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Occupation-Centered Anatomy and Applied Biomechanics Courses: Design and Outcomes

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Abstract

Occupation-centered course design allows occupational therapy (OT) educators to differentiate ourselves from other professions while communicating the distinct value of occupation to our students. While there have been numerous calls to action for centering occupation in the OT classroom and proposed models to approach course design, there is limited literature on occupation-centered course design in specific courses, notably foundational science courses like anatomy and applied biomechanics. In this study, we outline our course design process in two courses taught concurrently, as well as our prospective study to determine if an occupation-centered course design allowed students to meet objectives and the effect of undergraduate preparation on objective achievement. We also explored students' agreement with importance of occupation-centered instruction, and our ability to stay occupation-centered. Fifty-five students completed pre and post course surveys rating their ability to perform the five objectives for each course and their level of agreement about the role of occupation in these courses. We found statistically significant increases in all objective ratings, with some ratings more than doubling. Post-course ratings among students with different undergraduate backgrounds were similar despite being statistically different at baseline. Students placed high value in occupation-centered course design at both time points. Students rated the ability to stay occupation-centered lowest in the first few weeks, with Anatomy rated lower than Applied Biomechanics in all weeks. This suggests that the incremental improvements made in the course delivery were effective; however, it was more challenging to create an occupation-centered course in Anatomy.

Keywords

Occupation-centered, instructional design, learning outcomes, anatomy, biomechanics

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ABSTRACT

Occupation-centered course design allows occupational therapy (OT) educators to differentiate ourselves from other professions while communicating the distinct value of occupation to our students. While there have been numerous calls to action for centering occupation in the OT classroom and proposed models to approach course design, there is limited literature on occupation-centered course design in specific courses, notably foundational science courses like anatomy and applied biomechanics. In this study, we outline our course design process in two courses taught concurrently, as well as our prospective study to determine if an occupation-centered course design allowed students to meet objectives and the effect of undergraduate preparation on objective achievement. We also explored students' agreement with importance of occupation-centered instruction, and our ability to stay occupation-centered. Fifty-five students completed pre and post course surveys rating their ability to perform the five objectives for each course and their level of agreement about the role of occupation in these courses. We found statistically significant increases in all objective ratings, with some ratings more than doubling. Post-course ratings among students with different undergraduate backgrounds were similar despite being statistically different at baseline. Students placed high value in occupation-centered course design at both time points. Students rated the ability to stay occupation-centered lowest in the first few weeks, with Anatomy rated lower than Applied Biomechanics in all weeks. This suggests that the incremental improvements made in the course delivery were effective; however, it was more challenging to create an occupation-centered course in Anatomy.

Background

Nearly 25 years ago, Yerxa (1998) opined that as occupational therapy (OT) educators we have a responsibility to center occupation in our curricula and courses, allowing us to differentiate ourselves from other professions. By centering occupation, we can socialize future occupational therapists to the profession and communicate our distinct value to the public (Yerxa, 1998). Whiteford and Wilcock (2001) concurred, noting "our knowledge base will be strengthened through greater internal consistency and unification" (p. 82). Teaching content as it relates to occupation allows OT students to appreciate the importance of learning topics with respect to their future careers, consistent with adult learning theory (McGrath, 2009). To educate students on this core value, each course and topics within the course need to be integrated and connected to occupation, an approach known as subject-centered education (Hooper et al., 2015).

In subsequent years, scholars examined how well the OT education community responded to these calls to action, by examining both coursework and educators' views on occupation-centered curricula. Some educators have responded to this call to action, using methods such as experiential learning and service learning (Miller & Roberts, 2020; Quinn & Cremin, 2021). However, occupation-centered curricular and course design continues to be inconsistent in programs in the United States (US) and worldwide, especially in coursework where opportunities like experiential learning and service learning are challenging. Krishnagiri et al. (2017) found that although the participants they interviewed from US OT programs expressed occupation as core to the profession, not all participants described their curriculum in a manner that explicitly centered occupation. Some participants indicated their use of occupation was synonymous with other concepts and was not an isolated idea. Others believed the value of occupation was implicit with the teaching modes, and others seemed to completely divorce occupation from the course and course content (Krishnagiri et al., 2017). Another study found that many programs had curricular philosophies or threads tied to occupation and participants were eager to explain these overarching themes. However, some noted these occupation-centered threads as "existing largely on paper only" (Hooper et al., 2018, p. 6). A participant quoted in another study echoed this sentiment, noting that educators "do believe in occupation as core focus…but this core intention does not get enacted so explicitly" (Canty et al., 2020, p. 10). Another participant admitted that students do not even remember studying occupation due to being "overwhelmed with other stuff," (p. 6) and concluded that her program struggles to iterate the value of occupation (Canty et al., 2020). When interviewing OT educators in Australia, di Tommaso et al. (2019) noted similar findings, reporting that although all the educators interviewed believed at least somewhat that occupation was important in their work as instructors, some continued to cling to bottom-up approaches, including impairment-focused instruction, as primary teaching strategies. These researchers focused primarily on scholars' and instructors' value of occupation. Including students' perceptions would add richness to this line of research, as it triangulates findings and helps confirm instructors' intended connection to occupation.

