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Journal
Schools, 21(2)

ISSN
1550-1175

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Publication Date
2024-09-01

DOI
10.1086/732437

An Examination of User Preferences and Creativity in Engineering Education*

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Introduction

In 2024, disparities persist in achieving equality and equity for diverse learners, particularly in science, technology, engineering, and mathematics (STEM) education. This discrepancy is attributed to inadequate financial investments across school systems and ingrained cultural and racial biases in our nation. Achieving democracy in education necessitates providing learners with flexible learning approaches and access to appropriate tools

*This research project is funded by the National Science Foundation (grant 1826632).

Schools: Studies in Education, volume 21, number 2, Fall 2024.
 Published by The University of Chicago Press for the Francis W. Parker School, Chicago. https://doi.org/10.1086/732437

within formal and informal educational settings. John Dewey, an American educational reformer and psychologist, envisioned schools as social hubs for building democratic societies (Bruce 2018). This underscores the importance of honoring diverse epistemologies, or ways of knowing, within our education system's formal and informal environments. Cultural relevance, rooted in specific ethnic communities, shapes identities and learning preferences, demanding equitable representation in curriculum content.

Our research aims to understand the engineering curricula that is used in our education system and the preferred learning methods involving types of content women and students of color prefer. For example, types of content and their representations may include word problems, images, or simulations.

Traditional assumptions about the lack of diversity in engineering may overlook the influence of cultural perspectives on learners' preferences. Thus, we adopt a critical examination of curricular opportunities and external factors beyond individual learners, focusing on learner preferences and experiences with engineering and mathematical content.

We investigate current engineering curricula to discern how learners prefer to receive content, particularly during the initial years of undergraduate education. We hypothesize that the underrepresentation of women and students of color in engineering stems from the Eurocentric/White-centric values and learning approaches embedded in existing curricula. Addressing this issue requires greater empathy for learners' perspectives and creativity in curriculum design to enhance participation.

Our study, part of a broader investigation into engineering curricula, explores typologies, self-efficacy, creativity, empathy, interest, and user preferences. Specifically, we focus on a pilot study conducted alongside a data mining project. The data mining component involved gathering engineering course catalog information from 38 universities and subsequently developing an algorithm to collect publicly available syllabi for analysis, focusing on curricular preferences of diverse students across three universities involving focus groups. This article focuses on the development of typologies from 38 universities and gathering information about learner preferences from students, with a focus on three universities (i.e., Central, West, and Pacific Northwest United States).

Democracy and Education

Diverse representation is a cornerstone of democratic education, as outlined in Dewey's seminal work, *Democracy and Education*. Dewey fervently rejected notions of inherent racial superiority as early as 1909, emphasizing equal opportunities for individuals of all races and the importance of diverse representation in society. He argued for expanding demographic representation in democracy and education, breaking down barriers of class, race, and nationality to foster broader interactions among individuals (Dewey 2018). Fallace (2017) specified, "The intermingling in the school of youth of different races, differing religions, and unlike customs creates for all a new and broader environment. Dewey insisted that democratic man associated 'in all kinds of ways and for all kinds of purposes . . . in a multitude of diverse groups,' that created 'varied and free points of contact with other modes of association.' Such 'back and forth play' and 'diversity of stimulation' among the cultural groups were essential to bringing forth novel ideas that would contribute to progress" (Fallace 2017, 480–81).

In *Democracy and Education*, Dewey envisioned diverse representation as essential for a democratic education system. The mingling of youths from different racial, religious, and cultural backgrounds in schools creates a rich and inclusive environment conducive to the exchange of ideas and progress. Dewey believed that democratic education should promote free and equitable processes, including diverse representation and experiences in curricula, to foster innovation and societal advancement. However, Dewey noted that current education systems often fail to achieve diverse representation, particularly in terms of class and race. The lack of representation and diverse epistemologies poses a risk to all students, hindering their intellectual growth and perpetuating inequities. Recognizing the importance of public education to democracy, scholars like W. E. B. Du Bois emphasized the need for an education that cultivates competence, community, and individual agency.

