AI-driven mobile application: unraveling students' motivational feature preferences for reading comprehension

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Abstract

Purpose – This study investigates user preferences for motivational features aligned with self-determination theory (SDT), emphasizing autonomy, relatedness, and competency. The study seeks to identify the most appealing and effective motivational features in AI-driven mobile apps for fostering autonomy, promoting relatedness, and enhancing feelings of competency in the context of reading comprehension.

Design/methodology/approach – Employing a mixed-methods research design based on the self-determination theory, the study used triangulation of methods to enhance the research findings' quality, completeness, validity, and understanding.

Findings – Both qualitative and quantitative findings showed similarities in the emphasis on personalization, progress tracking, social interaction, gamification, differences in specific feature preferences, and nuanced recommendations, highlighting the importance of a comprehensive and user-centric development approach.

Research limitations/implications – The study design and sample size might constrain the statistical power and generalizability of the results. The study used a convenience sample of students from one school.

Practical implications – The synthesis of findings suggests the need for a comprehensive development strategy that incorporates both the commonalities and nuanced recommendations from qualitative and quantitative data. Combining the strengths of both findings, a holistic user-centric approach that integrates personalization, progress tracking, social interaction, and gamification is crucial for effective app development. Recognizing that individual preferences may vary, developers should consider tailoring features to accommodate a range of user needs, as indicated by qualitative and quantitative insights.

Originality/value – This comprehensive approach contributes to advancing knowledge in AI-driven mobile applications and their impact on student motivation and reading comprehension in the Philippine context. Also, it provides valuable insights for designers and developers, contributing to creating engaging and user-friendly platforms that enhance reading comprehension skills.

Keywords Reading comprehension, AI-driven mobile applications, Motivation, Self-determination theory

Paper type Research paper

In the ever-evolving landscape of education, the digital age has become the catalyst for transformative change, reshaping traditional paradigms and ushering in a new era of pedagogical possibilities. In tandem with this revolution, reading comprehension is vital in the digital age, as people are exposed to various types of texts and media online. However, screen reading often leads to multitasking and distractions, presenting unique challenges compared to paper, including information overload. (Liu, 2022). Therefore, students must develop strategies to effectively comprehend and retain what they read in digital environments. Studies (Chi, 2024 and Orellana *et al.*, 2024) emphasize that reading

comprehension remains a global challenge, with students grappling to attain proficiency. In addition, UNICEF's 2022 report reveals a critical global education crisis: 64% of 10-year-olds lack basic reading skills, highlighting an urgent need for worldwide educational reform. (UNICEF, 2022). Furthermore, the Southeast Asia Primary Learning Metrics (SEA-PLM) 2019 report showed the lowest reading, writing, and mathematics capability among Filipino 5th graders. In the Philippine setting, the Department of Education (DepEd) acknowledges the need for targeted interventions to address reading comprehension issues among students (DepEd, 2021). Moreover, reading online requires different strategies and skills than reading on paper, such as skimming, scanning, browsing, and keyword searching (Azmi *et al.*, 2020). The persistent issues in reading comprehension, both on a global scale and within the Philippine context, highlight the immediate necessity; there is a critical demand for inventive solutions to captivate and inspire students.

Introducing Artificial Intelligence (AI) into educational technology presents a promising avenue for addressing these challenges. As Hwang *et al.* (2020) posited AI's potential to transform learning experiences lies in its ability to tailor content delivery, adjust individual learning styles, and elevate overall engagement. The infusion of AI into educational technology represents a paradigm shift, allowing for the creation of intelligent, responsive, and motivating learning environments. (Walter, 2024 and Aristanto *et al.*, 2023)

One way to enhance reading comprehension in the digital age is to use AI-driven mobile applications to provide personalized and adaptive support for learners. Li *et al.* (2022) explore the core characteristics of AI apps, shedding light on features, functionalities and trends. However, more studies must be done on how AI-driven mobile applications can incorporate motivational features based on the student's preferences that engage and sustain students' interest and effort in reading comprehension tasks. Motivational features, such as feedback, rewards, goals, choices, challenges, and social interaction, can influence students' intrinsic and extrinsic motivation (Ryan and Deci, 2020). Understanding students' motivational feature preferences is essential for designing effective AI-driven mobile applications catering to their diverse needs and preferences. As of the authors' knowledge, no study has focused on identifying the theory-based motivational preferences of students to be incorporated into AI-driven mobile applications to boost comprehension in the Philippine context. The primary objective of this study is to investigate users' preferences for motivational features, specifically those aligned with self-determination theory (SDT) with autonomy, relatedness, and competency, within AI-driven mobile applications aimed at enhancing reading comprehension. The study aims to identify the motivational features that users find most appealing and effective in fostering a sense of autonomy, promoting relatedness, and enhancing feelings of competency in AI-driven mobile apps in the context of reading comprehension. By exploring user preferences, the research seeks to inform the designers and developers of AI-driven mobile applications that align with users' motivational needs, ultimately contributing to creating more engaging and user-friendly platforms for improving reading comprehension skills.

