Collaborative Team-Teaching to Promote Interdisciplinary Learning in the Undergraduate Classroom: A Qualitative Study of Student Experiences

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ABSTRACT

In this article we examine students' learning experiences within a new team-taught general education course designed to explore the big idea of "What does it mean to be human?" from multiple disciplinary perspectives. Semi-structured interviews with students provide insight on how learners are experiencing this new instructional model and its implications for interdisciplinary learning. Our conversations with students reveal that students affirm the value of interdisciplinary education and perceive this collaborative and co-instructed model as beneficial to their learning. This new curricular approach, while not without its challenges, was found to have positive implications for bolstering learner interest, fostering perspective-taking behaviors, and creating a classroom environment in which students perceive their intellectual contributions as valued.

INTRODUCTION

Interdisciplinary instruction at the undergraduate level is increasing rapidly (Katz, 2015). As captured in a recent widescale survey conducted by the Association of American Colleges and Universities (AAC&U), nearly 55% of its member institutions currently offer interdisciplinary courses in their general education program (Hart Research Associates, 2016). Moreover, over half of surveyed institutions were in the process of rethinking their general education programs to prioritize more integrative curricular structures. The University of Arizona is no exception, with explicit language in the institutional strategic plan calling for an envisioning of a new general education program consisting of "interdisciplinary grand challenge courses" (University of Arizona, 2018). Driven by the demand for more integrative general education experiences that span disciplinary boundaries, the University of Arizona joins other institutions of higher education in the process of rethinking existing structures and questioning what a new model might entail.

Yet despite this demonstrated interest and prioritization of interdisciplinary teaching and learning across institutions of higher education, research on the implementation of interdisciplinary curricular programs and courses has not kept pace (National Academies of Science, Engineering, & Medicine, 2018b). While important work has been done to document and analyze the nature and experience of teaching undergraduate interdisciplinary courses in order to provide valuable insight on interdisciplinary instruction (Juris et al., 2014; Luckie et al., 2012; Noy et al., 2017; Nungsari et al., 2017), there is still much to be learned in this domain. What works for student interdisciplinary learning, and how it works, remains largely unexplored resulting in a limited understanding of how interdisciplinary pedagogic strategies and course structures influence the student learning experience and promote opportunities for the development of interdisciplinary thinking (De Greef et al., 2017; Juris et al., 2014; Newell & Luckie, 2013; Rhoten et al., 2006). This work contributes by examining the perspectives and contributions of students on the forefront of such curricular interventions. In this article we examine the student learning experience within a new team-taught Honors course designed to approach a big idea from multiple disciplinary perspectives in order to provide insight on how students are experiencing this instructional approach and its implications for interdisciplinary learning. This study is part of a multi-year institutionally grant-funded project to advance instructional practice through scholarship of teaching and learning. The course under investigation is the first of three eventual pilot courses which will be informed by what we learned this first year.

We take the position that students' learning experiences and priorities must be a central point of the conversation. Prioritizing the student voice allows practitioners to consider more fully how curricular reform processes are experienced by our students, and how students perceive their learning within interdisciplinary classrooms. Yet, empirical research that centers the student in the evaluation of teaching and learning in interdisciplinary higher education remains limited (Gombrich & Hogan, 2017). Drawing on data gathered though semi-structured interviews with 15 undergraduate students enrolled in the pilot course, we add an account of the learning experience through the eyes of students. These narratives provide valuable insight on how learners perceive their experiences within this innovative curricular model and elucidate key strengths and drawbacks to utilizing a team-teaching and co-convening organizational course structure to promote interdisciplinary reasoning in the classroom. Our findings contribute to the growing scholarship on undergraduate interdisciplinary teaching and learning as we continue to push for impactful and meaningful interdisciplinary learning experiences for our students.

COURSE DESIGN: USING A TEAM-TAUGHT CO-CONVENING STRUCTURE

In their recent work, Looft and Myers (2019) highlighted the synergy between Honors programming and interdisciplinary pedagogies, and reminded readers that in the United States "[a] highly interdisciplinary approach to learning has long been a pillar of the honors mission and vision" (p. 142). They cited various characteristics that can make University Honors programming a rich setting to explore interdisciplinary learning and curricular structures including characteristically smaller class sizes with lower student to faculty ratios, multidisciplinary faculty collaborations, and an emphasis on discussion-based seminars that allow for deeper engagement with complex topics. Accordingly, scholars have proclaimed the unique position of Honors programs and courses to explore multifaceted contemporary and global issues such as human rights and social justice (Szasz, 2017). In synergy with this work, this paper responds to the call for intentional research on Honors curricular experiences necessary to answer crucial questions related to the value and effectiveness of honors programming and coursework, particularly within the domain of interdisciplinary classroom learning.

