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Review of hackathon adoption factors in education

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ABSTRACT

Hackathons have gained popularity recently as a platform for fostering innovation and collaboration, providing hands-on learning experiences for students to design, prototype, and solve real-world problems. While studies have explored hackathon adoption in education, there is a scarcity of chronological reviews on this subject. This article addresses the gap by presenting a comprehensive literature review using a systematic methodology, analyzing 30 relevant articles spanning 2012 to 2022 from databases like EBSCOhost, Scopus, and Google Scholar. The study identifies five key adoption factors: perceived usefulness, perceived ease of use, behavioral intention, self-efficacy, and collaborative learning. Findings suggest that individuals are more likely to adopt hackathons when they perceive them as valuable and easy to engage with. Moreover, participants with a desire to engage, exhibit confidence in their abilities, and have prior hackathon experience are more inclined to embrace Hackathons. This highlights the importance of effective teamwork and knowledge sharing during hackathons, contributing to increased adoption rates. This study's contribution lies in identifying hackathon adoption factors relevant in education, providing insights for assessing progress, overcoming barriers, and making informed decisions to stay relevant in the evolving digital landscape. Ultimately, the adoption of hackathons in education holds the potential to revolutionize teaching and learning, enhancing student engagement, collaboration, and achievement. Educational institutions, by understanding these factors, can effectively integrate hackathons to develop creative and memorable learning spaces.

Introduction

Hackathons, an event that has gained increased popularity amid the COVID-19 pandemic, are employed to harness the creative potential of individuals who engage collaboratively for a brief period with the aim of solving specific problems (Bertello et al, 2022; Oyetade et al, 2023). Hackathons are recognized as events that stimulate innovation by leveraging digital technology across a multitude of professional fields such as music, fashion, open data, business, civic goals, and education. They provide a platform for individuals to collaborate, learn, and create novel solutions to complex problems. Hackathons are increasingly being used as a tool to drive innovation, solve real-world challenges, and foster a culture of collaborative learning (Heller et al, 2023; Medina & Nolte, 2020; Nikiforova et al, 2022). A Hackathon improves collaboration, experimentation, and learning, influencing how organizations are run and boosts efficiency across the entire global economy.

Since the turn of the millennium, huge organizations have started to take an active interest in Hackathons to increase one's capacity for inventiveness (Medina & Nolte, 2020). Despite different definitions of "Hackathons," several studies agree that these are occasions when people or groups collaborate to improve or develop new software application within a specific timeframe (Gama et al, 2018, Komssi et al, 2014). According to Čović and Manojlović (2019), the major skills that students typically learn from participating in an educational Hackathon includes collaboration, project management, teamwork, negotiation, time management, and communication (Sadovykh et al, 2019, Steglich et al, 2021). However, because there are so many contributing factors at play

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during this process, it is challenging to correctly forecast how well a student would manage circumstances when various technologies are introduced.

In recent years, many universities have started organizing Hackathons, with the aim of promoting innovation, collaboration, and experiential learning among students (Oyetade, 2023). In the context of education, Hackathons have been used to promote innovation, entrepreneurship, and STEM education. However, the adoption of Hackathons in education is still limited, with many students and faculty members unaware of the benefits of Hackathons or how to participate in them. Hackathons are not limited only to the industry to explore ideas and create software prototypes; they are excellent for disrupting other domains and accelerating education and learning settings (Russo et al., 2022, Sadovykh et al, 2020). Student interaction will be more fully incorporated into Hackathon implementation than is generally done with just standard classroom activities (Duhring, 2014). The Hackathon as a technology, however, has the potential to disrupt many other organizational sectors, including education. This increases the likelihood that technology-enhanced collaborative learning and project-based learning will be utilized in this new environment, raising the possibility that students will acquire higher order thinking skills and the ability to use what they've learned in new contexts (Gama et al, 2018).

Hackathons engage students in the learning process and help them retain new information while also enhancing their problem-solving, interest, and creativity skills (Oyetade et al, 2022a). It has potential benefits for teaching and learning as a project-based learning method or curriculum since it gives students the chance to pick up new technical abilities while boosting interest and engagement (Duhring, 2014). As more education institutions become aware of the benefits Hackathons can provide, a better, more lucid policy for how to incorporate it into the academic curriculum should be developed. This is essential to maintaining the push for innovation (Horton et al, 2018; La Place & Jordan 2022; Seidametova et al, 2022). With its inclusion in the curricula, there will be some variations in how students behave in response to this novel strategy for fostering collaboration, engagements, and participation among students as they learn (Oyetade et al, 2023; Rennick et al, 2018). This study aims to investigate Hackathon adoption factors in education by conducting a systematic literature review and answering the question – What are the Hackathon adoption factors in education. The study also seeks to answer the following sub-questions and map a distinct focus particular to Hackathon research for guidance towards practice:

i. Which models have been applied to research Hackathon adoption?

ii. What methodologies have been used to examine Hackathon adoption?

iii. What are the key factors that studies on Hackathon adoption have found to be most effective?