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The mismatch between the calls to action from leaders of our profession and the literature exposing what is occurring on the ground led us to evaluate our own teaching assignments and gauge our commitment to occupation-centered course design. Auspiciously, in 2019, our OT program underwent a curriculum revision, giving us an opportunity to redesign two courses to make explicit the distinct value of occupation to our students. Given the calls-to-action for occupation-centered teaching, we committed to making the new courses occupation-centered. Unlike the courses that most successfully implemented an occupation-centered design, according to Miller and Roberts (2020), ours were foundational science courses, with lecture and laboratory components, entitled Anatomical Structures Supporting Occupational Performance ("Anatomy") and Applied Strategies in Biomechanical Performance ("Applied Biomechanics").

A literature review revealed very limited research regarding foundational science courses and an occupation-centered approach, and interestingly, Hooper et al., (2018) noted that many instructors had the most difficulty conveying the distinct value of occupation in courses related to foundational sciences. One study did relate two foundational sciences courses to occupation, with the authors finding that the students gained a deeper appreciation of the nature of occupation at the conclusion of the semester (Bagatell & Womack, 2016), supporting our endeavor to redesign these courses. Given the paucity of literature regarding connecting foundational science courses like ours to occupation, we saw an opportunity to study our process. The aims of our study were to answer the following research questions: 1) Will designing two foundational science courses in Anatomy and Applied Biomechanics in an OT curriculum using an occupation-centered approach still allow students to meet course objectives? 2) Does undergraduate preparation affect outcomes in coursework in these content areas? 3) Do OT students agree with the importance of centering occupation in their coursework, even foundational science courses? and 4) Even though as instructors we think our courses are connected to occupation, do the students agree?

Description of Course Design

We began designing our new courses approximately four months prior to the start of the semester in which they were taught concurrently. The curriculum redesign placed these courses in the second semester of the entry-level program, planned for Spring (January to May) 2020. We knew we wanted to use both occupation-centered course design as well as have the two classes compliment and build upon each other. We implemented a backward course design, which is used in many graduate curricula including OT (Belleza & Johnson, 2019). Backward course design requires identification of student-centered learning outcomes first, prior to week-to-week topical considerations (Emory, 2014). When identifying the outcomes of each individual course, we reflected on what we wanted our students to achieve at the end of the course (Nilson, 2016) and several years down the road (Fink, 2003). The OT program's curriculum dictated some of these outcomes in the form of competencies, and we identified additional outcomes that we felt were necessary for safe and competent clinical practice (Emory, 2014). This

process led to creating our course objectives, made explicit to students on the syllabi, an imperative step in andragogy (McGrath, 2009). These course objectives are outlined in Table 3. When creating our objectives, we wanted to remain occupation-centered and relate to occupational performance, likely a stark difference from the course objectives found in the prerequisite anatomy or biomechanics courses our students had already completed.

Course descriptions were pre-determined by our program's curriculum committee. In Anatomy students focused on body structures, body functions, (American Occupational Therapy Association, 2014) and principles of biomechanics. In Applied Biomechanics students learned biomechanical activity analysis, motor and sensory evaluations, and biomechanical interventions for the application to patient transfers and material handling (American Occupational Therapy Association, 2014). The second stage of backward course design is determining how students will demonstrate achievement of the learning objectives (Emory, 2014). We used evidence-based teaching practices from the literature including frequent, low-stakes quizzing and performance-based skills checks, found to "interrupt the process of forgetting (Brown et al., 2014; Walck-Shannon et al., 2019) and decrease test anxiety (Hochstein, 2019). Lastly, we planned daily topics and activities to achieve the course objectives (Emory, 2014). It is through this last stage that we embarked on making our course occupation-centered. Using the Occupational Therapy Practice Framework in existence at the time, the OTPF-3 (American Occupational Therapy Association, 2014), we selected at least one occupation from each occupation category listed in the framework to link the weekly topics of each class to an occupation, and to each other. We also used established research for teaching methods (activities) to help students achieve their learning outcomes such as hybrid flipped classrooms (Day, 2018; Luburic et al., 2019), active learning activities (Entezari & Javdan, 2016), and peer learning opportunities (Boud, 2001). We prepared evidence-based strategies every week of the semester. Table 1 outlines the organizing occupation, topics for each class, and teaching and assessment methods planned across the courses.

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Table 1

Organizing Occupation, Topics for Each Class, and Teaching and Assessment Methods Planned Across the Courses, Taught Concurrently in Second Semester of OT Program

Occupation	Anatomy Topic	Applied Biomechanics Topic	Teaching Method Used (both classes)	Assessment Used (both classes)
Dancing (Week 1)	• Introduction to kinesiology and biomechanics	• Directionality • Planes of motion • Orientation	• Hybrid flipped classroom • No stakes quizzing • Peer learning	• Low stakes quizzing • Biomechanical activity analysis
Feeding (Week 2-3)	• Bones, joints, cartilage, and ligaments • Elbow and forearm anatomy	• Goniometry/ palpation/motion screen • Elbow/forearm range of motion (ROM) and manual muscle testing (MMT)	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Cadaver dissection	• Low stakes quizzing • Health conditions worksheet • Biomechanical activity analysis • Low-stakes skills check • Assessment worksheet • Participation in dissection lab
Cooking (Week 4-5)	• Wrist and hand anatomy • Skin, vessels, upper extremity circulation, • Hand conditions	• Manipulation/ prehension patterns • Grip/pinch/coordination testing • Wrist ROM and MMT	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Application questions • Cadaver dissection	• Low stakes quizzing • Health conditions worksheet • Low stakes skills check • Assessment worksheet • Participation in dissection lab
Showering (Week 6-7)	• Shoulder anatomy • Brachial plexus • UE nerves	• OT intervention to build strength, endurance and increase ROM • Pain assessment • Physical agent modalities • Shoulder ROM/MMT • Scapulohumeral rhythm • Specific muscle MMT	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Application questions • Cadaver dissection	• Low stakes quizzing • Health conditions worksheet • Low stakes skills check • Assessment worksheet • Participation in dissection lab