Related works

Over the last decade, there has been a substantial transition toward online learning, marking a dynamic digital transformation in the educational landscape that reshapes the learning environment. Sum and Oancea (2022) provide a comprehensive analysis, highlighting the adaptation of innovation and technology integration to foster better engagement and support. In addition, as noted by Okoye *et al.* (2023), digital technologies have become integral to educational practices, influencing how knowledge is acquired and disseminated. Allen and Seaman's annual reports on Online Learning in Higher Education (2020) reveal a steady increase in students engaging in online courses, highlighting the growing prominence of

digital platforms. Another notable review by Keshavarz and Mirmoghtadaie (2023) discusses the evolution of educational technology and its integration into traditional learning environments. The 2021 EDUCAUSE Horizon Report examined how incorporating Open Educational Resources (OER) into teaching syllabi can boost students' involvement and active participation. This integration is highlighted as a method to potentially increase educational engagement, offering a more interactive and inclusive learning experience. This phenomenon reveals a complex interplay of drivers, challenges, opportunities, and impacts. Several studies underscore the transformative potential of digital tools in enhancing student outcomes, with personalized learning experiences positively affecting achievement, motivation, and engagement (Walter, 2024; Ahmad Bhat, 2023; Deci and Ryan, 1985). However, studies show that challenges like disparities in access and skills and resistance to change necessitate a nuanced implementation strategy (Mikhailov *et al.*, 2024).

*Comprehen*ding written text is an intricate cognitive skill encompassing tasks such as decoding words, grasping their meanings, establishing connections between sentences and paragraphs, drawing inferences, and vigilantly monitoring one's understanding (Capodieci *et al.*, 2020). Proficiency in reading comprehension is a fundamental skill crucial for achieving academic success and fostering lifelong learning. However, reading comprehension in the digital age poses new challenges and opportunities for learners and educators. Reading online requires strategies and skills different from reading on paper, such as skimming, scanning, browsing, and keyword searching (Azmi *et al.*, 2020). Online readers also need to evaluate the credibility, relevance, and accuracy of multiple sources of information and integrate them into a coherent understanding of the topic, as mentioned by Klimova and Zamborova (2020). The literature on reading comprehension in the digital age has explored various aspects of this complex phenomenon (Capodieci *et al.*, 2020; Kiili *et al.*, 2024; Kumar and Dhar, 2023). The literature underscores the importance of cultivating skills specific to online reading while recognizing the multifaceted aspects influencing comprehension in the ever-evolving digital age.

Utilizing technology can be a valuable resource to bolster reading comprehension by granting access to diverse texts, amplifying motivation and engagement, providing support in comprehension processes, and streamlining feedback and assessment. OECD (2021) emphasizes that in today's digital age, the sheer volume of information requires readers to differentiate factual content from personal viewpoints, effectively enhancing critical literacy skills. In addition, scholars suggest some implications for teaching and learning reading comprehension in the digital age (Zuo *et al.*, 2023; Saroyan, 2022). Scholars emphasize the importance of embracing digital advantages, providing explicit instruction in online reading strategies, encouraging diverse reading experiences, and fostering critical thinking in online tasks.

The emergence of AI-driven solutions in educational technology is a promising trend that has the potential to transform learning outcomes, enhance teacher practice, and foster skills and values that are essential for the future. According to UNESCO, AI can help address some of the most significant educational challenges today, such as access, quality, equity, and inclusion, while ensuring that human-centered principles guide its application. AI can also accelerate students' holistic development by providing personalized learning, real-time feedback, and opportunities for critical thinking and problem-solving (Kopp and Thomsen, 2023). Moreover, Artificial intelligence can enhance the gratification of teaching by automating responsibilities like lesson planning and grading, allowing teachers to focus on building relationships and providing guidance to students (Ibrahim, 2023). Furthermore, Exploring attitudes, preferences, and needs towards AI-informed mobile mental health apps among young people (Götzl *et al.*, 2022) and investigating the impacts of mobile-assisted vocabulary learning outside the classroom using digital flashcards for English as Foreign Language learners (Rahmani *et al.*, 2022), neither study delves into the motivational

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preferences of students in AI-driven mobile apps based on the theoretical framework of SDT principles, with the former focusing on mental health and the latter on vocabulary learning.

