

## **Elevating Student Voices in Collaborative Textbook Development**

**Leah M Wiitablake, Clemson University**

Leah M. Wiitablake is a current doctoral student in the Engineering and Science Education department at Clemson University. Her dissertation research focuses on undergraduate student interest and perceptions, in particular, the perceptions of and interest in the geosciences from students from traditionally minoritized groups. As a graduate research assistant, Leah has worked on designing and assessing virtual reality field experiences for introductory geology courses and is currently involved with educational research focused on the collaborative development of robotics textbooks as open educational resources.

**Amber Taylor**

**Landry Samuels**

**Jalani Ziad Eanochs**

**Caleb Jovan Hardin**

**Shi'ron Williams-Mattison**

**Samuel Cole Fambrough**

**Dr. D. Matthew Boyer, Clemson University**

Boyer is a generalist in the learning sciences, with a PhD in educational psychology and educational technology. His interests focus on effective knowledge building and transfer with digital technologies. His current work involves how STEM knowledge and skills are developed in technology-enhanced learning environments.

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## **Abstract**

Traditional proprietary textbooks for undergraduate students often cost hundreds of dollars and create barriers to learning by restricting which and how many courses students take and forcing students to decide whether or not they purchase their textbooks [1], [2]. Having low-cost or free alternatives for course textbooks helps give all students access to learning materials and can lower barriers such as affordability and retention [3], [4]. Such alternatives to traditional textbooks are considered Open Educational Resources (OER). OER can be comparable in quality to traditional textbooks [5]. Given the proper context, they have been shown to lower the number of D, F, and Withdrawal letter grades, or DFW rates, in classrooms [3]. This evidence, showing the potential for OER to improve student learning outcomes, informed our intention to bring students into designing OER.

This paper describes the design and implementation of our model for the collaborative development of OER that intentionally integrates undergraduate student perspectives. Situated in a U.S. Department of Education grant-funded interdisciplinary, cross-college project creating OER in the form of three robotics textbooks. We focus on the work of the Collaborative Design Team, composed of undergraduate students from project partner institutions, a graduate Research Assistant, and a faculty member from engineering education. Specifically, we share the process of elevating and incorporating undergraduate student voices into the design of OER content authored by graduate students with subject matter knowledge in Robotics. We discuss our process for reviewing each chapter of the OER textbook, including readings to prompt student thought and reflection, and how we leverage the Universal Design for Learning (UDL) Guidelines [6] for examining the chapters for learner-centeredness. We highlight the benefits of including students in creating learning materials, such as how students know what works in teaching and learning and what falls short. As such, incorporating student feedback can infuse materials with learner-centered elements and provide opportunities to improve how textbook-based OER presents information, perspectives, and ways of thinking about the subject matter in ways that traditional textbooks often lack.

## **Introduction**

With a small number of publishers controlling most of the college textbook market and students being unable to control which textbooks are assigned to a course, prices for traditional college textbooks continue to grow at incredible rates [2]. For example, rates for textbooks in the decade following the year 2006 were more than four times that of inflation [2], while undergraduate students are now estimated to spend over \$1,000 per year on textbooks [4], [7]. Responses to surveys show student discontent with high textbook prices. For example, in a survey by Martin et al. (2017), 54% of comments by students regarding textbooks were negative, often regarding textbook buyback prices, required new editions, and limited textbook use in the course after purchase. Findings from the same survey also indicate that faculty are willing to move to OER with support from their institutions [8].

A report from the OER Research Hub by de los Arcos et al. (2014) investigated several hypotheses regarding OER, such as if OER improves student performance and access. They found that students report an “increased interest in the subjects taught” when using OER. Notably, a greater number of students rated “agree” or “strongly agree” to the statement “Use of OER leads to improvement in student performance and satisfaction” than did educators [9]. Overall, de los Arcos et al. (2014) present evidence that using OER resulted in better learning, greater access to the general public, and was better for students financially, though retention was not affected much by OER practices. Knowledge available to the public was also accessed mainly according to need, despite the wide range of resources they could access. Also, supporting resources did little to affect how well independent learners learned (or did not learn) the material.

