



# Social platforms as Tools for Inclusive Pedagogy: Case of Perusall for Collaborative Reading



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## Abstract

Extant literature is replete on the importance of inclusive pedagogy, which is crucial in engaging every student irrespective of their background to have access to knowledge. Although social platforms like Perusall aim at collaborative reading and enhance students' engagement in reading, literature is sparse on the extent to which these tools accommodate the learning needs of diverse learners. This study is a contribution to close the gap by exploring the Perusall website, research reports on Perusall, and the author's personal experience with Perusall to determine features of the platform that can contribute to diverse learners engaging in collaborative reading. This paper focuses on features in Perusall that can enhance accommodation of learning needs for diverse learners and discusses how instructors can be intentional in leveraging the features to be inclusive for collaborative reading and learning in diverse learners. The paper highlights the features of Perusall that instructors can leverage through the lens of Universal Design for Learning that defines multiple forms of representations, engagement, and actions at the core of inclusive pedagogy.

**Keywords:** Inclusivity; Diversity; Social platform; Perusall; Collaborative reading

## Introduction

Social and collaborative learning platforms are tools that instructors can leverage to enhance the learning experience of students, as they learn from and with others. The overarching goal of these social and collaborative platforms is for learners to share knowledge and interact with one another. It is important for institutions to easily integrate these platforms with the Learning Management System. Instructors should also be able to leverage features of the social platform to enhance the learning experience, as users collaborate in the learning experience. This paper focuses on the specific case of Perusall, a social platform, which I have adopted as an online tool to engage my students since 2020, when the global pandemic (COVID19) precipitated online instruction. I examine how instructors can leverage the features of Perusall in enhancing inclusivity that is at the core of teaching with social justice in mind by making knowledge accessible to every student irrespective of their cultural and social background.

Perusall is a social platform that enhances student learning through collaborative annotation of readings and communication

with peers [1]. Institutions of learning can integrate Perusall easily into popular common Learning Management Systems like Sakai, Canvas, and Blackboard. The goal of the platform is to help students master reading faster, understand the material better, and get more out of their classes. Students collaborate in reading using Perusall by highlighting a section in the text and annotating by typing in a comment representing an observation, perspective, reference, or a question for clarification. They can follow an annotation thread arising from a classmate's comment by typing additional comments or simply upvoting comments to agree on what others have stated. Introverts who are quiet in the traditional classroom setting can actively participate in the collaborative reading and low-stakes assignments through Perusall. Effective annotations by students involves engaging points in the readings, stimulating discussion, offering informative questions or comments, and helping others by addressing their questions or confusions. When classmates respond to peers' questions or mention them in a comment or question, an email notifies the students immediately even if they are not on Perusall.

Students sharing their knowledge through annotations enhance the teacher's ability to guide them through effective feedback [2] to overcome misconceptions and challenges to enhance learning.

The developers of Perusall proffered that through collaborative annotation, learning will be fun and less daunting as students receive rapid responses to their questions and get past confusions quickly. Perusall thus shifts the traditional teaching paradigm from teacher-centered solitary experience with students' over-reliance on instructors for questions and answers to a student-centered paradigm that is engaging, empowering students to be owners of their knowledge. Students collaborating in reading before class save time for instructors to focus on complex issues revealed through their annotations and making class time more productive.

Social platforms like Perusall became popular among educators in dire need to engage students during the COVID-19 pandemic. However, social platforms are not enough to engage every student. Instructors must be intentional in leveraging the features to engage every student to have access to knowledge. Although studies have reported benefits of social platforms in engaging students through collaborative reading [3,4], the literature is sparse on leveraging feature of the platform to enhance engagement of diverse learners, which is at the core of inclusivity and teaching for social justice. The goal of the research reported in this article was to explore features in Perusall that instructors can leverage to enhance every students' access to knowledge. As such, the following research question guided the study: What are features in Perusall that instructors can leverage to enhance students access to knowledge? I examined the literature on Perusall and my personal experience using the platform in discussing how instructors can leverage features of Perusall to enhance student access to knowledge during collaborative reading.

### Literature Review

It is imperative for instructors to be inclusive to meet the learning needs of every student. Although inclusivity in the classroom initially focused on educating students with disabilities in the least restrictive environment, according to the Education for All Children Act, or Public Law 94-142, it has shifted to address the learning needs of diverse students. The increasingly multicultural nature of classrooms is a challenge for instructors to meet the learning needs of diverse learners, especially those whose culture does not align with the dominant culture of the education system. According to Ware (2004), to be inclusive implies identifying and removing all barriers that hinder student learning, which means "increasing participation for all students who are experiencing inequities in education [5]."

In a national survey on inclusive pedagogy the major themes that emerged in defining inclusive teaching were equity and sense of belonging [6]. Equity implies engaging students based on their needs so they can reach their potential while a sense of belonging implies creating a learning environment where every student

feels welcome and safe to participate in learning. Inclusivity infers diversity considered broadly as differences in learners with respect to various cultural and social attributes. In educational contexts, diversity is the total of the ways in which individuals are both alike and different referring to multiple dimensions that include gender, race, ethnicity, language, culture, religion, sexual orientation, class, mental and physical ability, and immigration status [7] and their intersectionality [8]. The classroom is a microcosm of the world in which each student is a unique representation of diverse experiences, values, abilities, understanding, approaches, and beliefs. This uniqueness of students within a given culture refers to "...the collective programming that these people have in common; the programming that is different from the other groups, tribes, regions, minorities or majorities, or nations [9]."

Inclusive teachers embrace and respond to diversity among learners by designing educational environments that are accessible and affordable for diverse learners. They mitigate systemic barriers that are preventing some of the underrepresented groups in the classrooms from reaching their full potential by creating accessible learning environments that respect diversity in various forms. Inclusive teachers focus on equity that acknowledges differences among learners in creating learning opportunities based on learning needs for the success of every student. These teachers reflect on who is being excluded in the classroom and create structures that welcome and engage every student in learning [10].