In addition, Darling-Hammond (1996) also understood that having a democratic education was fundamental in developing a deeper understanding of the requirements of democracy in education. Darling-Hammond emphasized, "This is an education that seeks competence as well as community, that enables all people to find and act on who they are, what their passions, gifts, and talents may be, what they care about, and how they want to make a contribution to each other and the world" (1996, 5).

Scholars, such as the individuals mentioned earlier, understood in the twentieth century that, diversity across people and content must be central to the concept of democracy in education. Achieving greater diversity, equity, and inclusion in epistemologies and curricula is essential for realizing the democratic ideals of education posed by Dewey and others, particularly in the United States.

Background

For decades, significant financial resources have been allocated to academic institutions, both for-profit and nonprofit, aiming to enhance the representation of underrepresented groups in engineering, including women, students of color, and individuals with disabilities (George et al. 2001; Malcom et al. 1976). Despite these concerted efforts to increase and retain diversity in STEM programs, particularly in engineering, the progress in representation, especially for Black and Brown students, remains disappointingly minimal across most engineering programs (Carnevale et al. 2010; Causey et al. 2022; Halpern et al. 2007; Heilbronner 2013; McGee 2021; McGee and Robinson 2020; National Science Foundation [NSF] 2022; Ong et al. 2011; Walden et al. 2018). Although the NSF (2022) reported that women have achieved parity in some fields, many others still fall well below population representation. The exact reasons behind such gender and racial disparities in engineering remain elusive (Causey et al. 2020).

Studies have delved into various factors including race, gender, and ability, with some specifically focusing on pedagogy (Hancock et al. 2021; Holly 2021). For instance, James Holly Jr. (2021) used autoethnography and a Black woman's experiences to critically analyze the prevailing power dynamics in engineering, offering insights for White scholars to better support Black students and confront White supremacy. Similarly, Hancock and colleagues (2021) applied disability critical race theory to propose recommendations for early childhood personnel preparation programs and special education pedagogy. Some scholars have pointed to gender and racial bias as contributing factors to the lack of representation (London et al. 2020). These biases may manifest differently across various educational institutions and systems, aligning with Dewey's principles on democracy and education.

Racial and gender biases undoubtedly perpetuate racist and gendered practices that are deeply embedded in US society, resulting in persistent underrepresentation in specific fields and disciplines (Frank et al. 2020; London et al. 2020). The dearth of representation can be traced back to racial injustices and practices that inadvertently or unconsciously diminish the status of underrepresented groups through coded language, such as the notion of "readiness" (Brown-Jeffy and Cooper 2011). These racist practices are directly linked to disparities in health, employment, income, and education, perpetuating a system that privileges White groups over Black and Brown individuals, and males over other genders. Although race and gender undoubtedly contribute to the issue of broadening participation, other forms of bias and discrimination are closely intertwined with diverse epistemologies (Vaditya 2018). Epistemologies are culturally influenced methods of acquiring knowledge, and it is vital to include a variety of epistemological perspectives to promote a genuinely democratic education process across our educational system.

Literature Review

Epistemologies, which define how we acquire knowledge, along with ontologies, which shape our existence in the world, and axiology, which determines what we value, are fundamental aspects of individual and group cultural identities. This concept was highlighted by Holly and Masta (2021), who observed that institutions, often labeled as predominantly White, are deeply entrenched in Whiteness across their structures and practices. He noted, "Whiteness will always try to separate itself from its history while reinforcing itself with new iterations. For example, researchers might use the phrase predominantly White institutions to connote whiteness. However, this phrase diminishes the fact that colleges and universities are not just predominantly white; they embody whiteness in every structure and practice within the institution. Brown and Black people might be present in the institution, but the institution itself is whiteness" (799).

