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Interactive Self-Learning Modules (ISLMs) in Sustaining Student Engagement and Learning Outcomes: A Meta-Synthesis

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Abstract

Interactive Self-Learning Modules (ISLMs) have emerged as effective tools in enhancing student engagement and improving learning outcomes, particularly in the Philippine educational context. This meta-synthesis reviewed 11 qualitative and mixed-method studies between 2023 and 2025. The PRISMA 2020 flow diagram was used in the selection process, and the studies included were determined using the CASP checklist. Thematic analysis revealed three key meta-themes: enhancing engagement through interactive design; supporting outcomes through personalized, feedback-driven instruction; and ISLMs as catalysts for sustained engagement and outcomes, highlighting mobile access, cultural relevance, and student-centered learning. The findings confirm ISLMs' positive impact on students' motivation, autonomy, critical thinking, and academic performance. It is recommended that a wider, context-specific implementation of ISLMs be implemented in Philippine education.

Keywords: Interactive Self-Learning Modules, Qualitative Study, Sustaining Student Engagement and Learning Outcomes

Introduction

Interactive Self-Learning Modules (ISLMs) are digital or printed instructional materials designed to allow learners to progress independently, often featuring interactive elements such as quizzes, multimedia, and feedback mechanisms that support autonomous learning (Cortez *et al*., 2021) [24]. Changes in education have always been visible, with modern changes being mostly technology-induced and sometimes altering learning environments with significant impacts on student engagement and learning outcomes. Williams *et al*. (2023) [81] argue that interactive learning environments can foster cognitive and emotional engagement in students, particularly with self-paced modules that offer immediate feedback and multimedia resources. Wijaya and Vidianti (2020) [82] indicate that interactive electronic modules can indeed significantly enhance students' academic performance through self-directed study and stronger learning through engaging learning activities. According to Al Mamun *et al*. (2020) [3], the purpose of such modules is to provide self-directed learning and regularly organized content to achieve specific learning objectives, often incorporating elements such as navigation links and multimedia components. Research shows that interactive learning environments and flipped classroom techniques greatly enhance student engagement and understanding, as documented in research on their effects on life sciences, as mentioned by Al Mamun *et al*. (2025) [5].

Moreover, Zhang *et al*. (2023) [85] highlighted that digital instructional modules grounded in inquiry-based learning and self-regulation principles are increasingly recognized for their ability to enhance student engagement and improve academic performance. Persistence and motivation are naturally encouraged by these educational systems, which strike a balance between direct instruction and student initiative. In line with this, Arshad *et al*. (2021) [8] found that students typically perform better, especially in the sciences, when they employ self-regulated strategies that are incorporated into learning modules. Al-Hassan and Ali (2024) [2] noted that the provision of space for students to investigate subjects using mobile-based materials boosts enhanced attention and supports the consolidation of conceptual understanding. Efe and Topsakal (2022) [29] further noted that digital learning games and interactive activities matched with teaching goals not only enhance interest but also enhance learners' confidence and motivation.

Interactive modules with helpful features like step-by-step instructions, experiential learning opportunities, and ongoing feedback are typically the most successful when incorporated into online education platforms as mentioned by Al Mamun and Lawrie (2023) [4]. These components not only support students in maintaining their academic progress but also inspire critical thinking and self-directed learning. Accordingly, students who regularly participate in well-designed interactive modules tend to perform better, particularly in learning environments that provide flexibility and immersive experiences, based on Goode *et al*. (2023) [38].

Despite the growing body of international research supporting the effectiveness of interactive self-learning modules (ISLMs) in enhancing student engagement and academic performance, there is still limited evidence on their application and impact within the Philippine educational context. In particular, few studies have examined how interactive modules can be designed and implemented to suit the unique needs of Filipino learners, considering cultural, institutional, and technological factors. This study aims to address this gap by examining the development and implementation of interactive self-learning modules in the Philippines and their potential to enhance student engagement and learning outcomes.

Research Objective

This systematic review aimed to synthesize how interactive self-learning modules sustain student engagement and learning outcomes in the Philippines.

Review of Related Literature

Interactive Learning in the Philippine Context

According to Lutching (2024) [55], in the Philippine educational landscape, the shift toward technology-mediated instruction, particularly the use of Interactive Self-Learning Modules (ISLMs), has gained traction in response to the demands of remote learning and flexible modalities. Although ISLMs have been widely distributed in recent years, empirical evidence of their pedagogical effectiveness is still emerging. Existing studies, however, provide a promising outlook on their capacity to enhance student engagement and academic performance.

Flores and Carreon (2022) [33] investigated the implementation of digital ISLMs in selected public high schools across the Philippines. Their findings established that learners exposed to interactive and self-paced modules exhibited increased motivation and improved academic outcomes in science and mathematics. The study underscored that the design of ISLMs, particularly their autonomy-supportive structure and integration of multimedia, contributed to heightened cognitive involvement and accessibility among Filipino learners.