Although Perusall is an online tool designed primarily to engage students in collaborative reading in preparation for class discussion, there has been a significant shift to other benefits of the tool espoused by educators during Perusall Exchange®. Perusall Exchange is an annual community conference that started in 2021 as synchronous and asynchronous opportunities for participants to attend at their convenience while still engaging in dynamic dialogue with other attendees and presenters on the Perusall platform. I participated in the first three conferences (2021, 2022, 2023) sharing and gaining knowledge on some of the benefits of the social platform discussed in the next section.

Perusall enhances Just in time teaching (JiT) [11] allowing students to respond to content before class posting comments throughout the reading or video thus guiding the instructor to focus on areas of confusion during class time [12]. The platform enhances formative assessment [13], the single most essential element that enhances learning especially for low achieving students [14]. Effective formative assessment [15] embodies equity "to remedy the injustices visited on an entire group of American society that in the past have been underserved by their schools..." [16]

Students' annotations in Perusall reveal their thinking and knowledge that instructors rarely recognize during class discussion but crucial for effective feedback in the formative

assessment process. Perusall engages students in sharing, helping, asking, and commenting [17] and encourages feedback, which is core in formative assessment. For example, students from cultures where one does not ask elders questions or compete with peers might experience challenges in using Perusall. However, Peacock [18] reported on international students reflecting that while Perusall is ethnocentrically panoptic, they enjoyed it as a peer-centered break from the filioptic ways in which these culturally different students had been traditionally educated before coming to the United States. Perusall can thus disrupt the cultural barriers in students interacting and sharing or questioning other perspectives.

Perusall enhances team-based learning (TBL), which is an interactive learning strategy that improves critical thinking and collaboration skills. For example, it allows students and instructors to collaboratively markup patient cases facilitating the achievement of different components of TBL including the application of in-class activities, simultaneous reporting on case questions, and immediate feedback on application of learning material [19]. Perusall enhances the SHAC (Share, Help, Ask, and Comment) technique that encourages peer feedback, engages students in social annotation, and increases interaction [20]. The SHAC technique [17] is integral to the Synchronous Online Flipped Learning Approach, or SOFLA®, [21] that combines flipped learning with online learning in an eight-step learning cycle with structured, interactive, multimodal activities, both asynchronous and synchronous.

A recent study confirmed that open annotations can encourage historically marginalized students to share knowledge and ideas [23]. The authors found that Perusall fosters more equitable interactions for historically minoritized students with women reporting that open annotations deepened their knowledge and engagement with the source and their peers. Women of color acknowledged the benefits of social annotations as a tool that redistributes epistemic authority [22]. Perusall has also been identified as a tool that enhances the principles underlying Indigenous ways of knowing, being and doing by promoting critical thinking and shared analysis, interconnection and reflection, and bidirectional relationships [23]. Social annotations through Perusall are thus a novel approach to address the disengagement of historically minoritized students and other marginalized groups who continue to experience exclusion associated with minimal inaccessibility to knowledge.

While the benefits of Perusall are implicit of features that enhance learning for every student, there is dearth in the literature on how instructors can harness specific features of this collaborative social platform to enhance inclusivity.

### Theoretical Framework

The theoretical framework in exploring the inclusivity features

in Perusall for this article is the universal design for learning (UDL) (CAST, 2018). The UDL draws upon neuroscience and education research, which have provided a different understanding of individual differences, characterizing them instead as predictable, normal variability that exists across the population. Three underlying principles of the UDL ensure access to knowledge: (1) multiple means of engagement, (2) multiple representations, and (3) multiple actions and expressions. These principles can ensure all learners have access to knowledge through meaningful, challenging learning opportunities. The principles align with the theory of multimodality that involves diverse ways of expressing oneself and different forms of media, such as print, drawing, photography, and audio and video recording [24].

Instructors employing multiple means of engaging students are reflecting on the 'why' of learning that stimulates the affective networks resulting in motivating student interest in learning. It is important to consider different strategies that are promising to motivate diverse learners to be engaged in learning. Instructors must also present opportunities through the recognition networks that engage the 'what' of learning. This involves using different modes of representation of information to enhance clarity. It is also crucial that students share their knowledge through strategic networks that engage the 'how' of learning. Learning is idiosyncratic, which means no one method of engaging students, representing information, or demonstrating knowledge will meet the learning needs of diverse learners in the classrooms.

The UDL principles are robust in mitigating barriers in students' access to knowledge as they present opportunities for choice that aligns with specific learning needs. Every student, regardless of their cultural background, can access knowledge in providing feedback to enhance teaching and learning. The UDL is thus an appropriate framework for exploring features in Perusall that allow multiple representation, engagement, and expression that support inclusive pedagogy.

### Methodology

I used a qualitative method that involved examining data on the use of Perusall. I engaged in a self-study on implementation of Perusall in my courses since adopting the social platform in 2020. Self-study is "teachers' systematic and critical examination of their actions and their context as a path to develop a more consciously driven mode of professional activity" [25]. It is an inquiry-oriented approach that is personal, reflective, collaborative, and constructivist [26]. This format allows investigators' questions of practice "that are individually important and also of broader interest to the teacher education community." (Loughran et al., 2004, p. 4) Self-study allowed me to question the underpinnings of my beliefs and practice and influence of my background, experiences, and culture on my teaching [25].

**Sources of data**

I used multiple sources of data: 1) personal experience through courses I taught between the fall semester of 2020 and spring semester of 2023, 2) anecdotal reports by colleagues on their use of Perusall, 3) Perusall website, and 4) literature on

Perusall mostly from the Perusall Exchange annual conferences (Table 1). The primary source of data was my personal experience through courses I have taught (Table 2) while the other sources were mostly to corroborate my experience and findings in using Perusall.