Additionally, a study by Xodabande and Hashemi (2022) on learning English with electronic textbooks on mobile devices does not address the motivational preferences of students in AI-driven mobile apps based on the SDT framework, emphasizing vocabulary learning instead of language comprehension. In addition, AI-driven mobile applications are emerging technologies that use AI to provide personalized and adaptive support for reading comprehension. These applications harness the power of AI to analyze students' reading behaviors, preferences, strengths, and weaknesses; to provide feedback, guidance, and scaffolding; and to adapt the content, difficulty level, and pace of reading activities according to student's needs and goals (ten Have and Patrão Neves, 2021).

Theoretical framework
Motivational feature preferences refer to the degree to which learners prefer certain features or elements in an educational technology designed to enhance their motivation, such as timely feedback, rewards, challenges, social interaction, goal-setting aids and others, as Jin *et al.* (2023) noted. According to Jin *et al.* (2023), the multifaceted nature of students may have different motivational feature preferences depending on various factors, such as learning goals, self-efficacy, interest, and prior experience. Reflecting on Reinders *et al.* (2022), understanding learners' motivational feature preferences can help educators and designers create more effective and engaging educational technology supporting learners' autonomy, competence, and relatedness. The theoretical framework guiding this study is the self-determination theory (SDT) established by Deci and Ryan (1985), a widely used theory of human motivation that distinguishes between intrinsic and extrinsic motivation. As highlighted by Hsiao and Bi *et al.* (2024), neglecting the exploration of the motivation behind technological engagement can lead to a potential shift towards a more technology-dependent lifestyle. With a nuanced understanding of the underlying motivational factors, the benefits derived from such technological activities may be protected.

A theoretical framework that can help address this challenge is SDT, which proposes that human motivation and well-being hinge on fulfilling three fundamental psychological needs—autonomy, competence, and relatedness (Deci and Ryan, 1985). Autonomy is the feeling one has a choice and willingly endorsing one's behavior; competence refers to mastery and effectiveness in one's tasks; and relatedness is the need to feel connected and belongingness with others (Mayo *et al.*, (2022). Following SDT, fulfilling these needs enhances the likelihood of students experiencing intrinsic motivation characterized by inherent interest and enjoyment in learning rather than relying on extrinsic motivation, which involves pursuing external rewards or responding to external pressures (Ryan and Deci, 2020).

In the context of AI-driven mobile apps, SDT can provide opportunities for students to exercise autonomy, competence, and relatedness in their learning process. For example, an app could allow students to choose their learning goals, topics, and pace and provide feedback and support tailored to their needs and preferences. An app could also enable students to monitor their progress and achievements and challenge them with tasks that are optimally matched to their skill level and learning style. An app could facilitate social interaction and collaboration among students and foster community and shared purpose (Wang *et al.*, 2022). By applying SDT principles to designing and developing AI-driven mobile apps, educators and developers can enhance students' motivation and engagement in digital learning and improve their comprehension outcomes. Research has shown that meeting the three basic psychological needs significantly positively affects intrinsic motivation, increasing students' psychological engagement in online learning environments (Pan, 2023).

Additionally, AI can incorporate gamified elements, such as rewards, badges, leaderboards, and challenges, making reading more fun and engaging for learners (Almusaed *et al.*, 2023). Mobile apps driven by AI can have a higher level of engagement and efficacy if the proper incentive framework is used. Moreover, intrinsic motivation has been linked to higher levels of cognitive processing, deeper understanding, and better retention of information (Ryan and Deci, 2000). Therefore, by supporting students' autonomy, competence, and relatedness in AI-driven mobile apps, educators and developers can create more effective and enjoyable learning experiences.

There needs to be more related literature needs to be thoroughly investigated regarding the motivational preferences of students in AI-driven mobile apps that can be designed and developed to enhance learner motivation based on the theoretical framework of SDT principles to boost reading comprehension.

Methodology
This research utilizes a mixed-methods design, combining quantitative and qualitative methodologies. The research focuses on comprehensively exploring student preferences within AI-driven mobile applications for reading comprehension. The study aims to provide a nuanced understanding of motivational feature preferences by combining qualitative and quantitative results. This approach ensures a thorough examination aligned with objectives, allowing for a holistic analysis of the motivational features that users find most appealing and effective in fostering a sense of autonomy, promoting relatedness, and enhancing feelings of competency in an AI-driven mobile app in the context of reading comprehension. While specific references and sources may vary based on the literature, but this design draws inspiration from Creswell's work on mixed-methods research (Creswell, 2014; Creswell and Clark, 2017). Utilizing methodological triangulation can improve research findings' quality, comprehensiveness, validity, and understanding. It also proves beneficial as it helps circumvent the shortcomings and research biases associated solely with a single research approach (Bhandari, 2023), a practice also employed in this study.