To identify the crucial elements needed for students to successfully complete operation tasks, as well as to assess the degree to which the consequence of the identified factors affects academic proficiency, this study intends to investigate Hackathon adoption factors in education using a systematic literature review methodology utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline in our study. The anticipated outcomes have a lot of potential in terms of increasing student instruction and assessment. The findings of this Hackathon research can be used to guide and facilitate the design and development of an improved curriculum aimed at teaching-learning of computer programming in schools.

Research and Methodology

This section delves into the research on factors influencing educational hackathons, aiming to identify various ways in which hackathons can enhance academic curriculum. The PRISMA guidelines were adhered to guide the study. The PRISMA guideline is a widely accepted framework for conducting systematic reviews and ensures transparent reporting and methodological rigor (Sarkis-Onofre et al, 2021). Its application in our research enhances the reliability and validity of our findings, providing a comprehensive analysis of the factors of Hackathon adoption. Also, by adhering to the PRISMA guideline, we aim to minimize bias, ensure replicability, and improve the overall validity of our findings. Furthermore, in the context of our research on Hackathon adoption, the PRISMA guideline provides a systematic and transparent process for identifying relevant studies. This ensures that our literature review is comprehensive and minimizes the risk of excluding important factors of Hackathon adoption. By employing predefined search strategies, inclusion and exclusion criteria, and thorough screening procedures, we can confidently identify and include relevant studies in our analysis. By organizing and summarizing the evidence, we can identify common factors and potential patterns of Hackathon adoption in education.

Search Strategy

The articles undergoing review are sourced from the databases of EBSCOhost, Scopus, and Google Scholar, all of which are subscribed to by the authors' institution. This selection ensures a thorough compilation of academic literature on the adoption of hackathons. To expedite the process, additional relevant research from these databases was also sought in the reference sections of the retrieved papers. Search keywords include: ("Hackathon" OR "Hackathons" OR "Hackathon Evaluation") AND ("Education" OR "Educational Strategy" OR "Adoption") AND ("Collaborative Learning" OR " Project Based Learning").

This search resulted in 112 papers and those that were not genuinely relevant to the keyword descriptors were removed after an assessment of these articles. 30 publications that were published between 2005 and 2022 were the results of the review. Following this, eligibility was determined using inclusion and exclusion criteria. The process for retrieving data from databases is depicted in Figure 1. The search yielded 112 papers, and those that were not relevant to the study objectives were excluded based on inclusion and exclusion criteria. The final review comprised 30 publications published between 2005 and 2022.

Eligibility Criteria

A total of 112 articles were identified through a database search in alignment with the study's objectives. Duplicate articles were removed, and the titles, abstracts, and keywords of the remaining articles were examined. These articles full-text versions were examined for eligibility with the following criteria to direct the authors in compiling pertinent studies for inclusion in this review.

Items chosen for inclusion in the study were based on the following:

i. Articles written in English.
ii. Articles on Hackathon adoption or acceptance studies.
iii. Articles that placed a strong emphasis on models, design, and factors of adoption.

Items chosen for exclusion in the study were based on the following:

i. Articles written in other languages.
ii. Articles that assessed general Hackathon and technology usage perceptions but no factors
iii. Publications with a focus on hackathon, technology adoption but not in an academic institution.
iv. Publications with no defined methodology

Synthesis Method

This section was coded to answer the main research question and the sub-questions.

i. Theoretical Framework: The models were divided into original and modified models. The original model was the actual model while the modified models are extensions of the original models or combination with other models.
ii. Study design: The three main study design types—quantitative, qualitative, and mixed method—were identified in the study and were the focus of the investigation.
iii. Effective factors: Based on data from individual studies, significant factors influencing Hackathon adoption intentions were identified.

Findings

This section presents the findings found from the review of the 30 eligible studies for review. These are presented by the study characteristics, publication distribution by year and school category, research design, data collection method, and theoretical framework.