Holly's (2021) insight into institutional cultural identity aligns with observations made by other scholars, such as Bonilla-Silva and Peoples (2022), who emphasize the normative nature of Whiteness within historically White colleges and universities, contrasting them with historically Black colleges and universities (HBCUs) and Hispanic-serving institutions (HSIs). They argue that despite the racial connotations in the names of HBCUs and HSIs, the pervasive Whiteness in most colleges remains largely invisible due to its dominance. For example, Bonilla-Silva and Peoples (2022) concluded:

> Although the racial component of HBCUs and HSIs is tattooed in their names, the objective, overwhelming whiteness of most colleges is not. This is because whiteness, as the dominant racial identity, is normative (Lewis, 2004), thus invisible. But space is always a social product (Lefebvre, 1991) and embodies the weight of race and other social divisions. Space has a history that shapes it in particular ways reproducing a certain set of social relations. . . . Specifically, space

> reproduces hegemonic relations, serving as "a means of control, and hence, of domination, of power" (ibid:26) Furthermore, as race, space, and power is interconnected, it creates differential opportunities for Whites and people of color (1490).

The intersection of race, space, and power underscores the differential opportunities experienced by Whites and people of color within these institutional contexts, shaping social relations and perpetuating hegemonic structures. This interconnectedness highlights the need to critically examine representation and inclusion in higher education, particularly in STEM fields.

Recent data from the NSF regarding doctoral degrees conferred in engineering fields in 2021 revealed stark disparities in representation. Only 24 percent of recipients overall were women, with just 7 percent Latinx and 4 percent African Americans among US citizens and permanent residents.[1] Similarly, undergraduate STEM and engineering programs exhibit low levels of racial diversity, with enrollments comprising only 16 percent Latinx and 6 percent African Americans. These statistics underscore the ongoing challenges in achieving equitable representation in STEM education, despite efforts to broaden participation encouraged by federal agencies. Holly (2021), as indicated earlier, noted that Whiteness consistently tries to detach from its historical roots while evolving in different forms. He criticized the term "predominantly White institutions" for failing to grasp the extent to which colleges and universities embody Whiteness in every aspect. Despite having a diverse student body, these institutions fundamentally uphold and propagate Whiteness.

This idea established academic merit, although Holly is not the only author to recognize this aspect of institutional cultural identity. It is a phenomenon recently noted in the sciences as well.

According to the report "Women, Minorities, and Persons with Disabilities in Science and Engineering" (table 2–8), undergraduate STEM and particularly engineering programs have enrollments of only 16 percent Latinx and 6 percent African Americans, as indicated earlier, although proposals among federal agencies encourage broadening participation in STEM (NSF 2021). For undergraduates, we have the following lack of racial diversity, according to the NSF report "Women, Minorities, and Persons with Disabilities in Science and Engineering" (table 5–9): undergraduate STEM

1. In this article we refer to Latinx and Hispanic interchangeably. Various regions in the United States assign individuals with Spanish lineage in different ways.

and particularly engineering programs have graduating classes of only 12 percent Latinx and 4 percent African Americans (NSF 2021).

Curricula Preferences and Epistemologies

Nearly half a century ago, Hilliard highlighted the significance of considering what both teachers and students bring to the educational context in terms of content selection, methods of consideration, and utilization (1974, 4). He underscored the critical oversight that educators might have regarding the influential role of learners' ethnic identity and culture in the learning process. Surprisingly, the current educational landscape still largely reflects the same biases identified by Hilliard in 1974. The prevailing White-dominated education systems tend to privilege White epistemologies in content construction and delivery, perpetuating a lack of inclusion and fostering an undemocratic educational process devoid of diversity and equity in representation (Frank et al. 2020; Grosfoguel 2007).

This article asserts that epistemologies, ontologies, and axiologies serve as the conceptual underpinnings essential for collaboratively devising advanced methods and interventions to initiate a transformation in engineering curricula. One approach, among many, to grasp individual or cultural group epistemologies is by scrutinizing user preferences (Grosfoguel 2007).

Recent research indicates that underrepresented groups initially express intentions and aspirations to pursue STEM pathways at rates comparable with their male and White counterparts but exhibit higher rates of attrition after enrollment (Causey et al. 2022; Hancock et al. 2021; NSF 2022). This study aimed to lay the groundwork for investigating user preferences and potential reasons behind the low completion rates in engineering. Analysis of completion rates among African American and Latinx students reveals extended graduation timelines (Causey et al. 2022; NSF 2022; Walden et al. 2018). Structural biases, including race and gender, as well as factors like academic climate and a sense of belonging, contribute to these prolonged timelines (Campbell-Montalvo et al. 2022). Furthermore, underrepresented groups may face delays due to the absence of empathic curricula and frustrations stemming from unfamiliar content representations and delivery methods.