Rest & Sleep (Week 8)	• Cardiorespiratory and thorax anatomy • Facial anatomy/ Mastication	• Chewing, swallowing • Respiration • Blood pressure/Metabolic Equivalents (METs)/Aerobic capacity	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Cadaver prosection	• Low stakes quizzing • Low stakes skills check • Biomechanical Activity Analysis • Participation in prosection lab
Work: Housekeeper Job (Week 9)	• Back, spine, and neck anatomy	• Biomechanical principles for bending/lifting/carrying • Posture assessment	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Cadaver prosection	• Low stakes quizzing • Health conditions worksheet • Low stakes skills check • Participation in prosection lab
Toileting (Week 10)	• Hip, buttocks, and thigh anatomy	• Transfers and bed mobility	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Cadaver prosection	• Low stakes quizzing • Biomechanical Activity analysis • Participation in dissection lab
Hiking (Week 11)	• Knee, ankle, and foot anatomy	• Gait and wheelchair mobility/Assistive devices	• Hybrid flipped classroom • No stakes quizzing • Peer learning • Cadaver prosection	• Low stakes quizzing • Health conditions worksheet • Assessment worksheet • Participation in dissection lab
Occupational Performance (Week 12-13)	• Conditions affecting occupational performance	• Introduction to orthotics • Pain intervention	• Hybrid flipped classroom • Peer learning	• Final exam • Clinical application of orthotics

Note: Between instructional weeks seven and eight the courses were moved online due to COVID-19.

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Methods for Evaluation of Student Learning Outcomes and Course Connection to Occupation

This prospective quantitative study used a convenience sample of graduate students at a research-intensive university in the Midwestern US. The university's Institutional Review Board (IRB) deemed this study as exempt due to the educational nature of the study. Students enrolled in both the master's and doctorate entry-level programs spend the first two semesters of the program in identical coursework, including the two classes outlined in this study occurring in the second semester of the curriculum. These courses were conducted concurrently over 13-weeks of content in spring semester 2020. All course instruction was moved online in March 2020, due to COVID-19. At that time, we needed to modify several planned teaching strategies, such as the hybrid flipped classroom, and assessment techniques, such as participation in prosection lab. The topics and the organizing occupation remained the same.

Procedure and Analysis

To answer research question one, in the first week of the semester, all 89 students enrolled in the courses were asked to complete a pre-course survey via Qualtrics Survey Software (Qualtrics, Provo, UT). The students were asked to rate their current skill level for each course's objectives (see Table 3) on a 10-point scale, ranging from 1 (unable) to 10 (able). Students were asked to complete this same survey at the conclusion of the semester. Mean ratings and standard deviations were computed for students who completed all questions at both time points. An overall Anatomy objective score was computed by totaling the ratings for each of the five objectives, with 50 the maximum possible rating. This was also done to compute an overall Applied Biomechanics objective score. Paired t-tests were used to evaluate differences between pre and post course objective ratings.

To explore our second research question, demographics of students' undergraduate major and number of undergraduate classes in anatomy and kinesiology/biomechanics were also collected. Undergraduate majors were categorized into three broader categories: 1) Kinesiology and/or Exercise Science, 2) Health Sciences, and 3) Other (psychology, other sciences, and other humanities). Number of undergraduate courses in anatomy, as well as number of kinesiology courses taken were collected and categorized into none, 1-2, or 3 or more. The pre and post overall Anatomy objective and overall Applied Biomechanics objective scores were compared between students in the three undergraduate major categories using Independent samples Kruskal-Wallis Tests with Bonferonni correction and post-hoc pair-wise comparisons. This comparison was also run based upon the number of undergraduate anatomy and kinesiology courses using Independent samples Mann-Whitney U test or Kruskal-Wallis Test with Bonferonni correction as appropriate.

For our third research question, we created four statements for students to rate. At the time of the study, we did not find any scaled survey to help us explore students' perceptions of occupation-centered course design. Students were asked at both time-

points to rate their opinion on the following statements regarding occupation-centeredness in Anatomy and Applied Biomechanics on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree):

1. *Occupation should be the core of an occupational therapy foundational course in human anatomy.*
2. *Occupation as the core of a course in human anatomy will be beneficial for my learning.*
3. *Occupation should be the core of an occupational therapy course in applied biomechanics.*
4. *Occupation as the core of applied biomechanics will be beneficial for my learning.*

Frequencies, percentages, and change scores were calculated at both time points for each statement.

Finally, to explore students' opinions on how well we connected each course to occupation, students rated the connection as "poor," "adequate," or "strong" weekly. Additionally, students used the same scale to rate the connection between the two courses. This rating was gathered as a "ticket out" following class time to ensure high response rate. "Tickets out" or "exit tickets" are an education strategy used in face-to-face instruction to elicit student feedback, among other objectives (Kirzner et al., 2021). If an occupation outlined in Table 1 spanned more than one week, scores were still collected at the end of each week (e.g., feeding covered two weeks). Percentages of responses were calculated for each rating.

