Linguistic and Philosophical Investigations
ISSN: 1841-2394, e-ISSN: 2471-0881
Vol 23 (1), 2024
pp. 21–32

A Review of Fogg's Behavior Model (FBM) and Hook Models for Gamified Learner Experience in Higher Education

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Abstract

Background/purpose – This paper provides an overview of the integration and application of the Fogg's Behavior Model (FBM) and the Hook Model for gamified learner experience in higher education, particularly in enhancing student engagement. By assessing a wide range of academic research and practical case studies, this study aims to explore how these models contribute to creating engaging and effective educational experiences.

Materials/methods – The review was carried out on 31 articles published from 2014 to 2024. These 31 discrete studies were selected because they met the inclusion criteria based on the research questions of this review. The review used as a tool to assist the review process.

Results – The results indicate that both the FBM and the Hook Model can be integrated into digital learning environment, with the FBM focusing on stimulating motivation, enhancing abilities, and setting triggers, while the Hook Model forms user habits through cycles of triggering actions, providing variable rewards, and encouraging investment.

Conclusion – This review confirms that blending FBM and the Hook Model enhances digital and gamified learning, stimulating motivation, promoting positive behavioral changes, and sustaining student engagement effectively.

Keywords: Fogg's Behavior Model, Hook Model, Gamified Learning, Student Engagement, Higher Education.

Received: 20 April 2024 **Revised:** 10 June 2024 **Accepted:** 26 June 2024

1. Introduction

In the realm of contemporary higher education, as learning environments undergo digital transformation, educators continually seek new methods to enhance student engagement and learning outcomes (Akour & Alenezi, 2022). Gamification, an emerging educational strategy that uses game design elements in non-game contexts to stimulate students' interest and engagement, has become a significant direction in educational innovation (Saleem et al., 2022). In this context, understanding and applying effective behavior change models is crucial for designing effective gamified learning experiences. The FBM and the Hook Model are widely recognized in the field of behavioral science as powerful tools for promoting

behavior change (Ali et al., 2023). These models provide a systematic approach to analyze and design educational interventions that can motivate and sustain student behaviors (Zekry & McKee, 2023).

The FBM highlights three key elements: motivation, ability, and triggers, emphasizing that only when these elements coexist can behavior effectively be prompted (Fogg, 2009; Fuß et al., 2014). In the educational sector, this model is particularly suitable for designing accessible and appealing teaching activities, demonstrating significant application potential. On the other hand, the Hook Model, through its four core components—triggers, actions, variable rewards, and investments—creates a cyclic process aimed at forming and maintaining user habits (Eyal, 2014). Within educational settings, this model provides a framework for course and activity design that not only momentarily captures students' attention but also helps foster lasting learning habits. The integration of these two models lays a theoretical and practical foundation for developing strategies that can continually motivate students and enhance educational outcomes (Filippou et al., 2016; Troyer et al., 2020; Maushagen & Troyer, 2021).

This review aims to explore how the FBM and the Hook Model can be integrated into gamification strategies in higher education to enhance student engagement. Through systematic evaluation methods and meta-analysis, this paper synthesizes existing literature on the application of these two models, analyzing how they individually and jointly affect student behavior change, and exploring their potential impact on enhancing student engagement and teaching effectiveness. Furthermore, this review discusses the implementation challenges and optimization strategies for these models in a gamified educational setting, providing directions for future educational practice and research.

2. Related Works

2.1. Fogg's Behavior Model（FBM）

Figure 1. Adapted from the Fogg Behavior Mode.

The FBM provides a theoretical framework for designing persuasive systems aimed at effectively influencing individual behaviors (Takács et al., 2023). The model emphasizes that the occurrence of a behavior depends on the effective combination of three core factors: motivation, ability, and triggers (Ashtari & Taylor, 2021; Salim et al., 2023). Within this framework, the realization of a target behavior results from the intersection of these three elements. FBM offers a set of guiding principles that direct behavior change by enhancing an individual's motivation, improving their ability to perform behaviors, and using appropriate triggers to facilitate the occurrence of these behaviors, thereby guiding students to adopt desired actions and change their behavioral habits (Jurgelaitis et al., 2019).