An empathic curriculum should encompass content that is accessible, adaptable, and supportive for all students, incorporating diverse epistemologies. Although initial enrollment figures for individuals from underrepresented groups are promising, prolonged completion rates suggest existing efforts to promote interest in STEM fields are insufficient in retaining students.

The objective of this study was to investigate the potential association between user preferences for empathic curricula and creativity. For instance, we explored whether highly creative Black students exhibit preferences for 2D images, text, simulations, or other forms of curricular representations commonly encountered in classrooms. This research adopts a user-centered design approach to identify existing curricula and explore ways to develop more inclusive curricula for all students (Grosfoguel 2007). In a manner akin to how usability engineers employ user-centered design principles and user profiles to guide product design and evaluation, we advocate for a similar approach in curriculum development (Miyake et al. 2010). Thoughtful attention to curricular affordances that both welcome and challenge students can enhance the accessibility of content and broaden participation in STEM fields (Frank et al. 2020; Hancock et al. 2021; Holly 2021; McGee and Robinson 2020).

Previous studies have examined various intrapersonal and contextual factors such as learning style preferences, stereotype threat, culturally relevant pedagogy, and math anxiety, which influence the perceived usability of curricula (Brown-Jeffy and Cooper 2011; Campbell-Montalvo et al. 2022; Ceci and Williams 2011; Huang and Brainard 2001). However, the systematic investigation and development of curricula based on user preferences remain largely unexplored in undergraduate engineering programs and other disciplines across educational levels (e.g., K–16 and graduate programs in math, biology, physics, and psychology).

To foster democratic education and empathic curricula, it is imperative to examine the curricula currently employed in engineering programs at institutions of higher education. Our study aimed to establish and use a model for examining curriculum content, employing computer-assisted aggregation and simulation of various curricular types.

A considerable number of women and individuals from underrepresented groups experience stress, anxiety, and trauma resulting from past negative experiences in mathematics, engineering, and physics lessons (Huang and Brainard 2001). Factors such as self-confidence, stereotype threat, and expectancy effect contribute to the challenges faced by non-White-male learners in navigating current curricula (Frank et al. 2020; Holly 2021; London et al. 2020; McGee and Robinson 2020). These negative experiences often persist into engineering programs, necessitating the development of empathic curricular materials to help students identify and manage their emotional reactions. Research on stereotype threat and expectancy effect underscores the prevalence of negative learning experiences among women and students of color, particularly in mathematics learning (Huang and Brainard 2001;

Steele and Aronson 2004). These issues likely extend to engineering and other disciplines, highlighting the need for interventions to address them.

Although prior efforts have attempted to address the underrepresentation of women and students of color in engineering through curriculum design, institutions of higher education in the United States must be more attuned to the intricacies of the learning process by understanding user preferences (Huang and Brainard 2001).

Curriculum evaluation should occur on two levels: effectiveness in conveying essential information for learning beyond the classroom, and facilitation of learners' professional identity and connection to content with broader representation and diversification. Our project provides insights into how both dimensions align in evaluating program retention and success. Various curricular affordances, such as display rules for learning materials, influence engineering users' perceptions of content usability. For instance, the initial presentation of learning materials through abstract equations may elicit feelings of intimidation in certain groups, whereas graphical representations may offer a more intuitive understanding. These affordances significantly affect how women and other underrepresented groups respond to course content (Nazareth et al. 2013; Unsworth and Engle 2007; Varma and Frehill 2010). A cursory examination of engineering books and authors reveals a dominance of works by male authors in the United States, highlighting potential insensitivity to the needs of women and students of color in the current educational landscape (Huang and Brainard 2001).