This study was conducted during a semester-long general education course at the University of Arizona's Honors College. Three faculty from the Honors College- representing diverse disciplinary backgrounds in the humanities, social sciences, and natural sciences- worked together to co-

design the new integrative course in fall 2019 and ran the course in spring 2019. The thematic focus of the course, "What does it mean to be human in the 21st century?" was selected by the faculty team with the intention that each of them would be able to guide students in approaching the question from the tools and scholarly insights of their disciplinary expertise. While the collective course was broken into three separate course sections, with each section led by the faculty member trained in that discipline, a central design feature was that all students were brought together regularly in co-convening sessions to engage in collaborative peer learning activities designed to promote interdisciplinary thinking. Specifically, for every fourth or fifth class meeting, students from across the three sections worked together in mixed disciplinary groups demanding at least one student from each of the three sections.

This structured approach is representative of the "jigsaw technique", a research-based cooperative learning technique in which students first become knowledgeable on a particular segment of the material, and then come together to share this knowledge and accomplish collaborative activities with other students (Aronson, 1978). The use of the jigsaw technique as a way to facilitate collaborative learning in the context of interdisciplinary instruction has been recommended by others in the scholarship of teaching and learning for its alignment with interdisciplinary instructional aims (De Greef et al., 2017; Dezure, 2017). As applied in the course model under investigation, students first worked in their individual course sections to contemplate the question from the specific disciplinary lens of their professor, while the other two courses did the same. In their individual disciplinary-grounded sections, students were provided multiple opportunities to explore the idea using selected disciplinary methods and frameworks informed by the faculty member's academic and research expertise. For example, students enrolled in the course section led by a professor from the social science discipline examined the proposed question predominately through social science modes of inquiry, notably through the framework of ethnomusicology and sound. Students enrolled in the course section led by a professor from the humanities examined the question predominately through the lens of photography (e.g., extrinsic and intrinsic analysis, close reading). Finally, students enrolled in the course section led by a professor from the natural sciences emphasized experimentation, scientific design, and systems-thinking as ways of examining the proposed question. Then, during the collaborative co-convened sessions, students from the three classes came together to form new cross-disciplinary groups consisting of at least one member from each course. In these newly formed groups students took turns teaching each other the

material on which they had become experts. In the context of the course, this involved students from each group sharing their insight on how the given topic could be approached from their disciplinary lens.

Figure 1: Illustration of Jigsaw Technique Employed in the Course
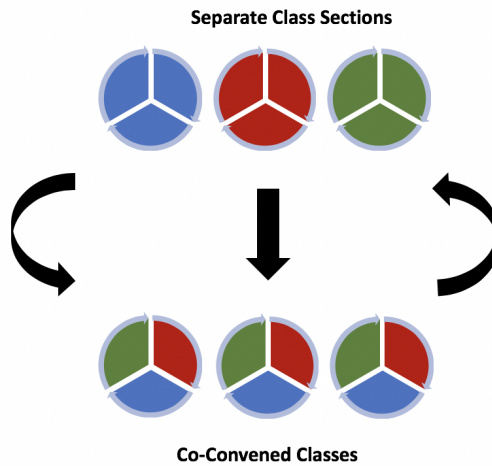
Beyond promoting interdisciplinary instructional aims, the jigsaw technique is a tool to engage students in teaching their peers and is recognized as an evidence-based strategy to support deeper learning. The process of explaining to others is active and generative, and requires elaborative processing as leaners must generate, organize, and integrate knowledge. Doing so therefore moves students beyond being passive recipients of knowledge, and encourages them to focus on deeper questions and levels of comprehension (National Academies of Science, Engineering, & Medicine, 2018a). This thinking was captured by one of the course participants in her description of why she would choose to enroll in another course using this structure in the future:

I thought that this was one of the most impactful courses I've ever been in. Reflecting back, I feel like I've really grown as a student and I've learned a lot from my peers. Which I think being able to teach, being able to learn and teach someone else what you've learned, is really a great way to implement the information in you. And it is a great learning method or learning technique. And so, I would 100% enroll in another class like this. (Vanessa)

METHODS

We conducted a qualitative study to gain a better understanding of how students are experiencing this instructional approach. Participants were recruited from the 42 undergraduate students enrolled in the pilot course trio. All students enrolled in the courses were invited to participate in a semi-structured interview with a member of the research team, separate from the faculty team, during the final two weeks of the course. 15 students (35%) agreed to be interviewed. As depicted in Table 1, as a 100-level general education course the majority of students were in their early undergraduate career. However, because students across all levels and departments could enroll in the course, there was a full range in academic level, and three of the interviewed participants were graduating seniors. Also notable is that the majority of participants were majoring in a STEM field, which is likely to have shaped students' familiarity and affinity with the scientific perspectives presented in the course. While interview participants represented all three sections of the course, the greatest level of representation was from the natural science course (7 students), and the lowest representation from the humanities course (2 students). While this discrepancy does mirror the uneven number of students enrolled in each section, it also provides a less comprehensive view of individual experiences in the Humanities section of the course. Pseudonyms are used throughout the paper to protect students' privacy.

