Quality and Usability of Inclusive and Contextualized Science Learning Modules: Teachers' and Students' Perspectives

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ABSTRACT:

Inclusive and contextualized science learning modules play an important role in supporting meaningful and equitable learning experiences. However, limited research has explored how teachers and students perceive the quality and usability of these instructional materials. This study explored teachers' perceptions of the quality and students' perceptions of the usability of inclusive and contextualized science learning modules. A qualitative descriptive research design was employed involving 11 secondary science teachers and 8 students selected through purposive sampling. Data were collected through semi-structured interviews and analyzed using Braun and Clarke's reflexive thematic analysis. The findings revealed four themes describing module quality: multimedia-enhanced learning experiences, contextualized learning experiences, collaborative knowledge construction, and inclusive learning support. Three themes emerged regarding module usability: cognitive accessibility, instructional clarity, and flexible learning access. The findings indicate that participants perceived module quality and usability as related but distinct constructs. Teachers emphasized pedagogical characteristics that promote learner engagement, contextualization, collaboration, and inclusivity, whereas students highlighted usability characteristics that facilitate comprehension, independent learning, and equitable access to learning. These findings contribute to the understanding of the characteristics of inclusive and contextualized science learning modules that provide empirical insights that may inform future instructional practice in inclusive science education.

Keywords: inclusive education, contextualized learning, science learning modules, module quality, module usability.

Introduction

Introduce the research topic and context The increasing emphasis on inclusive education has transformed the way instructional materials are designed and implemented across educational systems (García-Campos et al., 2020; Tzou et al., 2021). Inclusive education advocates equitable learning opportunities by ensuring that all learners, regardless of their abilities, backgrounds, or learning needs, have access to meaningful and engaging educational experiences (Cumming & Rose, 2021; Roski et al., 2021). In science education, achieving inclusivity requires instructional materials that accommodate learner diversity while promoting active participation,

critical thinking, and authentic learning (Squillaci, 2023; Tzou et al., 2021). Science learning modules, particularly those that are contextualized to learners' environments and experiences, have become essential instructional resources for facilitating learner-centered instruction and supporting independent learning (Lasala, 2023; Picardal & Sanchez, 2022).

Contextualized learning modules have gained considerable attention because they connect scientific concepts to learners' everyday experiences, local communities, and cultural contexts (Fayzullina et al., 2023; Wiyarsi et al., 2020). Such connections enable learners to construct knowledge by relating abstract scientific principles to authentic situations, thereby improving conceptual understanding and learner engagement (Demelash et al., 2024; Picardal & Sanchez, 2022). Previous studies have shown that contextualized instructional materials increase students' motivation, participation, and academic performance by making learning more relevant and meaningful (Ilyas & Liu, 2020; Picardal & Sanchez, 2022). Similarly, multimedia-supported instructional materials have been found to enhance conceptual visualization, promote active engagement, and accommodate diverse learning preferences through the integration of videos, animations, simulations, and other interactive resources (Hasanah, 2023; Lee et al., 2023; Mikropoulos & Iatraki, 2022; Tani & Manuguerra, 2022).

Beyond contextualization and multimedia integration, the quality of learning modules is also influenced by their accessibility, organization, clarity, and responsiveness to learner diversity (Estrada-Molina et al., 2021; Vlachogianni & Tselios, 2023). Inclusive instructional materials should provide clear instructions, logical sequencing of content, learner-friendly language, and flexible learning activities that enable students with varying abilities and backgrounds to participate meaningfully in the learning process (Roski et al., 2021; Squillaci, 2023). Likewise, module usability—the extent to which learners can effectively, efficiently, and independently use instructional materials—is an important consideration in promoting positive learning experiences (Ramos et al., 2021; Vlachogianni & Tselios, 2023). Modules that are easy to navigate, well organized, visually appealing, and supported by contextualized activities can facilitate independent learning while reducing learners' cognitive load (Estrada-Molina et al., 2021; Lasala, 2023; Mertasari & Candiasa, 2022).