Method

We explored curricula through a mixed-methods sequential design, which begins with exploratory activities and builds to more systematic testing of a research question concerning how particular user preferences influence student participation. We developed a series of algorithms (a set of rules) and explored curricula activities that would afford a more systematic testing of curricula. The development of computational models (an algorithm/set of rules) allowed us to visualize curricula in beneficial ways that would assist us in knowing whether or not an instructor diversified their curricula (e.g., equations, text, images, videos, simulations), including knowing current content used in the field of engineering and engineering education. By investigating current curricula content, we were able to learn more about the intersection of user preferences in general and user preferences of engineering students across specializations (i.e., electrical, computing, industrial, chemical, civil engineering, and software). In addition to learning which current curricula content is used, investigating user preferences helped us to understand content perceptually and to identify which content users preferred from a representative sample of all groups, nationally and internationally. Integration of this work will culminate in typology categorization and creation by which engineering curricula can be evaluated and made more responsive to users' preference. With these user preferences kept at the forefront of curricular design, engineering programs are likely to be more accessible to a wider range of learners. As mentioned earlier, this article is a part of a larger study. We assessed whether or not student learners preferred to learn their content through the use of equations, text, 2D and 3D images, videos, and simulations.

Research Questions

Specifically, our guiding research questions are:

Q1. What are the essential characteristics of engineering curricula for which a distinctive typology can be established for modes of presentation? (data mining, content, and analysis)

a. Are there quantitatively and qualitatively distinct profiles of engineering curricula modes of representation?

b. What essential characteristics of engineering curricula are identified by the computer search that are also evident in the typology generated using a manual search? What new qualities are evident in the computer-generated results?

Q2. What typology of curricula do women and students of color exhibit a preference for? What are the essential characteristics of engineering curricula for which a distinctive typology can be established for modes of presentation? (data mining, content, and analysis)

a. Are there quantitatively and qualitatively distinct profiles of engineering curricula modes of representation?

b. What essential characteristics of engineering curricula are identified by the computer search are also evident in the typology generated using a manual search? What new qualities are evident in the computer-generated results?

Q3. Are the representations of user preferences predicted by creativity?

Participants

We surveyed 102 undergraduate engineering students at three universities regarding their preferences for how STEM topics are presented. The User

Preference Survey was distributed along with the Torrance Tests of Creative Thinking (TTCT) during in-person focus groups.

General US census categories were used to guide how we defined our participants. The demographic breakdown of all students shows 27 students (26.5 percent) identify as female, 74 students (72.5 percent) identify as male, and one (0.1 percent) identifies as other (which included nonbinary, lesbian, gay, bisexual, trans, and queer). The identity category was open to all gender and racial identities. No identity was excluded. In the survey, the four most identified ethnicities were Latinx/Hispanix/Chicanx (30), White American (24), Asian/Pacific Islander (20), and African American (9). The ethnic identity categories may be viewed by some as too broad. We acknowledge that the categories themselves can be viewed as biased and based on a predominantly White American definition of ethnic groups. The four most identified races were White (42), Asian (30), multiracial (11), and Black (6).

In terms of primary language, 83 students spoke English as their first language and 10 spoke Spanish as their first language. Seventy-five percent of the students were between 19 and 21 years of age, with only one at 18 years of age and five at 31 years of age or older. Forty-five students (44 percent) were enrolled in both an engineering class and a mathematics class at the time of the study, 44 students (43 percent) were enrolled in an engineering class and not mathematics, 10 students (10 percent) were not enrolled in engineering nor mathematics, and three students (3 percent) were enrolled in mathematics but not engineering.

Procedures

This study involved a team of six faculty members and more than 10 undergraduate students. The lead researcher enlisted 10 undergraduates to manually sift through course catalogs from 38 universities, aiming to gather engineering course content. The objective was to examine the types of engineering curricula undergraduate students encounter at these sampled universities. Upon compiling all engineering course data, our research team conducted various analytics on the content. Subsequently, we performed a topical analysis to identify the most commonly used terms. In addition, we developed an algorithm to automate a web scraping tool kit, enabling the collection of syllabi and available engineering courses from online sources. This effort resulted in the acquisition of more than 3,000 syllabi, supplementing the course catalog information. We are currently in the process of analyzing the data obtained through web scraping.

For the purposes of this article, we concentrate on a subset of participants involved in our pilot project. During the pilot study, students underwent the TTCT, a process lasting approximately 30 minutes and requiring in-person administration. In addition, participants completed the User Preference Survey, which was administered both in person and online and took about 10 minutes to complete. Out of 126 surveys administered, 102 were deemed usable for analysis. Demographic information and representation preferences were collected from participants using Qualtrics.