**Table 1:** Sources of data in reflecting on features of Perusall that enhance inclusivity.

Sources of data		Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023
Personal experience through course	Urban Education(EDU 211)	X	X	X	X	X	X
	Educational Measurement (EDU 401)	X	N/A	X	N/A	X	N/A
Perusall website		X	X	X	X	X	X
Perusall Exchange annual conferences		N/A	X	N/A	X	N/A	X
Anecdotal reports		N/A	X	X	X	X	X

\*Source of data explored represented by X; Source of data not explored represented by N/A

**Table 2:** Courses in which I engaged students in Perusall.

Semester	Course Title and Number
Spring 2021	Students teach Secondary School (EDU 450)
	Urban Education (EDU 211)
Summer 2021	Engage Research (EDU664)
Fall 2022	Educational Measurement (EDU 401)
Spring 2022	Urban Education (EDU 211)
	Mental health and student achievement (EDU 471)
	Racial diversity and student achievement (EDU 471)
Summer 2022	Engaged Research (EDU 664)
Fall 2023	Educational Measurement (EDU 401)
	English Language Classroom (EDU 471-003)-
	Mathematics and multilingual learners in High School (EDU 471)

The primary sources of data were reading assignments in my courses focusing on the following: 1) Reading assignments through Perusall, 2) Students’ annotations of readings, 3) Analytics on student engagement in assignments, and 4) Students’ feedback on their use of Perusall. I have uploaded examples of these data sources in the appendix section. I examined information about features of Perusall that I gleaned from the Perusall website and the Perusall Exchange presentations through the lens of the UDL in discussing how to leverage features in Perusall to enhance student access to knowledge as they engage in collaborative reading.

The data from Perusall website were associated to the assignments in my courses. Perusall has explicit descriptions of its features, and the onus is on the instructor to leverage these features to enhance student access to knowledge and engagement in learning. I read the descriptions of features in Perusall with reference to assignments in my courses to determine how they can contribute to inclusivity. I read the contents in the Perusall website to identify topics that are relevant to inclusivity. For example, the following information on the website refers to the accessibility of the platform to diverse learners:

Students can have course materials read aloud to them from within Perusall without using specialized screen reader software. Instructors can easily make alternate versions of materials available to students with particular needs. Perusall includes resizable and responsive user interface components with zooming or resizing to change the text. A “dark mode” with a darker user interface that is more readable in low light conditions is available. (Perusall.com)

These descriptions of what Perusall can afford are important for instructors who are intentional in creating structures that will enhance inclusivity in their teaching. I reflect on these descriptions through the lens of the UDL in determining how specific features can enhance inclusivity.

The data from Perusall Exchange conferences were to confirm the claim that Perusall is a tool that enhances inclusivity. I examined 150 abstracts submitted to the Perusall exchange

conference and identified those related to inclusivity (Table 3). I listened to the recorded presentations on the Perusall Exchange site to identify any feature of Perusall that was likely to enhance students’ access to knowledge. For example, in a presentation on ‘using analytics’ the author discussed features that allow instructors to gain insight of students’ misconceptions to provide feedback. This presentation corroborated my personal experience in using analytics of students’ performance in collaborative reading to provide feedback that supports learning for all learners irrespective of cultural background. Although there were Perusall Exchange presentations that explicitly referred to inclusivity, there was minimal reference to specific features that enhance inclusivity. We cannot assume inclusivity simply based on the presence of features that enhance engagement. It is important for instructors and students to be aware of the features and leverage them to enhance access to knowledge.

**Table 3:** Samples of topics with inclusivity themes at the [Perusall Exchange conferences](#).

Title of Perusall Exchange Presentation	Themes related to inclusivity
Promoting equity and inclusivity with Perusall.	Equity, inclusivity
Maximizing student engagement with Perusall.	Engagement
Perusall pedagogy for inclusivity and active learning.	Inclusivity
Framing Perusall annotations within indigenous principles of learning and teaching.	Indigenous principles
Keeping ESL learners engaged in online reading activities on Perusall.	ESL learners, engaged
Perusall: Facilitating SOFLA in second language pre-service and in-service teacher education.	Facilitating SOFLA; second language
Perusall for inclusive pedagogy in the classroom.	Inclusive pedagogy
Engineering formative feedback practices and developing assessment literacy in teacher education via instructor modelling on Perusall.	Formative feedback

According to the developers of the platform, Perusall increases engagement, motivates collaboration, and builds community while intrinsically and extrinsically motivating students to participate in assignments before coming to class. I have been intentional in exploring features in Perusall that increase engagement of every student in my courses. I used multiple sources of data to corroborate my experience on features that enhance inclusivity. I also used critical friends for authentic feedback on my perspectives. For example, one of my critical friends requested that I include data on students’ perspectives on using Perusall in my courses and reflect on those who did not value the essence of collaborative reading through Perusall. Another critical friend reminded me to state a disclaimer of no relationship to the developers of Perusall and that I had no financial benefits in the research and publication of this article. The features of Perusall I have reflected on that enhance inclusivity are not exhaustive.

I employed recursive analysis [27] and backward and forward mapping [28] in exploring how my personal experience in engaging students in using Perusall to enhance access to

knowledge intersected with the principles of the UDL that guided the analysis of the data. I identified student anxiety as a major target for inclusivity features to enhance engagement.

### Findings

In examining data from my personal experience with Perusall within the UDL I realized the interconnectedness of the three underlying principles (representation, engagement, and expressions/action) with respect to features in Perusall that can be leveraged to enhance inclusivity. For example, Perusall presents features for instructors to engage in multiple representations of reading material for students to annotate that include videos, podcasts, and articles. Although every student might have access to the text article, one who commutes to campus with minimal seat down time to focus on text might benefit from audio recording while driving before the collaborative reading. Perusall also has features that enable multiple ways including audio, for students to express themselves during collaborative reading. The audio feature can enhance representation, engagement, and action by

students. It is thus reasonable to reflect on the three principles of the UDL holistically in discussing features of Perusall that enhance inclusivity. I focus on student anxiety that embodies multiple challenges especially diverse learners to engage in collaborative reading and learning.

Features in Perusall that address the affective needs of learners are likely to reduce anxiety that interferes with their engagement in collaborative reading. The American Association of Psychology defines anxiety as an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure. A student’s ability level is negatively correlated to anxiety [29], which aligns with the current research in neuroscience that stress affects thinking and learning. Anxiety is one of the variables in the affective filter that plays a role in second language acquisition and when elevated affects language acquisition [30]. Lowering the affective filter creates a feeling of

safety that motivates students to engage in collaborative reading [31]. It is important to consider factors that elevate students’ anxiety in collaborative reading in discussing how instructors can leverage features in perusal to mitigate their anxiety and enhance engagement in learning. I identify student anxiety associated with 1) familiarity with the social platform, 2) financial constraints, 3) cognitive demand, 4) sense of belonging, 5) background noise, and 6) feedback.

