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Diane M. Long
Ithaca College

Anita W. Mitchell
University of Tennessee Health Science Center

Carla Chase
Western Michigan University

Bernadette Mineo
A.T.Still University- Arizona School of Health Sciences

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Abstract

One of the expected outcomes of higher education for all entry-level occupational therapy (OT) students is to develop the capacity to think critically and engage in complex clinical reasoning. Beliefs about the justification of knowledge (*epistemic* cognition) and the nature of knowledge (*ontological* cognition) underlie the ability to develop sophisticated ways of thinking. There is a scarcity of research specific to occupational therapy students in the literature related to epistemic and ontological cognition. Based on a discussion prompted during an AOTA Scholarship of Teaching and Learning (SoTL) workshop in 2014, OT faculty members from three entry-level occupational therapy programs initiated a longitudinal SoTL project designed to assess the epistemic and ontological beliefs of their respective student cohorts and compare results cross-institutionally. The Epistemic Beliefs Inventory (EBI), a modified Four-Quadrant Scale (mFQS), and 4 open-ended questions were used to assess student views at the beginning and end of a period of didactic learning in each occupational therapy program. Results suggest changes in student views may be based on the context and curriculum of the OT program in which they were enrolled. The findings associated with this SoTL project have implications for OT educators who want to help their students develop more mature views about knowledge in preparation for the metacognitive demands of clinical practice.

Keywords

Occupational therapy education, student, cognition, curricula

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Entry-Level Occupational Therapy Students' Beliefs about Knowledge and Knowing: Findings from Three Masters Level Programs in the US

Diane Long, EdD, MOTR/L¹, Anita Mitchell, PhD, OTR, FAOTA²,
Carla A. Chase, EdD, OTRL³, and Bernadette Mineo, PhD, OTR/L⁴
Ithaca College¹

University of Tennessee Health Science Center²

Western Michigan University³

A. T. Still University-Arizona School of Health Sciences⁴
United States

ABSTRACT

One of the expected outcomes of higher education for all entry-level occupational therapy (OT) students is to develop the capacity to think critically and engage in complex clinical reasoning. Beliefs about the justification of knowledge (*epistemic* cognition) and the nature of knowledge (*ontological* cognition) underlie the ability to develop sophisticated ways of thinking. There is a scarcity of research specific to occupational therapy students in the literature related to epistemic and ontological cognition. Based on a discussion prompted during an American Occupational Therapy Association (AOTA) Scholarship of Teaching and Learning (SoTL) workshop in 2014, OT faculty members from three entry-level OT programs initiated a longitudinal SoTL project designed to assess the epistemic and ontological beliefs of their respective student cohorts and compare results cross-institutionally. The Epistemic Beliefs Inventory (EBI), a modified Four-Quadrant Scale (mFQS), and four open-ended questions were used to assess student views at the beginning and end of a period of didactic learning in each OT program. Results suggest changes in student views may be based on the context and curriculum of the OT program in which they were enrolled. The findings associated with this SoTL project have implications for OT educators who want to help their students develop more mature views about knowledge in preparation for the metacognitive demands of clinical practice.

INTRODUCTION

A common challenge faced by occupational therapy (OT) educators is responding to students who become frustrated when the answer to their questions is “it depends.” The therapeutic process is subject to multiple considerations creating the need to encourage OT students to think with more flexibility and depth. For instance, during a case study discussion, students may look for an answer that is considered the correct one only to be faced with a series of “if this, then this” responses which better match actual real-life practice.

Occupational therapy clinicians must be able to think in the moment, and devise sound treatment interventions resulting in appropriate client outcomes. Because occupational therapy knowledge is *not* certain or simple, students need to develop more sophisticated ways of analyzing and evaluating knowledge, and to examine the source of that knowledge. One’s ability to engage in the type of complex and creative thinking required of clinicians depends in part on the conceptualization one has *about* knowledge. More sophisticated beliefs about the **justification of knowledge** (*epistemic* cognition or **EC**) and the **nature of knowledge** (*ontological* cognition or **OC**) can influence the persistence and metacognitive skills needed to solve the types of complex problems encountered in OT practice (e.g., Hooper, 2006; Muis & Franco, 2009, 2010; Schraw, Dunkle & Bendixen, 1995). Occupational therapy educators can assist the development of students’ epistemic and ontological (EOC) beliefs by first understanding what their students’ beliefs are in order to then facilitate movement toward more sophisticated views.

An improved understanding of students’ beliefs about knowledge could have a positive effect on student learning if faculty intentionally tailored instruction to foster high levels of epistemological and ontological thinking. Knowing students’ beliefs about sources of knowledge and the nature of knowledge can provide baseline information to thereby plan educational approaches and design learning activities that explicitly support and further develop students’ capacity for complex clinical reasoning.

THEORETICAL BACKGROUND

Research shows *epistemic and ontological* cognition (**EOC**), or **beliefs about knowledge and knowing**, can influence problem solving, learning, and achievement. Greene, Torney-Purta, and Azevedo (2010) defined EC as beliefs about the means of *justification of knowledge*. Examples of such justification of knowledge include: accepting the word of authority figures such as professors or as written in textbooks, by personal experience, or by reasoning. Whereas EC entails the means of justifying the knowledge one has or seeks, OC involves *beliefs about the nature of knowledge*. Examples of OC include ideas such as knowledge is certain, unchanging, simple, and discrete (as when following protocols) versus that knowledge is evolving, complex, and integrated (which is further along the developmental continuum).

Greene and colleagues (2010) proposed that beliefs about knowledge could be described and combined together as epistemic and ontological cognition (EOC). They identified four different *EOC positions* held by individuals: 1) the position of the *realist*,

2) the *dogmatist*, 3) the *skeptic*, or 4) the *rationalist* (Greene et al., 2010). The order (from realist to rationalist) represents development of greater sophistication in EOC. *Realists* strongly agree that knowledge is simple and certain and accept authority figures or personal experience as sources of justification for knowledge claims. In the view of the realist, textbooks and professors share simple and certain facts about a topic that can be assumed correct at face value. *Dogmatists*, *skeptics*, and *rationalists* perceive knowledge as more complex than realists, but each of these positions differ in their views about appropriate *sources of justification* of knowledge. *Skeptics* tend to justify knowledge claims through personal experience or logic; *dogmatists* through authoritative sources; and *rationalists* through a combination of the two sources, depending on the context. A rationalist view is advantageous for solving problems with more than one potential solution (Greene et al., 2010; Schoenfeld, 1983) such as the occupational performance problems encountered by OTs. Promoting students' development of a rationalist view should be a consideration of OT educators.

Hofer (2006) argued that students must understand a discipline's underlying assumptions about how knowledge is created in order to learn in the discipline, as in the disciplines of health care. As students grasp and adopt a discipline's ways of knowing, more sophisticated EOC is facilitated and expertise develops. Clinical experiences, client perspectives, and research create a broader picture of the specific knowledge needed by occupational therapists, that is *discipline specific* knowledge.

While a number of studies examining students' epistemological beliefs have been conducted in various disciplines (e.g., Anderson-Meger, 2014; Hofer, 2000; Schommer-Aikins, Duell, & Barker, 2003), only a few have been described in the OT literature. Within the profession of OT, in two separate studies, Mitchell (2014, 2015) found differences between entering and post-didactic OT students' views of *discipline specific* knowledge, suggesting that OT programs may facilitate development of discipline specific EOC. No other research in EOC was found specific to occupational therapy students, leaving limited information in the OT literature for those educating occupational therapy students.