As illustrated in Figure 1, the area where behavior occurs is visually represented at the overlap of the three factors (Plak et al., 2023; Daghestani et al., 2020). The intersection area between motivation and ability is referred to as the "Enabled Action" zone, indicating that an individual is ready to respond to triggers and take actions when they have sufficient motivation and ability. The overlap between motivation

and triggers is defined as the "Opportunistic Action Zone," which suggests that individuals tend to seize opportunities to act under the influence of strong motivation and appropriate triggers. The intersection area between ability and triggers is called the "Facilitated Action Zone," indicating that action can still occur even if motivation is weak, as long as the individual has the ability and encounters a trigger. The central area where all three overlap represents the ultimate occurrence of behavior, embodying the core argument of the FBM: target behaviors can only be successfully achieved when motivation, ability, and triggers are all present (Fogg, 2009).

2.2. Hook Model

The Hook Model is a design framework aimed at establishing and maintaining user habits, widely used in the development of persuasive features, especially in scenarios aimed at improving learning habits. This model guides users through a cyclical process involving four key stages: Trigger, Action, Variable Reward, and Investment. By navigating these stages, the Hook Model effectively establishes enduring user habits (Eyal, 2014). The Trigger stage prompts the user to initiate an action; the Action stage is the actual behavior undertaken by the user; the Variable Reward provides a dynamic incentive that reinforces the action; and the Investment stage involves the user contributing time or resources, which increases their commitment to the behavior and sets the stage for future triggers.

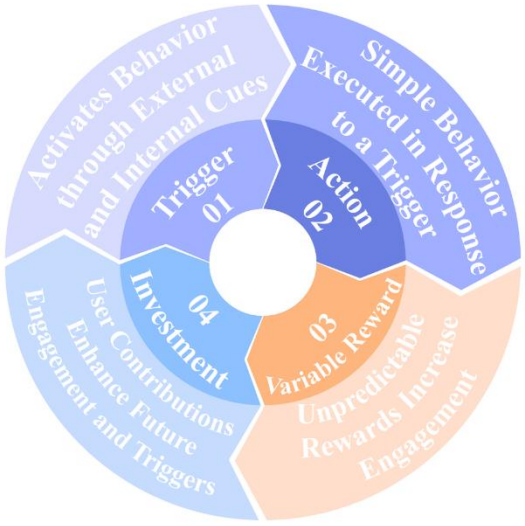

Figure 2. Adapted from the Hook Model.

As depicted in Figure 2, the Hook Model consists of a closed-loop cycle through its four core components: Trigger, Action, Variable Reward, and Investment. And this model aims to shape and reinforce user habits. Initially, the Trigger phase initiates user behavior, incorporating not only external cues such as notifications and icons but also internal cues triggered by emotions and behaviors (Salim et al., 2023). Once users establish an intrinsic connection with these triggers, habit behaviors are automatically activated under specific emotional drives. Subsequently, the Action phase describes the user's direct response to triggers. In this stage, product designers ensure that users can easily undertake the intended actions by simplifying the operation process and enhancing user motivation. For instance, in the language learning platform Duolingo, users are motivated to start brief learning modules through regular emails and notifications, demonstrating how triggers are transformed into actions. The third phase, Variable Reward, enhances user engagement and desire by providing unpredictable rewards. The feedback users receive after completing actions in this stage is randomized, which stimulates users' curiosity and desire to explore due to the uncertainty in rewards. Finally, the Investment phase involves the user's commitment to the product, including time, data, social capital, or money (Filippou et al., 2016). This investment not only sets the stage for the next round of triggers but also makes the next trigger more appealing, the action easier to

execute, and the reward more attractive, thus deepening the user's habitual behavior. Through the continuous cycle of these four stages, users gradually develop a dependency on the product, establishing sustained behavioral habits.

By applying the Hook Model, educators can design an effective cycle of triggers, actions, rewards, and investments within the learning process, thereby attracting and maintaining students' interest and engagement. This model provides a clear framework that helps us understand and design educational strategies capable of initiating and sustaining students' learning habits (Magnotta et al., 2021) .