Results

Fifty-five students (62% response rate) completed both pre and post course surveys rating their ability to perform the ten course objectives and their agreement with the four statements on occupation-centered course design. Ten of the students had an undergraduate major in kinesiology or exercise science, 10 majored in other health sciences and 35 had majors in other categories, such as psychology, other sciences, and other humanities. Forty-eight students took one or two classes in anatomy and seven took three or more. No students selected "none" as four credits of physiology is required for matriculation into our OT program, and many students took two courses that combined physiology with anatomy. However, 32 students had no undergraduate classes in kinesiology or related coursework. Sixteen took one or two classes, and seven took more than three.

Students rated themselves as improving on all ten objectives following the two classes, with the mean post-course rating 8.19 on 10-point scale. The five Applied Biomechanics objectives were rated lower at the beginning of the semester compared to the five anatomy objectives, but four out of the five greatest improvements were noted with the Applied Biomechanics objectives. The overall Anatomy objective score increased 19.8 points, and the overall Applied Biomechanics objective score increased 24.97 points. Statistically significant increases in ratings occurred for every objective, as well as the overall objective ratings at the conclusion of the courses, as outlined in Table 2.

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Table 2

Pre and Post Semester Ratings of Anatomy Objectives (Numbered 1-5) and Applied Biomechanics Objectives (Numbered 6-10) with Change Scores, n=55

	Time-point		
Objectives	**Pre Mean (SD)**	**Post Mean (SD)**	**Change**
1. I am able to understand the anatomical underpinnings for individuals to be able to move and feel for participation in life.	4.73 (1.78)	8.22 (1.12)**	3.49
2. I am able to understand principles of kinesiology and biomechanics and how they can support or hinder occupational performance.	4.07 (2.03)	8.49 (1.14)**	4.42
3. I am able to examine the relationship between anatomical structures, body functions, performance skills, and the ability to perform daily activities and occupations.	4.62 (1.63)	8.38 (0.97)**	3.76
4. I am able to investigate how anatomical structures become injured and recover in response to occupations, habits, environment, and development throughout the lifespan.	4.0 (1.76)	7.98 (1.31)**	3.98
5. I am able to explore limitations in person factors expected with health conditions affecting anatomical structures and systems studied in this course and potential effects of these on occupational performance.	4.2 (1.56)	8.35 (1.27)**	4.15
All Anatomy Objective Ratings Combined	**21.62 (7.90)**	**41.42 (5.03)***	**19.8**
6. I am able to identify movement-related (musculoskeletal), sensory, and physiological factors important to screen/evaluate to support occupational performance.	3.89 (1.72)	8.24 (1.23)**	4.35
7. I am able to demonstrate knowledge and skills measuring and interpreting results for joint mobility/stability, sensory (touch, proprioception, temperature, and pain), muscle strength, edema, manipulation/coordination, balance, and vital signs.	2.95 (1.78)	8.25 (1.14)**	5.3
8. I am able to compare assessment results to activity analysis for priority occupations, and identify interventions for select conditions learned this semester.	2.58 (1.65)	7.73 (1.39)**	5.15
9. I am able to explore the effects of posture, positioning, functional mobility and gait patterns, and habits on clients' and caregivers' body structures and functions, performance skills, and ability to perform occupations and activities.	3.29 (1.87)	8.20 (1.18)**	4.91
10. I am able to apply anatomical and kinematic principles to restore and compensate for musculoskeletal, sensory, and physiological impairments; including physical agent modalities, orthoses, therapeutic exercise, and education.	2.76 (1.84)	8.02 (1.13)**	5.26
All Applied Biomechanics Objective Ratings Combined	**15.47 (7.93)**	**40.44 (5.38)****	**24.97**

**Denotes p=0.023 ** denotes p<0.001. SD=Standard Deviation. Students rated objectives on a scale of 1-10, with a maximum of 50 for each course's objectives.*

Pre and post semester mean ratings with standard deviations (SD) of the overall five Anatomy and five Applied Biomechanics objectives categorized by undergraduate major and number of courses taken are outlined in Table 3. When we explored effects of undergraduate major on course objective ratings, we found that the students with undergraduate majors listed in the "other" category rated themselves statistically significantly lower on Anatomy objectives than those with kinesiology/exercise science major pre-semester *(p*=0.006). Students with majors in the "other" category demonstrated the largest increase in their rating (21.17 points), compared to health science majors (19 points) and kinesiology majors (15.8 points), so that at the conclusion of the semester, we found no statistically significant differences among final ratings of Anatomy objectives. We also discovered that students with no previous kinesiology courses had statistically significantly lower ratings on the Anatomy objectives pre-semester than those students with three or more undergraduate courses (*p*=0.007). These students also demonstrated the largest increase in objective ratings (21.26 points) compared to students with three or more classes (14 points) or one to two classes (18.81 points). There were no significant differences noted among the categories at the end of the semester. We observed no statistically significant differences based on number of previous anatomy classes either pre or post semester. Additionally, we did not find statistically significant differences in Applied Biomechanics objective ratings among the undergraduate major categories, number of prior anatomy classes taken, or number of kinesiology courses taken at either timepoint.

At the beginning of the semester, a large majority of the students agreed or strongly agreed with the statement that occupation should be at the core of Anatomy (83.65%) and Applied Biomechanics (89.09%). Over 96% of the students agreed or strongly agreed that occupation as core would be beneficial to their learning for each course. A small number of students disagreed with three of the four statements regarding occupation as the core at the beginning of the semester, but none disagreed at the conclusion of the semester. All four statements demonstrated the largest post course positive change at the "Strongly agree" level, with occupation as core of Applied Biomechanics appreciating the greatest gains. Table 4 summarizes the frequencies and changes for these statements.