**Familiarity with platform**

Students who are not familiar with Perusall are likely to develop anxiety when presented with assignments that require them to use the platform. Student engagement occurs when they interact with course material and or with each other [32]. Perusall has a set of directions (Table 4) with examples on how students can navigate the platform to engage in collaborative reading and annotation.

**Table 4:** Sample of instructions on how to navigate the Perusall platform.

Occasions in Collaborative Reading that can cause Anxiety	Instructions to Reduce Anxiety: Directions in Perusall Website on how to Navigate the Platform
What you will see when you open a document (assignment for collaborative reading)	When you open a document, you’ll see highlights superimposed on the document that represent comments that you and other students have entered.
Colors of highlighted segment in reading material	Yellow highlights indicate comments or questions by you or other students; blue highlights indicate comments from your instructor.
How to start reading and annotate	To start a conversation, highlight some text; once you finish highlighting, you will see a panel open on the right where you can type your comment. Press Enter or Return to submit the comment; your classmates will see it appear in real time. (If you are having trouble highlighting text, see this page.)
Notifications to your annotation	When someone responds to your question or comment, you will receive a notification by email, and you can post a reply by either signing on or merely replying to the email.
Responding to peer’s comments	To add to a conversation started by one of your classmates, click on the text highlight to open the conversation panel, type your comment, and then press Enter.
Annotating figures	You can also highlight part of a figure rather than text by using the toolbar buttons at the top. When you have elected to highlight a figure, click, and drag to draw a box around the area of interest, or simply click to drop a map pin.
Formatting which comments to see	While reading the document, change which comments you see by clicking the filter dropdown at the top of the page (which says All comments by default).

**Source:** Adapted from Perusall.com

These directions that are explicit can mitigate anxiety and enhance inclusivity especially for diverse learners as they feel more comfortable using the platform. In my courses I introduce the platform to students by walking them through the various features and descriptions on how to navigate the platform. I share the link to the explicit instructions on how to navigate the Perusall website and an example embedded in Perusall website on how to engage in effective annotation of an assigned reading. This intentionality to reduce students’ anxiety by enhancing their ability to navigate the platform aligns with my teaching philosophy of a growth mindset, which acknowledges that every student can attain their utmost potential when barriers to learning are eliminated.

Students can develop anxiety even when they are familiar with the platform and thus unable to access reading materials. Perusall has features through interface that can be navigated using keyboard to allow access to texts for students who are blind, visually impaired, or simply feel more comfortable using the keyboard functionality. Students can press the Tab key to move between buttons or links, and press Enter to “click” the currently highlighted button or link. Perusall also has a built-in read-aloud feature that opens using the read-aloud panel on the right navigation bar. These unique features in Perusall represent multiple ways of engaging students that are inclusive of all learners. Students have the choice of how to be engaged and how to express their knowledge. For example, they can read and/or

listen to the text and start a conversation by text or through audio. Explicit directions on how to use distinctive features in Perusall represent an inclusive strategy to mitigate anxiety because “no matter how well we develop tools that can tap into the knowledge and skills we want students to learn, students have to engage with these tools to demonstrate their learning.” [33] Furthermore, “creating opportunities for students to engage in collaborative discussions and interactive experiences requires a skill set that may take time to learn and grasp.” [34] Students who are familiar with the platform will benefit from the directions indirectly because their peers with anxiety filters will be more engaged in collaborative reading.

### Financial constraints

Traditional sources of reading materials that include textbooks can be expensive for students who are financially challenged, which makes knowledge inaccessible. In the case of my courses,

students are getting the required textbooks free beginning the fall semester of 2020 following a multi-year contract between the college and Barnes and Nobles. However, the contract that allows students to get books for free does not apply when instructors upload books to Perusall for collaborative reading, which means students might be required to purchase the book online. This can be a source of anxiety especially for students who are financially constrained. Features in Perusall allow instructors to engage students in multiple sources that include books from the Perusall catalogue, Web page, documents, folders, podcast, and video (Figure 1). Although instructors have used open-source books for collaborative reading in Perusall (e.g., McFarlin, 2020), they have hardly discussed open-source materials in terms of inclusive pedagogy. Instructors who are aware of the inclusive features of Perusall can mitigate students’ anxiety arising from financial needs by offering choices that include free sources of reading material.