The FBM focuses on motivational factors that trigger behaviors, promoting more active student participation in learning activities by setting appropriate trigger conditions and reducing the difficulty of the target behavior (Zekry & McKee, 2023). In contrast, the Hook Model emphasizes creating engaging content, utilizing techniques such as emotional stimulation, narrative methods, and visual presentations to enhance students' attention and interest, thereby increasing engagement. The application of these models holds significant value in higher education, enhancing the appeal and enjoyment of learning and stimulating student enthusiasm (Filippou et al., 2016).

2.3. Gamification

Gamification involves the application of game design elements and principles in non-game contexts, such as education. This approach leverages the theoretical foundations of the FBM and the Hook Model by incorporating motivational elements (motivations and triggers in FBM), such as points, badges, and leaderboards (Neugebauer et al., 2023), as well as creating engagement cycles with variable rewards (a core feature of the Hook Model) (Cheong et al., 2014). Through these strategies, gamification transforms the learning experience into an active and engaging activity (Saleem et al., 2022). This not only enhances the intrinsic and extrinsic motivation of students but also facilitates sustained engagement and habit formation in educational settings.

Research indicates that the introduction of gamification elements can significantly enhance student engagement and intrinsic motivation, thereby improving learning outcomes. By integrating game elements into course design, educators can make the learning process not only more fun and rewarding but also promote the formation of habits, which are difficult to achieve in traditional educational models (Ohn et al., 2018). This educational strategy, through the strategic application of the principles of the FBM and Hook Model, not only motivates students to learn due to the gamification elements but also helps them form sustainable learning habits, potentially transforming traditional educational teaching and learning environments. Through this approach, learning becomes not just an acquisition of knowledge but also a continuous, self-driven process.

3. Research Questions

In the process of promoting innovative teaching strategies in higher education, un-derstanding and applying the FBM and the Hook Model is crucial for fostering positive changes in student behavior (Zekry & McKee, 2023). This study aims to explore the role of these two models in stimulating specific behavioral changes and enhancing student engagement, particularly in terms of how they affect the dynamics of student participation in educational environ-ments. Additionally, the research will examine how these models can enhance learning outcomes by boosting active student participation, as active engagement is a key factor in teaching success. Given the challenges associated with integrating the FBM and Hook Model to enhance the gamified teaching experience, this paper poses the following re-search questions:

(1) What are the patterns and trends of FBM and Hook Model applications in higher education from 2014 to 2024?

(2) What are the roles of FBM and Hook Model in promoting student engagement?

(3) How can the FBM and Hook Model be effectively integrated to optimize the gam-ified experience in higher education?

Through a systematic analysis of these key questions, this study will provide insights into how both behavioral models can be effectively utilized in higher education to enhance student engagement and learning outcomes. This will not only contribute to theoretical advancements but also offer guidance to practitioners, helping them design more effective teaching strategies and learning environments.

4. Research Methods

This review employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The review framework of this study is constructed based on the PRISMA guidelines to ensure the rigor and transparency of the evidence integration process (Sarkis-Onofre et al., 2021). The review process includes the following steps: identifying relevant literature from various databases and other resources, filtering literature that meets the inclusion and exclusion criteria; evaluating the eligibility of the remaining literature; conducting quality assessments and thematic relevance reviews of selected studies; systematically extracting data; and performing qualitative summaries and quantitative meta-analyses (where applicable) (Page& Moher, 2017). Additionally, to ensure the completeness and replicability of the research, this study meticulously records the rationale in the decision-making process and the potential impacts on the research findings. The application of this methodology aims to provide solid evidence support for research on behavioral models in higher education through rigorous scientific methods.