Supporting this, Reyes *et al*. (2023) [66] developed ISLMs tailored for senior high school physics instruction in General Santos City. The modules incorporated simulations and exploratory tasks aimed at demystifying abstract scientific concepts. Results indicated significant improvements in learner performance, with students reporting that the interactive features of the modules facilitated better comprehension and sustained engagement. This aligns with existing literature advocating for inquiry-based instructional design in self-learning contexts.

Moreover, Solis and Delos Reyes (2021) [73] evaluated the use of ISLMs in Araling Panlipunan for Grade 8 learners in Laguna. Their quasi-experimental study revealed increased levels of student participation and the development of critical thinking skills. These outcomes were attributed to the integration of scenario-based activities and embedded assessments within the modules, which promoted analytical thinking and learner autonomy.

Further evidence from Martinez and Cruz (2024) [57] focused on junior high school mathematics instruction in Cavite. Their study employed a quasi-experimental design to compare traditional instruction with ISLM-based teaching. Learners who engaged with ISLMs showed significantly higher retention rates and developed more favorable attitudes toward mathematics. The results emphasize the role of interactive content in mitigating math anxiety and improving long-term achievement.

Complementary findings from Briones *et al*. (2023), examined Filipino online learners' engagement and self-regulation using digital platforms. The study affirmed that students with higher self-regulated learning competencies were better able to navigate and benefit from ISLMs. Similarly, Funa *et al*. (2023) [35] highlighted that preservice teachers in the Philippines adopted goal-setting and reflective strategies when interacting with modular content, suggesting that ISLMs can cultivate metacognitive skills critical for lifelong learning.

The role of gamification in ISLMs was explored by Yeung *et al*. (2023) [83], whose study showed that incorporating both digital and analog game elements led to enhanced cognitive engagement and satisfaction. Vo and Ho (2024) [77] added that the effectiveness of ISLMs depends not only on their design but also on learners' expectancy-value beliefs. Modules perceived as relevant, meaningful, and autonomy-supportive were positively correlated with sustained engagement and improved academic performance.

Self-Regulated Learning and ISLMs

Self-regulated learning, characterized by goal setting, monitoring, and reflection, is essential for academic success in self-learning environments. According to Arshad *et al*. (2021) [8], incorporating self-regulation strategies within ISLMs empowers students to take ownership of their learning. Their findings revealed that students who used self-regulated learning features within digital modules demonstrated improved academic performance, particularly in science-related subjects.

A study by Funa and Talaue (2021) [36] explored Filipino students' perceptions of biology self-learning modules (SLMs) during the pandemic. Findings revealed that students appreciated the interactive and self-paced nature of the modules, which aligned with constructivist and self-regulated learning principles. The modules encouraged goal setting and independent study, contributing to improved engagement and conceptual understanding of science subjects.

Similarly, Funa *et al*. (2023) [35] explored how Filipino preservice teachers cultivated and utilized self-regulated learning strategies in online settings. Their findings highlighted the critical role of interactive digital tools and well-structured modules in enhancing reflection, effective time management, and goal-oriented actions. The study advocates for the development of ISLMs that encourage self-regulation to maintain student engagement and support academic achievement.

In another study, Briones *et al*. (2023) carried out a nationwide survey involving Filipino students in science education to assess their engagement, self-regulated learning abilities, and self-efficacy in online settings. The results revealed that students with higher self-regulation were more actively involved with interactive modules and achieved better academic results. The study highlights the value of incorporating self-regulated learning strategies into ISLMs to foster learner independence and improve educational outcomes. They also assessed the quality of virtual learning materials, including ISLMs, used in Google Classroom across Philippine schools. Stakeholders, including teachers and students, emphasized the importance of interactivity, clarity, and alignment with learning outcomes. The findings suggest that well-designed ISLMs can foster deeper engagement and improve comprehension, especially when paired with platforms that support feedback and collaboration.

Student Engagement Through Interactive Learning

Student engagement is widely known as a critical predictor of academic achievement across learning modalities. In the context of self-paced instructional formats, Interactive Self-Learning Modules (ISLMs) have emerged as a pedagogical tool that supports sustained attention, motivation, and deeper learning.

A study conducted by Al-Hassan and Ali (2024) [2] demonstrated that mobile-based ISLMs embedded with inquiry-driven and exploratory learning tasks significantly enhance students' conceptual understanding and focus. These findings underscore the importance of designing instructional materials that encourage active investigation and promote higher-order thinking processes.