Materials

Torrance Tests of Creative Thinking

The TTCT was used to assess divergent thinking. The two types of TTCT (Torrance 1966) are figural and word based. The picture and word-based exercises involve five mental characteristics: fluency, elaboration, originality, resistance to premature closure, and abstractness of titles. The TTCT is one of the most widely used tests to measure creative problem-solving on the indicated five mental characteristics.

User Preference Survey

The survey presented five topics in STEM in a variety of ways, including text, equation, two- and three-dimensional illustrations with and without color, animations using the same variations as the illustrations, and an interactive simulation. Topics, in order, were: statics, projectile motion, magnetic fields, waves, and Pythagorean theorem. Participants were asked to rank each curricula representation in order of preference from 1 to 5, 8, or 9, depending on how many representations were used, with 1 being the highest rank (table 1).

Table 1. Overall Preference by Topic for All Students

Topic	Text (%)	Mathematical (%)	Image (%)	Animation (%)	Application (%)
Statics	18.42	13.33	68.24		
Projectile	18.24	16.84	48.42	22.28	
Magnet		19.82	82.98		
Waves		26.14	75.78		
Pythagorean	15.96	40.52	36.66		10.17

Rationale for Choices of What Topics and Representations to Present to Study Participants

To create the representation preferences survey instrument, we needed to determine what topics to study and what representations to create for those topics. We chose the topics and representations in consultation with current and prior engineering students and engineering instructors. We chose representations for phenomena studied early in the engineering curricula. One fallout of that decision is that some of the topics overlapped with topics some students had been exposed to in high school physics and math courses.

The topics we chose for the survey instrument included:

1. Statics
2. Magnetic fields
3. Projectile motion
4. Wave phenomena
5. Pythagorean theorem

In each case, we chose to provide a textual description of the phenomenon, a mathematical expression for the phenomenon, and a variety of illustrative visual images of varying complexity for each phenomenon that varied in the degree of verisimilitude to a real-world example, the amount of annotation, the use of color, and the interaction level. Not all topics were suitable for all levels of representation. Something that both instructors and students had suggested was for students to assemble physical representations using real-world objects, but it was not achievable for the survey instruments.

Results and Analysis

We conducted descriptive statistics on preference questions, breaking down the data by demographics. Due to small sample sizes and nonnormal distributions of responses, along with ordinal data presented as ranks for each type of presentation, we focused our analysis on nonparametric techniques. Specifically, we used Pearson's chi-squared test to assess the uniformity of responses across demographics. To explore responses based on a creativity index derived from the TTCT, we opted for the Kruskal-Wallis H test instead of ANOVA, as it is suitable for comparing means among groups with nonnormally distributed data. We examined both raw scores and scores categorized by their relation to the mean (high and low for above and below average, respectively), employing a Dunn's post hoc test with Bonferroni adjustment for pairwise comparisons. Given the exploratory nature of our study and ongoing data collection, we set alpha levels at 0.10.

When participants were presented with physics topics such as statics, projectile motion, magnetic fields, and waves, they showed a preference for images and animations over text and mathematical expressions. However, when it came to representing the Pythagorean theorem, participants favored mathematical expressions followed by images, text, and physical demonstrations, in that order.

Limitations

Due to the COVID-19 pandemic, our capacity to administer the TTCT was constrained, as the test's creator stipulates that it must be conducted in person. In addition, our pilot study suffered from a limited sample size for participants who completed both the TTCT and the User Preference Survey. This scarcity in sample size affected the robustness of our data analysis and the generalizability of our findings.

Conclusion

Our initial findings have unveiled intriguing insights: students exhibit diverse preferences in curriculum content, with variations depending on gender and racial background. In our study, Black students predominantly favored textual materials over visual aids like images, equations, and free body diagrams, as illustrated in figures A1 through A3. Conversely, White and Asian students showed a preference for line and pseudorealistic illustrations. Meanwhile, Hispanic students showed the least preference for equations. It is important to note that our study was not designed to establish causation but rather to explore student learner preferences (table 2).