Although previous studies have examined the effectiveness of contextualized learning materials (Fayzullina et al., 2023; Picardal & Sanchez, 2022) and the pedagogical benefits of multimedia integration (Hasanah, 2023; Mikropoulos & Iatraki, 2022), much of the existing literature has primarily focused on students' academic achievement, instructional interventions, or module validation. Comparatively fewer studies have explored the experiences and perspectives of both teachers and students regarding the quality and usability of inclusive and contextualized science learning modules. Teachers, as instructional implementers, provide valuable insights into the pedagogical characteristics that contribute to high-quality learning materials (Ramos et al., 2021), while students, as primary users of the modules, offer important perspectives regarding usability, accessibility, and overall learning experiences (Vlachogianni & Tselios, 2023). Understanding these complementary perspectives is essential for developing instructional materials that are both pedagogically sound and responsive to learners' needs.

Given the increasing demand for inclusive and contextually relevant instructional resources in science education, there remains a need to examine how teachers and students perceive the characteristics of effective science learning modules. Specifically, identifying the features that teachers associate with module quality and the characteristics that students consider important for module usability can provide evidence-based guidance for improving instructional materials that support diverse learners (Estrada-Molina et al., 2021; Mertasari & Candiasa, 2022). Such evidence is particularly valuable in promoting inclusive science education, where instructional materials must balance pedagogical quality with

usability to maximize learner engagement and participation (Tzou et al., 2021).

Therefore, this study explored the quality and usability of inclusive and contextualized science learning modules from the perspectives of teachers and students. Specifically, it sought to (1) explore teachers' perspectives on the quality of inclusive and contextualized science learning modules and (2) explore students' perspectives on the usability of inclusive and contextualized science learning modules. By examining the experiences of both participant groups, the study aims to contribute to the improvement of science learning modules that are inclusive, contextually relevant, and responsive to the diverse needs of learners. The findings are expected to provide valuable insights for curriculum developers, instructional designers, science educators, and policymakers engaged in the development and implementation of inclusive instructional materials.

Methodology

This study employed a qualitative descriptive research design to explore teachers' perceptions of the quality and students' perceptions of the usability of inclusive and contextualized science learning modules. Nineteen participants, comprising 11 secondary science teachers and 8 students from public secondary schools, were selected through purposive sampling based on their direct experience with the modules. Teacher participants had at least one year of experience teaching science using the modules, while student participants had completed learning activities using them.

Prior to data collection, ethical approval was obtained from the appropriate institutional and school authorities. Participation was voluntary, and all participants were informed of the study's purpose, procedures, and their right to withdraw at any time without penalty. Written informed consent was obtained from teacher participants, while parental consent and student assent were secured for student participants. Participants' anonymity and confidentiality were protected through the use of identification codes (e.g., P1 and S1), and all interview data were securely stored and used solely for research purposes.

Data were collected through researcher-developed semi-structured interview guides that were validated by three experts in science education, curriculum and instruction, and qualitative research and pilot-tested before administration. Individual interviews, lasting approximately 45–60 minutes, were audio-recorded with participants' consent, transcribed verbatim, and anonymized for analysis. The data were analyzed using Braun and Clarke's (2006, 2021) reflexive thematic analysis, following the phases of familiarization, coding, theme generation, review, definition, and report writing. An inductive coding approach was employed to allow themes to emerge directly from participants' narratives. To ensure the trustworthiness of the findings, the study employed member checking, peer debriefing, and an audit trail, while rich descriptions of the research context and participants enhanced transferability.

Results

The qualitative analysis of the teacher perceived quality of the science learning module reveal four themes and three themes on students perceived quality of science learning module.

Participants' Perceived Module Quality

The module quality of science learning modules were explicitly emphasized by teachers as (1) engaging, contextualized, collaborative knowledge construction, and inclusive support.