In a related study, Zainuddin *et al*. (2023) [84] examined the role of gamification in both digital and non-digital ISLMs and its effects on learner engagement and satisfaction. Their results revealed that mixed gamification strategies, when integrated with inquiry-based content, effectively elevated cognitive engagement and learner motivation. This suggests that ISLMs must strike a balance between technological interactivity and pedagogical intent to maximize impact.

Yeung *et al*. (2023) [83] corroborated these conclusions by demonstrating that the combination of gamification and inquiry-based tasks leads to enhanced conceptual depth and sustained attentional engagement. Their research highlights the effectiveness of instructional design that integrates challenge-based learning with interactive feedback mechanisms.

Furthermore, Vo and Ho (2024) [77] examined how students' expectancy-value beliefs mediate engagement within online learning environments. Their findings indicate that ISLMs that incorporate meaningful content, student autonomy, and opportunities for exploration foster stronger motivational profiles and improved academic outcomes. The inclusion of relevance and learner agency in module design is therefore essential to sustaining engagement over time.

Interactive Self-Learning Modules (ISLMs) and Sustained Learning Outcomes

Interactive Self-Learning Modules (ISLMs) allow students to learn at their own pace, revisit difficult topics, and explore lessons through interactive activities, all of which contribute to more meaningful and lasting learning experiences. A study by Alvarado and De Guzman (2024) [6] found that learners who used ISLMs in their science classes not only performed well in immediate assessments but also retained what they learned weeks after the lessons ended. These results highlight how ISLMs help students build a stronger foundation of knowledge.

Ramirez and Santos (2023) [65] noted that students who regularly used ISLMs became more aware of their learning processes. They learned how to monitor their progress, identify gaps in their understanding, and take steps to improve. All of which are key to achieving sustainable academic growth.

Interestingly, the benefits of ISLMs became even more visible during the pandemic, when face-to-face classes were replaced by distance learning. A study by Lim and Rivera (2025) [54] found that students who used ISLMs during this period were able to continue learning effectively, even with limited access to real-time instruction. This shows how ISLMs can help maintain the quality of education even in challenging situations.

Methodology

According to McClean and Shaw (2005) [59], meta-synthesis is a qualitative research approach that seeks to build conceptual understanding by thoughtfully reinterpreting and weaving together findings from existing qualitative studies. In this study, the method was used to bring together insights from a range of relevant research, creating a stronger foundation for exploring how interactive self-learning modules support student engagement and improve learning outcomes within the Philippine education system.

Search Strategy

A scholarly electronic database search was conducted to find English-language journal articles related to the Interactive Self-Learning Modules sustained Students Engagement and Learning Outcomes, using the Harzing Publish or Perish Version 8 software with access to both Google Scholar and Crossref databases. Relevant studies to interactive self-learning modules, published between 2023 and 2025, were collected and reviewed. The keywords applied in the Google Scholar search via Harzing Publish or Perish Version 8 software included: qualitative study, interactive self-learning modules, sustaining student engagement and learning outcomes relevant to the Philippine context. The PRISMA 2020 flow diagram was used to systematically organize and document the selection process.