Although the scheduled topical outline (see Table 1) lasted 13 weeks, we did not have ticket out data for two weeks: the first week (Dancing) class was moved online due to inclement weather, and we did not include a ticket out for the final exam week. All available data were included for each date, and response rates ranged from a low of 49 students (55%) to 89 students (100%).

For the 11 weeks that we collected ticket out data, at least 74% of students rated our ability to connect each course to occupation as adequate or strong. More students rated the connection to occupation as strong for Applied Biomechanics compared to Anatomy for all 11 weeks. Every student rated the Applied Biomechanics connection to occupation as adequate or strong in weeks three and ten. Larger differences between number of students rating Anatomy and Applied Biomechanics as adequate or strong occurred in weeks one through three. Figure 1 compares the percentage of students rating each course's connection to occupation as adequate or strong. Over 90% of students rated our ability to connect the two courses together each week as adequate or strong, with the exception of week 11 (88%).

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Table 3

Comparison of Course Objectives Mean Ratings Based on Undergraduate Major and Number of Related Undergraduate Courses Completed, n=55

	Anatomy Objectives		**Applied Biomechanics Objectives**	
Undergrad Major	**Pre Mean (SD)**	**Post Mean (SD)**	**Pre Mean (SD)**	**Post Mean (SD)**
Kinesiology/Exercise Science	27.2 (6.03)	43 (6.16)	16.6 (7.91)	42.5 (6.55)
Health Sciences	23.6 (6.87)	42.6 (6.5)	17.6 (9.45)	39.4 (6.55)
Other	19.46 (7.87) §	40.63 (4.31)	14.54 (7.54)	40.15 (4.64)
Number of Anatomy Courses Completed				
1-2	21.42 (8.15)	41.25 (5.11)	15.4 (8.33)	40.0 (5.54)
3 or more	23 (6.33)	42.57 (5.11)	16 (4.73)	43.43 (2.89)
Number of Kinesiology Courses Completed				
None	19.16 (7.69) §	40.72 (4.38)	13.75 (7.11)	39.28 (4.99)
1-2	23.69 (7.31)	42.5 (5.29)	18.38 (9.15)	41.94 (4.89)
3 or more	28.14 (5.46)	42.14 (7.22)	16.71 (7.42)	42.49 (7.41)
Total	21.62 (7.9)	41.42 (5.02)	15.47 (7.92)	40.44 (5.37)

§ Statically significant difference compared to other categories at p<0.01 level. Students rated objectives on a scale of 1-10, with a maximum of 50 for each course's objectives combined.

Table 4

Student Agreement with Statements Regarding Occupation Centered Course Design, n=55

Statement	**Timepoint**	**Frequency**			
		Disagree	**Neutral**	**Agree**	**Strongly Agree**
Occupation should be the core of an OT foundational course in human anatomy	Pre	2	7	22	24
	Post	0	5	21	29
	Change	-2	-2	-1	+5
Occupation as the core of a course in human anatomy will be beneficial for my learning	Pre	1	1	23	30
	Post	0	2	20	33
	Change	-1	+1	-3	+3
Occupation should be the core of an OT course in applied biomechanics	Pre	1	5	22	27
	Post	0	2	14	39
	Change	-1	-3	-8	+12
Occupation as the core of applied biomechanics will be beneficial for my learning	Pre	0	2	20	33
	Post	0	0	17	38
	Change	0	-2	-3	+5

Note: none of the statements were rated “strongly disagree” by the students at either timepoint.