Population
Data were obtained from 71 Baguio City National Science High School (BCNSHS) respondents only. The respondents were between 12 and 20 years old; 59.2% were female, and 40.8% were male. 15.5% were at the grade 7 level, 15.5% were in grade 8, 7% were in grade 10, 47.9% were in grade 11 and 14.1% were in grade 12 level students. An interview with five students was conducted to add to the data collected.

Procedures
The theoretical framework employed in this study highlights the fundamental psychological needs, including autonomy, competence, and relatedness, as Deci and Ryan (1985) outlined, which guided the researcher in developing the questionnaire for this study. Survey questions underwent content validation, such as subject expert review, which was collected to validate the questionnaire and calculate the content validity index. Content validity is vital to ensure overall validity (Yusoff, 2019). The first phase of the research involved administering structured online surveys to a sample of 71 participants in Baguio City National Science High School (BCNSHS). A scale on the Likert scale, extending from 1–5, was utilized along with open-ended questions to gauge participant preferences. The quantitative data was analyzed using descriptive statistics. JASP statistical software is a freely available open-source tool (JASP Team, 2023) used for descriptive statistics in this study. The second phase of the research involved conducting in-depth interviews through video calls to 5 participants, using

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semi-structured questions to explore their motivations, experiences, and opinions in more detail. In the third phase, qualitative data was used for thematic analysis. The interviews were transcribed verbatim, identifying patterns and coding open-ended questions into categories that capture the variety of answers. This was conducted to help quantify and analyze the additional information provided by the respondents. The fourth phase of the research involved integrating the findings from both phases, using triangulation, complementarity, or expansion strategies to achieve a holistic understanding of the phenomenon (Johnson and Onwuegbuzie, 2004). The triangulation approach was employed to integrate findings from interviews and surveys. By merging interview and survey data, highlighting commonalities and differences to build a robust understanding of the subject. The integrated analysis of quantitative and qualitative findings comprehensively explores students' motivational feature preferences in AI-driven mobile applications. The study adhered to ethical principles and standards, ensuring informed consent, confidentiality, anonymity, and voluntary participation of the participants. Before commencing the study, the research proposal underwent ethical scrutiny and approval from the Institutional Review Board (IRB). However, the study also has some potential limitations that must be acknowledged. First, the statistical power and generalizability of the results might be constrained by the study design and sample size. The study used a convenience sample of students from one school - BCNSHS, which may not represent the broader population of students who use AI-driven mobile applications such as Duolingo, ChatGPT, Text to Speech and others used by the students to boost their reading comprehension. Second, the study may need help collecting data, such as low response rates or ethical concerns. The study employed strategies to mitigate these challenges, such as providing incentives and obtaining informed consent.

Results and discussion

The survey consisted of nine structured and three semi-structured questions that aimed to evaluate the preferences of students regarding motivational features to be integrated with the AI-driven mobile app based on the three psychological motivations: autonomy, relatedness, and satisfaction. The survey had 71 respondents and used a Likert scale. The number 5 is assigned to *Strongly Agree* responses, 4 for *Agree*, 3 for *Neutral*, 2 for *Disagree*, and 1 for *Strongly Disagree* see Table 1 below. To compute the Average Weighted Mean (AWM), descriptive statistics, as shown in Table 2 below, were performed using statistical tools such as JASP Analysis Tools.

The survey outcomes offer valuable insights into students' preferences and perceptions regarding using AI-driven mobile applications for reading comprehension. The study aimed to pinpoint the satisfaction, attitude, and impact of the different AI-mobile apps such as chatbots, Google Translate, Duolingo and others that users find most appealing and effective in fostering autonomy, promoting relatedness, and enhancing feelings of competency within

Scale	Interpretation
4.21–5.0	Strongly Agree
3.41–4.20	Agree
2.61–3.40	Neutral
1.81–2.60	Disagree
1.00–1.80	Strongly Disagree
Source(s): Table by authors	

Table 1.
Scoring of responses

	Valid	Mean	Std. Dev
How much do you agree with the statement, "I use AI-driven mobile applications for reading comprehension?	71	2.394	1.102
To what extent do you believe AI-driven mobile applications effectively enhance your reading comprehension skills?	71	3.197	1.037
How important are motivational features in AI-driven mobile applications for supporting your reading comprehension?	71	3.127	1.170
How important do you perceive autonomy in choosing how you engage with AI-driven mobile applications for reading comprehension?	71	3.113	0.994
To what extent do you feel a sense of relatedness to others (peers, educators) when using AI-driven mobile apps for reading comprehension?	71	2.704	1.006
How satisfied are you with the current AI-driven mobile apps you have used for reading comprehension in terms of supporting autonomy, competence, and relatedness?	71	3.141	0.990
AVERAGE Weighted Mean		2.946	

Table 2.
Descriptive statistics

Source(s): Table by authors

these applications, ultimately providing a holistic understanding of students' attitudes and preferences in this context.