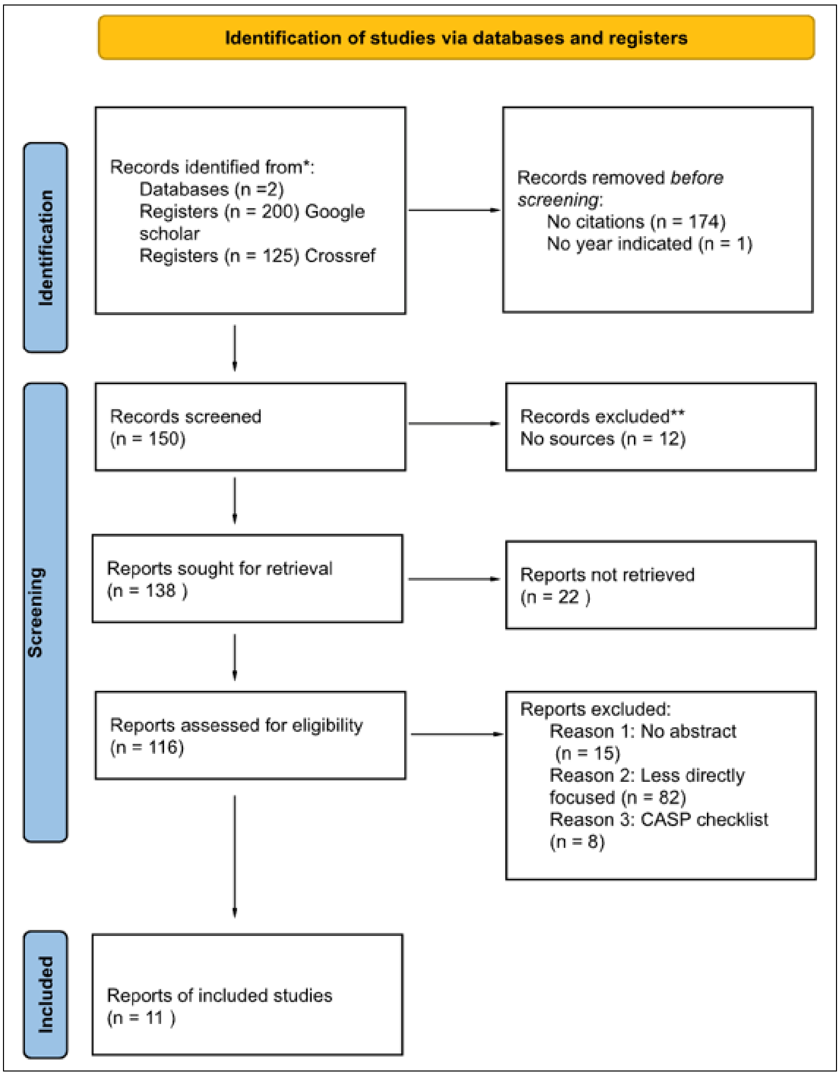

Fig 1: Identification of studies via databases and registers using PRISMA

There were three (3) stages of the research paper selection process using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Diagram: Identification, Screening, and Inclusion. A total of two hundred (200) studies were retrieved from Google Scholar, and one hundred twenty-five (125) studies from Crossref, resulting in three hundred twenty-five (325) records initially identified using the Harzing Publish or Perish Version 8 software. During the identification stage, one hundred seventy-five (175) studies were excluded before screening because one hundred seventy-four (174) studies had no citations, and one (1) study had no indicated publication year. This left one hundred fifty (150) studies for the screening phase. In the first part of the screening, twelve (12) studies were excluded due to having no accessible sources, reducing the number to one hundred thirty-eight (138) studies. Next, twenty-two (22) reports could not be retrieved after attempts were made. The remaining one hundred sixteen (116) studies were assessed for eligibility. Out of the one hundred sixteen (116) studies, fifteen (15) were excluded due to no available abstract, two (2) studies were excluded for being less directly focused on the core topic, and eight (8) studies did not meet criteria based on the CASP checklist. This resulted in a final selection of eleven (11) eligible studies that were included in the meta-synthesis.

The Critical Appraisal Skills Programme (CASP) checklist for Systematic Reviews was employed to evaluate the remaining studies. These search terms were intentionally chosen to retrieve relevant data from the databases and to consolidate variables necessary for the meta-synthesis.

According to Sandelowski and Barroso (2003) [70] the final number of studies included in the process of meta-synthesis depends on the decision and agreement of the researchers, context of the investigation, and availability of resources. Some authors claim (regarding the requirement to formulate conclusions) that a meta-synthesis should include at least 10 or 12 primary studies. The eleven (11) included studies met all inclusion criteria-these were qualitative or mixed-methods studies that focused on interactive self-learning modules (ISLMs), demonstrated methodological soundness, and were contextually relevant to education in the Philippines. The characteristics of the included studies on ISLMs are displayed in Table 1 as a basis for the thematic analysis.