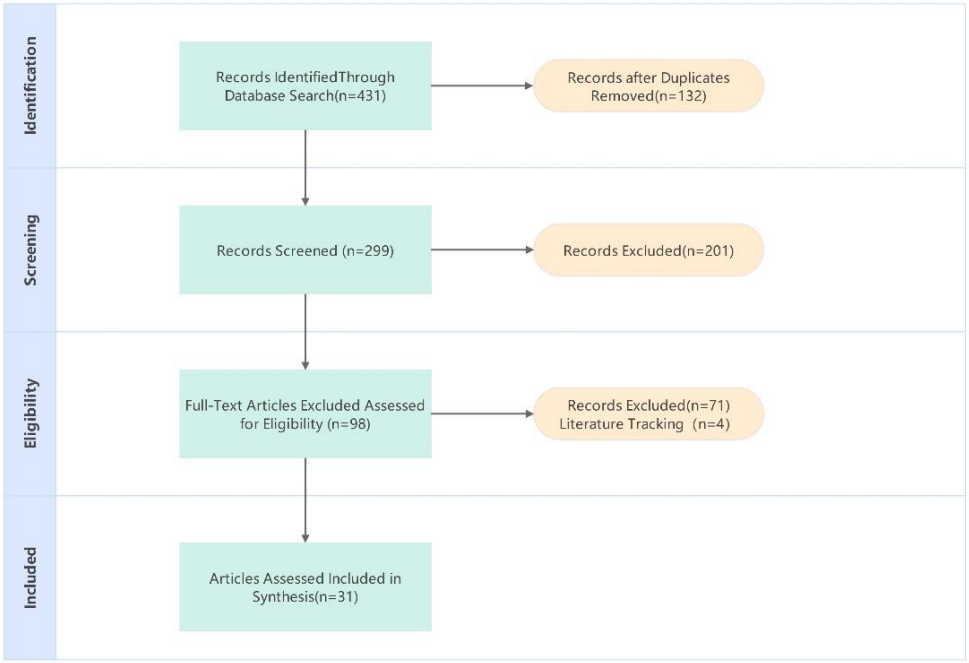

Figure 3. Overview of literature search process utilizing PRISMA.

As shown in Figure 3, this paper utilized specific keywords "Fogg's Behavior Model AND higher education AND student engagement", "Hook Model AND gamification AND higher education," and "behavioral change AND gamification AND models AND higher education" to conduct searches in databases such as Web of Science, IEEE, Wiley, Springer, and Science Direct Scopus, initially retrieving a total of 431 articles. After removing 132 duplicate articles, 299 remained for preliminary screening. At this stage, the titles, keywords, and abstracts of the articles were primarily examined, and those that did not meet the inclusion criteria were filtered out. The selection criteria, based on the standards of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), were as follows (Page& Moher, 2017): (1) articles written in English, (2) peer-reviewed articles or book chapters, (3) reports, (4) feature articles, and (5) published between 2014 and 2024. Ultimately, 98 articles met the inclusion criteria. In the third phase of detailed content review, the exclusion criteria included: (a) studies published in non-English, (b) studies

lacking full-text availability. Out of these 98 articles, 27 were selected that met all research standards. Further tracking of references in these 27 articles identified an additional 4 relevant studies. Therefore, the analysis and discussion in this review are based on these 31 articles. Table 1 displays the year of publication and the contributions of the FBM and Hook models in these 31 articles.

Table 1. Overview of included studies.

Reference	Year	Contributions
1 Beardsley et al.	2020	Validates FBM's motivational dimension in student behavior differences
2 Plak et al.	2023	FBM's motivational dimension in explaining student behavior
3 Wang et al.	2022	Develops questionnaire measuring FBM triggers for Chinese college students
4 Zhou et al.	2021	Using FBM to analyzes low-carbon consumption behavior in university
5 de Toledo et al.	2024	Proposes FBM transcription as a computer tool
6 Filippou et al.	2015	Combines FBM and Hook model to enhance study habits
7 Heinrich et al.	2023	Analyzes privacy behavior based on the FBM
8 Daghestani et al.	2019	Applies FBM to determine gamification elements
9 Andrés et al.	2022	Applies FBM's trigger in behavioral change
10 Alhasani et al.	2024	Applies FBM as one of supporting theories
11 Balakrishna et al.	2023	Motivates desired behaviors using game mechanics stated by FBM
12 Fuß et al.	2014	Uses FMB to promote motivation in game
13 Wen et al.	2023	Uses FMB to improve learning effects
14 Takács et al.	2023	Applies FBM for Enhancing behavior through intrinsic and extrinsic motivation with triggers in gamification
15 Ashtari et al.	2021	Applies FBM for Enhancing student engagement
16 Jurgelaitis et al.	2018	Applies FBM for Enhancing student engagement and motivation
17 Lopez et al.	2017	Analyzes the elements relevant to gamification that motivate individuals to perform a task based on FBM
18 Salim et al.	2023	Applies FBM for behavior change and promoting student engagement
19 AL-Smadi	2015	Applies FBM in gamification to improve student engagement
20 Filippou et al.	2015	Proposes 8-step process to improve student habits based on FBM
21 Alshammari et al.	2023	Proposes a theoretical framework to design a persuasive game based on FBM
22 Bouchrika et al.	2019	Applies FBM in gamification to improve student engagement
23 Aldemir et al.	2017	Applies FBM in gamification elements to improve learning
24 Ohn et al.	2018	Proposes a conceptual learning model in online gamified platform based on FBM
25 Rahayu et al.	2022	Applies Hook model in gamification elements to improve student engagement
26 Neugebauer et al.	2023	Applies FBM in gamification to improve motivation and performance