Interviews lasted between 22-45 minutes and were conducted at on-campus locations selected by the interviewees, predominately in cafes or student community spaces. The decision to meet students in these spaces, and to have the research team conduct interviews rather than the faculty team, was intended to facilitate more open student reflection and feedback on their experience. An interview guide was used to develop a list of general areas to be covered with the student and to remind the interviewer to ask about certain things, but it was a flexible and dynamic process as new questions emerged from the discussion in-line with the qualitative interviewing process (Taylor et al., 2015). All interviews were recorded and later transcribed verbatim. Informed by the scholarship of interdisciplinary teaching and learning, educational psychology, and the learning sciences we noted emerging themes during the transcription process and first round of coding. NVivo analytic software was used to support the development of coding categories around concepts such as *multi-perspective taking*, *role of instructor*, and *student choice* relevant to shedding light on how students perceived their interdisciplinary learning experience. This process was accompanied by ongoing analytic memo writing to help identify patterns and make

connections between what was emerging in our conversations with students and key theoretical concepts from the literature. Through the coding process, we classified and categorized patterns across our conversations with students to elucidate relationships and trends among course participants. Our findings and conclusions were shared with all student interviewees to allow for respondent validation or member checking (Maxwell, 2013). This process provided an opportunity for participants to affirm the accuracy and completeness of our interpretations and offer feedback, as is reflective of our intention to more authentically represent student voices regarding the ongoing curricular reform process.

Table 1: Background of student participants interviewed for the study using pseudonyms

Student	Year	Major	Course
Lucas	1	Biochemistry	Social Science
Kevin	1	Physiology & Spanish	Social Science
Mark	1	Computer Engineer	Social Science
Natalie	3	Computer Science & Business	Social Science
Kaitlin	1	Physiology	Social Science
Vanessa	4	Psychology	Social Science
Marissa	1	Geoscience	Humanities
Sienna	1	Biochemistry	Humanities
Tanya	4	Ecology	Natural Science
Mason	2	Philosophy, Politics, Ed. & Law	Natural Science
Lexi	1	Geography & Music	Natural Science
Simone	1	Environmental Studies	Natural Science
Denise	2	Nursing	Natural Science
Olivia	4	Education	Natural Science
Joan	3	Computer Science	Natural Science

As with all research, our study had limitations. Both researchers conducted the interviews, each with our own styles and rapport with participants, and followed up with different questions as conversations evolved. While we regularly consulted and discussed emergent themes, the NVivo and memo writing analytic process was primarily undertaken by a single member of the team. A more collaborative team approach to analysis would have encouraged consensus building and may have revealed new lines of inquiry. Finally, while all students were invited to interview through both email and an in-person class visit, it is reasonable to assume that students who

may have had a negative experience in the course would be less enthusiastic to take the additional time to interview with a member of the research team. In this case, more critical student perspectives may be underrepresented resulting in a skewed representation of learner interest and appreciation for interdisciplinary educational approaches.

FINDINGS

Our conversations with students revealed that while this course model was not without its challenges, students largely affirmed the value of interdisciplinary education and approaches and saw the collaborative and student-centered nature as valuable to their learning. Furthermore, students noted how structured and intentional role-playing activities embedded in the co-convening organizational structure encouraged perspective-taking behaviors and appreciation for multiple ways of knowing. In analyzing the data, connections are made with existing literature on traits, dispositions, and processes relevant to interdisciplinary and learner-centered instruction. The following analysis intersperses the voices of student with relevant literature to capture and communicate key themes which emerged from our conversations with students.

Appreciation for Interdisciplinary Approaches in the Classroom

A dominant rationale for interdisciplinary education is the need to answer a question, solve a problem, or address a topic that is too broad or complex to be dealt with adequately by a single discipline or profession. This narrative is present in large research organizations such as the National Science Foundation (NSF) and the National Academies of Science, Engineering, and Medicine (NASEM), as well as in the existing scholarship of interdisciplinary teaching and learning. This call for interdisciplinary undergraduate education generally argues that the historically siloed knowledge structure of academia does not accurately reflect the complex and integrated nature of the world it functions in. In other words, the problems of the world are complex, and complexity demands interdisciplinarity (De Greef, 2017; Holley, 2009; NASEM, 2018b; Noy et al., 2017). The synergy between the complexity of the world, and engagement with interdisciplinary approaches is captured by Dezure (2017) in her proclamation that "the more the pedagogy engages students in experiences based in the complexities of the real world, the more there is a need to employ interdisciplinary approaches to problem solving" (p. 562). Through our conversations with students, we found that they largely substantiated this rationale. Specifically, as captured in our conversations with Kevin and Tanya, students recognized and

appreciated the importance of interdisciplinary approaches to address difficult problems, and perceived the interdisciplinary and collaborative nature of the course as valuable to their learning.