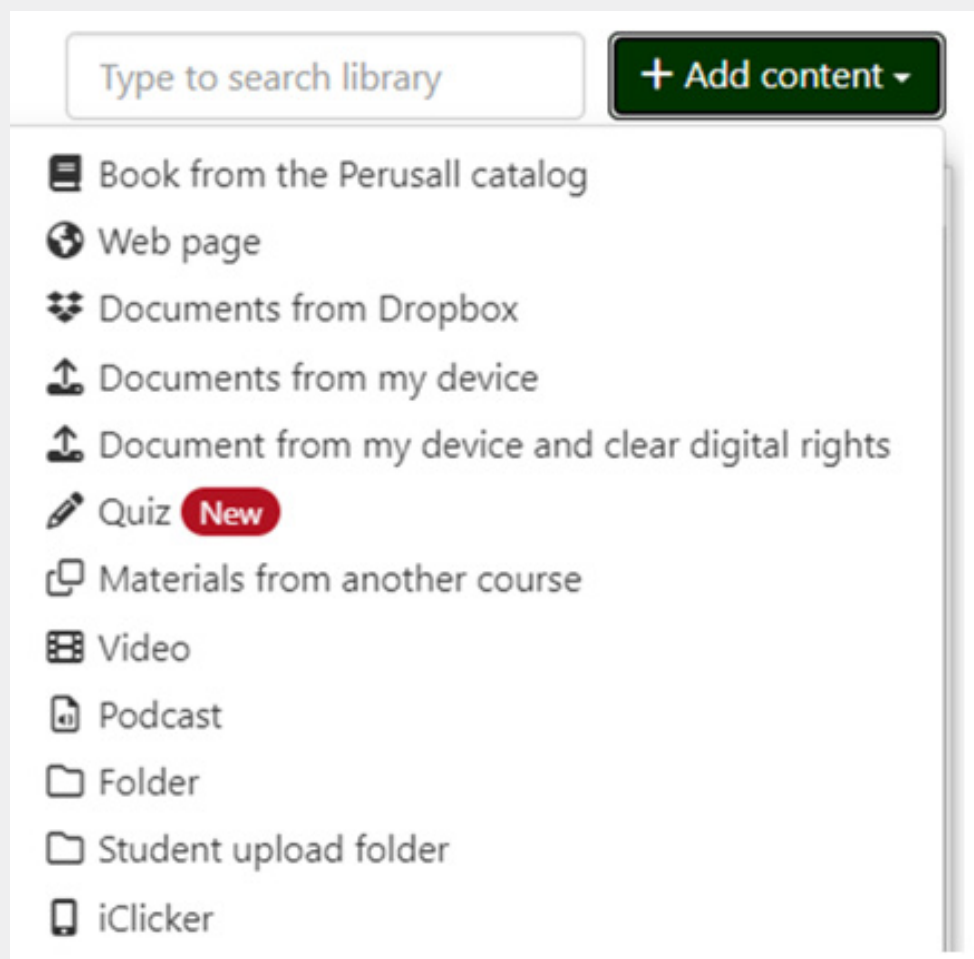


Figure 1: Multiple sources of reading materials.

### Self-efficacy

Anxiety is a common response to unfamiliar circumstances, which can result in low self-efficacy. Self-efficacy is a person's belief in their ability to succeed in a particular situation [35], which can determine their level of engagement. Individuals with low self-efficacy see difficulties as threats and are likely to avoid them. Reading anxiety due to diverse factors like students' primary language, cognitive demand of texts, and length of texts can result in reading avoidance. Nonnative English speakers whose self-esteem is highly related to language anxiety [30] can develop anxiety when assigned lengthy reading materials. Individuals can also experience reading anxiety in their first language as well [36]. Inadequate reading background or deficiencies in literacy skills can result in reading anxiety. It is important for instructors to assign texts that are relevant and familiar to students. In cases of unfamiliar texts, I engage students in reflecting on major themes in the text prior to collaborative reading to reduce the cognitive

demand in reading unfamiliar text, especially for students whose primary language is not English. Reading choices that are relevant to students' majors may affect reading engagement and intrinsic motivation [37].

Perusall has features that allow instructors to mitigate such anxiety through high comprehensible inputs like videos, podcasts, and audios that have lower cognitive demands than the traditional print-based materials. In the case of lengthy reading materials that can be overwhelming for some students increasing their anxiety in collaborative reading, the instructor can use features in Perusall to assign smaller chunks of the text to students based on their learning needs. Perusall also has features that allow different due dates and/or extensions (Figure 2) based on students' learning needs that include time to formulate thoughts before sharing to enhance inclusivity. Instructors must be familiar with students' learning needs to activate the feature for deadline submission for specific students to be inclusive of diverse learners.

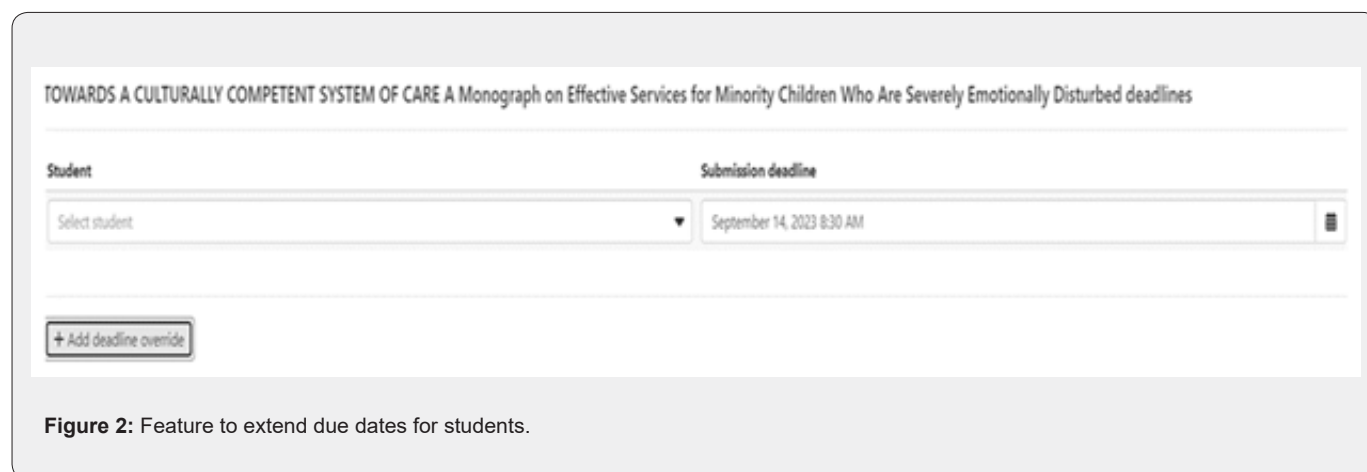


Figure 2: Feature to extend due dates for students.