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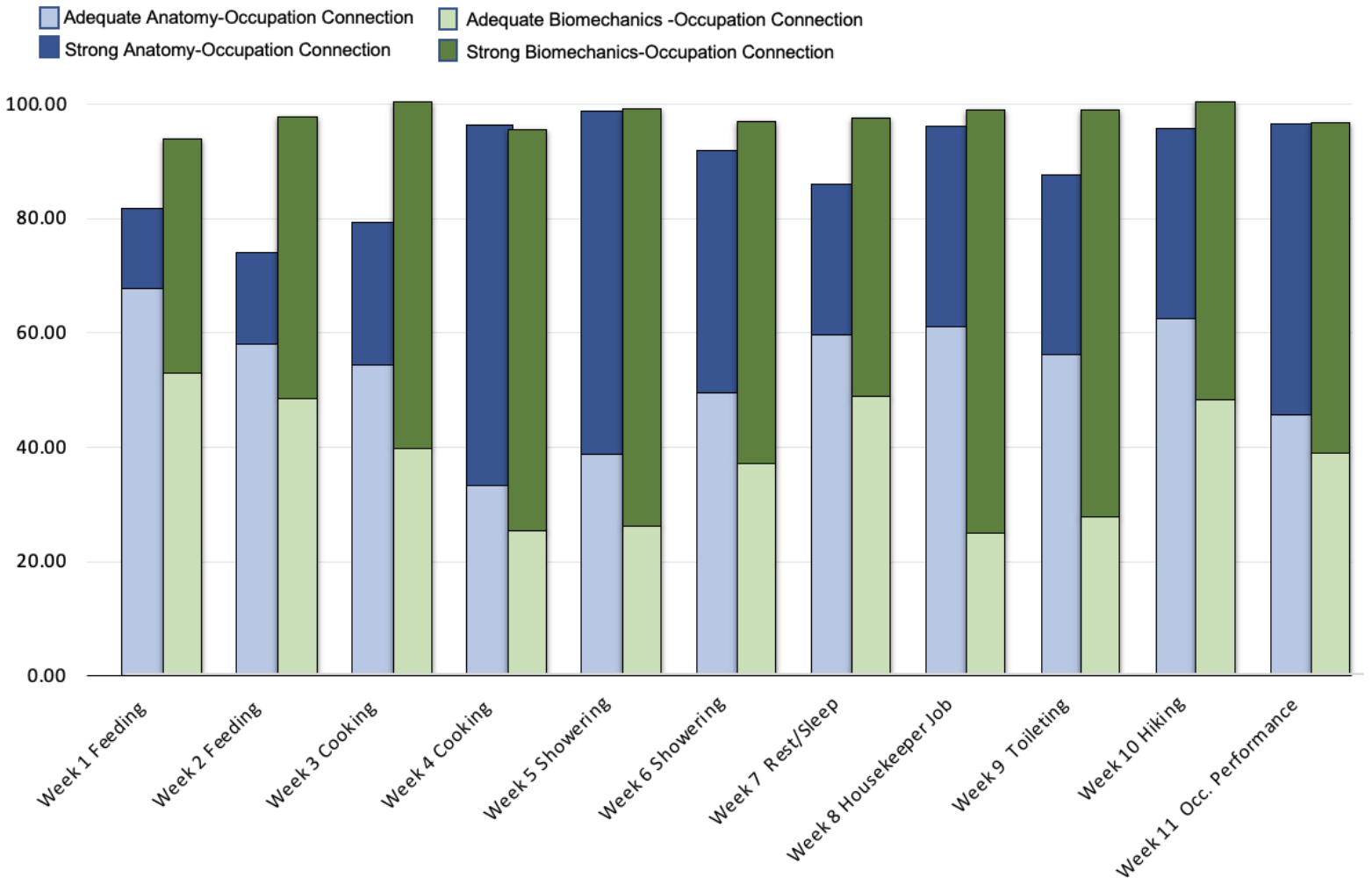
Figure 1

Percentage of Students Rating Connection of Each Course to Occupation as Adequate or Strong by Week and Occupation (Number or Respondents Ranged From 49 to 89 Per Week)



Discussion

This research demonstrates positive effects after teaching two newly redesigned courses, Anatomy and Applied Biomechanics, that placed occupation at the core and used evidence-informed teaching and learning strategies. Our students demonstrated large, statistically significant increases in all ten learning objectives for the entirety of the semester. Even though all students had at least one anatomy course prior to starting our program, they rated their performance on the Anatomy objectives low at the start of the semester. Prior research has found that students feel unprepared from undergraduate coursework related to anatomy, and subsequently recommend standalone anatomy courses within OT programs, and/or additional student resources related to anatomy in OT programs (Giles et al., 2021).

Specifically, we feel students need to be exposed to content related to anatomy and applied biomechanics as it relates to occupation. Fortune and Kennedy-Jones (2014) asserted that allowing our students to think in an "occupational way" (p. 297) should be present throughout the entirety of the OT curriculum. This presence should go beyond an overarching curricular thread and be present and overt in each class as well (Hooper et al., 2020). Our research demonstrates that occupation can be present in instruction in foundational coursework, like our Anatomy and Applied Biomechanics classes, heeding Yerxa's prompts (1998). Whiteford and Wilcock (2001) explicitly mentioned anatomy in their paper, stating "…in the minds of students who have no clear notion of why they are learning anatomy, physiology, or neuroscience, and how these subjects contribute to the occupational therapy profession's particular view of humans…" (p. 82), and go on to affirm that they are not surprised by the difficulty students have connecting the value of occupation to information and skills learned in the OT curriculum (Whiteford & Wilcock, 2001). Our research adds an occupation-centered approach in specific coursework to the knowledge base for other educators to draw upon.

We surmised that moving coursework online due to COVID-19 resulted in lower ratings of some course objectives at the end of the semester compared to if we had remained in person, specifically those which we had planned intensive skill-based experiences. We created video guides of prosected human bodies instead of the students handling the cadavers in the lab, which may have resulted in the smallest improvement (3.49 points) for the objective: *I am able to understand the anatomical underpinnings for individuals to be able to move and feel for participation in life.* The objective with the lowest rating at the conclusion of the semester: *I am able to compare assessment results to activity analysis for priority occupations and identify interventions for select conditions learned this semester,* would have likely been rated higher if students could have participated in the final exam that we had planned for Applied Biomechanics (see Table 1). This experience would have required students to interpret results and identify interventions based on small group assessment and intervention planning with a live case study. When modified to an online format, the intervention portion was not well defined and the multiple choice/multiple answer format, which reveals more surface

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learning than application exams (Nilson, 2016). Additionally, while the students were exposed to creating an activity analysis in coursework prior to Applied Biomechanics, we may need further refinement in linking the activity analysis to assessment and intervention that addresses the biomechanical aspects of occupation.

We were pleased to see that the differences in students' perceived ability to perform course objectives based on undergraduate preparation found at the beginning of the semester were not present at the conclusion of the courses. This finding aligns with Robertson et al. (2019), who also found no statistically significant differences in final grades of dental and medicine students based on amount of undergraduate anatomy coursework. Additionally, Giles et al. (2021) found no statistical difference in final course grades in undergraduate degree and number of courses in anatomy. Even though we used student perceptions on achieving learning objectives as opposed to final student grades as our outcome measure, we believe these findings in their study and ours are related.