SoTL PROJECT DESIGN

The scholarship of teaching and learning (SoTL) is "an inquiry-driven approach to teaching in which educators look carefully and critically at their students' learning, use the results to improve their teaching, and share what they have found with their colleagues in their institutions and fields" (Huber, 2013, p. 2). SoTL includes efforts to use and examine best practices in education that result in improved student learning outcomes and socialization into the profession (Gupta & Bilics, 2014). Use of evidence-based teaching practices, researching the effects of teaching strategies, and examining the characteristics of learners are some of the options for faculty members who are invested in education.

Since 2007, the American Occupational Therapy Foundation (AOTF) and/or the American Occupational Therapy Association (AOTA) has offered SoTL workshops for OT academic faculty and clinical educators interested in teaming with others to explore

educational topics. The authors met at one such workshop that was held as an AOTA pre-conference Institute in April, 2014. This collaborative cross-institutional SoTL project represents a longitudinal effort that was sparked by the workshop. The first three authors conducted the research at each of their respective institutions; the fourth author served as an ongoing SoTL mentor and coach to foster and support their sustained endeavor, assist with problem solving cross-institutional work (e.g. addressing IRB issues), and various other challenges that occurred.

In keeping with the premise of SoTL, the purpose of this descriptive, longitudinal project was to examine the EOC of OT students from each of three programs and compare the student outcomes across programs. A snapshot of OT students attending entry-level OT programs at different types of institutions with different institutional profiles was deliberate to allow for consideration of context and to measure the EOC of a larger group of OT students. The questions the authors aimed to address through this project included: 1) What are the differences in EOC between incoming and departing aggregated cohorts at each program? and 2) How do students' EOC across programs compare initially (upon entry to their respective programs) and over time (i.e. upon completion of the didactic portions of their respective curricula)?

Each program requested and received IRB approval from their respective institutions to conduct the project as an element of OT program evaluation on their campus. All were granted permission to share de-identified, aggregated data between institutions. All participant responses were de-identified and treated as anonymous.

Tools Used to Evaluate Students' EOC and Additional Data Collected

The Epistemic Beliefs Inventory (EBI), the Modified Four-Quadrant Scale (mFQS), four open-ended questions and a brief demographic questionnaire were administered to all student groups to evaluate their EOC.

The EBI is a 32 question Likert-scale tool that includes statements of belief related to the certainty of knowledge, the simplicity of knowledge, and the source of authority of knowledge (Schraw, Bendixen, & Dunkle, 2002). A sample question reads "It bothers me when instructors don't tell students the answers to complicated problems." Response options include selection of 1 through 5 on a Likert scale with 1 labeled *strongly disagree* and 5 labeled *strongly agree*. Higher scores indicate agreement with less sophisticated ways of thinking. In general, internal consistency reliabilities in the literature have ranged from .50 to .65., and test-retest reliability ranges from .62 to .81 (Schraw et al., 2002).

The EBI has been used in numerous studies and research supports the construct validity of five factors (Schraw et al., 2002). The factors as reported by Schraw et al., (2002) include: Simple Knowledge (i.e., knowledge is made up of separate facts), Certain Knowledge (i.e., knowledge is absolute and knowable), Omniscient Authority (i.e., authority figures are the only sources of knowledge), Quick Learning (i.e., learning occurs quickly or not at all), and Fixed Ability (i.e., individuals are born with the ability to

acquire knowledge, and this is unchangeable). The EBI allows examination of student views about knowledge in a general sense (i.e. *domain general*).

The mFQS (Schraw & Olafson, 2008) is an unmarked diagram consisting of a 150 mm vertical line intersecting a 150 mm horizontal line at the mid-point (see Figure 1). The identifier at the left end of the horizontal line that represents the students' epistemological worldview (EW) reads "*Epistemological Realist*" and at the right end reads "*Epistemological Relativist*." The identifier at the top of the vertical line that represents the students' ontological worldview (OW) reads "*Ontological Relativist*," and at the bottom reads "*Ontological Realist*." It should be noted that the terms *relativist* as used in the mFQS and *rationalist* as used by Greene et al. (2010) describe similar concepts.

Students who participated in the project were given definitions of each term on the mFQS modified with relevant OT examples that had been used in a previous research study (Mitchell, 2014). They were asked to think about the lines as continua between opposing concepts and indicate with an X on each line how closely their beliefs aligned with the concepts.

The mFQS has been used in previous studies of OT students (Mitchell, 2014, 2015). Although no reliability or validity data have been published for this instrument, the mFQS provided a holistic measure of OT-specific EOC (discipline specific) and afforded the OT students the opportunity to explain their rationale for their mFQS rating.

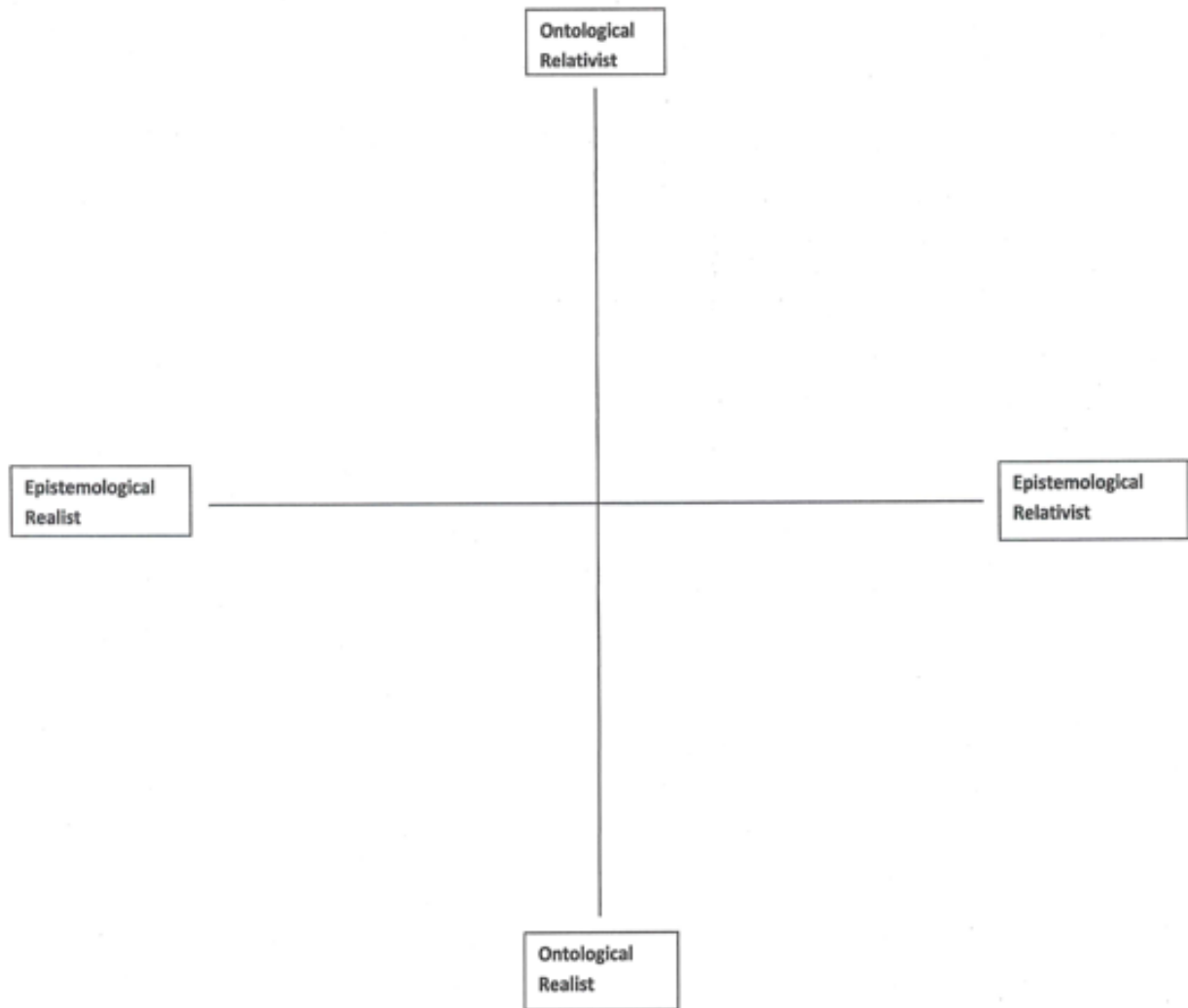


Figure 1. Modified Four-Quadrant Scale

The four open-ended questions that students were asked to answer had been developed by Mitchell (2014) for a previous research study. The questions focused on student perceptions of the role of the instructor in their learning, what learning experiences were deemed important, and how students thought about more than one right answer to clinical situations or faculty viewpoints as follows:

1. Think back on important learning experiences you've had during your coursework and/or fieldwork. Why were the experiences important? Which types of learning experiences do you think will be most helpful or useful to you in the future?"
2. Imagine a situation in which there is/was more than one viable option for assessment or treatment with a client. How will you/did you decide which option to follow? What will be/were the most important considerations in your choice? Please give details.
3. What should the role of the instructor (classroom or clinical) be in terms of your learning? Explain your answer.

4. Think about times when two instructors (classroom or clinical) explain the same thing differently. Can one be more correct than the other? Can one ever be sure of which explanation to believe? If so, how? If one can't be sure of which explanation to believe, why not?

Students' answers to these additional open-ended questions, along with the mFQS narrative data, were included to provide insight for interpretation of the quantitative data obtained from the EBI and mFQS.

DATA COLLECTION AT EACH OT PROGRAM

The entry-level OT programs at each of the three institutions had some differing characteristic features, and timing of various curricular elements were not structured exactly the same. Decisions about when to administer the evaluation tools were determined according to the academic terms when the course load was wholly discipline-specific.

All three OT programs offered a master's level degree in OT as the final degree earned upon completion of all program requirements. For all three programs, student surveys of departing cohorts occurred upon completion of the *didactic* coursework at the master's level. This meant there was a 19-month interval between the initial and second administration of the evaluation tool at Program 1, a 24-month interval at Program 2, and an 18-month interval between survey administrations at Program 3.

Surveys were administered during a regularly scheduled class by the researcher on site for institutions 1 and 2. At institution 3, the initial survey administration was conducted during an in-person class and the second administration was conducted online through Blackboard Academic Suite™ within 2 weeks of completing the didactic coursework. All data collection occurred between 2014 and 2017.

ANALYSES AND SCORING

Data analysis was completed using SPSS version 25 (IBM, 2016) and included descriptive statistics, visual analysis, and inferential statistics as described in the results section. Given the cross-institutional nature of this SoTL project and the differing requirements of each Institutional Review Board, de-identified, aggregated data was used and cohorts from each school were treated as independent groups. Responses to open-ended questions were used to inform the interpretation of the data and to uncover examples that illustrated the theoretical concepts in question.

For the scoring of the EBI (which uses a Likert scale from 1-5), the median of 3 was considered neutral and used as the benchmark when interpreting results as being more or less in agreement with the end range descriptors. Three of the possible five indices of the EBI were analyzed in keeping with the theoretical focus of the project: Simple Knowledge (SK), Certain Knowledge (CK), and Omniscient Authority (OA). Simple and Certain Knowledge indices were combined into a SKCK index to improve the reliability of the indices and in keeping with previous factor analyses suggesting that simple and certain knowledge comprise a single factor of the EBI (Leal-Soto & Ferrer-Urbina,

2017). One item was removed from the SKCK index resulting in a 1st administration internal consistency reliability of .63, and a second administration reliability of .66. Similarly, two items were removed from the OA index, resulting in a first administration reliability of .58, and second administration reliability of .54

Participant responses on the 0-150 mm. axes of the mFQS were measured using a ruler as per standard scoring procedures (Schraw & Olafson, 2008). The values were recorded and used as scale data. Participants' written responses were read to glean some understanding of participants' reasoning for their choices.

CROSS INSTITUTIONAL FINDINGS

There were 53 (40.15%) participants from Program 1, 32 (24.24%) from Program 2, and 46 (34.8%) participants from Program 3 in the first administration of the survey tools. A slightly smaller number participated in the second administration with 50 (41.66%) from Program 1, 31 (25.83%) from Program 2, and 40 (33.33%) from Program 3.

A two-way ANOVA was used to determine the interaction effects between aggregated incoming and departing cohorts' scores and the programs. A statistically significant interaction was found ($F(2, 238) = 4.65, p < .01$) suggesting that the program housing the cohorts was a factor. To see specifically how the students at the three programs compared to each other, a one-way ANOVA was used to determine if there were statistically significant differences in the variables across programs at the start and end of the project. The scores for SKCK and OA from the EBI, and EW and OW from the mFQS were examined.

At the start of the project, participants' responses to questions about SKCK suggested a statistically significant difference between programs ($F(2, 128) = 17.82, p < .001$). Tukey's post hoc analysis showed that mean scores for SKCK from participants at Program 1 were significantly higher than from participants at either Program 2 ($p < .001$) or Program 3 ($p < .001$), but not between Program 2 or Program 3 ($p = .99$). No statistically significant differences between programs was found for OA ($F(2, 128) = 8.09, p = .082$), EW ($F(2, 123) = 1.50, p = .23$), or OW ($F(2, 123) = 2.54, p = .08$).

At the end of the project there were statistically significant differences in 3 of the 4 variables: SKCK ($F(2, 117) = 19.42, p < .001$), OA ($F(2, 118) = 8.31, p < .001$), and OW ($F(2, 111) = 5.25, p = .007$). No statistically significant differences between programs was found for EW ($F(2, 111) = 3.51, p = .03$). Tukey's post hoc analysis showed that mean scores for SKCK from participants at Program 3 were significantly higher than from participants at either Program 1 ($p < .001$) or Program 2 ($p < .001$), but not between Program 1 or 2 ($p = .14$). Mean scores for OA from participants at Program 3 were significantly higher than from participants at Program 1 ($p = .01$). Mean scores for OA from participants at Program 2 were not significantly different from Program 1 or Program 3 ($p = .09$). Mean scores for OW from participants at Program 3 were significantly higher than from participants at Program 2 ($p = .005$). Mean scores from participants at Program 3 were not significantly different from Program 1 ($p = .21$).

These differences between programs at the three institutions are illustrated in Figure 2 and helped us confirm that programmatic differences were likely influential for student views of EOC. The cross-institutional finding led us to look more carefully at each program (Boughey, 2011).