Frequency of usage
The first question, probing the frequency of using AI-driven mobile applications for reading comprehension, revealed a mean response of 2.394. It suggests that students engage with these applications occasionally or rarely, indicating a relatively low level of involvement.

Perceived effectiveness
The second question, assessing the perceived effectiveness of AI-driven mobile applications in enhancing reading comprehension skills, yielded a mean response of 3.197. Students expressed a somewhat neutral to slightly positive stance, indicating a perceived benefit but not a robust one.

Importance of motivational features
The third question, focusing on the importance of motivational features, generated a mean response of 3.127. Students demonstrated a somewhat neutral to slightly positive view, suggesting varied valuations of motivational aspects.

Autonomy level
The fourth question, addressing the level of autonomy in choosing engagement with AI-driven mobile applications, resulted in a mean response of 3.113. Students appeared neutral to slightly positive, indicating a perceived but not substantial level of autonomy.

Relatedness
The fifth question, assessing the level of relatedness with peers and educators during AI application use, yielded an average response of 2.704. Students fell within the neutral range and did not feel strongly connected or disconnected during application use.

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Satisfaction
The sixth question, inquiring about students' satisfaction with the overall experience of using AI-driven mobile applications, resulted in a mean response of 3.141. Students exhibited a mixed or moderate evaluation of their experience.

The survey question data shows the most popular motivational features in AI-driven mobile applications for reading comprehension that they find most helpful or enjoyable. The most agreed features, as depicted in Figure 1, were progress tracking (50.7%), personalization (49.3%), and challenges (47.9%), followed by social interaction (47.9%), feedback (46.5%), goals (46.5%), gamification (45.1%), and rewards (31%). The other category (4.2%) included responses that were either irrelevant, negative, or unclear, such as "I do not know", "I have never used AI", "none", and "memorization". These responses suggest that some respondents may need help understanding the concept and benefits of AI-driven mobile applications for reading comprehension or may have reservations or misconceptions about them. The respondents valued features that can support their self-regulated learning, such as progress tracking, personalization, and challenges, as well as features that can foster their social and emotional engagement, such as social interaction and feedback, which aligns with Zimmerman's idea (Zhang *et al.*, 2024). These features can help users monitor their learning process, adjust their learning strategies, set realistic and attainable goals, overcome difficulties, receive timely and constructive feedback, and interact with others with similar interests or challenges.

On the other hand, the respondents showed less agreement on features that can provide extrinsic motivation, such as rewards and gamification, which may indicate that they preferred intrinsic motivation over external incentives. The study by Liu *et al.*, (2022) revealed that while immediate rewards may initially boost a person's inherent interest in an activity, this influence tends to wane as the person develops a natural motivation for the activity over time. Essentially, the initial external incentives serve as a catalyst for engagement, but as one's internal drive strengthens, the reliance on these external rewards decreases.