Our third research objective sought to reveal OT students' perceptions of relating Anatomy and Applied Biomechanics to occupation and how much it would facilitate their learning. Even though students placed a high value of having occupation as a core of a course related to anatomy and biomechanics at the beginning of the semester, increases were noted for both courses at the "strongly agree" level and no student disagreed at the end of the semester. We feel this reflects the value the instructors placed on occupation, including it throughout a variety of content areas and demonstrating this value in instruction, and relating the importance of content to future practice as occupational therapists. Centering occupation in these two courses further bolsters the impact learning occupation has on our students' professional identity (Hooper et al., 2020). Researchers are just beginning to explore student voices with occupation-centered course design (Breen-Franklin & Atler, 2022), and our study adds to this necessary body of scholarship.

Lastly, we examined our ability in making the courses occupation-centered from the students' perspective. We knew that tying course content to some occupations would be challenging, but we wanted to use the categories of occupations as outlined in OTPF-3 to display the breadth of OT to entry-level students. Consequently, we were not surprised that more students rated certain weeks as adequate or strong compared to others, especially in Anatomy. The two weeks covering showering were rated among the highest for both classes, where the body structures of the shoulder including the brachial plexus, as well as range of motion, manual muscle testing, and scapulohumeral rhythm are closely tied to performing this occupation. Conversely, facial anatomy and mastication are not as closely connected to rest and sleep. More students rating the connection to occupation as strong each week in Applied Biomechanics may reflect students' current understanding of what occupational therapists do in clinical practice. In Applied Biomechanics, students worked with lab faculty and each other, performing skills required for competent clinical practice; thus, they perceived a stronger connection

to OT and occupation itself. Collecting this data weekly did allow us to focus on what worked well and what did not in Anatomy to make iterative changes for future weeks, as evidenced by the increases noted after the first three weeks. The move to online instruction due to COVID-19 restrictions, which happened between Showering and Rest/Sleep, did not appear to strongly influence students' ratings of each course's connection to occupation.

Limitations

Although our study provides novel information about occupation-centered course design and outcomes for foundational science classes, it is not without limitations. The abrupt move to fully online course delivery was an unforeseen challenge. Nonetheless, we feel our results provide an opportunity for future study of foundational science courses taught in a hybrid or online format in OT curricula.

For course objective ratings, we only included data from students who completed both surveys, thus, missing perceptions of some students. Additionally, the weekly occupation-centered ratings were a required 'ticket out' for students during face-to-face instruction, allowing us to capture nearly all students' ratings for weeks 1-6. This was no longer possible following online instruction, where our weekly numbers were lower. Despite these missing data, this study provides strong data for other OT programs to follow.

In our study, we did not investigate time from previous anatomy and biomechanics/kinesiology coursework. Our program requires a finite time between course completion and matriculation, but students do take breaks or gap years, and some course work is completed early in baccalaureate degrees, increasing the time and decreasing the ability to recall (Brown et al., 2014). It is possible that time from completion of coursework, and not the major or number of courses, was responsible for the statistically significant differences at the beginning of the semester.

Implications for Occupational Therapy Education

Based on our findings of this study, we make the following suggestions for OT programs:

- Recommend occupation-centered course design in all coursework, including foundational classes like Anatomy and Applied Biomechanics.
- Recommend using evidence-informed teaching and learning strategies in designing all coursework.
- Recommend keeping Anatomy within the OT program to ensure students meet the knowledge domains needed for clinical practice.
- Continue attracting and admitting students with diverse undergraduate preparation and not just those related to exercise science or health science majors.
- Consider the necessity of certain pre-requisites for students, specifically related to kinesiology.
- Possible continued usage of hybrid format for courses including Anatomy and Applied Biomechanics.

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Conclusion and Future Directions

In conclusion, occupation-centered course design is feasible and a worthwhile endeavor for foundational science courses like Anatomy and Applied Biomechanics. Students continue to meet course objectives using this design and it promoted leveling inequities from various undergraduate preparation. Students deemed occupation-centered course design important, and it allowed them to witness the value of occupation in our instruction. Occupation-centered course design is not without challenges and requires reflective teaching practices and iterative changes to continue to create exemplar OT courses. Future directions include building upon and continuing scholarship in this area to add to the knowledge body for OT programs.

References

American Occupational Therapy Association (AOTA). (2014). Occupational therapy practice framework (3rd ed.) *American Journal of Occupational Therapy*, *68*(Supplement_1), S1-S48. https://doi.org/10.5014/ajot.2014.682006

Bagatell, N., & Womack, J. L. (2016). Human capacity for action as core content in occupational science education, *Journal of Occupational Science*, *23*(4), 514-518. https://doi.org/10.1080/14427591.2016.1226682

Belleza N.C., & Johnson, M. (2019). Using the backward design process to integrate interprofessional education utilizing simulation in OT and PT educational curricula. *Physical Therapy Collection, 56*.

Boud, D. (2001). Making the move to peer learning. In Boud, D., Cohen, R. & Sampson, J. (Eds.), *Peer learning in higher education: Learning from and with each other* (pp.1-20). Kogan Page.

Breen-Franklin, A., & Atler, K. (2022). Use of the subject-centered integrated learning model and the occupational experience profile to promote students' connections among occupation, self, and the profession. *Journal of Occupational Therapy Education, 6*(1). https://doi.org/10.26681/jote.2022.060117

Brown P., Roediger H. L., & McDaniel, M. A. (2014). *Make it stick: The science of successful learning.* Belknap Press of Harvard University Press.