Similarly, a meta-analysis by Clinton & Khan, (2019) found lower withdrawal rates in courses with open textbooks, as well as no difference in learning performance between courses with open textbooks and those with traditional textbooks. Paskevicius (2017) discusses open pedagogy and OER, and suggests that students involved in open pedagogical practices may have higher engagement in their learning. Open pedagogy can promote collaboration between educators and students when combined with lessons and learning objectives that push towards farthing knowledge for all [11].

By including students in the process of developing learning materials, educators leverage similar notions as those invoked with “no taxation without representation” and “nothing about us without us” [12]. For example, encouraging the involvement of students in the developmental process of creating learning materials, in this instance OER, may be a way to increase relevance of material and quality of resources. Undergraduate students, having been in the U.S. education system most of their lives, have first-hand experience and background knowledge on what works and doesn’t work in the classroom from a student perspective. When given the space and support to share, students recall past educational experiences and elaborate on challenges and, most importantly, solutions. Involving students in OER development has the potential to address equity concerns and increase representation of diverse perspectives and experiences in OER content. It also benefits the quality and relevance of OER content and involves the students themselves in terms of experiential learning and skill development.

### **Collaborative Development of OER**

A U.S. Department of Education grant, Open Textbooks Pilot Program, funds this work. The grant consists of an interdisciplinary team of individuals across three colleges and universities collaboratively creating three OER robotics textbooks. An OER librarian leads the grant from University 1 (see Wiitablake, Boyer, et al., 2022 for more information regarding the structure of the grant). Here, we will discuss the efforts of the Collaborative Design Team undergraduate students from two of the three universities, all located in the Southern United states. The Collaborative Design Team comprises individuals from two universities (Figure 1). University 1 is a public, R1, Primarily White Institution (PWI) with which the Research Assistant, Faculty Member, and two contributing undergraduate researchers are associated. University 2 is a private university that belongs to the Historically Black Colleges and Universities (HBCU) classification, to which the remaining four contributing undergraduates are associated.

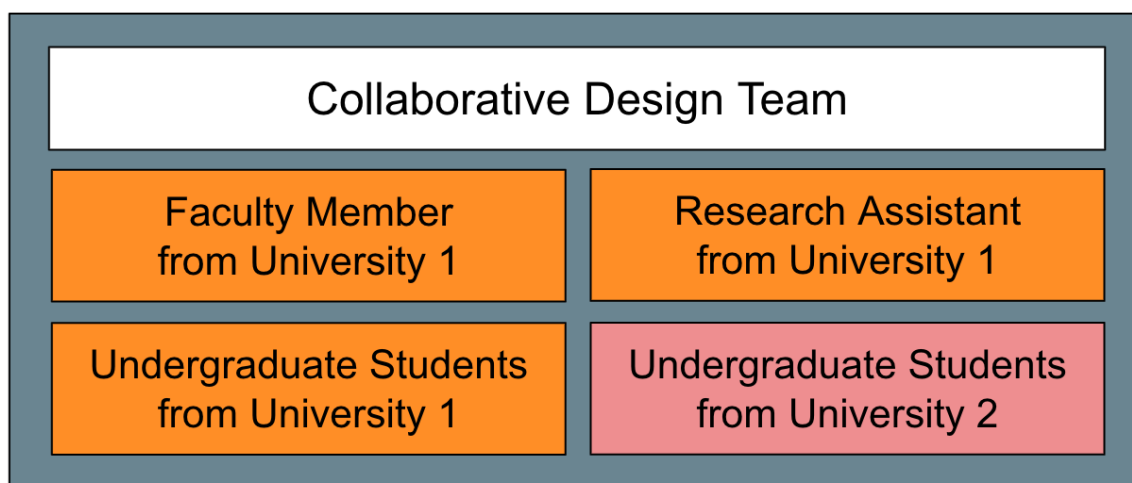


Figure 1. Composition of the Collaborative Design Team.