Well, I guess when you look at a question about what it means to be human, I mean that's a big question that I don't know if anyone has a very concise nice answer to. And so I think you have to look at it from a lot of different angles. And the way to do that is to take an interdisciplinary approach. When you have a big problem, you have to consult others, a lot of different methodologies, and a lot of different perspectives in order to arrive at some kind of answer to it. So, you have to combine those. You can't just say 'this is what it means to be human' because it really varies and it's circumstantial and it changes. And so, I guess one theme is like you really have to, and it sounds kind of corny, but it's like you have to work together and you have to combine those perspectives in order to scratch at the surface of those bigger ideas. (Kevin)

I think this idea of having to collaborate with different disciplines, that is the key (…) Different departments all have something to say, and maybe one has the highest relevance to you. But if you're actually going to do something that's worth it you have to consider almost all the parts. Even if it seems hard, or even impossible and you can't do that, you can. It just takes effective communication and long planning. (Tanya)

Perspective-Talking Through Guided Role-Playing

"There is no one answer, or one way, or one thing. It just depends on how you're looking at it, and how you're communicating it" (Olivia)

Not only did students articulate the importance of interdisciplinary approaches for more adequately addressing complex topics, but as elucidated in the above exchanges we also found numerous instances in which students stressed the importance of broadening their perspectives. Broadly speaking, perspective taking involves "viewing a particular issue, problem, object, behavior, or phenomenon from a particular standpoint other than your own" (Repko et al., 2017, p. 165). These are the cognitive and social skills individuals require to understand how other people think and feel, and are essential in appreciating and taking on conflicting points of view. For example, Tanya's comment explicitly links the importance of collaboration between different academic departments to the opportunity to broaden one's

perspective. Similarly, Kevin noted that an individual's understanding of an issue is "circumstantial and it changes."

Perspective-taking is acknowledged as central to engaging in interdisciplinary work and is also linked with values or attitudes synergistic to interdisciplinary work such as open-mindedness, tolerance, humility, empathy, appreciation for diversity (Repko et al., 2017), rejection of dualistic solutions, ability to seek common ground (Newell, 2010), and an expanded recognition of their own worldviews (Augsburg et al., 2013). When applied to interdisciplinary collaboration and research, perspective-taking typically involves analyzing a problem from the perspective of each involved discipline and being able to identify the similarities and differences between them. It enables individuals to recognize, understand, and ultimately integrate multiple ways of knowing or investigating. Through perspective-taking practice, individuals can increase their ability to understand the differences between disciplines, become more aware of academic and personal biases, and engage in the type of role-playing that allows us to appreciate and recognize the contributions of alternate perspectives (Repko et al., 2017), all of which are essential to interdisciplinary work.

Creating opportunities in the classroom for students to engage in perspective-taking processes was a central instructional goal of the design process. The co-convening organizational structure of the course was intentionally selected to allow for students and faculty from the three disciplinary-specific sections to be brought together on a regular basis to engage in guided cross-disciplinary discussions and projects. Specific pedagogical approaches such as the jigsaw technique and engagement with collaborative group projects were further used to promote the exchange of ideas and push students' thinking further on an issue through the integration of multiple perspectives. For example, in the co-convened sessions, students engaged in disciplinary role-taking as they were asked to assume a specific disciplinary position in their approach to a particular text or question. To illustrate this, in Week 7 of the course, the instructor team assigned all students a common text, Rachel Carson's book *Silent Spring (1962)*. Students in each course were led through a process of examining this text from the lens of their assumed disciplinary background (i.e., the tools, concepts, and methods of the discipline represented by their course).

Following these three to four discipline-specific class meetings, students then worked in cross-disciplinary groups to share this thinking with their peers. Specifically, students instructed their peers on how the insights and tools of their discipline informed their interpretation of the text, and worked collectively to integrated these ideas to contribute to a deeper overall

understanding. A few students, including Kaitlin, specifically described how the course structure demanded disciplinary role-playing and pushed them to engage with multiple perspectives:

I think it was just coming together and looking at those different sources and seeing how all these different approaches can make up one thing. And I get sort of a bunch of epiphanies throughout the entire co-convened session just because like the Natural Sciences would approach it from the way that I didn't think was even possible, or like the humanities. And yeah, I just think it's cool to see how we all just approach it differently and then come together. (Kaitlin)

A similar role-taking process was undertaken in the final project as students worked in cross-disciplinary teams to approach a contemporary question of their choice from multiple disciplinary insights. This pushed students to consider the multiple and varied ways in which scholars might approach a complex real-world question. By creating opportunities for students to engage with and apply different perspectives to the same concept, text, or big idea, instructors demanded that students consider how others might look at the same thing in a different way. Our conversations with students suggested that these role-taking and collaborative pedagogies additionally promoted self-reflection on bias and an increased appreciation for multiple ways of knowing.