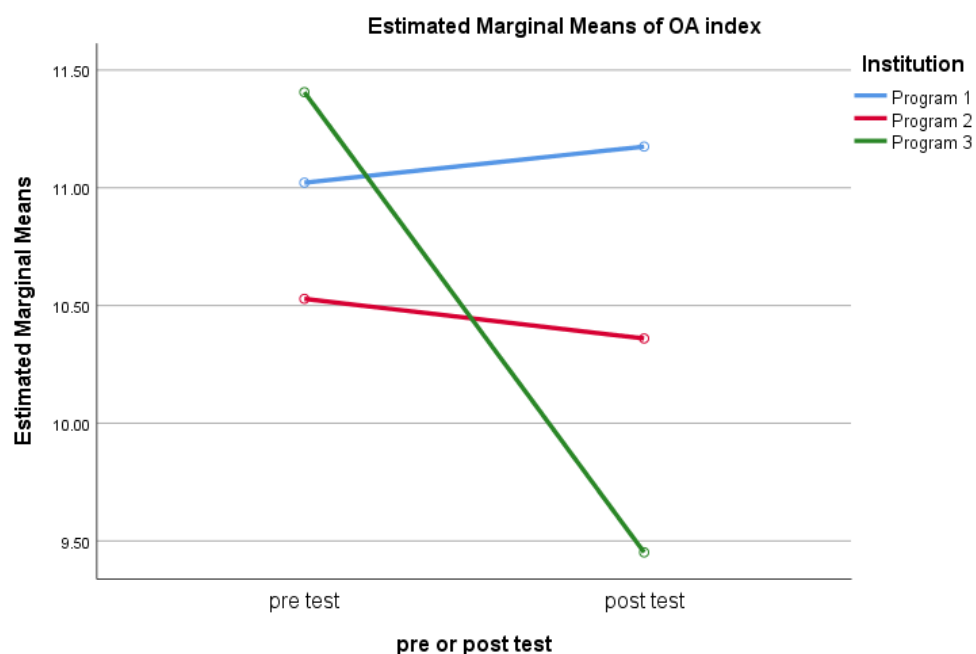


Figure 2a. Estimated marginal means of variables cross institutions.

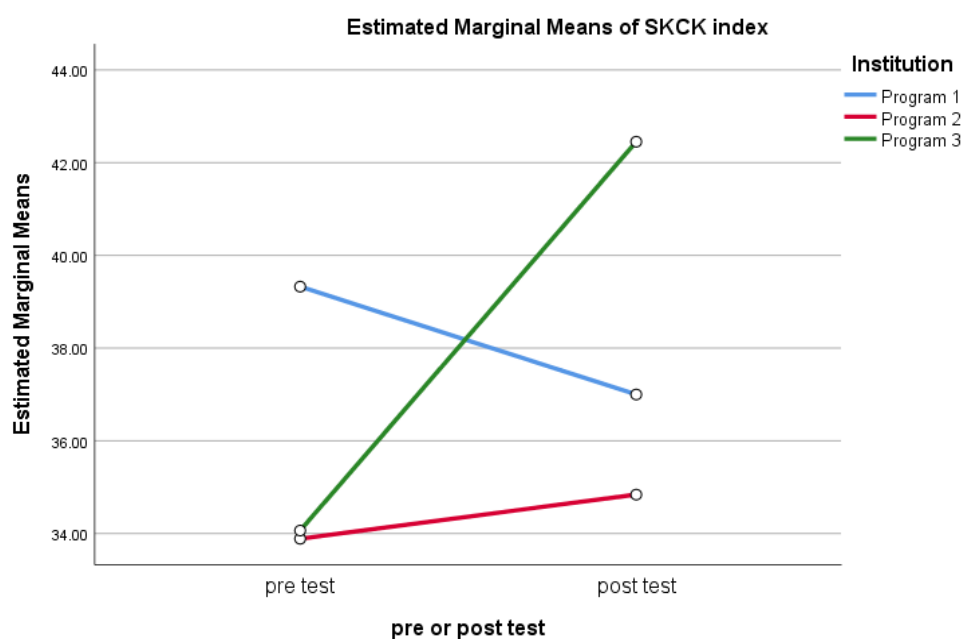


Figure 2b. Estimated marginal means of variables cross institutions.

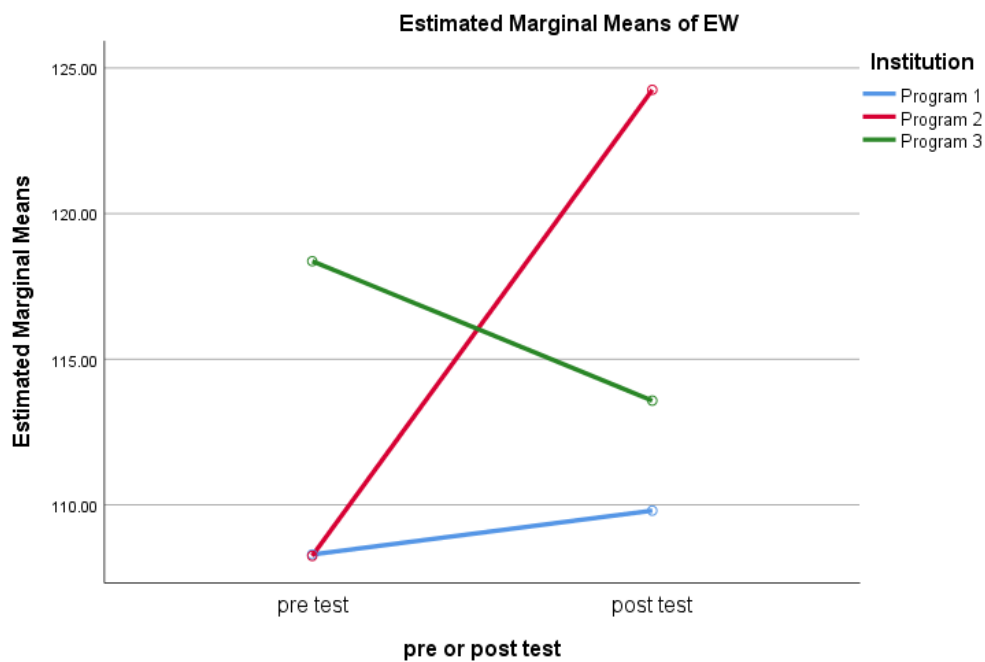


Figure 2c. Estimated marginal means of variables cross institutions

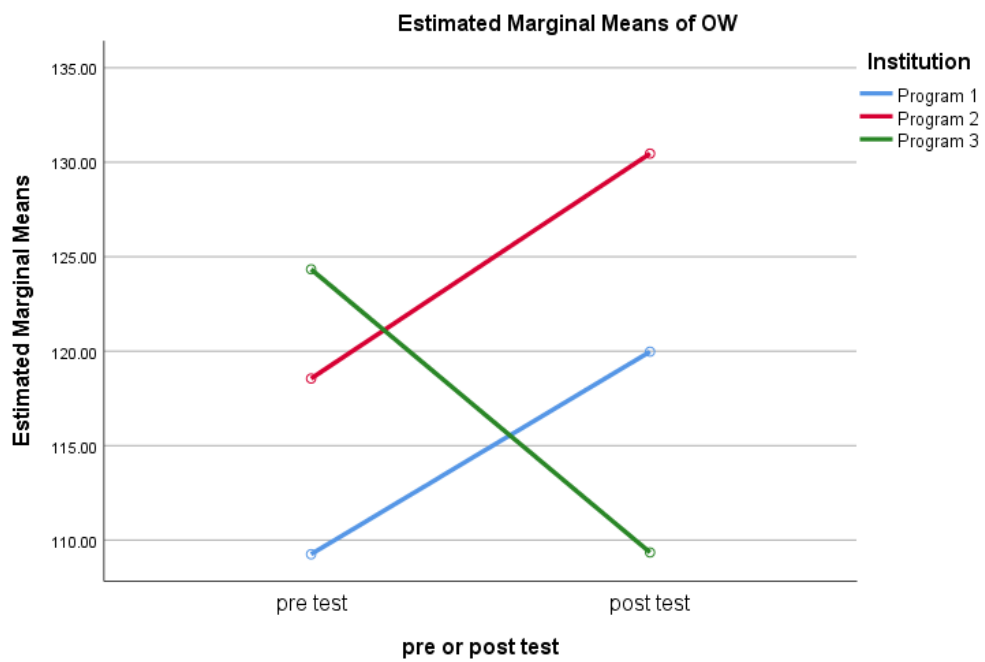


Figure 2d. Estimated marginal means of variables cross institutions.