Our observations suggest a discrepancy between instructors' teaching methods, which primarily involve text, equations, and some images, and the more varied preferences expressed by learners. This misalignment highlights the

Table 2. Preference for Presenting a Statics Problem, by Race[a]

Representation	White (%)	Black (%)	Hispanic (%)	Asian (%)	Multi (%)	Other (%)
Text	17.33	32.14	16.66	13.04	14.58	21.42
Equation	11.55	12.50	8.33	15.52	12.50	7.14
Free body diagram	15.11	25.89	25.00	16.14	10.41	14.28
Line illustration	33.77	13.39	25.00	32.29	41.66	42.85
Pseudorealistic illustration	22.22	16.07	25.00	22.98	20.83	14.28

[a]No participant identifying as Hispanic ranked any presentation mode as rank 1.

need for further research into curriculum design, particularly in understanding how diverse epistemologies intersect with prevailing representations, often centered around White male perspectives. By delving deeper into content, representations, and user preferences across gender, racial, and cultural lines, we can gain valuable insights into shaping more inclusive and effective engineering programs and curricula.

To further our commitment to promoting diversity in engineering education, we have embarked on an extensive analysis of curricular materials sourced from diverse environments such as catalogs and syllabi. This endeavor aims to identify user preferences among all students while also discerning variations between different racial groups and genders. Currently, our research involves more than 800 participants, supplemented by focus groups and additional User Preference Surveys.

In our exploration of democracy in education, we underscored the importance of equity and diverse knowledge acquisition processes. Recognizing the influence of culture on knowledge acquisition, we advocate for curriculum representation that reflects diverse cultural perspectives and acknowledges individual preferences. A democratic education system should accommodate various learning styles and preferences, ensuring that all voices are heard and valued. Yet the prevailing educational landscape often fails to provide opportunities for learners to engage with their preferred content due to a lack of diversity in curricula.

Instructors should proactively diversify course content to accommodate the varied preferences of learners. In a truly democratic education system, curriculum development should be inclusive, considering the perspectives of all stakeholders rather than solely relying on dominant voices. By prioritizing diverse representation and honoring learner preferences, we can create a more inclusive and effective educational experience for all.

Appendix

There is a pole (such as a stick or a pipe) on a hinge attached to a surface (such as a wall). The pole is on a hinge such that it can swing freely toward the ground.

There is a connector (such as a cable, wire, or rope) that is attached to the end of the pole at a 45 degree angle that holds the pole to be parallel with the ground below it.

There is a connector (such as a cable, wire, or rope) that hangs from the end of the pole. At the other end of the connector is a weigh (such as an anvil, a microphone, or a person).

There is a specified amount of weight that the connector attached to the surface can carry before failure.

The problem is to determine the maximum weight that can be hung without the connector breaking.

Fig. A1. Text

$$\sum F = 0$$

$$\swarrow \qquad \searrow$$

$$\sum F_x = 0 \qquad \sum F_y = 0$$

Fig. A2. Equation

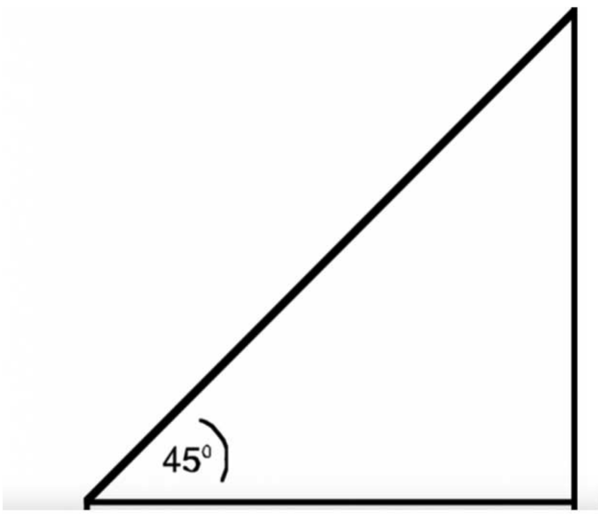

Fig. A3. Line illustration

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