https://doi.org/10.1007/s11606-021-06737-1

Shuell, T. (1986). Cognitive conceptions of learning. *The Review of Educational Research, 56*(4), 411-436. https://doi.org/10.2307/1170340

Siegle, D., Rubenstein, L. D., & Mitchell, M. (2014). Honors students' perceptions of their high school experiences: The influence of teachers on student motivation. *Journal of the Gifted Child Quarterly, 58*(1), 35-50. https://doi.org/10.1177/0016986213513496

Simonsmeier, B.A., Flaig, M., Deiglmayr, A., Schalk, L., & Schneider, M. (2021). Domain-specific prior knowledge and learning: A meta-analysis. *Educational Psychologist, 37(1),* 31-54. https://doi.org/10.1080/00461520.2021.1939700

Sylvan, L., Brock, K. L., Perkins, A., & Garrett, J. (2020). Building blocks of knowledge: A close look at prerequisite coursework for graduate programs in speech-language pathology. *ASHA Perspectives: SIG 10 Issues in Higher Education, 5*(5), 1262-1271. https://doi.org/10.1044/2020_PERSP-20-00042

Tod, D., Booth, A., & Smith, B. (2022). Critical appraisal. *International Review of Sport and Exercise Psychology, 15*(1), 52-72. https://doi.org/10.1080/1750984X.2021.1952471

Van Calster, K., Lens, W., & Nuttin, J. R. (1987). Affective attitude toward the personal future: Impact on motivation in high school boys. *The American Journal of Psychology*, 1-13. https://doi.org/10.2307/1422639

Willis, L. B., Schall, K. C., & Piazza, L. (2018). A survey of communication sciences and disorders undergraduate students' research experience and interest in a master's thesis and phd degree. *ASHA Perspectives: SIG 10 Issues in Higher Education, 3*(10), 11-26. https://doi.org/10.1044/persp3.SIG10.11

Zaleski, Z. (Ed.). (1994). *Psychology of future orientation*. Wydawnictwo Towarzystwa Naukowego Katolickiego Uniwersytetu Lubelskiego.

Appendix A

Survey Questions

1. Are you an SLP master's student or AuD student?
2. Are you attending a graduate program in the Northeastern, Southern, Central, or Western region?
3. Which graduate program do you attend?
4. In which year of your program are you?
5. Did you graduate with an **undergraduate degree** in Communication Science and Disorders (CSD) (or the equivalent)?
    a. If yes:
        i. What year did you graduate from a CSD **undergraduate program or** complete a CSD **post-baccalaureate program**?
        ii. Did you graduate from a CSD **undergraduate or post-baccalaureate** program in the Northeastern, Southern, Central, or Western region?
        iii. From which CSD undergraduate program or post-baccalaureate program did you graduate?
        iv. Did you learn any aspects of appraising a research article in CSD **undergraduate/post-baccalaureate** classes? (Appraising research is defined as identifying the article's strengths and weaknesses to determine the usefulness and validity of the research findings, also known as critically appraising or critiquing, among other terms).
        v. Did your instructors use a hands-on tool for teaching article appraisal, such as an article appraisal worksheet or template, in your **undergraduate/post-baccalaureate** CSD class(es)?
        vi. If yes:
            1. How helpful was it to use an article appraisal worksheet to learn how to critically appraise articles in your **undergraduate/post-baccalaureate** CSD program? (very helpful, somewhat helpful, a little helpful, not helpful at all, no opinion)
6. Have your instructors used a hands-on article tool for teaching article appraisal, such as an appraisal worksheet or template, in your **SLP/AUD graduate** program?
    a. If yes:
        i. How helpful has it been to use an article appraisal worksheet to learn how to critically appraise articles in your SLP/AuD graduate program? (very helpful, somewhat helpful, a little helpful, not helpful at all, no opinion)
7. Rate how much you agree or disagree with the following statement? (strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree)
    a. It is necessary to learn aspects of appraising a research article during CSD undergraduate/post-baccalaureate.
    b. I received adequate instruction during my CSD undergraduate/post-baccalaureate program to prepare me for article appraisal in graduate school.
    c. Article appraisal skills are necessary as a clinician.
8. On a scale of 1-5 (1 is least confident, 5 is most confident)
    a. How confident are you in your article appraisal skills?

9. On a scale of 1 to 5 (1 is not important at all and 5 is extremely important), how much importance did your instructor place on learning article appraisal?
    a. In your undergraduate/post-bacc CSD program?
    b. In your graduate SLP/AuD program?
10. Please share any additional comments/feedback you have related to the survey questions or about learning how to appraise research.