### Design and Implementation

The grant was designed to intentionally integrate undergraduate student perspectives in the development process of creating these open robotics textbooks. As such, the purpose of the Collaborative Design Team is to review the OER robotics textbook chapters produced by the authoring team, specifically looking for places to incorporate learner-centeredness into the material. The undergraduate students, who review the textbook chapters using their background knowledge and experiences as a lens of what works in an academic setting and what can be improved, are the key pieces in constructing learning materials that have higher efficacy. This background knowledge and experience that students bring to the project is then complimented by introducing the students to the UDL Guidelines [6]. Readings to orient students included online articles on learner-centeredness, UDL guidelines, curriculum development and instructional design, learner-centered design, multimedia learning, open education, and research methods for document analysis (see Table for the list of topics and links).

Table. Selected online articles to orient students on the project. Full-citations are included in the References.

Topic	Citation	Link
UDL Guidelines	[6]	<a href="https://udlguidelines.cast.org/">https://udlguidelines.cast.org/</a>
Learner-Centeredness	[14]	<a href="https://www.learnupon.com/blog/learner-centered/">https://www.learnupon.com/blog/learner-centered/</a>
Curriculum Development and Instructional Design	[15]	<a href="https://online.ndm.edu/news/education/curriculum-development-instructional-design-process/">https://online.ndm.edu/news/education/curriculum-development-instructional-design-process/</a>
Learner-Centered Design	[16]	<a href="https://opentext.wsu.edu/theoreticalmodelsforteachingandresearch/chapter/learner-centered-design-theory/">https://opentext.wsu.edu/theoreticalmodelsforteachingandresearch/chapter/learner-centered-design-theory/</a>

Learner-Centered Design	[17]	<a href="http://cei.hkust.edu.hk/teaching-resources/learner-centered-course-design">http://cei.hkust.edu.hk/teaching-resources/learner-centered-course-design</a>
Collaborative Design	[18]	<a href="https://www.netsolutions.com/insights/why-collaborative-design-to-build-products/">https://www.netsolutions.com/insights/why-collaborative-design-to-build-products/</a>
Multimedia Learning	[19]	<a href="https://ctl.wiley.com/principles-of-multimedia-learning/">https://ctl.wiley.com/principles-of-multimedia-learning/</a>
Open Education	[20]	<a href="https://sparcopen.org/open-education/">https://sparcopen.org/open-education/</a>
Document Analysis	[21]	<a href="https://lled500.trubox.ca/2016/244">https://lled500.trubox.ca/2016/244</a>

The students, being from two different universities, were offered to contribute to this project as part of an inquiry course and received course credit (those who attended University 1), or compensated monetarily as part of hourly contract work (those who attended University 2). Both groups of students were told about the compensations of time for the students from the other university. The students were mentored for a one-hour period once a week. Due to scheduling conflicts, the groups (one group for each university) typically met separately, though there were opportunities for cross-group fertilization between student groups. The first group of the week met with both the Faculty Member and the Research Assistant, while for the second meeting of the week the students met with only the Research Assistant, with occasional drop-ins by the Faculty Member. A timeline of when the groups from the two universities participated in the project can be seen in Figure 2.

Spring 2022	Summer 2022	Fall 2022	Spring 2023
<b>University 1 Group 1</b>		<b>University 1 Group 2</b>	
<b>University 2 Group 1</b>		<b>University 2 Group 2</b>	

*Figure 2. A timeline of when students from both universities participated in the project.*

The students from both universities were assigned tasks weekly, with a completion deadline of the following week. Tasks varied from readings, reflections, annotated bibliographies, and group discussions. Following this introduction to learner-centeredness, pages from a chapter of the OER textbook in development were assigned weekly. Students were assigned to read over and comment on the text-in-progress, with an emphasis on identifying pitfalls and, more importantly, proposing solutions based on their past experiences and the readings.

Ideally, the essential aspect of the grant is the student participation and feedback in creating these textbooks. As such, highlighting and elevating student voices is critical to this project.