The survey question aimed to identify which motivational features are least helpful or enjoyable for users of AI-driven mobile applications for reading comprehension. Responses showed that the most disliked features, as shown in Figure 2, were challenges (31%), feedback (28.2%), social interaction (26.8%), and personalization (26.8%). The least disliked features were progress tracking (14.5%) and the other choice (4.3%). This result suggests that users prefer more autonomy and control over their learning process rather than being pressured by external factors such as competition, evaluation, or social comparison. Hence, this research indicates and reinforces that intrinsic motivation fosters a greater willingness
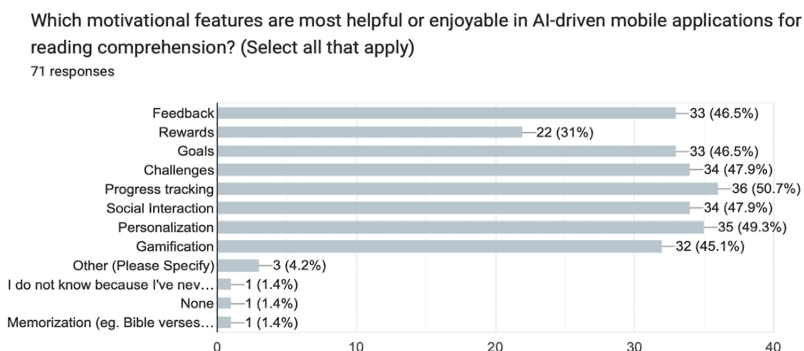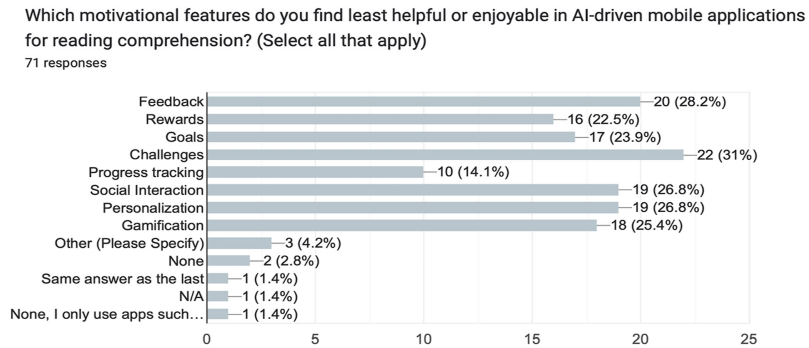
Which motivational features are most helpful or enjoyable in AI-driven mobile applications for reading comprehension? (Select all that apply)
71 responses

Source(s): Figure by authors

Which motivational features do you find least helpful or enjoyable in AI-driven mobile applications for reading comprehension? (Select all that apply)

71 responses

Source(s): Figure by authors

among learners to take responsibility for the outcome, underscoring that granting students increased autonomy results in intrinsic motivation (Bandhu *et al.*, 2024). Based on SDT, intrinsic motivation is enhanced when learners perceive that they have autonomy, competence, and relatedness in their learning activities. Therefore, AI-driven mobile applications for reading comprehension should consider how to design motivational features that support these psychological needs rather than undermine them. For example, feedback could be more informative and constructive, rather than judgmental or punitive; rewards could be more meaningful and aligned with learners' goals, rather than arbitrary or extrinsic; and social interaction could be more collaborative and supportive, rather than competitive or distracting (Ryan and Deci, 2000).

To examine open-ended questions, the responses regarding students' preferences on motivational features supporting autonomy, competence, and relatedness needs for reading comprehension uncover sub-themes by breaking down the themes according to the SDT and breaking them down to arrive sub-themes as depicted in Table 3. Respondents emphasized the importance of incorporating user control and personalization by personalizing and customizing content and settings, as well as feedback and progress tracking by allowing users to set and track their reading goals. About relatedness, preferences were mentioned, such as creating a social component of the app and implementing features like virtual study groups to foster a sense of community. In the context of competence, gamification and rewards, they suggest features like leaderboards and quizzes to maintain user engagement.

The finding also coincides with the research of Mishra and Malhotra (2021). As participants interact with the gamified setting, they willingly engage in virtual challenges to experience enjoyment and play, fundamental aspects inherent in human nature. Intrinsically motivated activities are pursuits that individuals find inherently interesting and engage in without external influences, deriving pleasure solely from the act. In addition, incorporating fun and engaging activities, including progress charts and animations, will make the learning experience enjoyable. Other recommendations included the integration of inbuilt narration for improved story comprehension and expert-verified situations aligned with AI-generated statements.

Additionally, one respondent suggested making the app accessible offline to accommodate users with limited mobile data. By integrating these diverse suggestions, developers have the opportunity to enhance the motivational features of AI-driven mobile applications, ultimately improving the overall learning experience for users.

Table 4 shows the themes and sub-themes identified after thoroughly analyzing interview responses and open-ended questions. Respondents emphasize the importance of

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Themes/sub themes	Frequency	Citation examples
Autonomy	14	
User Control and Personalization	2	Making the application offline Personalize the experience by letting users
	1	Customize content and settings
Interface Design and Accessibility	2	Implement visually appealing and user-friendly interface
Feedback and Progress Tracking	2	Allowing users to set and track their own reading goals
Relatedness	17	
Community Building	2	Creating a social component to the app
	1	Implement features like virtual study groups to foster a sense of community
Real-world Connection	1	Connecting the content to real-world situations
Competition and Collaboration	4	Leaderboard to encourage friendly competition
Recognition and Social Interaction	3	Adding more motivational features
	6	Making the application more fun for children
Competence	17	
Learning Engagement	4	Making the application more engaging
Information Accuracy	1	Providing specific and efficient answers
	1	Ensure the accuracy of the information to maintain user trust and confidence
Content Improvement and Update	1	Giving users access to exclusive content or discounts for completing reading challenges
Gamification for Learning	3	Adding fun activities and progress charts
	2	Using gamification features such as leaderboards and quizzes
Source(s): Table by authors		