Appendix B

Free Responses

1. My instructors at the graduate level misspell "Citation" as "Sitation" and confuse citations with references. Many do not know very much about research, whether they are first year doc students or SLP-CCCs. Even one teacher who is an AuD/SLP-CCC misspelled "citation."
2. I didn't realize how much of this was entailed in grad school and I feel like my undergrad could have def prepared us better. For my grad program, I don't think they take this into consideration, they just expect us to have these skills. It would have been nice to learn how to properly appraise an article the first week of classes or so being that this was an everyday thing! I know that I'm smart and I am a high-level reader but reading certain articles like that confuses me like no other. When I think I know the main idea, I will talk about it with others and see that I totally missed the main idea/concept or at least important key factors of the research article.
3. I was never provided direct instruction on article appraisal in my undergrad. Instead, it became a developed skill through participation in a variety of assignments. At my grad program I took an evidenced-based practice course that provided more concrete info on appraising research articles.
4. Undergrad: discussed important of EBP and finding articles that are similar to a patient's case and whether treatment is appropriate and what type. Graduate: wrote a literature review for a research methods class.
5. My undergrad courses (psych) did a much better job of preparing me to evaluate research than the one basic course the CSD program throws in.
6. I did receive lots of instructions on article appraisal skills in my undergrad, but it was only because I took an elective undergrad honors thesis course. Outside of this course, no other required CSD course I took in undergrad put any emphasis on article appraisal, meaning other students who did not take the elective honors thesis course received no instructions on this topic at all.
7. My program claims that evidence-based practice is extremely important, but we only read primary literature in the one class that taught quality appraisals. Reading primary literature is a skill that needs to be practiced regularly. I'm confident in my skills because I came into the program with a graduate degree from an unrelated field.
8. I learned that most about article appraisal through a graduate assistantship in a research lab rather than my actual classes.
9. While I did learn how to appraise articles, it was not in a classroom setting or during a course. I was active in research projects outside of the classroom and that is where I learned my appraisal skills.
10. I feel like in my undergraduate coursework, we were given a template for critical appraisals, but I never truly understood what I was doing/reading/looking for. I feel like if I was given instruction on each aspect of how to critically appraise articles with relevant examples, I would have understood the process way more. In my graduate program, we are expected to be able to do critical appraisals of articles well and thorough but, if you weren't given adequate background knowledge of how to read articles and appraise them, these assignments are extremely hard and frustrating.

11. In my Graduate SLP program I would have liked to have more in depth discussions on how to synthesize information from multiple research articles. I know very well how to appraise an article but less confident in my ability to use 3-5 articles in order to come to EBP clinical decision.
12. I hated being assigned articles to read at first! Not until I started to get deep enough into my training did I begin to personally see the importance in getting info out of articles.
13. My instructor at my undergraduate program did an excellent job of teaching the basic aspects of what to look for and to make sure we check where the information came from. The class was extremely informative with lots of discussions. The information provided was useful. Taking a gap year between undergrad and grad school was not helpful in remembering the information learned from that class. I would have loved to have the same information at the graduate level.
14. I really didn't read research articles until graduate school so I wouldn't have been able to learn through application in undergrad CSD courses. In middle school and high school we did a lot about credibility, reliability, and validity of info we read (thanks to growing up in a hyper informational access world due to technology). I also took several research courses outside of CSD in undergrad that touched on it. The majority of my education on it came from high school.
15. For my graduate program and there was a substantial amount of emphasis placed on appraising research articles.
16. I learned article reading skills as an undergraduate, but not in relation to the CSD department or part of any of their coursework.
17. In my graduate program I have found that it is crucial to learn how to appraise research in order to know what the best evidence-based practice is and determine if the article is relevant to this field and will be beneficial to you as the clinician.
18. I did not receive any instruction in my undergrad in regard to appraisal or research, at least some exposure would have better prepared me for my graduate program where we have gone in depth in terms of research appraisal
19. In my undergraduate courses there was not an emphasis on research except for my Honors class which was not mandatory. In that course, it was semi-talked about. In my graduate course it was very important, and we had a whole class about research and how to appraise research.
20. I did my post-bac because I switched careers and needed to take the pre-requisites. My first career was pretty research focused so I had research skills going into the post-bac. However, I did feel that in my post-bac not much emphasis was given to research appraisal, and the assignments associated to research article were more so reading responses or group summaries.
21. I think in post-bac programs, emphasis should be placed on understanding the data and statistics, the validity of the research, and research terminology. Before my post-bac program, I was an English major and I feel that this did really help me for understanding the research articles but understanding the specific terminology and statistics of the article was the most difficult for me when reaching grad school.
22. The research course that I completed in undergrad was not a required course for all majors. I chose to do research with a specific professor and in her class, I learned a great deal about critically reading research. This was not a shared experience across students who chose to do research with other professors.

23. My undergraduate courses had us give multiple presentations using articles and the instructors would comment on validity, research, etc. In graduate school, we had an entire course dedicated to article appraisal and article/literature review writing.
24. Very important to learn how to appraise.
25. I have had extensive experience appraising research outside of my CSD coursework (e.g., previous graduate degree, journal editorship, peer-reviewer, published researcher), so it's difficult to say what my CSD coursework has contributed.
26. The skill should be incorporated in more courses rather than just the one research course.