## Elevating and Incorporating Student Voices

Students possess a wealth of knowledge about education and educational experiences that, for the most part, is overlooked as a resource when developing materials [22]. By allowing students to examine and reflect on how information is presented to them as students, they not only grow in recognizing their own academic experiences, but their knowledge of classroom pedagogy expands. Bovill et al. (2011) suggests the following characteristics as ways to integrate students into design; inviting students to be collaborators, supporting dialogue between students and developers, fostering collaboration by allowing for teaching and learning responsibility, and serving as facilitators between students and educators.

As part of this research, we feel it is important to highlight students' own words. Students have much to bring to the academic table, and elevating and disseminating their ideas and knowledge is a priority. This paper is meant to expand on prior work where the students discussed what UDL and learner-centeredness are and why these are essential additions to academia and learning (Wiitablake, Eanochs et al., 2022). As such, the lead author asked those who have participated or are currently participating in the grant as part of the Collaborative Design Team to reflect on their experiences with the project. The idea was to leave the task open for interpretation, though prompts were supplied to all students to get started with the writing. In addition, meetings were set up as-needed, with students being able to choose whether or not they needed additional guidance from the Research Assistant. These approaches allowed the students to take the initiative in the writing process and agency over their contributions. Below, you can read their thoughts on the project.

Undergraduate 1:

*Participating in the [University 1]-[University 2] OER project was a great benefit to me as an undergraduate student because of the great wealth of information made available to me. I believe that it is very important that students understand, to some extent, how they are being educated. Students, being responsible for the information that they consume, should be able to assess the quality of their education. Reading the information surrounding the Universal Design for Learning theory, as well as the correlating OER theory, helps me to properly criticize the quality of the pedagogy that is used in postsecondary education.*

*I think the reason I participate so much in this project is a combination of the beauty of educational theory and the great cooperation between [University 1] and [University 2]. I absolutely enjoy learning about the various advancements made to ensure that the public can have free, unrestricted access to information. I also feel, as a matter of speaking, honored that I have a place in the advancement of education for students everywhere. My superiors at [University 1] have also made the entire process enjoyable and fulfilling. Given the great way that they have structured the project, my tasks seemed to be educational discovery projects instead of more work. They also ensure that I gained experience regarding the proper reading and interpreting of academic articles and journals. For example, a professor from [University 2] sent my colleagues and me books on robotics that we were able to keep for several months for research. With this additional*

*information, I made specific edits in the sections regarding robotic kinematic motion. In addition to the great advice I was given regarding doctoral programs, I feel that I will be more competent as a researcher.*

*Regarding other institutions copying this model, some suggestions include direct communication between the student reviewers and the textbook authors. If direct communication cannot be conveniently facilitated, the authors should include notes in more technical sections explaining why the technical information is included. The largest problem that student reviewers may have is the lack of operating knowledge in the reviewed subject. In other words, the students understand the fundamentals of the subject matter but not to a degree where they are able to concisely verbalize this information in text. As a result, reviewers tend to make edits that identify the problem, but do not specify a viable solution. Communication with the authors will resolve this problem by simultaneously educating the reviewer more intuitively and allowing the author to more tailor their writing to learning students. This, by definition, satisfies some of the requirements of UDL.*

*Other suggestions include ensuring that the student reviewers clearly understand the end goal of their tasks. As an example, if an institution decides to write a textbook regarding 3D printing to train technicians at an automotive company, the reviewers should understand the products that the company produces. More importantly, the work environment, as well as the level of initial expertise the company expects, should be understood by the reviewers. In this way, the edits made (as well as the original written content) will be directly tailored to the work environment.*

*I personally believe that knowledge and the access to knowledge should be free and open to everyone. By extension, those that can and want to understand knowledge should have every available resource to learn. However, given the current structure of the educational system, most knowledge is limited in some way. If there are no restrictions to this information, its quality could be substandard. Even though these disadvantages are not intended, the effect that it has on the public and on students is detrimental. The general solution to this problem is to encourage an environment of learner-centeredness. This is facilitated by resources that are easy to access. Thus, programs such as this are very important in the process of solving many of the educational problems that are present today.*