FINDINGS PER PROGRAM

Independent t-tests were used to examine the statistical significance of any changes within the cohorts at each program and found inconsistent changes per variable based on program. Specific results per program are included in the following sections and a summary of results per program are shown in Table 1. Interaction plots were generated to illustrate the changes per variable per program (see Figures 3-5). It is helpful to remember that for SKCK and OA, higher scores suggest less sophisticated ways of thinking, and for OW and EW the inverse is true, i.e. higher scores suggest more sophisticated beliefs.

Table 1

Results of Independent t-Tests for Incoming and Departing Cohorts Per Institution

	Domain-General						Discipline – Specific					
	SKCK			OA			OW			EW		
Program	df	t	p	df	t	p	df	t	p	df	t	p
1	101	-0.89	.38	101	0.49	.63	98	-2.87	.005**	98	-2.13	.04*
2	61	-7.08	< .001***	61	4.33	< .001*	54	2.15	.04*	54	0.84	.41
3	83	2.11	.04*	85	-0.40	.69	82	-1.63	.11	82	-0.23	.82

Note. SKCK = Simple and Certain Knowledge; OA = Omniscient Authority; OW = Ontological Worldview; EW = Epistemic Worldview

* $p < .05$

** $p < .01$

*** $p < .001$

Program 1

Program 1 was a private, teaching-focused college of approximately 6000 students offering professional and liberal arts degrees. The program awards a Bachelor of Science (BS) in Occupational Science after the first four years of the combined BS/Master's program and a Master's of Science in Occupational Therapy (MSOT) after successful completion of seven months of additional didactic coursework at the masters level, six months of Level II Fieldwork (FW) and eight weeks of an additional specialty fieldwork experience. Students' beliefs about knowledge and knowing were assessed the first time within the first week of senior year for combined BS/MS students (n=46) and first full semester for students who enter as Professional Entry Level (PEL) students (n=7), for a total of 53 students from Program 1. Students were surveyed again after all didactic coursework, two one-week Level I fieldwork experiences, and one Level II fieldwork were completed (n=42 BS/MS students; n=8 PEL students).

The analysis of differences between incoming and departing cohorts at Program 1 yielded statistically significant changes in domain-specific EW and OW, but not in the domain-general aspects of SKCK or OA (See Table 1 and Figure 3). The differences between the incoming and the outgoing scores for students in this project indicated a shift toward more sophisticated beliefs about knowledge and knowing within OT (EW and OW) but not in general beliefs about simple and certain knowledge (SKCK) and omniscient authority (OA). Thus, although the scores indicated student beliefs about the source and the nature of knowledge in general did not change, students did develop a more sophisticated worldview related to knowledge within the OT discipline.

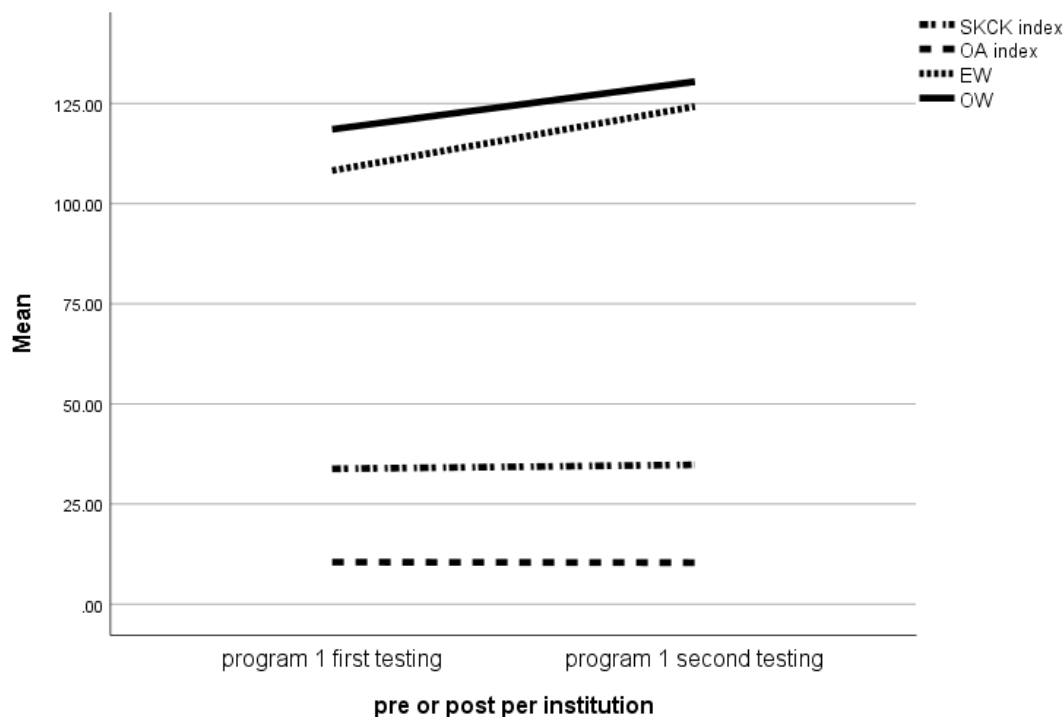


Figure 3. Differences in scores of incoming and departing cohorts at institution 1. OW and EW scores increased significantly.

Simple and Certain Knowledge – Domain General

Incoming cohorts scored below the median point of 3 for SKCK on the EBI ($M = 2.4$, $SD = .33$) with little change when departing ($M = 2.5$, $SD = .44$). This suggests that this group of students tended to have weaker beliefs that, in general, knowledge was simple and certain from the beginning of the project through the end of the project. Weaker beliefs in simple and certain knowledge suggests that students were ready to engage in higher levels of thinking. Students who believe that knowledge is indeed complex and is changeable tend to think more broadly and consider more possibilities. In response to the prompt “Think about times when two instructors (classroom or clinical) explain the same thing differently. Can one be more correct than the other?” One student stated, “No, everyone sees truth differently and values different aspects of a topic so they could be equally right.” Another student stated, “Depends on their background and viewpoints.”

There probably is a right answer, but each will have personal opinions/ biases.” This finding was consistent with Mitchell’s (2015) finding wherein departing students did not deviate significantly in their domain general beliefs about SKCK over time, and were below the median initially and when departing.

It is not known if prior coursework in the curriculum had influenced the students’ views, but it is likely that the distribution of courses in the first three years of the curriculum was influential in fostering the view of knowledge as less simple and certain. Occupational therapy faculty members teach 9 credits in the freshmen/sophomore years and 15 credits in the junior year. Of these courses, Human Development, Research Methods, Quantitative Concepts, and Individual in Group Work in Health Sciences can and have been taught by non-OT faculty. In the years preceding the SoTL project, these courses were all taught by OT faculty who brought an OT perspective to the courses. The students in the BS/MS program were required to complete a broad general education curriculum in addition to taking four hard science courses prior to the senior year (chemistry, biology, anatomy, and physiology). Their background was thus grounded more in social sciences with an occupational therapy influence than hard sciences. In addition, the institution is known as liberal. Whether students chose to attend the institution because of the liberal nature of the institution or if they developed less acceptance of simple and certain views over time while at the institution is unknown.

Omniscient Authority – Domain General

In contrast to the more relativistic beliefs about the nature of knowledge, students were above the median of 3 for OA both incoming ($M = 3.50$, $SD = .59$) and departing ($M = 3.50$, $SD = .57$), with no change in beliefs about an omniscient authority being the source of knowledge. The findings suggested that the students leaned toward the view that the source of knowledge was external to themselves. Students also cited hands-on experience as a strong source of learning. In this way, both dogmatist and skeptic positions were evident at both the beginning and end of the project. Interestingly, there is a heavy emphasis on evidence-based practice woven through all of the practice courses in the curriculum and in the three-semester research sequence. The view of evidence as an authority could be a result of this type of curricular programming. Students are required to complete a full research project under the guidance of faculty as part of the typical curriculum. They were not yet ready to view themselves as creators of knowledge, perhaps still relying on faculty oversight as a source of authority for the research process.