Canty, G., Roberts, M. J., & Molineux, M. (2020). Characteristics of occupation-based education within entry-level occupational therapy programs: Professional leaders' perspectives. *Journal of Occupational Therapy Education, 4*(2). https://doi.org/10.26681/jote.2020.040202

Day, L. J. (2018). A gross anatomy flipped classroom effects performance, retention, and higher-level thinking in lower performing students. *Anatomical Sciences Education, 11*(6), 565-574. https://doi.org/10.1002/ase.1772

Emory, J. (2014). Understanding backward design to strengthen curricular models. *Nurse Educator*, *39(*3), 122-5. https://doi:10.1097/NNE.0000000000000034

Entezari, M., & Javdan, M. (2016). Active learning and flipped classroom, hand in hand approach to improve students learning in human anatomy and physiology. *International Journal of Higher Education*, *5*(4). https://doi.org/10.5430/ijhe.v5n4p222

Fink, L.D. (2003). *Creating significant learning experiences: An integrated approach to designing college courses.* Jossey Bass: Wiley

Fortune, T., & Kennedy-Jones, M. (2014). Occupation and its relationship with health and wellbeing: The threshold concept for occupational therapy. *Australian Occupational Therapy Journal, 61*, 293-298. https://doi.org/10.1111/1440-1630.12144

Giles, A., Conrad, W., Lunsford, D., & Valdes, K. (2021). Exploring anatomy coursework and perceptions of occupational therapy students: A survey study. *Journal of Occupational Therapy Education*, *5*(1). https://doi.org/10.26681/jote.2021.050106

Hochstein, D. (2019). Student attitudes and (lack of) anxiety for online practice quizzes. *Association for University Regional Campuses of Ohio, 25*(Spring 2019), 92-107.

Hooper, B., Mitcham., M.D., Taff, S.D., Price, P., Krishnagiri, S., & Bilics, A. (2015). The issue is—Energizing occupation as the center of teaching and learning. *American Journal of Occupational Therapy*, 69(Suppl. 2), 6912360010. https://doi.org/10.5014/ajot.2015.018242

Hooper, B., Krishnagiri, S., Price, P., Taff., S.D., & Bilics, A. (2018). Curriculum-level strategies that U.S. occupational therapy programs use to address occupation: A qualitative study. *American Journal of Occupational Therapy*, 72, 7201205040. https://doi.org/10.5014/ajot.2018.024190

Hooper, B., Krishnagiri, S., & Price, P. (2020). The principles of occupation-centered education. In S. Taff, L. Grajo., & B. Hooper (Eds). *Perspectives on occupational therapy education* (pp. 117-127). SLACK.

Kirzner, R.S., Alter, T., & Hughes, C.A (2021). Online quiz as exit ticket: Using technology to reinforce learning in face-to-face classes. *Journal of Teaching in Social Work, 41*(2), 151-171. https://doi.org/10.1080/08841233.2021.1898521

Krishnagiri, S., Hooper, B., Price, P., Taff, S.D., & Bilics, A. (2017). Explicit or hidden? Exploring how occupation is taught in occupational therapy curricula in the United States. *American Journal of Occupational Therapy, 71,* 7102230020. https://doi.org/10.5014/ajot.2017.024174

Luburic, N., Sladic, G., Slivka, J., & Milosavljevic, B. (2019). A framework for teaching security design analysis using case studies and the hybrid flipped classroom, *ACM Transactions on Computing Education, 19*(3). https://doi.org/10.1145/3289238

McGrath, V. (2009). Reviewing the evidence on how adult students learn: An examination of Knowles' model of andragogy. *Adult Learner: The Irish Journal of Adult and Community Education*, 99-110.

Miller, M., & Roberts, M. J. (2020). Teaching and learning occupation in occupational therapy education: A qualitative evidence synthesis. *Journal of Occupational Therapy Education, 4*(3). https://doi.org/10.26681/jote.2020.040313

Nilson, L. (2016.) *Teaching at its best* (4th ed.) John Wiley & Sons.

Quinn, S., & Cremin, K. (2021). Occupation-focused learning and personal development through service learning. *Journal of Occupational Therapy Education, 5(*3). https://doi.org/10.26681/jote.2021.050304

Robertson, E.M., Thompson, K.L., & Notebaert, A.J. (2019). Perceived benefits of anatomy coursework prior to medical and dental school. *Anatomical Sciences Education, 13*(2), 161-181. https://doi.org/10.1002/ase.1882

di Tommaso, A.D., Wicks, A., Scarvell, J., & Isbel, S. (2019). Uncovering educator perspectives of occupation-centred education in Australia: A qualitative study. *Australian Occupational Therapy Journal, 66,* 174-182. https://doi.org/10.1111/1440-1630.12529

Walck-Shannon, E.M., Cahill, M.J., McDaniel, M.A., Frey, R.F., & Brame, C. (2019) Participation in voluntary re-quizzing is predictive of increased performance on cumulative assessments in introductory biology. *Life Sciences Education, 18*(2). https://doi.org/10.1187/cbe.18-08-0163

Whiteford, G. E., & Wilcock, A. A. (2001). Centralizing occupation in occupational therapy curricula: Imperative of the new millennium. *Occupational Therapy International, 8*(2), 81-85. https://doi.org/10.1002/oti.134

Yerxa, E. J. (1998). Occupation: The keystone of a curriculum for a self-defined profession. *American Journal of Occupational Therapy*, *52*(5). https://doi.org/10.5014/ajot.52.5.365