Appreciation for Multiple Ways of Knowing

One of the desired course learning outcomes outlined in the syllabus is that students would reflect on and recognize their own biases and develop an increased appreciation for cross-disciplinary collaboration and multiple ways of knowing. Our initial conversations with students suggested that this occurred in various ways. For example, Vanessa described how looking at a topic from multiple perspectives, including the perspectives of her peers, developed a deeper understanding her own field of study, and the ways in which her approach to a topic might differ from her peers as a result:

Getting the perspectives of others has been really helpful in me understanding my own scholarly area as well. Like allowing me to compare what my answers are to theirs, and what my theories are to theirs. (Vanessa)

Meanwhile, another student specifically articulated how the course challenged her to rethink her preconceived bias towards STEM, and more fully appreciate the insights of other fields of study:

I would say that it [the course] has had an impact on how I think. The co-convened really showed me that we're not all these separate entities all the time. If we work together as a group we can achieve a lot more, and I think that's something that I'm going to be more open to. I don't know how to put this in a nice way, but I never really understood social sciences and humanities. I don't think I fully understood that they had a greater role. I've come from a science-oriented family and a business-oriented family, so those are just like 'okay we look at the facts. This is how it's going to be done, right?' And humanities and social sciences, I didn't think had those aspects to them. And I think this class really showed me that there are other aspects of those majors and areas that I didn't appreciate before. (Joan)

Perhaps most illustrative of this is Denise's reflection on how the role-playing exercises underpinning the course shifted her thinking when approached with an end-of-course activity. At the start and conclusion of the course the same case study was presented to students. In this activity, students were informed of a major change being undertaken at the university and provided with a series of professional insights and concerns from diverse stakeholders on campus. Students were then asked to consider the merits of these insights and describe how they would move forward with addressing the proposal. I asked Denise about her experience with this activity and she described how her approach to the task changed as a direct result of having engaged in the role-playing exercises throughout the course. She described how she found herself "more open-minded" to reading and considering the various disciplinary contributions at the conclusion of the course, compared to the initial activity. When I followed up to ask why she felt this way, she explained that she noticed herself paying more critical attention to each of the included insights to try to understand each member's approach or contribution by intentionally considering how each person might view the issues. When I asked why she felt her approach had changed she replied:

I think because I had spent an entire semester listening to each of those perspectives. I think that really changed it. Actually [the instructor] said it. He said, 'It's like really empathy that you're going at with each of the disciplines, like imagining okay, if I was in the shoes of this, or if I was in the shoes of this, like how would this affect it?' So, I think that that is what had the most influence on how I changed my perspective. (Denise)

While existing tools are limited in their ability to measure growth in perspective-taking abilities, these accounts provide encouraging evidence that structured and intentional role-playing strengthened through the jigsaw technique can support perspective-taking behaviors and appreciation for multiple ways of knowing. While further research is needed to examine the role of interdisciplinary pedagogies in promoting perspective-taking processes and appreciation for multiple ways of knowing, these findings have promising implications for future iterations of this co-convening and co-taught course design.

Value for Learner-Centered Instruction

Our conversations with students revealed preconceived understandings about general education courses which contrasted with their experience in the pilot course. The students we spoke with overwhelmingly indicated a sense of obligation and low expectation for learning when enrolling in general education courses. Participants contrasted the collaborative nature of the pilot course with the lecture-based style of instruction they experienced in the general education program. Several students, including Natalie and Kevin, conveyed appreciation for the type of thinking afforded within this course model:

I like when I have to think in my Gen Eds. I know a lot of people who take their Gen Eds because they want them to be really easy. But in the case of this one, I like how I left every day thinking about what we had talked about rather than leaving and moving on to the next thing. I felt more stimulated I think trying to sort of like fit the puzzle pieces together. (Natalie)

I was really happy to see the way it did work out, because when I went into it I just thought it was another honors, you know 'Gen Ed', and that you would just be taking the class and you would have a project or papers and stuff. But I didn't suspect that we would be working with two other classes, and then also working with the students in those classes to create a final project, a proposal, a presentation and everything. So, it was it was more than I expected. And it was it was more work, but it was good work. (Kevin)

Kevin's comment further highlights a mismatch between the type and amount of work he expected from the course based on prior general education coursework and the actual expectations of the course. It seems that for several students, the type of work expected in the course was more demanding than

prior general education experiences, and did not match their expectations when enrolling in the course. As described by Sienna:

Last semester. I had a Gen Ed that literally I would sit down, listen to the guy and then I'd take a test at the end of the semester and get like an A on it (…) this one I had to work a lot more for it, and there weren't even any tests. (Sienna)

This presents an obvious challenge when considering the preparedness and expectation of effort students are bringing to these new collaborative course structures. If students believe that the general education program is fundamentally easy and requires minimal effort, then the high level of critical thinking and collaboration required to be successful in this new course model is likely to cause frustration and possibly deter students from participating, or enrolling in another course using this model. This reaction was illuminated in my continued exchange with Sienna:

Interviewer: Do you feel that you would enroll in another course using this model in the future?