Table 1: Studies on ISLMs included in the meta-synthesis

S. No	Authors and Year	Region	Category	Research Approach	Title	Students Engagement	Learning Outcomes
1	Handog, S., & Aliazas, J. V. (2024) [42]	Calabarzon Region IV-A	Secondary	Mixed Methods	"Adaptive e-learning module in teaching physical science for improved student engagement and critical thinking skills".	1. Adaptive e-learning paths allowed students to learn at their own pace, reducing frustration and enhancing focus. 2. Interactive content and simulations captured student interest, making science concepts easier to understand. 3. Lessons were visually engaging, which increased motivation and sustained attention. 4. The approach encouraged independent learning and held learners accountable. (S_1)	5. ISLMs developed critical thinking by including problem-solving activities and open-ended tasks. 6. The modules provided instant feedback, which helped students identify errors and improve. (S_1)
2	Lasala, Nl. (2023) [52]	Region V	Secondary	Mixed Methods	"Development and Validation of E-SelfIMo: E-Learning Self-Directed Interactive Module in Earth Science"	1. The platform provided structure and consistency in learning, which helped students stay organized. 2. STEM ISLMs integrated real-world problems, making learning meaningful and relevant. 3. Students reported increased engagement due to the interactive and hands-on nature of the modules.(S_2)	4. ISLMs promoted 21st-century skills such as collaboration, digital literacy, and communication. 5. Learning activities allowed for exploration and self-paced mastery of concepts. 6. The use of feedback tools improved self-assessment and reflection. (S_2)
3	Divinagracia, J. (2024) [27]	Region VI	Secondary	Qualitative Method	"Student's Experiences with a Calculus Video-Based Module: A Qualitative Study"	1. ISLMs enhanced engagement by using multimedia tools like videos, quizzes, and virtual labs. 2. Learning became more student-centered, shifting away from lecture-heavy methods. 3. Technology helped scaffold lessons, supporting students with different learning styles. 4. Innovative strategies promoted creativity and confidence in solving academic tasks. (S_3)	5. Students had better retention when content was presented interactively. 6. Modules supported inquiry-based learning, improving deeper understanding. 7. Innovative strategies promoted creativity and confidence in solving academic tasks. (S_3)
4	Santos, M. S. M. D., & Batiancila, R. M. (2025) [71]	Region VII	Tertiary	Mixed Methods	"Using Information and Communication Technology on Students' Mathematics Performance in National High Schools in the Philippines."	1. ISLMs increased student participation in math by presenting problems in more relatable formats. 2. Students developed more consistent study habits due to the structured pacing of the modules. 3. Modules helped reduce anxiety in math by allowing self-paced review and retry options. (S_4)	4. ICT tools embedded in modules simplified complex equations through visual representation. 5. Teacher monitoring tools within ISLMs helped track progress and intervene early. 6. The modules cultivated problem-solving confidence and mathematical resilience. (S_4)
5	Cao, J. (2024) [20]	National Capital Region	Tertiary	Qualitative Method	"Enhancing Student Engagement and Learning Outcomes through Interactive Approaches in College Vocal Music Instruction"	1. Interactive exercises kept students actively involved in improving vocal techniques. 2. Learners reported higher satisfaction and motivation to practice independently. 3. Creativity was supported through digital assignments and performance recordings. (S_5)	4. ISLMs supported practice-based learning with embedded audio-video demonstrations. 5. Students could review lessons repeatedly, increasing mastery and self-assurance. 6. Feedback mechanisms allowed for real-time performance evaluation. (S_5)
6	Lasala, N., *et al*. (2025) [53]	Region V	Secondary	Mixed Methods	"Effect of E-learning Self-directed Interactive Module (E-SelfIMo) on Students' Understanding of Earth Science Concepts"	1. Discovery-based ISLMs helped students learn through investigation rather than direct instruction. 2. Students engaged more when they were encouraged to observe, hypothesize, and draw conclusions. 3. The content was adapted to stimulate curiosity and self-driven exploration. (S_6)	4. Visual and interactive formats supported learners in grasping biological classifications. 5. The modules fostered analytical skills and scientific reasoning. 6. Student performance improved due to repetitive practice and guided discovery. (S_6)
7	Cano, J. & Lomibao, L. (2023) [19]	Region X	Tertiary	Mixed Methods	"A Mixed Methods Study of the Influence of Phenomenon-based Learning Videos on Students' Mathematics Self-efficacy, Problem-solving and	1. Students were more engaged when solving real-life scenarios. 2. E-learning tools supported brainstorming, group discussions, and shared submissions. 3. ISLMs encouraged role-playing and simulation-based tasks, making lessons more immersive. 4. Engagement increased when	5. Problem-Based Learning (PBL) within ISLMs enhanced critical thinking and collaboration. 6. Peer review and feedback processes developed communication and self-reflection skills. (S_7)

					Reasoning Skills, and Mathematics Achievement"	learners connected academic content with practical applications. (S_7)	
8	Estrellado, C.J. & Miranda, C. (2023) [31]	Calabarzon Region IV-A	Tertiary	Mixed Methods	Artificial Intelligence in the Philippine Educational Context: Circumspection and Future Inquiries	1. AI adjusted lesson flow based on student pace and comprehension, sustaining attention. 2. Students received personalized suggestions, motivating them to continue learning. 3. Intrinsic motivation grew as students felt their needs were being individually addressed. (S_8)	4. ISLMs used AI to analyze weak areas, helping learners improve in specific topics. 5. Real-time data helped teachers intervene effectively and boost student confidence. 6. The adaptive platform reduced cognitive overload and improved retention. (S_8)
9	Concepcion, E. & Vilanueva, D. (2023) [76]	National Capital Region	Secondary	Qualitative Method	"Interactive E-Learning Materials in Physics for an Enhanced Performance of Grade 10 Students"	1. The use of multimedia and interactive content mirrors the structure of ISLMs designed to sustain engagement. 2. Promotes peer collaboration and discussion, enhancing motivation and deeper understanding. 3. Emphasizes the role of digital tools in making abstract concepts more accessible and engaging. (S_9)	4. Encourages students to actively explore and construct knowledge, which supports self-directed learning in ISLMs. 5. The study demonstrated measurable gains in student performance, validating the effectiveness of interactive, student-centered approaches. (S_9)
10	Errabo, D. D., & Ongoco, A. A. (2024) [30]	National Capital Region	Secondary	Mixed Methods	"Effects of interactive-mobile learning modules in students' engagement and understanding in genetics"	1. Students using mobile platforms demonstrated increased motivation, participation, and satisfaction, which are essential for sustaining engagement in ISLMs. 2. Learners expressed high satisfaction with the mobile platform, citing ease of use, usefulness, and frequent engagement. 3. The platform supported peer interaction and group tasks, reinforcing social engagement within self-learning environments. 4. Students feel more in control of their learning, which boosts intrinsic motivation and self-regulation. (S_{10})	5. Mobile platforms enable flexible, anytime-anywhere access to educational content, boosting convenience and continuity in learning. (S_{10})
11	Modez, C., *et al.* (2024)	Calabrazon Region IV-A	Tertiary	Mixed Methods	"Innovation in Education: Developing and Assessing Gamification in the University of the Philippines Open University Massive Open Online Courses"	1. Points, badges, and rewards are used to increase motivation and sustain participation. 2. Combining AI and gamification stimulates higher-order thinking and sustained academic focus. (S_{11})	3. Tools such as simulations, educational apps, and AI-enhanced learning management systems (LMS) promote deeper understanding and long-term retention. 4. Artificial intelligence tailors educational materials to match individual students' learning pace, preferences, and performance, creating a more personalized and efficient learning process. (S_{11})