OT Specific EOC

In spite of no changes in EOC in terms of general views of knowledge, the students did move toward a more relativistic view of both epistemic and ontological worldviews in relation to the domain of OT. The students in the cohort began with scores well above the mid-point score of 75 on the semantic scale suggesting more relativistic views initially and continued to gravitate toward a strongly relativistic view. Student comments suggested that the emphasis on client-centered care and the inclusion of clients in decision making, and the evolving knowledge base of the profession through new research findings were the dominant factors in why they chose the relativistic viewpoint.

One student stated,

We have learned in our classes that OT is constantly changing and evolving. It is client centered and the client needs to be actively involved in planning and intervention. Treatment plans will vary based on diagnosis, context, social support, preferences, experience of the client, etc. There is no cookie cutter method to OT.

Another focused on the changing nature of the profession stating, "While there is a body of knowledge we must all have, this knowledge is constantly changing as new information is developed. There is also a standard of reality but all of our experiences, environment, etc. can make this reality different for various people."

Use of evidence-based practice and client-centered care were emphasized by the faculty through all the OT coursework. It seems that even though students viewed the sources of authority as external to themselves, they acknowledged that evidence changes and that the profession is still developing a knowledge base. They also viewed the client and context as factors that change the therapeutic dynamics. The relativistic view as defined by the mFQS is in keeping with Greene et al.'s (2010) expectations for those with a rationalist viewpoint. The relativistic viewpoint could also be related to their overall view of domain general knowledge as complex and changeable. The students might have been predisposed to think more broadly and as OT education progressed they applied their underlying viewpoint to OT content.

Beyond the classroom, an important consideration is that the students completed a level II fieldwork prior to the conclusion of the didactic portion of coursework. The program was designed so students would have the benefit of real-life clinical experiences to help inform their learning in the graduate level courses. It would be expected that students had experiences that led them to understand that a number of factors influence client care. The student experiences on Level II fieldwork are referenced in coursework by faculty who want students to link new learning to their clinical experience.

Program Specific Implications

Overall, the findings from Program 1 suggested that early influences from OT faculty members, a broad social science background, and the placement of the Level II fieldworks within the didactic sequence might have an influence on students' developing EOC. Students in this project had weak views of knowledge as simple and certain which is consistent with more mature thinking about knowledge at the onset, and began with relativistic views about the domain of OT. The overarching question for this program was "did the curriculum influence them or did they enter the institution with these beliefs?" A longitudinal study has been launched to help answer this question and results are now being analyzed. In unrelated cross-sectional studies of OT students in Program 1 using the EBI and mFQS, the same profiles emerged in other sophomore and senior cohorts (Long et al., 2017, 2018). The concern for this program is how best to capitalize on and further develop deeper and more mature views of domain general

knowledge and relativistic views of OT specific knowledge, in light of what appears to be a common student characteristic.

Program 2

Program 2 is within a college with multiple allied health professions that is part of a research-focused, state university of approximately 23,000 students. This program has two paths of entry that include 1) a combined BS/MS with a BS in Interdisciplinary Health Services earned during the program and an MSOT earned after a year and a half of graduate coursework (including fieldwork); and, 2) an MSOT for those who have completed a bachelor's degree. The student participants in this project were a part of the BS to MSOT program, thus, were working to complete their bachelor's degree during the first year of the MSOT program. Students in this program, unlike those in Program 1, had no contact with OT faculty prior to entering the OT program between their junior and senior year. The first measurement for the project was during the first week of classes taken by the students after being accepted into the OT program. The second measurement was taken at the end of the final semester of coursework, just before their first Level II fieldwork experience began.

The differences between the incoming and the outgoing scores for this cohort of students indicated a shift toward less sophisticated beliefs about the nature and characteristics of knowledge and knowing in general, moving toward a stronger belief that knowledge is simple and certain (an increase in SKCK scores). Students' scores also reflected a slight shift toward a broader view of the source of knowledge (represented by a decrease in OA scores; see Table 1 and Figure 4). Within the discipline-specific beliefs about knowledge, students' scores moved toward a more relativist worldview. Clinically, students might respond to the "it depends" variability in decision-making parameters with greater skill. The anomaly in these changes is in the SKCK scores, as theory suggests that beliefs should not decrease in sophistication during this period.

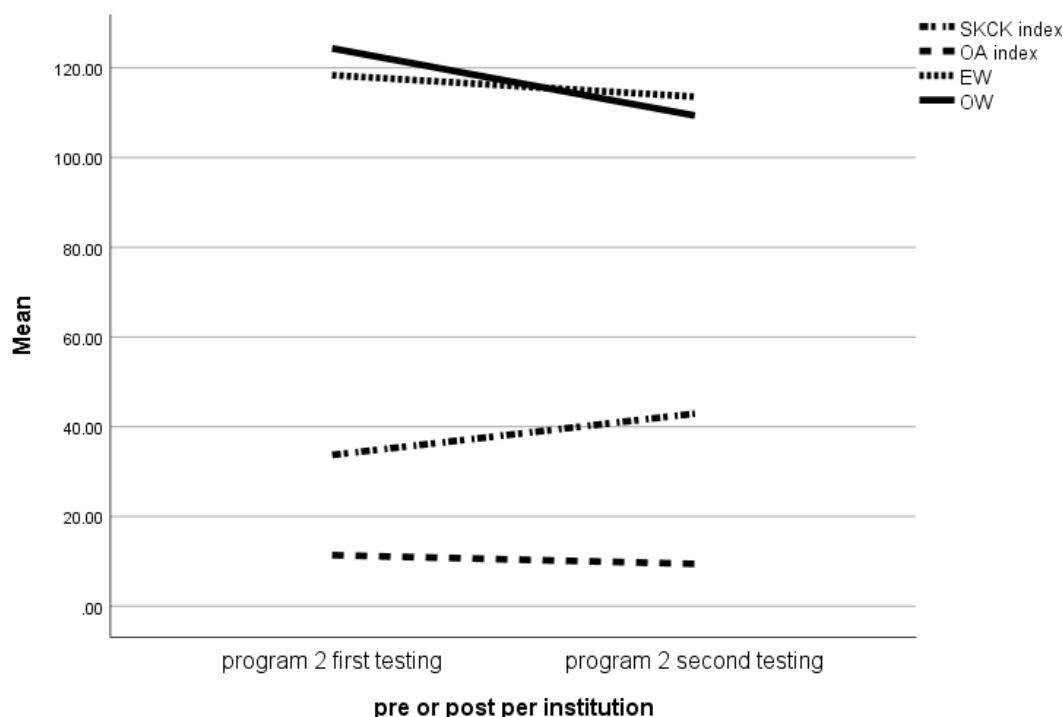


Figure 4. Differences in scores of incoming and departing cohorts at institution 2. SKCK scores increased significantly; OA and EW scores decreased significantly.