27 Zekry et al.	2023	Proposes a model for creating a more engaging learning environment based on FBM and Hook model
28 Cheong et al.	2014	Applies Hook model in gamification elements to improve student engagement
29 De Troyer et al.	2020	Applies FBM and Hook model in gamification for improving application usage
30 Maushagen et al.	2021	Applies FBM and Hook model in mobile learning application
31 Putri et al.	2021	Proposes a gamified microlearning framework based on FBM and Hook model

5. Discussion

5.1. Current Patterns and Trends of Behavior Models Application in Higher Education Research

Figure 4 systematically summarizes the theoretical models, research methods, research objectives, and technologies used in 31 relevant articles within the field of higher education. Regarding the application of theoretical models, the FBM was used in 24 articles, demonstrating its widespread application in analyzing students' motivations, abilities, and triggers. Comparatively, the Hook Model was independently used in only 2 articles, but it was applied together with the FBM in 5 articles, indicating that researchers are exploring the potential advantages of combining these two models. The research primarily utilized FBM to analyze and optimize the key drivers of student behavior—motivation, ability, and triggering factors (Ashtari & Taylor 2021; Salim et al., 2023). Although the usage frequency of the Hook Model is lower, it shows unique advantages in discussing how educational products can induce habitual behaviors in users (Filippou et al., 2016).

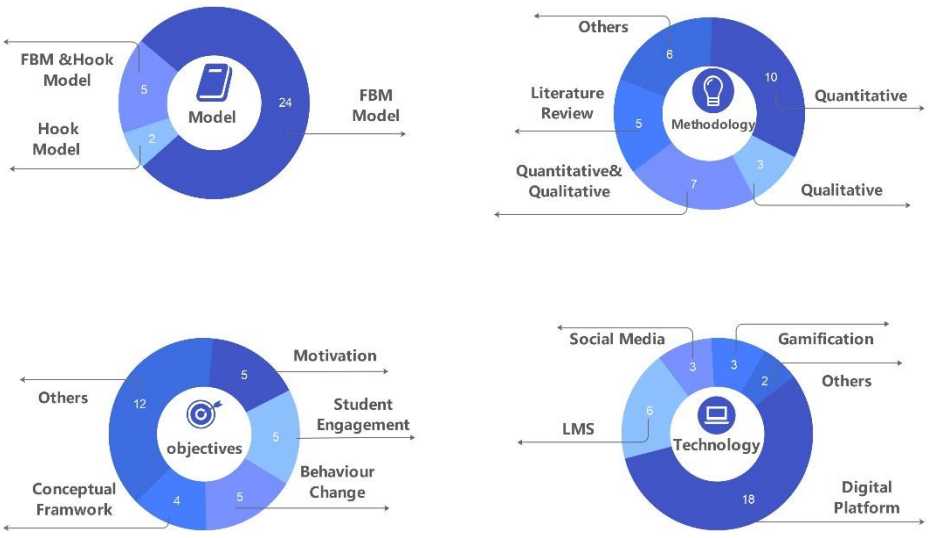

Figure 4. Findings from the review of included studies.