Theme 1. Multimedia-Enhanced Learning Experiences

Teachers perceived multimedia as an essential component of a high-quality science learning module. They emphasized integrating videos, PowerPoint presentations, websites, visual aids, and interactive resources to capture students' attention, facilitate the visualization of scientific concepts, and promote active participation. Participants also highlighted the importance of accessible visual elements, such as readable fonts and colorful illustrations, to

support learners with diverse learning needs. The participants shared:

"I would either start discussing the topic or show a video I got from the internet." (T1)

"I primarily rely on multimedia presentations from websites. I guide students on how to use these resources for research purposes." (T9)

"I utilize resources where students can touch, swipe, and interact as a group." (T7)

"I think the module should use larger pictures, colorful illustrations, and readable fonts because these help learners, especially those who struggle with reading." (T11)

The use of multimedia is not only considered by teachers as instructional support but as a means of enhancing engagement, improving conceptual understanding, and increasing the accessibility of science learning. It also enables teachers to present scientific concepts through multiple representations, creating more meaningful and inclusive learning experiences.

Theme 2. Contextualized Learning Experiences

Contextualization is considered by teachers as fundamental characteristic of a high-quality science learning module. They emphasized that learning becomes more meaningful when scientific concepts are linked to students' everyday experiences, local environments, and real-world situations. Participants also highlighted the use of localized materials and culturally relevant examples to increase learners' interest, understanding, and participation. The highlighted that:

"Learning is effective and meaningful when connected with the learner's life." (T1)

"I usually begin the lesson by citing examples that they can connect with based on their experience since my class is a mix of students with varying levels of understanding." (T3)

"I encourage them to share their experiences related to the topic, such as factors affecting climate. Since we live near the seashore, they can relate their experiences, making it more understandable." (T8)

"...the materials must be localized so that the learners have high performance and make them more engaged and motivated to learn." (T6)

These findings suggests that teachers viewed contextualization as a means of making science learning relevant, meaningful, and responsive to learners' realities. By integrating real-world examples, local contexts, and learners' experiences into instruction, science concepts become more understandable while fostering greater engagement and participation.

Theme 3. Collaborative Knowledge Construction

Teachers emphasized that collaborative knowledge construction is an essential characteristic of a high-quality science learning module. They pointed out learners needs to actively construct understanding through sharing their ideas, investigating scientific phenomena, applying concepts in authentic situations, and collaborating with peers. Participants also recognized digital platforms, such as social media, as avenues for extending learning beyond the classroom and encouraging knowledge sharing. The participants mention that:

"Then, when my students have already learned the concept, I usually let them share the information." (T2)

"I encourage them to share their experiences related to the topic in Science. I encourage applying what they learn in daily living." (T4)

"Letting students share what they learned in class will have a multiplying effect. I want my students to share what they learn in class through social media such as TikTok or Facebook." (T10)

These findings suggest that teachers viewed learning as an active and collaborative process in which students deepen their understanding by investigating scientific concepts, applying knowledge to real-life situations, and sharing their learning with others. Opportunities for inquiry, collaboration, and knowledge dissemination were perceived to

strengthen learners' engagement while promoting meaningful and sustained learning.

Theme 4. Inclusive Learning Support

Inclusive learning support is another characteristic of a high-quality science learning module. Teachers emphasized that modules should accommodate learners' diverse abilities, learning preferences, and educational needs by providing clear instructions, accessible language, differentiated learning activities, and appropriate instructional supports. They highlighted the importance of ensuring equitable participation by designing learning experiences that enable all students to engage meaningfully regardless of their individual differences. The participants stressed that:

"Because I know that my students have different learning abilities, I make sure that the module should provide activities that can be adjusted according to their level. I believe that there are students that need more guidance, while others can work independently. So I make sure that the module should cater to both." (T11)

"In my class not all students have the same reading comprehension, so I see to it that I modify the module provided by DepEd into a more simple and easy to understand. That is why I make sure that the instructions are clear enough so they can work independently." (T9)

"Some of my students learn better by reading, while others understand the lesson more when they watch videos or perform hands-on activities. Thus, in my class, I see to it that the module provide different ways for students to learn the same concept." (T3)

"I have students with visual impairments, so I use larger font for them so that they can read the text clearly. Also, in my class, I have students who have hearing impairment so I utilize videos with captions. With this, they can work and understand the lesson." (T5)

These findings suggest that teachers viewed inclusivity as creating equitable learning opportunities by reducing barriers to participation and accommodating learner diversity. Participants emphasized flexibility in instructional approaches, accessible learning materials, and differentiated support to ensure that all learners could meaningfully engage with science concepts. Such perceptions reflect the importance of designing learning modules that promote equitable access while responding to the varied needs and abilities of learners.