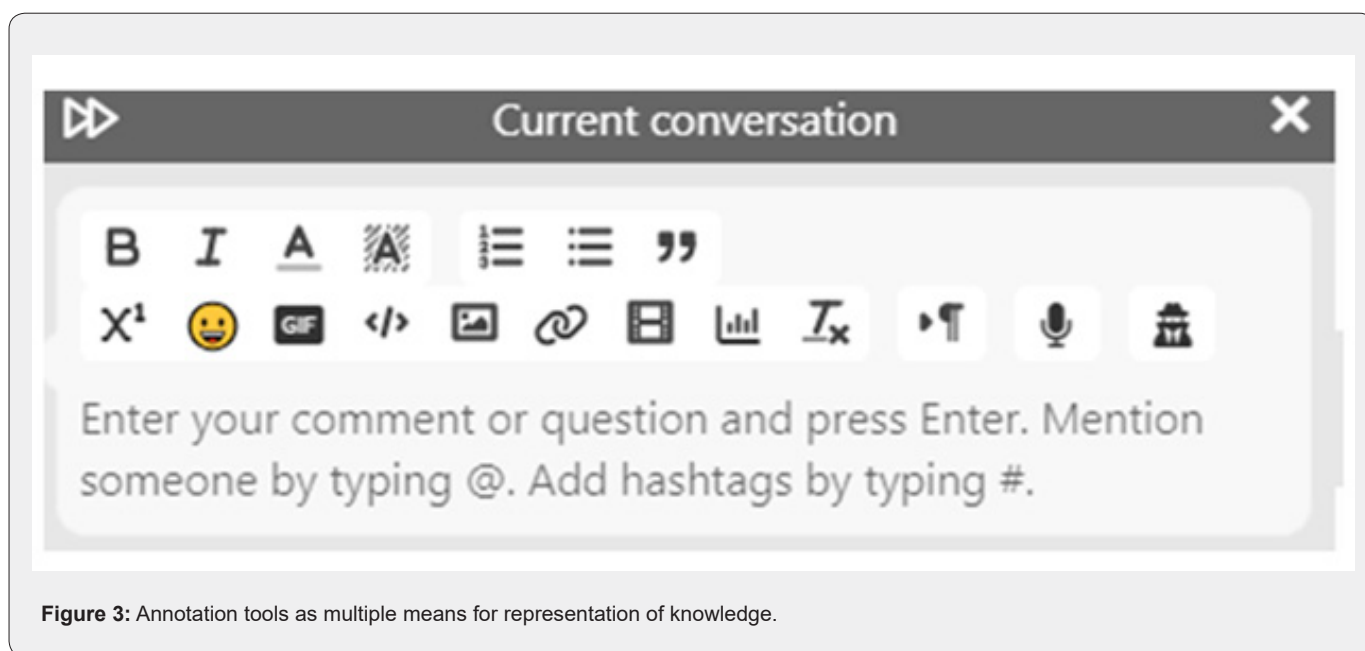
In my urban education course that enrolled students from diverse majors, I noticed that education majors were more engaged than some non-education majors in collaborative readings that focused on the education issue. Student motivation to read is at the core of their "success and their abilities to comprehend content, build knowledge, exercise higher level critical thinking skills, and internalize the skill sets that are necessary to productive careers." [38] Student engagement in reading is associated with motivation and substantial strategic effort [39-42]. Considering that American college students in general spend less time on both academic and nonacademic reading but more time in social media sites [37], it is important for instructors employ multiple representations of reading material that will appeal to diverse learners and motivate them to engage in collaborative reading.

### Sense of belonging

Social psychologist Maslow identifies belonging as a basic human need along food and water [43]. Students' sense of

belonging is entwined with self-esteem, which is confidence in one's value as a human being. It is a measure of how students fit with others or how appealing they might be to other people [44], which can affect their engagement in collaborative reading. Challenges that affect students' self-esteem are likely to affect their sense of belonging that correlates with success. Perusall has features that allow students to represent their knowledge through annotations in multiple ways. Students are encouraged to use the annotation features in posing thoughtful questions and comments that elicit responses from classmates, answering questions from others and Upvoting thoughtful questions and helpful answers, and sharing their knowledge. They can click on the specific feature (Figure 3) to Insert a math symbol, an emoji, a GIF, a code snippet, an image, a link, a video, and/or a poll. Students can also click on the feature for formatting, to enter text in a left-to-right language, to dictate their comment by voice, or to make the comment anonymous to other students.