Undergraduate 2:

*The [University 1]-[University 2] OER program is like a whole new pair of glasses. It gave me a new perspective of how the educational process could be, and just maybe, should be. One of the things I enjoyed most came after each of our discussions. After these meetings, I would then go to my lectures equipped with the UDL guidelines in mind or a better understanding of what*

*learner-centeredness is. I then could see why I did not understand the material being taught.*

*What if I just needed better representation of the material, more engagement, or a different way to express what I was learning. This is the approach I took when helping develop this textbook. Being a student and helping with this project gives us an advantage, and a unique opportunity to create a textbook that solves an issue that many students struggle with today. Some of these issues could be that the book is simply out of touch with how different things are taught today in the classroom with smart boards, interactive group settings, and all the other fancy gadgets we have (computers, iPads, etc...). Students reading this textbook will feel heard and excited to use this textbook because it was developed by their peers who had them in mind.*

*Finally, I know that all students would appreciate the opportunity to have access to a textbook that is an OER, which could save them hundreds of dollars. There are certain classes now that you don't have an option to not buy the textbook because access to the homework is included. This would then restrict you from having access to the homework if not purchased. For this reason alone, it is indicative of the importance of OER.*

#### Undergraduate 3:

*My experience on the OER project was very positive. As a student it made me feel heard and made me feel like I was making a textbook that for the first time I could understand completely. We worked alongside [Research Assistant] and [Faculty Member]. They taught us how to be respectful and intellectual in our annotations and studies. We learned the OER guidelines and the future of how we as students could learn. I looked forward to every Thursday because it helped me feel heard and look forward to education.*

#### Undergraduate 4:

*Throughout my time on the Open Educational Resource (OER) Project, I had the opportunity and privilege to learn about different learning styles and techniques that are centered around the learning methods based upon the Universal Design for Learning (UDL) guidelines. Within this framework, teachers can accustom their learning approaches to the needs and challenges of their students. This method of teaching is designed to eliminate the barriers to learning regardless of age, race, gender, ability, disability, cultural background, and socioeconomic status [24]. Within the United States of America, nearly 1 in 5 people have some form of a learning disability [25]. In addition, the recent COVID-19 pandemic has affected students' ability to learn and the teaching environment across the nation in an unprecedented manner [26]. These two circumstances are examples of the many obstacles that can be heavily impacted by the UDL principles inside and outside the classroom. Firstly, my colleagues and I uncovered that many of the problems that affect students' ability to learn stem from a multitude of factors externally and internally which include cultures, learning disabilities, internal*



*motivations, personal relationships, and financial situations. Secondly, we determined that classrooms should implement the UDL guidelines through a strategic and comprehensive approach. This approach would incorporate the principles through the core fundamentals of engagement, representation, action, and expression [6]. Overall, the UDL guidelines would promote the purpose of attaining equality amongst all students by removing the many barriers that affect learning here within the United States and among students around the world [27].*

*In the case for future suggestions, the project could be improved upon by speaking directly to the authors of the textbook as we were revising it, so we could inform them of our suggestions in a more vocal and direct manner. From this perspective, as students, it would increase the engagement as well as the guidance throughout the project from a different perspective other than a research assistant or a faculty member.*

Undergraduate 5:

*Working on the robotics research project for the development of a textbook has been a highly rewarding and exhilarating experience. Initially, I had some reservations about the project as I was not well-versed in its details. However, collaborating with [Faculty Member] and [Research Assistant] from [University 1] proved to be a seamless and enlightening process. I found the experience to be immensely enjoyable as it gave me the opportunity to contribute to the efforts of others in the publication of this book. Through the course of the project, I learned about the various guidelines and effective approaches to providing annotations that could enhance different learning outcomes. Moreover, I was elated to see that my opinions and contributions were given due consideration and weight, making me feel as though my voice truly mattered. Overall, this project has been a formative and intellectually stimulating experience, and I am grateful for the chance to participate in it.*