Participants' Perceived Module Usability.

The usability of a science learning module were given emphasis by the students as (1) cognitively accessible, (2) clear instructions, and flexible that can be utilized by all students with different learning needs

Theme 1. Cognitive Accessibility

Cognitive accessibility is considered by the students as an important aspect of module usability. They stressed that learning modules should present topics and activities in a logical and sequential manner that allow learners to understand science concepts progressively and complete learning tasks with minimal confusion. An organized structure was perceived to reduce cognitive demands and support independent learning. The participants shared:

"The presentation of topics should be in order so that the students will learn the concept presented easily." (S1)

"The procedure in every activity must be written in chronological order." (S8)

"I preferred a module that has an organized presentation of the topic." (S6)

These findings suggest that students associated module usability with a well-organized presentation of content and activities. A logical sequence of lessons and clearly structured procedures enabled learners to process information more efficiently, thereby facilitating comprehension and independent completion of learning tasks.

Theme 2. Instructional Clarity

Students perceived instructional clarity as an essential aspect of module usability. They emphasized that modules should provide clear, concise, and easy-to-follow instructions to enable learners to complete activities independently and correctly. Participants indicated that well-written instructions reduce confusion, promote

understanding, and facilitate the successful completion of learning tasks. They shared that:

"Instructions must be clear so the students can easily understand and perform the tasks properly." (S5)

"Instructions must be clear and simple." (S7)

"A module must have instructions that can be followed easily." (S2)

"The module set by the school was properly arranged and had clear instructions." (S4)

These findings suggest that students associated module usability with the clarity and simplicity of instructional directions. Clear instructions enabled learners to navigate learning activities with confidence, minimize errors, and accomplish tasks independently, thereby enhancing the overall usability of the learning module.

Theme 3. Flexible Learning Access

Students considered an inclusive and contextualized learning module as flexible to learning access. They stressed that the modules should provide multiple ways to access content, participate in learning activities, and demonstrate learning according to individual needs and preferences. Flexibility in instructional resources and learning tasks was perceived to enable equitable participation and support meaningful engagement among diverse learners. The participants shared:

"Based on my experience, not all students learn in the same way. There are some who understand the lesson better by reading, and there are some who learn more when they watch videos, pictures, or perform hands-on activities. That is why I always consider that the module should provide different options for every learner to learn." (S7)

"I do not limit the class activities to written exercises because some learners express their understanding better when they draw, create models, and when they present it orally. With this, I provide different ways for students to show what they have learned." (S6)

"One thing I noticed with my students is that not all of them have the same access to technology or internet connection. That is why, I still offer both printed and digital versions so that every learner has equal access to the learning materials." (S8)

These responses of the students means that module usability goes beyond ease of navigation and clear instructions to include flexibility in how learning is accessed and demonstrated. Providing multiple learning options and accessible formats enables learners with diverse abilities, preferences, and learning contexts to participate more effectively, thereby promoting a more inclusive and learner-centered educational experience.

Discussion

The findings revealed that teachers perceived the quality of an inclusive and contextualized science learning module through four interrelated dimensions: multimedia-enhanced learning experiences, contextualized learning experiences, collaborative knowledge construction, and inclusive learning support. Collectively, these dimensions suggest that teachers associate high-quality science modules with instructional materials that promote learner engagement, connect learning to authentic contexts, encourage active knowledge construction, and respond to learner diversity. Rather than functioning as independent characteristics, these dimensions complement one another in creating meaningful and inclusive science learning experiences.