The final collection of eleven studies was published as peer-reviewed journal articles. The authors represented are majority based in Asia (11 studies). These studies explored various aspects of Interactive Self-Learning Modules (ISLMs) in diverse educational contexts. Methodologically, the collection included both qualitative (3 studies) and mixed-methods (8 studies) approaches, providing rich insights into student engagement and learning outcomes.

Inclusion/ Exclusion Criteria

To maintain the quality and relevance of the studies incorporated in this meta-synthesis, particular criteria were applied throughout the selection process. The studies needed to focus on interactive self-learning modules (ISLMs) and how these support student engagement and learning outcomes. Both qualitative and mixed-method research were considered, including peer-reviewed journal articles, theses, and dissertations. In order to keep the findings up to date, only studies published from 2023 to 2025 were included. All sources had to be retrieved from Google Scholar and Crossref using the Publish or Perish Version 8 software (Harzing, 2022) [43], and the studies had to be written in English to maintain consistency and ease of interpretation.

Each study went through an evaluation using the Critical Appraisal Skills Programme (CASP) checklist, which helped determine if it met the necessary standards in terms of research design, credibility, and clarity. Studies were excluded if they did not directly focus on ISLMs, did not discuss student engagement or learning outcomes, or were purely quantitative without meaningful qualitative insights. Research that was outside the publication date range, lacked access to a full text or abstract, or did not meet the CASP quality standards was also not considered. By applying these criteria, only those studies that were most relevant and reliable were included in the final synthesis. This ensured that the analysis was based on sound evidence that could meaningfully inform educational practices, particularly in the Philippine context.

Data Analysis

Thematic data analysis was utilized to identify key patterns and recurring themes within the selected studies. The analysis adhered to the six-step framework outlined by Clarke and Braun (2017) [17], as cited in Canfield (2020) [21], which includes becoming familiar with the data, developing initial codes, identifying themes, refining and reviewing them, assigning clear definitions and names, and compiling the final report.

The analysis focused on synthesizing evidence from the included studies to determine how Interactive Self-Learning Modules (ISLMs) contribute to sustaining student engagement and learning outcomes, relevant to the Philippine context. Themes were developed based on recurring insights regarding the design, implementation, and impact of ISLMs.

Results and Discussions

The findings of this meta-synthesis are presented in alignment with the study's objective to propose how Interactive Self-Learning Modules (ISLMs) can sustain student engagement and learning outcomes, relevant in the Philippine educational context. Based on the synthesis of eleven eligible studies (S), three themes were identified: Enhancing Student Engagement through Interactive Design with four subthemes: gamification and motivation, multimedia and visual appeal, autonomy and self-pacing and peer collaboration and social learning; Supporting Learning Outcomes through Personalized and Feedback-Driven Instruction with three subthemes: 21st century skills, feedback and reflection, and mastery and retention; and Interactive Self-Learning Modules (ISLMs) as Catalysts for Sustained Student Engagement and Learning Outcomes.

Enhancing Student Engagement through Interactive Design

One of the most prominent themes across the reviewed studies is the role of ISLMs in enhancing student engagement through interactive and thoughtfully designed digital learning environments. These modules incorporate game-based mechanics, visual tools, and multimedia content to maintain attention and foster active participation. According to Mayer (2009) [58], Mayer's Cognitive Theory of Multimedia Learning explains how combining visuals, audio, and interactivity significantly boosts engagement and learning outcomes. This supports the use of videos, simulations, and quizzes in ISLMs to sustain student attention and facilitate deeper learning. Research from Chen and Sun (2012) [22], supports the use of multimedia content like videos and animations to enhance students' motivation and reduce cognitive overload, leading to improved attention and engagement in self-learning environments.