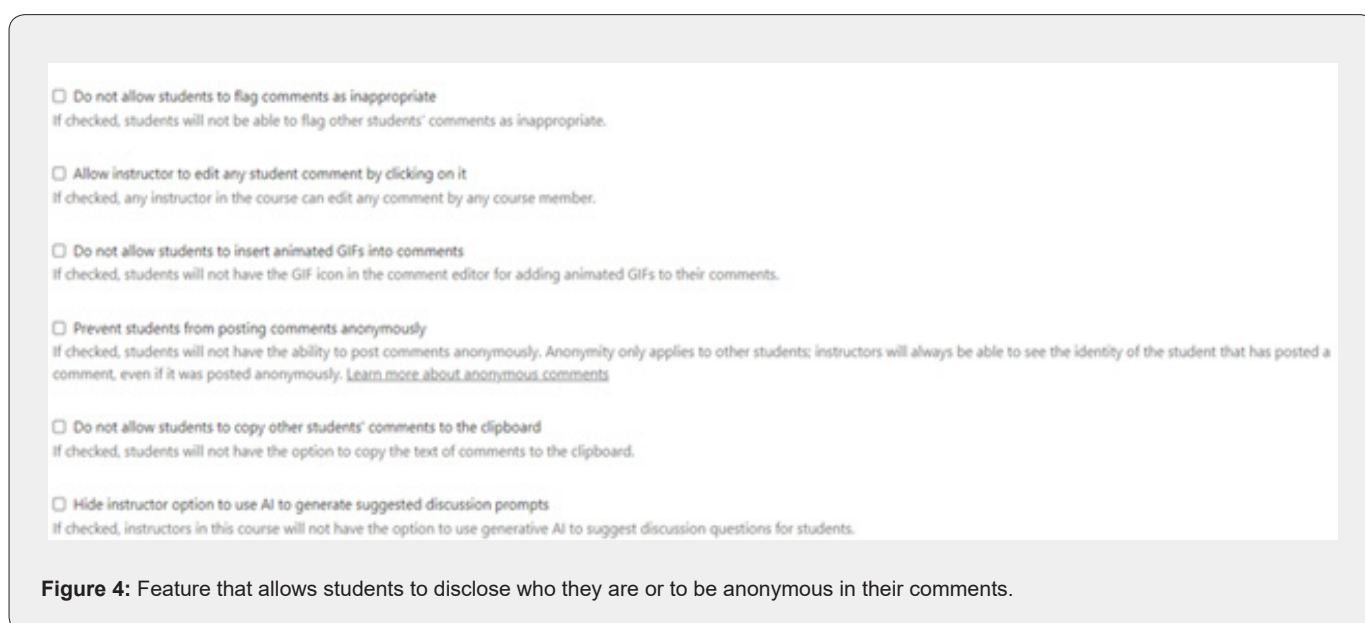


**Figure 3:** Annotation tools as multiple means for representation of knowledge.

Students differ in how they perceive relevance, value, and meaning in information from various sources and in specific formats. They have the choice to use features that will alleviate anxiety associated with low self-esteem in anticipation of their peers identifying their annotations. Their low self-esteem might be due to lack of confidence in their knowledge and fear of being perceived by their peers as less intelligent. It is challenging to have an environment where students and instructors gain a sense of connectedness online [45]. Instructors are responsible for creating opportunities and structures [10] for connectedness that will motivate students to engage in authentic collaborative reading. Although it is recommended that instructors have presence in

online courses it is important to avoid stifling students' voices [46]. This is a challenge in creating safe online spaces where both the instructor and students gain a sense of connectedness and in which students will respect each other and be willing to take the risk in sharing their knowledge to enhance learning.

Perusall has a feature (Figure 4) that instructors can activate so learners can decide if they want to be anonymous during collaborative reading or not. This feature enhances inclusivity as students who do not feel comfortable in sharing their identity are still able to share their authentic knowledge that their peers can have access to for collaborative reading and construction of new knowledge.



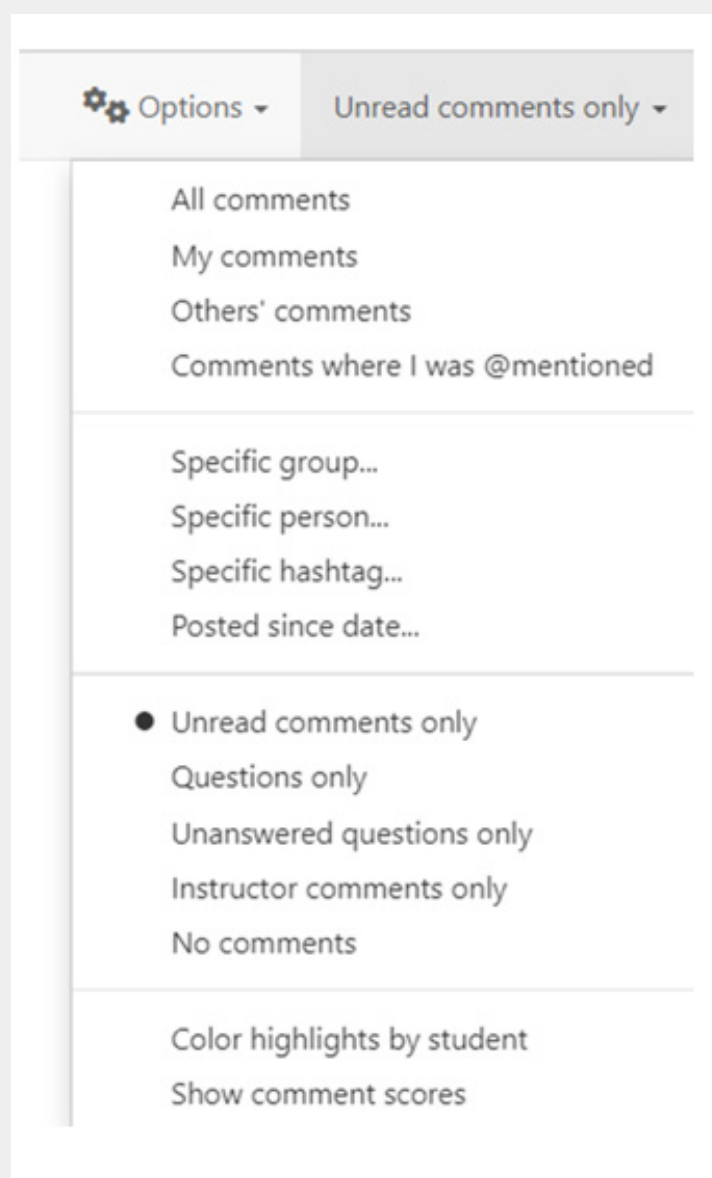
**Figure 4:** Feature that allows students to disclose who they are or to be anonymous in their comments.

Perusall has features that present multiple formats that include audio, video, and weblinks, which students can choose from in expressing their knowledge while having access to knowledge shared by others.

### Virtual pollution

Some students encountering excess information in the form of annotations by their peers can develop anxiety that interferes with their ability to engage in the reading. Reading material saturated with annotations can result in virtual pollution conceptualized as the compounded effect of disorder, and excess of various objects and graphics in a landscape [47,48]. Virtual pollution can result in distraction, eye fatigue, decreases in opinion diversity, and loss of

identity [49] and has also been shown to increase biological stress responses and impair balance [50]. Although many students using Perusall in my courses enjoyed engaging with annotations by their peers, some perceived the annotations as background noises and virtual pollutants that interfered with their engagement in the reading. The background noise or visual stimulation associated with what students can see at a given time increases anxiety especially for diverse learners, which can affect their engagement in collaborative reading. Perusall has features that students can manipulate to control what they can see at a given time. There is a drop-down tool (Figure 5) with options for students to select specific types of comments, groups, and annotation revealed in the background during collaborative reading and annotation.



**Figure 5:** Feature to regulate what learners can see during collaborative reading.

In a course with many students, which can result in excess annotations and virtual pollution, the instructor can control the background noise by creating smaller groups of collaborative readers. Students who continue to experience background noise and sensory stimulations within the smaller group can use the dropdown tool to limit what they can see during collaborative reading.