Sienna: Maybe. As harsh as it sounds, I was expecting this Gen Ed to be like an 'easy A'. That's why I took it in the beginning, because I need Gen Eds like a cushion. After the first month, I realized it's a lot more work than I was willing to put in. That's why it impacted me in a negative way. So, I did like the co-convened stuff, but it was so much work for a gen Ed. The incentive was that it was an Honors course, so you know what you're getting yourself into, but at the same time like it's a Gen Ed!

Moving forward, it is important that faculty consider student expectations regarding the level of effort and type of thinking in general education courses. New courses designed using collaborative learning strategies should acknowledge and address early on some of these biases that students carry.

While the level of engagement required in the course may have been greater than other general education experiences, or at least greater than some students anticipated, this does not seem to have influenced students' overall satisfaction or interest in the course. In contrast, we found that student interest in the course was notably high. A word frequency query run against student interview transcripts illuminated the following words at the forefront: *Interesting (154); Fun (42); Enjoy (32).* Existing research shows that learner

interest plays a key role in increasing student persistence and cultivating motivating learning spaces (NASEM, 2018a) and we find the use of the word 'interesting' to describe their learning experience 154 times across 15 interviews to be promising insight, especially when contrasted to low expectations of general education courses. Students' general satisfaction with the course was corroborated by the fact that 12 of the 15 interviewed students said they would like to take another class using this model in the future. Overall students overwhelmingly appreciated the student-driven nature of the course, and the multiple opportunities afforded to them to provide their input in both the small course sections and the co-convened sessions. Students perceived their active participation in the learning and knowledge production process as a valuable aspect of the course, and this was often portrayed as a contrast to other classroom experiences. The sharp contrasts drawn by students suggest that this curricular model helps to center the student in a way that is distinct and rewarding for them:

The biggest difference between the other gen ed I was taking and this one was that in the other one it was the teacher talking at the students and telling them whatever. But with this one it was… I want to call it Socratic. The teacher was more of a steward of what topics we'd be discussing. (Mark)

I mean, I'm used to taking Gen Ed's that are in lecture halls, where like discussion is a very small part of the actual curriculum. So actually, getting to know the people in my group, being able to talk as a class to hear everybody's opinions rather than just the narrative of the lecturer, I think that's really beneficial. (Denise)

Existing research shows that learner-centered teaching is linked to various positive student outcomes including improved critical thinking skills, increased motivation to learn, deeper learning and transferability, greater leaning satisfaction, and increased retention and persistence (Blumberg, 2019). Yet despite the strong narrative and push for learner- or student-centered teaching in higher education (Blumberg, 2019; Pascarella & Terenzine, 2005; Weimer, 2013), our conversations with students show that in many courses, especially within the current general education program, students continue to perceive that their input and engagement remains limited. This was succinctly articulated by Lexi:

I feel like it's a much different way of teaching than we're used to and format, and it becomes much more student and conversation driven which I think can be really enlightening and full of growth in its own way. (Lexi)

Later in the conversation with Lexi she described her experience in the classroom as "a very safe space for us to be able to talk and share our opinions and constructively criticize other opinions and other perspectives" and noted that while normally she would be "terrified" about raising her hand in the middle of such a big class she felt comfortable engaging in the large co-convened sessions. When I asked her to expand on the conditions that made the class feel like a safe space for her she quickly emphasized the role of the instructor:

[The instructor] makes it clear that your opinion is valid no matter what it is. And he is interested in hearing everybody's opinion. And is kind about it. And I have definitely had professors who are not like that. And I think it's really important for professors to make it clear that students' voices are valid. I think that's a really powerful thing that professors can do. (Lexi)