Table 3.
Student's preferences
on motivational
features

customization, personalization, user control, convenience, and AI experience. This finding supports the study of Luo *et al*. (2023) that customization and personalization affect users' continued intention to use technology. Respondents suggest that features like personalized recommendations, customizable settings, adaptive learning, goal tracking, and the ability to collect data contribute to autonomy by empowering users to choose reading materials aligned with their preferences and adjust difficulty levels. Social interaction features, including connecting with other readers and participating in reading communities, promote relatedness by cultivating a sense of belonging and enabling discussions. Another study by Miao and Ma (2022) emphasizes that significant learning happens through interaction, knowledge, and experience sharing. Progress tracking is highlighted in enhancing competence with features that provide a challenging yet manageable reading experience, fostering continuous learning and improvement. Gamification features, such as interactive quizzes and leaderboards, emerged in responses by creating an enjoyable learning environment that motivates users to read and progress.

Table 5 presents the responses and various recommendations for optimizing AI-driven mobile apps to meet users' effective motivation needs to be rooted in autonomy, competence, and relatedness. Key emerging themes include the emphasis on customization and user preferences, with respondents highlighting the significance of features like personalized recommendations, adjustable difficulty levels, and the ability to set personal reading goals to bolster autonomy. Fostering relatedness is another prominent theme, emphasizing social features and collaboration, inclusive messaging and support, and engaging and fun

Themes/sub themes	Frequency	Citation examples
Autonomy	18	
Customization and Personalization	3	Customizable things and features such as quizzes
	1	Allow us to choose topics of interest and offering adaptive learning experiences
	1	Logical, easy, responsible
User Control and Convenience	1	Its ability to collect essential data that I need When it is more updated and reliable
AI Experience and Features	1	Comprehend, plan, act and learn with human like levels of intelligence
	1	Translations
	1	Goal tracking
Relatedness	10	
Social Interaction and Community	1	Social interaction
	1	Anything that will interest the minds of readers
Language and Communication	1	Deep meaning words
	1	Google language
Motivational Elements	1	Motivational features I guess
	2	Feedback
	1	Making the application more fun for children
Competence	20	
Educational Content and Learning Tools	2	Deep learning
	1	Interactive quizzes
	4	Progress tracking
Improvement	2	Feedback
	1	Regional leaderboard

Source(s): Table by authors

Table 4.
Features that support autonomy, competence, and relatedness

interaction were identified as sub-themes, and features such as giving powerful motivation, supportive dialogue, and more games were some of the recommended responses. Regarding competence, skill improvement and adaptation, a noteworthy call for inclusivity and accessibility emerges, urging developers to consider features catering to users with disabilities, further underlining the importance of tailoring AI-driven mobile apps to accommodate diverse user needs. In summary, these suggestions collectively underscore the importance of a holistic approach, integrating customizable features, personalized feedback, community engagement, continuous improvement, and inclusivity to address the nuanced motivation needs of users.

Comparison analysis
Both qualitative and quantitative findings highlight the significance of personalization and customization in AI-driven mobile apps for reading comprehension. The survey data indicates that autonomy is valued, with a mean response of 3.113 for the importance of autonomy in choosing how to engage with AI-driven mobile applications. Respondents emphasize user control, customization, and personalization, aligning with the theme of autonomy. Both types of data reveal the importance of progress tracking for enhancing competence. The quantitative survey results strongly agree with the statement about progress tracking, and qualitative findings emphasize its role in fostering continuous learning and improvement. The mean response of 3.197 indicates that respondents generally

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Themes/sub themes	Frequency	Citation examples
Autonomy	14	
Customization and Personalization	2	Optimize customizable user preferences and setting
	1	Adjust the model hyperparameter
	2	Prioritize user customization
	1	I would suggest the optimizing AI-driven mobile apps should be able to help or to guide a student
Independent usage	1	I suggest that it can be used by the user without having to connect to wifi or data
Choice in Learning Paths	1	Choice in learning paths
Relatedness	14	
Social Features and Collaboration	1	By giving a powerful motivation
Inclusive Messaging and Support	1	Supportive Dialogue
	1	Messenger
Engaging Fun and Interaction	1	More games on comprehension that has a goal to make me feel motivated using it
Competence	20	
Skill Improvement and Adaption	1	Adapt task to my skill level, providing wins and room grow for lasting satisfaction
Inclusivity for People with Disabilities	1	Inclusivity for People with Disabilities
Pronunciation Improvement	1	Better pronunciation of words from AI
Source(s): Table by authors		

believe AI-driven mobile applications effectively enhance reading comprehension skills. In addition, some suggested features from the respondents were gamification, progress tracking, and challenges, which were identified as enhancing competence in the qualitative data.