SKCK– General Beliefs about Knowledge and Knowing

The mean score on the EBI at the first assessment was 2.4 ($SD = .40$) and at the second assessment the mean score was 3.0 ($SD = .27$) indicating a statistically significant difference (see Table 1). A higher score indicates an increase in the belief that knowledge is simple and certain. Based on current theory, it was anticipated that students' beliefs that knowledge is simple and certain in general would not change in this direction during this time period. When considering the change in SKCK between the first scores and the second scores for this cohort, it was helpful to take a broader view of what the students were experiencing within the curriculum at the time of the second scores to look for a possible rationale for this type of change in their beliefs about knowledge. The objective is to promote a belief system that recognizes that knowledge is multi-layered, complicated, and impacted by circumstances and away from a belief that knowledge is simple and certain. The second time this cohort took the EBI questionnaire and mFQS was during an acute care intensive where they were learning how to work with patients in the intensive care unit. When asked about decision-making steps as part of the questionnaire, students described patient situations that had clear and established parameters that had to be followed consistently. One possibility is that this course had them thinking in a very prescriptive manner as it pertains to knowledge. As one student stated, "we don't want to kill our patient" when asked about decision-making strategies.

Omniscient Authority – Domain General

A statistically significant difference was found between the incoming students' EBI OA mean score of 3.8 ($SD = .51$) and the outgoing students' mean score of 3.1 ($SD = .67$), with the decrease in scoring indicating a more sophisticated response. However, students' comments at the first assessment, as well as the second assessment, appear to place great emphasis on the role of the instructor to provide the knowledge needed to become an OT. One example of student comments regarding the role of the instructor (and many had a similar theme) was, "to guide me and give me what I need to be successful." When asked about when two instructors explain the same thing differently, one student stated about which to believe, "whichever one you understand most." These beliefs put pressure on the instructor in the learning environment as students have expectations that instructors are the ultimate authority and responsible for their success. The students' responses did include the client as being an authority following the didactic portion of the curriculum which might account for the expanded OA. A few students wrote such statements as, "the client should determine what treatment is needed" and "being client-centered means allowing the client to choose," in effect, moving the authority from the instructor to the client rather than explicitly recognizing their role in the clinical decision-making process.

OT Specific EOC

Most of the student cohort from Program 2 scored in the relativist quadrant of the mFQS at both assessment time periods, with slightly more relativistic beliefs about knowledge and knowing within the discipline at the post assessment. This was supported by comments made by students who described needing to "look at client's concerns and the situation around them," as well as "looking at the bigger picture to see what might bring the greater good" when considering treatment planning.

Program Specific Implications

Overall, the findings from Program 2 held some surprises in the SKCK responses that indicated a stronger belief that the nature of knowledge and knowing is simple and certain rather than the desired increase in awareness of the variability of knowledge that may lead to better professional reasoning. The type of coursework they were completing at the time of the second assessment may have negatively impacted their responses.

Use of these measurement tools to assess student understanding and beliefs around the nature and characteristics of knowledge has become part of ongoing program evaluation for Program 2. In order to help students develop a more mature clinical reasoning process, we are attempting to facilitate a more sophisticated belief system; one that looks to a variety of sources for information, that questions new information, and that understands that context matters when making decisions related to practice. After reviewing and analyzing this SoTL project, the plan has been modified to have the students take the second series of assessments as they begin their final semester rather than during their Acute Care / Intensive Care module. The process has also been made more explicit by facilitating discussions around knowledge and knowing and how their beliefs impact the quality and depth of care they provide to their future clients.

Program 3

Program 3 was located in a public university health science center of approximately 3,200 students. The cohort included in this project was over 50% larger than previous cohorts. Unlike students in Programs 1 and 2, students in Program 3 had completed all of their prerequisite course work elsewhere and may or may not have completed a bachelor's. In Program 3, students had very limited exposure to OT faculty prior to matriculation.

The EBI, mFQS, and questionnaire responses were collected first within two weeks of starting the program and then again after all didactic work was completed, just prior to the students' first Level II Fieldwork experiences. For Program 3, the only statistically significant differences between entering and departing students were in domain-general beliefs in simple and certain knowledge (see Table 1 and Figure 5).

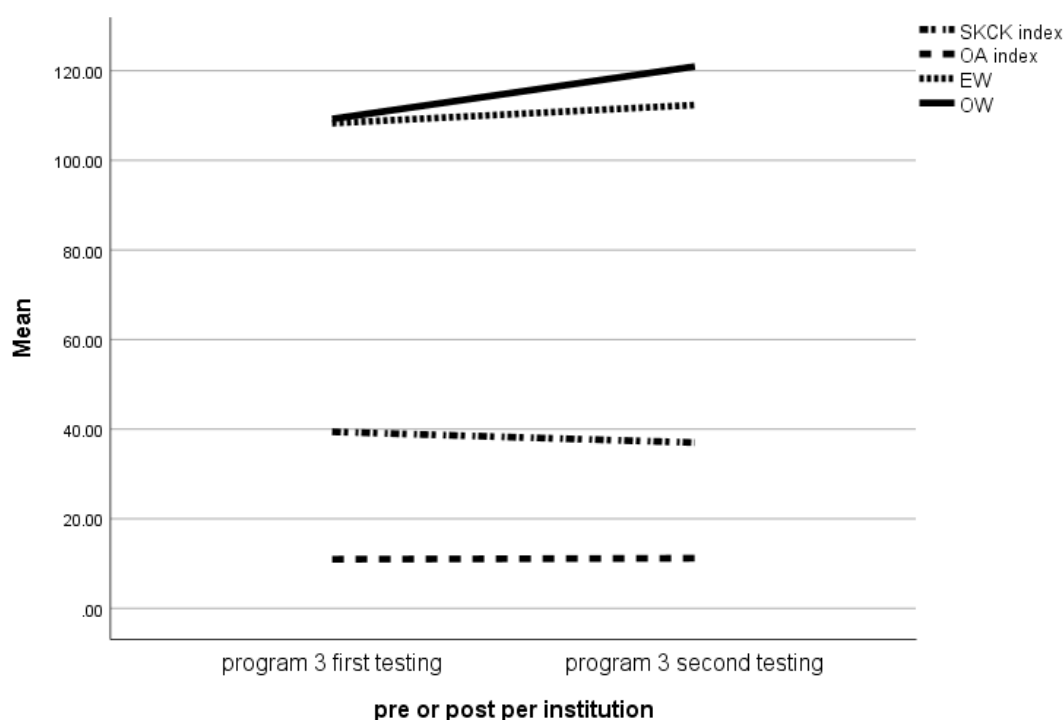


Figure 5. Differences in scores of incoming and departing cohorts at institution 3. SKCK scores decreased significantly (i.e., became more sophisticated).

Simple and Certain Knowledge – General Beliefs

Incoming students' scores on the SKCK factor of the EBI were already less than the median score of 3 ($M = 2.8$, $SD = .35$), suggesting weaker, or somewhat sophisticated, general beliefs related to simple and certain knowledge at entry into the program. In other words, most entering students in Program 3 seemed to have already moved beyond the idea that knowledge consists of discrete facts and the belief in one right answer to a problem. For example, when asked about instructors providing different answers to the same question, one student stated, "Some answers are more complicated than others, and [the question] can have multiple answers." Another

student responded, “You have to see which applies to the situation. The circumstances can be different when applying an answer. Therefore, both can be right.” This finding is consistent with Greene and colleagues’ (2010) predictions that strong beliefs in simple and certain knowledge would only be characteristic of young children through late elementary school. At the end of 18 months of didactic coursework, the students’ general SKCK beliefs were even weaker ($M = 2.6$, $SD = .38$), suggesting an even greater shift toward a belief that, in general, knowledge is tentative, complex, and integrated. It seems possible that exposure to complex occupational performance problems with more than one potential solution may have contributed to this shift.