As exemplified in this exchange and others, the instructor team played a critical role in facilitating classroom conversations and activities. When we asked students how they perceived the role of the instructor in the pilot course nearly all referred to the instructor as a "guide" or "facilitator." For example, Denise described the instructor as a facilitator who "gives us the information, asks a couple of discussion questions just to spark it [the conversation], and then we go from there". This characterization closely mirrors the existing scholarship on collaborative classroom pedagogies, which shift the role of instructor away from lecturer – or transmitter of knowledge – to facilitator or learning guide. Evidence shows that doing so allows learning to take new directions based on what learners bring to the table, while simultaneously helping to steer the conversation to promote deeper learning (Blumberg, 2019; NASEM, 2018b). While the role of instructors remains of high importance in learner-centered teaching, the emphasis is on guiding students to create "safe, respectful, and inclusive environments that facilitate student learning" while allowing students to create meaning of the content (Bloomberg, 2019, p. 4). While creating safe learning environments should be standard instructional practice, this is especially important when promoting interdisciplinary approaches as students are asked to seek out and embrace new perspectives that they may find uncomfortable while also reflecting on the weaknesses of the perspectives

they favor. Such learning "calls for students to be open to the possibility of discovering they are not as competent, smart, or capable as they had hoped" (De Greef et al., 2017, p. 138). Echoing Lexi's earlier testament of the importance of instructors creating space for students to actively contribute in class, several other students including Kevin, commented directly on the important role of the instructors in guiding the conversation and ensuring a positive classroom environment:

The professors did a good job at directing us, at guiding us through the co-convenes, but they didn't run it, per say. Like they didn't mandate or micromanage anything. They were there to start us off, but once the students got going it really felt like we were the ones running the section (...) It didn't feel like some kind of high school-esque, you know, stereotypical teacher-student kind of thing. It felt more like a productive section where the instructor was the guide and we would just explore these ideas in a really safe place. (Kevin)

Disengagement and Loss of Direction

While instructors played a key role in guiding class discussions by providing students with shared texts, implementing collaborative structures to ensure everyone had something to contribute (i.e., jigsaw technique), and establishing a receptive and kind classroom environment, the collaborative pedagogical approach remained a source of contention for some students. Specifically, some students expressed frustration or confusion regarding the heavy use of student-directed conversations. This was most vividly captured by Mason who felt class discussions were so heavily directed by students that at times they no longer reflected the content or theme of the course. He provided the following example, among others, of a class conversation gone astray to illustrate his point:

The class just evolved into the efficacy of testing on animals, which is not what the discussion was meant to be about. You know? Again, it's fine to have these discussions, but that's not what the class was about. And I think that sort of disconnect was just frustrating (...) it really just made the class feel like it had lost itself. It didn't know where it was. The class had lost its direction. (Mason)

This frustration captures the challenge, and possible shortcoming, of asking students to direct a conversation in which they may have only a surface-level understanding of the material. While the jigsaw technique is designed to encourage students to contribute their 'expertise' in a specific area

of the learning content, this highlights a key challenge of designing interdisciplinary educational initiatives that occur prior to students developing depth of knowledge in a specific area. This is also reflected in the varied schools of thought regarding the appropriate time to introduce interdisciplinary instruction, including debates on the value of breadth versus depth of disciplinary integration (Repko et al., 2017). This highlights a fundamental challenge of this course model, as it asks learners to take on a new role (in this case a specific disciplinary lens) that they are unfamiliar with or likely understand only at a surface level. In some cases this role-playing strategy resulted in students feeling they were unable to contribute valuable disciplinary insights, or uncertainty about whether their contributions were accurate. This was captured by Marissa who commented on how her own lack of knowledge regarding photography, the specific disciplinary area she was asked to represent, posed a challenge when engaging in the jigsaw structured peer exercises:

We are all just learning new things in this class. I feel like no one was really completely comfortable in what they were talking about. Because as much as like a few hours a week in class teaches me about photography, I'm ultimately like not a photographer. I'm not fluent in that language. I'm not fluent in that subset of Fine Arts. (Marissa)

Or perhaps as more succinctly expressed by Sienna:

We talked a lot, and sometimes I didn't know what I was talking about. I was BS-ing it. (Sienna)

A few students specifically suggested that future iterations of the course provide more structure to class discussions in order to maintain focus on the intended topic and provide clarity for students regarding what is expected from them:

I felt that class time where there wasn't things assigned, it didn't feel as effective. It didn't feel like the direction of conversation was really based on anything. It's was just kind of general. (….) There was a week where I was like I don't know what we're doing. Well, you know, I'm not sure what we're talking about. (Tanya)

I'd say maybe slightly more explicit direction on what the topics are about. More specifically, what the topics we are supposed to present to our classmates are about. I know that there seemed to be a lot of confusion (Lexi)

Some students also made reference to feeling that certain students drove the conversation at the exclusion of themselves or others, suggesting that instructors may need to consider new strategies for engaging students who do not actively engage in this discussion-style format:

I don't know if you noticed but in our class it's only like three people that ever speak up. I want to speak up, but I also don't want to be that kid. (Sienna)

It definitely felt like there were the same three people talking in the class, and I felt like our professor genuinely loved listening to what they had to say (…) I just felt that sometimes it was like there was no conversation really, it was just a one-sided conversation like the one I was talking about earlier. So that was like one of the big challenges. (Simone)