Gamification and Motivation

Gamification elements such as points, badges, and progress tracking were frequently employed to increase learner motivation and sustain participation (S11, S8). As mentioned by Hamari *et al*. (2014) [41], the competitive and reward-based structure of ISLMs contributes to intrinsic and extrinsic motivation, which is especially effective in maintaining learner interest over time. Studies revealed that gamified modules promoted not only consistent participation but also enthusiasm toward academic tasks (S2, S6). Likewise, Domínguez *et al*. (2013) [28] found that students using gamified e-learning environments demonstrated better task completion and academic performance than those in traditional learning settings. Deterding *et al*. (2011) [26] further emphasized that gamification supports learners' psychological needs—competence, autonomy, and social connection—resulting in deeper engagement and sustained participation.

Multimedia and Visual Appeal

The use of multimedia such as videos, interactive quizzes, and animations was found to be essential in capturing learners' attention and simplifying abstract concepts (S1, S3). According to Mayer (2009) [58], visually rich interfaces improve conceptual understanding, particularly in STEM subjects, by promoting cognitive engagement and reducing information overload. The appeal of visually dynamic modules enhances focus and helps students retain information more effectively (S5, S9). Another study form Clark and Mayer (2016) [23] explained that combining words and visuals according to multimedia learning principles increases knowledge retention and understanding. Similarly, Kay and LeSage (2009) [47] noted that multimedia tools such as animations and interactive videos significantly improved comprehension and engagement in science and mathematics education.

Autonomy and Self-Pacing

Many studies reported that ISLMs allowed students to learn at their own pace, thereby supporting autonomy, reducing anxiety, and encouraging self-regulation (S1, S4). This flexibility is especially beneficial in diverse classrooms, where learners progress at different rates, as stated by Means *et al*. (2014) [60]. Self-paced design fosters ownership of learning, which has been linked to higher motivation and deeper cognitive processing (S5, S8). Similarly, Artino (2008) [9] emphasized that self-regulated learners in online environments benefit from greater autonomy, which leads to increased satisfaction and academic success. Moreover, Zimmerman (2002) [86] highlighted the importance of self-pacing in developing metacognitive strategies, allowing learners to monitor and reflect on their own learning progress more effectively.

Peer Collaboration and Social Learning

Another engagement-enhancing strategy evident in ISLMs is the integration of collaborative features, such as group tasks and peer discussions (S7). These foster social presence and interactivity, which contribute to greater learner satisfaction and motivation as explained by Hrastinski (2009) [46]. Digital collaboration not only increases engagement but also helps develop teamwork and communication skills essential for 21st-century learners (S9). Supporting this, Vygotsky's (1978) [78] sociocultural theory underscores that learning is inherently social, and that peer interaction scaffolds cognitive development. In addition, Wang (2010) [80] found that collaborative learning tools in e-learning environments promoted not only knowledge construction but also social bonding, enhancing learner motivation and retention.

Supporting Learning Outcomes through Personalized and Feedback-Driven Instruction

Interactive Self-Learning Modules (ISLMs) were found to significantly support learning outcomes by incorporating adaptive, student-centered strategies such as real-time feedback, mastery learning, and problem-based tasks. These approaches are critical in helping students develop essential cognitive and metacognitive skills. Real-time feedback allows learners to promptly reflect and improve on their performance, while mastery-based instruction ensures that foundational understanding is achieved before progressing to more complex topics.

Gikandi *et al*. (2011) [37] emphasized that formative assessment that provides timely and constructive feedback enhances student engagement and promotes deep learning in online environments. They further noted that personalized feedback fosters a sense of ownership over learning and supports cognitive development. Similarly, Kay *et al*. (2016) [48] found that students who received continuous feedback and opportunities for reflection demonstrated higher levels of academic performance and self-regulation. Their study highlighted how self-paced and feedback-rich modules support metacognitive awareness and sustained academic success.

21st Century Skills

ISLMs often embedded open-ended and problem-based tasks, which were effective in cultivating higher-order thinking skills such as analysis, reasoning, and creativity (S1, S7). These findings align with literature advocating for inquiry-based digital learning environments to nurture critical thinking and collaboration, studies from Bell (2010) [11] and Silva (2009) [72]. Modules designed around real-world challenges also prepared students for practical applications of knowledge. Additionally, Trilling and Fadel (2009) [75] emphasized the need for education systems to foster 21st-century competencies such as problem-solving, information literacy, and adaptability. Similarly, Saavedra and Opfer (2012) [69] argued that authentic learning experiences in digital contexts help bridge the gap between classroom content and real-life skills required in the modern workforce.