Omniscient Authority – Domain General

In contrast to their weaker general beliefs in simple and certain knowledge, students entering Program 3 demonstrated stronger general beliefs in an omniscient authority as the source of knowledge, with mean scores above the median of 3 on the EBI OA scale ($M = 3.7$, $SD = .65$). For example, one entering student stated that the role of the instructor is “to teach us everything we need to know in a way that we all can understand and relate.” Greene and colleagues (2010) described students who seek authoritative sources of knowledge (such as instructors) as dogmatists. Believing in authoritative sources of knowledge could interfere with the critical thinking needed to solve occupational performance problems, if students seek the one authoritative answer to a problem rather than using logic and reason and considering the client’s needs, values, and situational factors.

The EBI does not include a personal justification factor, making it difficult to ascertain whether students in Program 3 may have demonstrated characteristics of Greene and colleagues’ (2010) skeptic. Skeptics value personal experience rather than an omniscient authority as a source of knowledge and may be inclined to make statements similar to the following remark from one student in Program 3, “Unless you have experienced it yourself, I don’t believe you can justify other’s opinions/explanations.” It is noted that a number of students in Program 3 made statements describing the importance of personal experience as a source of knowledge, consistent with Mitchell’s (2014) cross-sectional study that found evidence of dogmatist and skeptic positions in a sample of entering students. Active learning is a strong component of Program 3, and students participate in three two-week Level I fieldwork experiences during the didactic portion of the program. While these characteristics of the program may reinforce personal experience as a source of knowledge, the program could also capitalize on students’ desire to engage in “hands-on” learning to highlight and reinforce the core concepts of OT.

At the end of the didactic portion of Program 3, students’ general beliefs in an omniscient authority as the source of knowledge continued to be above the median of 3 on the EBI OA scale ($M = 3.7$, $SD = .54$), with no statistically significant difference between the mean scores of entering and departing students. This suggests that, similar to their beliefs at entry, the departing students had somewhat stronger beliefs in an omniscient authority as the source of knowledge, despite the need for OTs to consider multiple sources of knowledge and arrive at reasoned clinical decisions.

OT Specific EOC

No differences were detected on the OT-specific measure of EOC for entering and departing students in Program 3. Most students marked themselves at the relativist end of both continua, even at the beginning of the program. Students' explanations of their self-ratings ranged from statements describing beliefs in simple and certain OT knowledge to comments about the tentative, changeable nature of OT knowledge. For example, one student stated, "I do believe though, that there are some things of importance that need to be in more of a fixed state, so I did not put myself to the extreme side of relativism for either ontological or epistemological." Another student commented, "Sometimes practices need to change based on new research or you may need to adapt based on a client's situation..." These statements may reflect learning across the variety of types of coursework students experience in the program, including "hard science" coursework such as human gross anatomy, pathology, and neurobiology, as well as coursework specific to the occupational therapy department that involves case-based learning and incorporating evidence-based practice.

Mitchell's (2014) cross-sectional study found that at the end of the didactic portion of an OT program, some students were beginning to shift their beliefs in OT-specific knowledge away from a more dogmatist to a more rationalist position. Rationalists utilize a variety of sources of knowledge and consider multiple variables, including the context, during problem-solving. Although no statistically significant differences between the entering and departing students' domain-specific EOC were found for Program 3, many departing students made statements illustrating aspects of Greene and colleagues' (2010) rationalist position. For example, one student stated:

I think its (sic) important to use your resources such as a supervisor or a peer to help you decide which approach to take. You could also look at the evidence to decide what is best practice. Finally, if possible, you can discuss it with your client to see what intervention they would be interested in and what would benefit them.

Program Specific Implications

Overall, these findings may have implications for programmatic decisions such as the proportion of hard science prerequisite coursework to require, the number of students to admit, and the types of pre-OT bachelor's degrees to recommend. More than 25% of the prerequisite hours required for admission to Program 3 are in the hard sciences, and of the 72% of this sample who entered the program with bachelor's degrees, 64% of those were in science, technology, engineering, and math (STEM) fields. An emphasis on "soft" sciences and coursework requiring students to solve problems with more than one potential solution could promote beliefs about knowledge and knowing that are more consistent with the profession's ways of knowing and better prepare students for OT coursework and/or future practice. Further, the implications of accepting larger cohorts of students could include curricular changes that are less effective for fostering sophisticated beliefs about knowledge and knowing and the types of EOC that are characteristic of effective practitioners. It is interesting to note that a previous sample of students from Program 3 entered the program with more sophisticated

domain-general ontological and epistemic beliefs (as measured by the EBI) than those demonstrated by the departing students involved in this project.

RECOMMENDATIONS FOR FUTURE RESEARCH AND IMPLICATIONS FOR OT EDUCATION

The AOTA's education research agenda (2018) identified seven categories of research activity as priorities for advancing the understanding and effectiveness of OT education. This SoTL project may have implications for four of those priorities, namely *learner characteristics and competencies*, *theory-building research*, *instructional methods*, and *socialization to the profession*.

EOC is a learner characteristic that may have an important influence on OT student success. Educational psychologists have demonstrated relationships between EOC and persistence in problem-solving, the ability to solve complex problems, metacognitive skills, learning, and academic performance (e.g., Muis & Franco, 2009, 2010). This project provides a description of the EOC of OT students at three different programs in the United States, but it does not examine relationships between EOC and measures of OT student success. Future research examining the relationships between EOC and academic achievement, fieldwork performance, success on the national board examination, and clinical expertise in OT could help clarify the role and potential importance of EOC to selection and admission of OT students and the preparation of skilled practitioners. This, in turn, could inform educational theories supporting the development of successful OTs. If EOC plays an important role in OT student success, identification of instructional methods that are effective for enhancing more sophisticated EOC would also be an important priority for educators. Furthermore, since OT has been described as having its own ways of knowing (Hooper & Wood, 2002; Hooper, 2016; McClain, 1987; Mitchell, 2013; OT Model Curriculum Ad Hoc Committee, 2009; Richardson, Higgs, & Dahlgren, 2004;), the development of the more sophisticated EOC that is characteristic of successful OT practitioners is also important for socialization to the profession.

By implementing this cross-institutional SoTL project, it was possible to identify some differences in learner characteristics across the institutions over time. Given the differences in the structure of the programs, these findings raise interesting questions about the relationships between the structure of programs and their success at promoting the beliefs about knowledge and knowing that are characteristic of OT, i.e., the types of beliefs that foster the ability to solve problems with more than one potential solution. Considering these findings, it is recommended that others look critically at their own programs with regard to development of EOC in students. Future research including multiple programs categorized by structure could allow comparisons of the development of students' EOC over time and potentially identify optimal program structures for supporting the development of OT-specific EOC, e.g., timing and placement of Level II fieldwork in the curriculum.

The challenges posed by cross-institutional collaborations can be prohibitive to researchers seeking to conduct the types of large, rigorous research studies needed to develop and test theories that specifically support the preparation of OT practitioners. We approached the project from the viewpoint of program evaluation, as such, the limitations of this SoTL project included constraints inherent in using de-identified, aggregated group data for each program's student cohort. Development of a large database that could include data related to EOC among other important variables (for example, gender, age, previous degrees and work experience) and outcomes could facilitate the research needed to develop and test theory related to OT education. Continued exploration of the concepts of EOC, its influence on student success, and the interrelationships between instructional methods and program structure has the potential to influence, not only admissions and instructional methods, but also the development of OT educational theory and professional socialization.

CONCLUSION

In spite of the challenges of conducting cross-institutional research, there is potential for future research on the epistemic and ontological beliefs of occupational therapy students. As occupational therapy continues to consider the relative merits of master's versus doctoral entry-level degrees this type of research will become more important, particularly if the profession is espousing the higher degree as a way to increase the sophistication of thinking of entry-level clinicians. The procedures utilized in this SoTL project could be applied to students in a wider variety of programs with the intent to determine if the expectations of the profession are being met for producing clinicians with more mature thinking skills.

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