### Feedback

Feedback is among the major influences of learning and student success. The type of feedback and the ways it is given can be differentially effective [2]. Although grades are often portrayed as detrimental to students' motivation and interest in learning, when used appropriately, grades can be a meaningful and effective form of feedback [51]. Perusall intends to promote learner engagement through metric tools that include auto grading scores based on quality of annotation. However, the automatic grading system in Perusall can be a source of anxiety for many students, and thus is not a good strategy for inclusivity e.g., [13,52]. Instructors can manipulate features in Perusall to format the grading system to be more inclusive. I share the essence of the grading tool with my students in guiding them in self-assessment to enhance engagement in collaborative and quality annotations. I intentionally turn off the automatic grading system or reformat it in some assignments to reduce students' anxiety associated with the grading scores. When students know that the metrics reported in Perusall will not count towards their final grade they are more likely to engage in collaborative reading for mastery. The grading tool can reveal the quality and helplessness of students' annotations and engage them in formative assessment, which supports learning for everyone.

The algorithm feature of Perusall is another source of feedback on students' engagement that instructors can use without relying on the automatic grading system. The algorithm has features that analyze students' comments and report areas of challenge captured in the Confusion report. The confusion report is a summary of issues revealed through students' annotations, which serves as feedback on challenging areas in the readings that can guide instructors on what to focus on to enhance learning. These challenges that are associated with the whole class rather than a specific student enhance inclusivity as the teachers' actions based on the confusion report enhances learning for everyone irrespective of their individual challenges. Although the Confusion report is generated only after a certain threshold on the number of questions for a given issue, instructors can use specific features to respond to individual comments and challenges in the reading.

### Conclusion

Engaging students through multiple representations involves choices that can develop self-determination, pride in accomplishment, and increase the degree to which they feel connected to their learning. Perusall has features that contribute to building community by creating a space for peer-to-peer

interaction and empower students' autonomy through choice in what to focus on in sharing their knowledge with peers. However, individuals differ in how much and what kind of choices they prefer to have. It is therefore not enough to simply provide choice. The right kind of choice and level of independence must be optimized to ensure engagement related to students' actions, effort, persistence, and emotions during learning activities [53]. Instructors must also consider relevance to students [34] in preparing materials for collaborative reading. Creating an environment in which every student feels safe in taking risks in their learning is the first crucial step in creating an inclusive classroom.

The features of inclusivity in Perusall discussed in this paper assumes cultural competence in the instructor. Instructors must have knowledge of the students to identify reading materials that are readily accessible to learners and focused on the meaningfulness of the task [54] and relevant to engage students in meeting their learning needs. The instructor's ability to engage students in appreciating and respecting diverse perspectives in the classroom is embodied in culturally related pedagogies [55-57], which are beyond the scope of discussion in this paper.

Engaging students through multiple representations involves choices that can develop self-determination, pride in accomplishment, and increase the degree to which they feel connected to their learning. However, individuals differ in how much and what kind of choices they prefer to have. It is therefore not enough to simply provide choice. The right kind of choice and level of independence must be optimized to ensure engagement related to students' actions, effort, persistence, and emotions during learning activities [53]. Instructors must also consider relevance to students [58] in preparing materials for collaborative reading.

In this paper, I have discussed some features of Perusall that facilitate inclusive pedagogy through the lens of the UDL. Students differ in how they perceive and comprehend information based on conditions that include blindness, deafness, dyslexia, language, and their social and cultural experiences. Factors related to sources that include neurology, culture, personal relevance, subjectivity, and background knowledge can influence individual variation in accessing information. This diversity in students requires diverse ways of approaching and interacting with content. It is important for every student to have access to the source of information for collaborative reading.

Perusall has features for providing students multiple means of engagement, representation, and action and expression, which mitigate challenges especially for diverse learners to be successful in learning. Instructors cannot assume that the system [59] will result in the desired outcome that includes every student having access to knowledge simply because features exist for multiple representation, engagement, and action and expression. Instructors must be intentional and effective in leveraging the features to meet the diverse learning needs of learners. Strategies

like collaborative reading alone that claim active learning for students will not produce outcomes that disproportionately support underrepresented student groups [60]. Inequities in performance are reduced through a deliberate structure that considers a culture of inclusion. Instructors must continue to monitor the elements, interactions, and behaviors in the system to ensure a safe classroom environment and a mutually respectful online community [34] that will ensure every student engaging in their learning. Instructors who want students to experience the online learning community as a safe, positive learning environment where they feel valued and respected (Ritter & Polnick, 2008) must provide varied opportunities for students to be actively engaged and fully participate in their learning experiences. They must ensure students are aware of multiple means of representation, engagement, and action and expression to alleviate any anxiety and enhance engagement.

Supporting multiple pathways to success is essential for the development of high self-efficacy for all learners. Students who receive support in their learning can reinforce others through self- and peer-assessment and their efficacy expectations, providing a wide variety of models of how to reach the learning goal. Inclusivity is an intentional act and instructors must have the knowledge, skills, and attitudes to engage diverse learners. Their instructional pedagogy must be appealing to diverse learners, which can be challenging because 'one size cannot fit all'. In this article I discuss how instructors who are intentional in inclusive pedagogy can integrate Perusall into their teaching practice and navigate diverse features in the platform to enhance students' access to knowledge, which is at the core of inclusive pedagogy. "Under-developing even one student's potential will negatively impact the development of all other students" [61-70]

This study affords a view of my experience corroborated by other data that is replicable in using Perusall to enhance inclusivity. My experience with Perusall illuminates some features in the platform that instructors and students can leverage to eliminate barriers like anxiety that interfere with students' engagement in collaborative reading [71-75]. Instructors aware of these features and how to support students to minimize anxiety resulting from factors that include unfamiliarity with the platform, financial constraints, self-efficacy, sense of belonging, feedback that can contribute to anxiety in engagement students will be contributing to inclusive practices in using Perusall. My experience using Perusall as a tool for inclusive pedagogy intersects with the national recommendation for preparing culturally effective teachers who will support every student irrespective of their cultural and social background and experience to be successful in learning [76-81].

## Declarations

## Availability of data and material

The features that can enhance inclusivity that are discussed in the manuscript can be accessed at the Perusall social platform site,

<https://www.perusall.com/>.

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