The emphasis on multimedia-enhanced learning experiences supports the Cognitive Theory of Multimedia Learning, which explains that combining verbal and visual representations enhances learners' conceptual understanding while minimizing unnecessary cognitive load (Mayer, 2024). Likewise, the importance of contextualized learning experiences reflects the principles of contextual teaching and learning, where linking scientific concepts to learners' everyday experiences and local contexts improves relevance, engagement, and knowledge transfer (Kostøl & Remmen, 2022). These findings suggest that effective science modules should integrate multimedia resources with authentic learning contexts to facilitate meaningful learning.

Teachers also emphasized collaborative knowledge construction, highlighting inquiry, discussion, application, and knowledge sharing as important features of quality science modules. This finding is consistent with constructivist learning theory, which views knowledge as actively constructed through social interaction and authentic experiences. Previous studies have shown that collaborative inquiry and problem-solving strengthen scientific reasoning, conceptual understanding, and learner engagement (Li et al., 2020; Costabile et al., 2025). These findings reinforce the importance of designing science modules that encourage learners to investigate, communicate, and collaboratively construct scientific understanding.

The findings further underscore the importance of inclusive learning support, with teachers recognizing the need for differentiated instruction, accessible learning materials, and flexible learning opportunities that accommodate learner diversity. This aligns with the Universal Design for Learning (UDL) framework, which advocates providing multiple means of representation, engagement, and expression to reduce barriers to learning (Lohmann et al., 2023). Similarly, UNESCO's inclusive education agenda emphasizes creating equitable learning environments that enable all learners to participate meaningfully regardless of their abilities or backgrounds (Ainscow, 2020; Shaeffer, 2019). Together with previous research demonstrating the value of integrating pedagogical rigor, contextual relevance, and inclusive design in science instruction (Haas et al., 2021; Salehi et al., 2021; Tzou et al., 2021), these findings highlight that effective science modules should be designed as integrated instructional systems rather than isolated instructional components.

From the students' perspective, module usability was characterized by cognitive accessibility, instructional clarity, and flexible learning access. Students valued modules that were logically organized, provided clear instructional guidance, and offered multiple ways of accessing content and demonstrating learning. These characteristics reflect learner-centered instructional design, which emphasizes usability as an essential condition for independent and meaningful learning (Balo & Sanchez, 2025). Taken together, the findings indicate that participants conceptualized module quality and module usability as related but distinct constructs. Module quality was associated with pedagogical characteristics that foster meaningful and inclusive learning, whereas module usability emphasized the ease with which learners could understand, navigate, and independently engage with instructional materials. This distinction suggests that inclusive and contextualized science learning modules should simultaneously address instructional quality and learner usability to ensure both effective teaching and equitable learning opportunities.

Conclusion

This study explored teachers' perceptions of module quality and students' perceptions of module usability for an inclusive and contextualized science learning module. The findings revealed that module quality is characterized by multimedia-enhanced learning experiences, contextualized learning experiences, collaborative knowledge construction, and inclusive learning support, while module usability is characterized by cognitive accessibility, instructional clarity, and flexible learning access. These findings demonstrate that teachers and students evaluate learning modules from complementary yet distinct perspectives. Teachers emphasized pedagogical features that promote meaningful, contextualized, collaborative, and inclusive learning, whereas students highlighted usability features that enable independent, accessible, and flexible engagement with the learning materials.

The study contributes to the growing body of literature on inclusive instructional design by demonstrating that module quality and module usability should be considered as interconnected dimensions in the development of inclusive and contextualized learning materials. An effective science learning module should not only provide pedagogically sound and

contextually relevant content but should also be cognitively accessible, instructionally clear, and flexible enough to accommodate diverse learner needs. Integrating these dimensions may enhance learner engagement, improve independent learning, and promote equitable participation in science education.

The findings also provide practical guidance for curriculum developers, instructional designers, and science teachers in designing learning modules that align with the principles of inclusive education and contextualized instruction. Future studies may further validate these dimensions using diverse learner populations and educational settings to strengthen their applicability and inform the development of evidence-based frameworks for inclusive module design.

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Author Declaration

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