These narratives highlight some of the distinct challenges that stem from the collaborative and student-centered nature of the newly proposed model that will require creative instructional strategies to mitigate. While earlier we underscored the high frequency of the words *interesting*, *enjoy*, and *fun* used by students to describe the course, it is also important to note the frequency of the following words: *Difficult* (22); *Challenging* (40); *Confusing* (24). While overall impressions of the course were positive and students expressed interest in pursuing similar interdisciplinary learning experiences and course structures, the course was not easy or without challenges for students. In addition to the challenges previously noted, students expressed confusion about expectations during classroom discussions and assignments, a lack of cohesion between the three separate sections that strained group work, and weak connections to the big idea, which undermined their ability to integrate content across course sections.

CONCLUSIONS AND IMPLICATIONS

As institutions of higher learning shift towards more integrative curricular structures it is vital that student learning remains central to this conversation and that students are actively involved in the evaluation of these teaching and learning processes. While important work has been done to incorporate the student perspective in the evaluation of interdisciplinary team teaching models (Juris et al., 2014; Looft & Myers, 2019; Nungsari et al., 2017; Self

& Baek, 2017; Yanamandram & Noble, 2006), student feedback predominately occurs through post-course evaluations/surveys containing questions about students' perspectives on interdisciplinarity and their experiences with specific course features. Consideration for how students are experiencing interdisciplinary team teaching learning environments is not a common focus of analysis. This study contributes new knowledge by centering on the experiences and perceptions of students.

Drawing on qualitative interviews with 15 Honors students enrolled in a team-taught interdisciplinary general education course, we examined how this particular course model influenced the student learning experience and promoted opportunities for the development of interdisciplinary approaches, as seen through the eyes of learners involved in the course. Similar to Noy et al. (2017) we find that students largely affirm the values of interdisciplinary education and collaboration, and see the positive impact of exposure to new perspectives. In particular, they emphasize the importance of utilizing interdisciplinary approaches when addressing contemporary big questions and/or challenges, and they independently draw parallels between what this process would entail and what was asked of them in the course (e.g. consulting others, acknowledging bias, considering multiple perspectives, collaborating with peers).

We also found evidence that this course model is well-aligned with the instructional goal of promoting perspective-taking skills and behaviors among students. Specifically, the co-convening organizational structure and collaborative pedagogical approaches underpinning the course, such as the jigsaw technique, provide various opportunities for students to engage in structured role-taking, as they assume specific disciplinary positions to approach to a common text or question. Existing scholarship notes the jigsaw technique as a tool to facilitate interdisciplinary learning for its alignment with interdisciplinary instructional aims (De Greef et al., 2017; Rives-East & Lima, 2013) and its ability to break down complex problems into more manageable pieces that students new to interdisciplinary problem solving can more readily handle (Dezure, 2017). Our conversations with students provide encouraging evidence that the use of structured and intentional role-playing afforded by the jigsaw structure promotes perspective-taking behaviors including appreciation for multiple ways of knowing. Perspective-taking is widely acknowledged as a foundational competency for engaging in interdisciplinary work (De Greef et al., 2017; Newell, 2010; Repko et al., 2017), and these findings have promising implications for future interdisciplinary curricular initiatives aiming to develop learners'

perspective-taking competencies using similar collaborative classroom pedagogies.

The collaborative and student-centered nature of the course design is overwhelmingly perceived by students in the current study as interesting and valuable to their learning. Several students specifically note how instructors value their input in class conversations. This contrasts with students' prior classroom experiences, particularly within the general education program, in which they perceived dominate instructor knowledge and limited contributions from students. These findings resonate with existing research theorizing that learners who have control over their learning environment are "more likely to take on challenges and persist with difficult tasks, compared with those who perceive that they have little control" (NASEM, 2018a, p. 117).

However, making learner-centered teaching work in an effective manner is not simple, and some students in the study suggest that the lack of guidance provided by instructors hindered their learning process and led to feelings of confusion, loss of direction, and frustration with peers. These findings suggest that while instructors play a crucial role in enabling constructive and meaningful classroom discussions, they are also tasked with the complicated role of balancing the openness of learner-centered collaboration with the necessary level of guidance, structure, and scaffolding needed to foster deep learning. Prior research has revealed that students often self-report struggling with learner-centered approaches early on, but are more likely to perceive them as beneficial with continued exposure and experience (Weimer, 2013). While this study elucidates the wide range of experiences reported by students in the course, it is also important to consider how students' prior learning experiences may have prepared them for this type of collaborative and learner-centered instruction. As we continue to push for more effective and meaningful interdisciplinary learning experiences for our students the goal is not to create innovative stand-alone classes, but rather to create an integrated set of learning experiences which collectively develop students' capacity to thrive in collaborative, interdisciplinary, learner-centered environments.

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