Furthermore, Social interaction is critical in fostering relatedness in qualitative and quantitative data. Qualitative findings suggest creating a social component to the app, while quantitative results show the popularity of social interaction features. The mean response of 2.704 indicates a moderate level of relatedness when using AI-driven mobile apps for reading comprehension. Social interaction features, virtual study groups, and creating a sense of community are identified as essential for fostering relatedness and were suggested in some of the responses by creating a social component to the app. Despite the similarities, there are differences in the liking and disliking of specific features between the qualitative and quantitative data. For example, challenges are highlighted as disliked in quantitative results, while gamification and challenges are emphasized positively in qualitative findings.

Moreover, the qualitative data provides nuanced recommendations, such as integrating built-in narration, expert-verified situations, and offline accessibility. The quantitative survey results should explicitly capture these detailed suggestions for improvement. Another critical point is the need for inclusivity and accessibility, which is emphasized more explicitly in the qualitative data. Also, a response from the interview stresses the importance of considering features for users with disabilities, which is not explicitly mentioned in the structured results. Qualitative findings uncover specific sub-themes related to autonomy, competence, and relatedness. These sub-themes, such as the importance of user control, personalization, and social features, provide a richer understanding than quantitative ones.

Implications

The synthesis of findings suggests the need for a comprehensive development strategy that incorporates both the commonalities and nuanced recommendations from qualitative and quantitative data. Combining the strengths of both findings, a holistic user-centric approach that integrates personalization, progress tracking, social interaction, and gamification is crucial for effective app development. Recognizing that individual preferences may vary, developers should consider tailoring features to accommodate a range of user needs, as indicated by qualitative and quantitative insights. In addition, app creators should be mindful of discrepancies in preferences, especially regarding certain features like challenges, and strive to balance these differences in the design of AI-driven mobile apps. Customizable features and user control in AI-driven mobile apps must also be considered to enhance autonomy. Specific features like personalized recommendations, adjustable difficulty levels, and goal tracking should be prioritized based on qualitative insights. Developers should prioritize features contributing to skill improvement, including gamification elements like quizzes and leaderboards. The qualitative emphasis on continuous learning and improvement should guide the development of features that challenge users at a manageable level. Developers should prioritize features that enhance a sense of community and social interaction to foster relatedness. As the qualitative data suggests, inclusivity, support, and engaging interactions should be integrated to create a positive user experience.

Conclusions and recommendations

This study aimed to identify students' motivational features and preferences for AI-driven mobile apps to boost reading comprehension based on the self-determination theory. Synthesizing qualitative and quantitative findings paints a comprehensive picture of user preferences and expectations for AI-driven mobile apps focused on reading comprehension. Both data types underscore the significance of personalization and autonomy, indicating that users value the ability to tailor their experience with AI-driven mobile apps. Progress tracking and gamification elements stand out as essential components for enhancing competence, with users expressing a belief in the efficacy of AI apps for improving reading comprehension skills. Creating a sense of community and incorporating social interaction features are highlighted in qualitative and quantitative data, emphasizing the importance of relatedness for a positive user experience. While challenges are disliked in quantitative results, they are positively emphasized in qualitative findings. These differences underline the importance of understanding nuanced user preferences and striking a balance in feature design. The qualitative data provides nuanced and detailed recommendations, such as inbuilt narration, expert-verified situations, and offline accessibility, enriching the understanding of user expectations beyond what quantitative data alone can reveal. Qualitative insights explicitly highlight the need for inclusivity, particularly for users with disabilities. This emphasizes the importance of ensuring accessibility features in the app to cater to diverse user needs. Developers should adopt a comprehensive development strategy integrating qualitative and quantitative data insights, including personalization features, autonomy support, competence-building elements, and social interaction components. A holistic user-centric approach is crucial, seamlessly integrating personalization, progress tracking, and social interaction to enhance user engagement and satisfaction. Recognizing that user preferences vary, developers should consider tailoring features to accommodate various needs. Addressing discrepancies in feature preferences calls for a balanced design approach. Inclusivity and accessibility should be prioritized; ensuring features cater to users with disabilities and creating an inclusive environment for all users. Implementing a feedback loop within the app will enable continuous improvement based on user experiences and

preferences. Regular updates can address evolving user needs and maintain app relevance. By embracing a user-centric, inclusive, and adaptive approach, developers can create an application that meets user expectations and evolves to exceed them over time.

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