Undergraduate 6:

*When I first started this project, I was under the assumption that we would be building and programming robots, however this was a much better experience. Instead we learnt how to apply UDL guidelines and prior knowledge and experiences into a textbook for students who were interested in learning about Robotics but didn't have the knowledge nor opportunities to explore it. Every meeting was different than the last, and there was never a dull moment thanks to the wonderful project leader, [Faculty Member], and industrious research assistant, [Research Assistant]. Before I joined this project, I had no idea what OER Learning, or UDL Guidelines were nor why they were important until we dived deeper into the material and started applying these concepts into my classes. I began to see a major significance on how the material is taught has a different impact on understanding and enjoying the content.*

*I still don't have enough words to express how thankful I am to be able to have this experience, and have the opportunity to be a part of this project, with the*

*hope of having our work published, and making a positive impact in the department of education.*

## **Findings**

Acknowledging the limited feedback given due to the small sample of participants is necessary. Still, it does not detract from the opportunity to hear from students in their own words about experiences intended to engage and respect them as intentional design goals. These should not be overgeneralized to other contexts without considering important differences between environments; however, these findings provide the chance to build on positive experiences for engaging students.

- The OER project was beneficial because it allowed the student to understand how they are being educated, assess the quality of their education, and gain experience regarding reading and interpreting academic articles and journals. The student believes knowledge and access to knowledge should be free and open to everyone and encourages an environment of learner-centeredness.
- The OER project gave the student a new perspective of the educational process, and the student enjoyed the opportunity to create a textbook that solves issues that many students struggle with. The student believes that having access to a textbook that is an OER could save students hundreds of dollars and is indicative of the importance of OER.
- The OER project made the students feel heard and enabled them to work alongside research assistants and faculty members, learn about the future of how students could learn, and look forward to further education.
- The UDL principles taught in the OER project can help eliminate barriers to learning and can heavily impact learning environments affected by circumstances like learning disabilities or the COVID-19 pandemic. The student believes that classrooms should implement the UDL guidelines through a strategic and comprehensive approach, incorporating the principles through the core fundamentals of engagement, representation, action, and expression.

All undergraduates express positive experiences with the Open Educational Resource (OER) project between University 1 and 2. They mention the benefits of having access to free and open knowledge and the importance of learner-centered education. They appreciate the opportunity to contribute to creating a textbook that is more engaging and accessible for students. They also mention the benefits of learning about the Universal Design for Learning (UDL) guidelines and how they can be applied to eliminate barriers to learning for students with different abilities and backgrounds. Overall, they view the OER project as a valuable and fulfilling learning experience. However, the project could also benefit from improvement, such as the students working directly with the authors of the chapters so feedback could be more seamlessly incorporated and both undergraduate student reviewers and graduate student authors would grow their skills.

## Discussion

In preparing this paper, the undergraduate authors shared how their experience with this collaborative project led to a deeper understanding of pedagogical practices and learning in the classroom. They mentioned the importance of open access to information and the benefit that opening information can bring to others. As members of the Collaborative Design Team, they provided feedback and reviewed textbook chapters, using their background knowledge and experiences to construct learning materials that integrate the learner's needs. This approach recognized the importance of incorporating student participation and feedback in creating educational materials, elevating student voices and recognizing their knowledge and experiences. By allowing students to examine and reflect on how information is presented, they grow in recognizing their academic backgrounds and classroom pedagogy. This research highlights the value of incorporating student perspectives in developing educational materials, fostering collaboration, and supporting dialogue.

## Conclusion

Incorporating students into the design and development of educational materials while giving them the opportunity and confidence to share their experiences helps not only future students of the educational materials, but also the contributing students by expanding their content and pedagogical content knowledge. Leveraging student perspectives and feedback, in combination with attention to UDL guidelines, can lead to more learner-centered open educational resources.

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