Feedback and Reflection

Multiple studies emphasized the impact of timely and personalized feedback in ISLMs on student improvement and self-regulation (S1, S5). According to Nicol and Macfarlane-Dick (2006) [63], the integration of instant feedback tools not only guided learners toward correcting misconceptions but also encouraged self-assessment and reflection. Reflective practice, supported by peer or teacher feedback, was linked to deeper learning and confidence building (S8). Furthermore, Hattie and Timperley (2007) [45] highlighted that effective feedback provides clear goals, actionable steps, and motivational support, all of which enhance learning outcomes. Boud and Molloy (2013) [13] also stressed that feedback should be a dialogic process-ongoing and learner-centered—to build reflective and autonomous learners.

Mastery and Retention

Practice-based and repetitive elements within the modules were instrumental in reinforcing learning and improving long-term retention (S3, S5). Self-paced reviews and built-in tutorials allowed students to revisit content as needed, facilitating mastery of difficult topics (S9). These findings echo the value of spaced learning and retrieval practice in improving student performance as studied by Brown *et al*. (2014) [18]. In line with this, Roediger and Butler (2011) [68] demonstrated that repeated testing and retrieval practice significantly enhanced knowledge retention across various subjects. Karpicke and Grimaldi (2012) [49] also showed that practice testing outperformed rereading strategies, emphasizing its role in building durable learning.

Interactive Self-Learning Modules (ISLMs) as Catalysts for Sustained Student Engagement and Learning Outcomes

Interactive Self-Learning Modules (ISLMs) serve as powerful tools in sustaining student engagement and improving academic performance, especially in flexible or remote learning environments. These modules promote active participation, autonomy, and personalized learning by allowing students to progress at their own pace while receiving instant feedback and multimedia support. Such features not only maintain learners' interest but also encourage deeper understanding and long-term retention of content.

According to Al Mamun and Lawrie (2023) [4], well-structured ISLMs that include step-by-step instructions, and experiential activities enhance students' critical thinking and self-regulated learning. Additionally, Goode *et al*. (2023) [38] highlight that students exposed to interactive and immersive digital modules consistently outperform peers in traditional settings, showing higher motivation and academic gains.

This theme underscores the crucial role of ISLMs in creating learning environments that are both engaging and effective, particularly when designed with intentional interactivity and learner control.

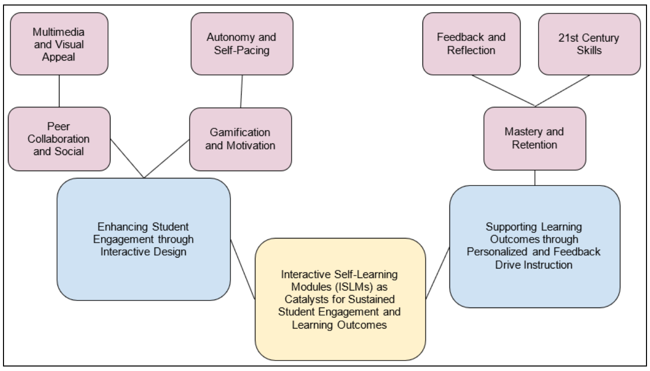

Fig 2: Framework for Interactive Self Learning Modules (ISLMs) in Sustaining Student Engagement and Learning Outcomes

Conclusion and Recommendation

The integration of Interactive Self-Learning Modules (ISLMs) in the Philippine educational system demonstrates strong potential in sustaining student engagement and improving learning outcomes. These modules, when designed with interactive features, personalized instruction, and feedback mechanisms, support the development of autonomy, critical thinking, and mastery learning among students. Findings from the meta-synthesis affirm the value of ISLMs in providing flexible, student-centered, and technology-driven instruction aligned with 21st-century education goals. However, challenges remain in contextualizing ISLMs to suit diverse learner needs and ensuring equitable access to digital tools and internet connectivity. To address these concerns, it is recommended that schools prioritize teacher training in ISLM design and implementation, particularly in promoting self-regulated learning strategies and feedback-driven practices. Local education authorities, in collaboration with teachers, parents, and community stakeholders, must support the development, monitoring, and continuous improvement of ISLMs to ensure their effectiveness in diverse classroom settings. Moreover, the ISLM framework must be pilot-tested and evaluated across various schools, especially in low-resource and rural settings, to assess scalability and impact. Policymakers, school heads, curriculum developers, and education researchers should be involved in validating the framework through evidence-based assessments, ensuring it aligns with national learning standards and addresses real classroom needs. Continuous feedback loops from these stakeholders can guide policy formulation and encourage wider adoption of effective ISLM practices.

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