Both the FBM and the Hook Model are considered effective in enhancing student engagement within the higher education environment (Ashtari & Taylor 2021; Rahayu et al., 2022). However, the specific application and strategy design require further research and practice based on the particular educational context and student needs (Filippou et al., 2016). Additionally, these models provide a solid theoretical foundation for gamification in education, emphasizing the critical interplay between triggers, ability, and motivation for effectively changing learner behavior. By integrating the FBM and Hook Model, educators

can design highly attractive and motivational gamified learning experiences, significantly increasing student engagement (Ohn et al., 2018).

Figure 4 displays the diversity of research methods, including quantitative methods for statistical validation of hypotheses, qualitative methods for an in-depth understanding of student experiences, and literature reviews for comprehensive mastery of existing knowledge, all of which enrich the reliability and depth of the research findings. Seven studies utilized mixed methods, combining quantitative analysis of usage data and qualitative feedback from students to evaluate the actual impact of these models on behavioral changes (Wang & Kang, 2022; Alhasani & Orji, 2024).

These changes include increased student engagement, consistent learning habits, and proactive learning behaviors. According to Figure 4, while research objectives vary, they all focus on key themes such as enhancing student motivation, increasing engagement, and facilitating behavioral changes, highlighting a collective effort to respond to learners' needs within the educational environment. In terms of technological applications, six articles explored the effects of Learning Management Systems (LMS), demonstrating their central role in higher education(Takács et al., 2023; Jurgelaitis et al., 2019; Andrés,2022). Social media and gamification technologies were each discussed in three articles, aimed at enhancing the interactivity and attractiveness of the learning experience. Most notably, 18 articles utilized various digital platforms, reflecting the widespread application of modern educational technology and its significance in teaching (Beardsley et al., 2020). These technological tools are not merely adjuncts but have become central elements in the design of educational experiences, aimed at fostering more dynamic and accessible learning environments (Troyer et al., 2020).

5.2. The Role of Behavior Models in Student Engagement

In the field of higher education, the FBM and the Hook Model provide crucial frameworks for understanding and shaping student behavior, particularly in enhancing engagement and forming habits (Filippou et al., 2016; Plak et al., 2023). These models assist educators in identifying and addressing the core factors affecting student engagement, thereby designing effective intervention strategies.

Figure 4 reveals that, the Hook Model used less frequently than the FBM in the higher education. This phenomenon suggests that although both models demonstrate effectiveness in promoting behavioral changes within educational settings, there are challenges in transforming learning into a natural and enduring self-sustaining behavior cycle. Although (Ohn et al., 2016) mentions the effectiveness of the Hook Model in promoting long-term engagement among higher education students, empirical studies related to it are scarce (Lopez & Tucker, 2017). This indicates that despite the FBM model being widely adopted in education due to its comprehensive application of motivation, ability, and triggers, the specific focus of the Hook Model on forming habitual behaviors has not yet been broadly applied in higher education. This suggests a potential area for further research and application to leverage the Hook Model’s unique features more effectively in educational settings.

According to the FBM, enhancing students' motivation towards a task is key to increasing engagement (Toledo et al., 2018). Therefore, teachers can stimulate students' intrinsic motivation by clarifying the meaning and value of tasks, making them more actively engaged in learning (Jurgelaitis et al., 2019). Additionally, the FBM aids in understanding students' capabilities and learning needs, thus providing targeted personalized learning support (Filippou et al., 2015). By adjusting teaching methods and content to fit specific learning conditions, students can engage more effectively, enhancing their sense of success and satisfaction (Filippou et al., 2016). Based on the Hook Model, student engagement can be further motivated by designing gamified reward mechanisms. For instance, implementing an achievement system that rewards students for completing specific tasks or reaching learning goals can enhance their engagement and proactivity. This model particularly emphasizes influencing student success through establishing regular learning habits and active participation (Rahayu et al., 2022). By integrating elements that promote habit formation, such as consistent feedback loops and beneficial challenges, educators can effectively cultivate students' sustained engagement (Cheong et al., 2014).

In summary, the FBM and the Hook Model provide a comprehensive set of tools that help educators understand and influence student behavior in higher education. Focusing on enhancing motivation, utilizing technology, and forming habits, these models offer solid theoretical support for designing teaching strategies that can continuously attract students and promote their learning success (Lopez & Tucker, 2017).

5.3. Integration of Behavior Models in Gamification

Incorporating gamification elements in higher education, especially through the integration of the FBM and the Hook Model, provides a comprehensive and effective method for enhancing student engagement and fostering long-term learning behaviors (Ashtari & Taylor, 2021; Jurgelaitis et al., 2019). The FBM focuses on motivation, ability, and triggers, which together determine the occurrence of behaviors (Neugebauer et al., 2023; Lopez & Tucker, 2017). It offers a theoretical foundation for understanding key factors that drive student behavior and is particularly useful in designing gamified learning activities, especially in the initial stages by stimulating students' interest and willingness to participate (Ashtari & Taylor, 2021; Rahayu et al., 2022).

The Hook Model, with its four core components: triggers, actions, variable rewards, and investments, emphasizes the creation of enduring habitual behaviors (Cheong et al., 2014). In the gamified environment of higher education, this model can design experiences that not only capture students' attention but also sustain their engagement. Particularly, by introducing uncertain rewards and encouraging students' personal investment, it can effectively cultivate their curiosity and sense of ownership, thus supporting long-term learning engagement (Maushagen & Troyer, 2021).

Integrating these two models can create a gamified learning environment that both stimulates motivation and promotes habit formation (Filippou et al., 2016; Troyer et al., 2020). For instance, a gamified learning platform might use FBM principles to design initial activities that are easy to engage with and align with students' motivations, while incorporating strategies from the Hook Model to ensure that these activities encourage regular participation and form positive learning habits. This could include using timely reminders as triggers, offering rewards that are closely related to students' interests and learning goals, and allowing students to enhance their learning experience through personalized settings, thereby encouraging sustained learning investment (Zekry & McKee, 2023).

In summary, by holistically applying the FBM and Hook Model in higher education, a more attractive and enduring gamified learning experience can be created. This integrated approach not only captures students' initial attention but also supports their long-term educational goals by understanding and utilizing the dynamics of motivation, ability, triggers, and habit formation (Troyer et al., 2020). Through this method, educators can design gamified systems that simultaneously meet students' immediate engagement and ongoing learning needs.

6. Conclusions

This paper has reviewed the applications of the FBM and the Hook Model in higher education and explored how these models enhance student learning engagement and behavior change through gamification strategies. The study shows that the FBM effectively promotes the achievement of student target behaviors by emphasizing three key elements: motivation, ability, and triggers. In contrast, although the Hook Model is less frequently applied in higher education, it demonstrates unique advantages in establishing enduring learning habits, particularly through its engaging cycle of triggers, actions, variable rewards, and investments. While both models show potential in fostering student engagement and behavioral changes, implementing gamification strategies in higher education still faces many challenges. One major challenge is how to effectively integrate the FBM and Hook Model to enhance long-term learning behaviors. Future research needs to further explore the specific effects of these models in different educational settings, especially how they interact to promote sustained student engagement and improve learning outcomes.

In summary, the FBM and Hook Model exhibit significant potential in the application of educational technology, providing a solid theoretical basis for designing more effective teaching strategies and learning environments. By continually optimizing the implementation of these models and incorporating empirical research findings, higher education can create more dynamic and engaging learning experiences. This will not only enhance students' learning motivation and engagement but also help form enduring learning habits, thereby promoting students' educational outcomes.

DECLARATIONS

Author Contributions. Conceptualization, methodology and writing: Mengqiu Tan and Siti Mahfuzah Sarif. Investiga-tion, validation and formal analysis: Mengqiu Tan. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest. the authors declare no conflict of interest.

Funding. This research received no external funding.

Ethical Approval. Ethical approval and participation consent were not required for this study.

Data Availability Statement. Not applicable.

Acknowledgments. We are grateful to all those who have discussed the model with us—at our universities and at academic conferences. We also thank our deans and colleagues for their support.

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