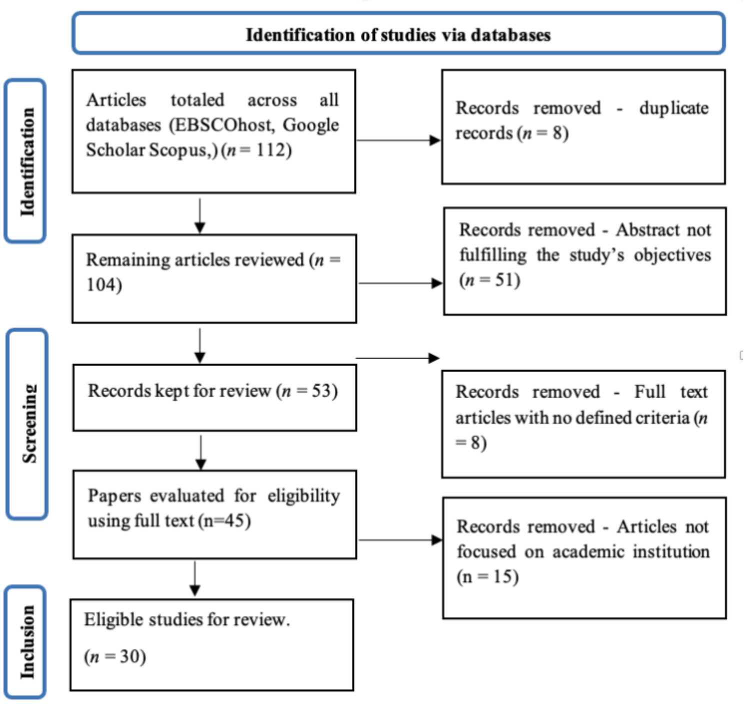

Figure 1: PRISMA flowchart diagram

Characteristics of the reviewed studies

The remaining 30 eligible studies were thoroughly examined to extract the benefits and offer specific details of hackathons in education across several disciplines are presented in Table 1.

Table 1: Characteristics of the Studies

Authors	Country	Method	Sample Size	Demographic Sampled	Theory/Framework	Data Analysis Instrument
Tarhini et al (2021)	Britain	Quantitative	366 Students	University	UTAUT2	Descriptive Analysis, CFA
Ali et al (2016)	Not Applicable	Quantitative	47 University Student	University	Not Applicable	Descriptive Analysis
Al-Rahmi and Zeki (2016)	Malaysia	Quantitative	340 Respondents	University	Constructivism Theory and Technology Acceptance Model (TAM)	SEM
Sun and Gao (2020)	China	Quantitative	169 Responses	University		Not Applicable
Arpaci (2017)	Turkey	Quantitative	221 Undergraduate Students	University	TAM	Not Applicable
Blayone et al (2017)	Ukraine	Quantitative	20 Professors and 224 Students	University	The General Technology Competency and Use framework	Mann–Whitney U test
Nikou and Economides (2017)	Europe	Quantitative	140 Students	Secondary School	Self-Determination Theory (SDT) of Motivation and the Technology Acceptance Model (TAM)	SEM
Shin (2018)	Not Applicable	Quantitative	79 Students	Not Applicable	Not Applicable	Descriptive and Inferential
Tarhini et al (2017)	Lebanon	Quantitative	569 Students	University	TAM	SEM and multi-group analysis
Elfeky et al (2022)	Saudi Arabia	Quantitative	240 Students	University	TAM	SEM
Oyetade et al (2022a)	South Africa	Quantitative	249 Students	University	Not Applicable	Descriptive and Inferential
Ramírez-Correa et al (2015)	Chile and Spain	Quantitative	Not Applicable	University	Technology Acceptance Model	SEM
González-Marcos et al (2021)	Spain	Mixed Method	160 Engineering Students	University	Not Applicable	Descriptive (Mann–Whitney U test)
Oke and Fernandes (2020)	South Africa	Qualitative	33 Stakeholders	University	UTAUT	
Ladachart (2021)	Thailand	Mixed Method	32 Preservice Biology Teachers	Not Applicable	Pedagogy of Science Teaching Test (POSTT)	Descriptive and Inferential
Pal and Vanijja (2020)	India	Quantitative	1595 Students	Colleges	TAM and SUS	Descriptive and Inferential

Tarhini et al (2014)	Britain	Quantitative	604 Students	University	Extended TAM	Descriptive, CFA and SEM
Han (2017)	Korea	Quantitative	840 Students	Secondary School	PBL	Descriptive and SEM
Salehudin et al (2020)	Indonesia	Quantitative	146 High School Students	Secondary School	PBL	Descriptive and Inferential (MANOVA)
Al-Rahmi et al (2017)	Malaysia	Quantitative	106 Students	University	Not Applicable	Descriptive and SEM
Virtue and Hinnant-Crawford (2019)	USA	Qualitative	28 High School	High School	PBL	Priori coding
Teo et al (2012)	Turkey	Quantitative	487 students	University	Extended TAM	Descriptive and SEM
Affia et al (2022)	Estonia	SLR	Not Applicable	Not Applicable	Not Applicable	Descriptive
Wang et al (2018)	USA	Mixed Method	587 applicants	University	Not Applicable	
Ansari and Khan (2020)	India	Quantitative	360 students	University	Collaborative learning	Descriptive and SEM
Oyetade et al (2022)	South Africa	SLR	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Geng et al (2019)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Theory of planned behavior and social cognitive theory	Not Applicable
Chatterjee and Bhattacharjee (2020)	India	Quantitative analysis	329 respondents	University	UTAUT	Structural equation modelling
Salloum et al (2019)	United Arab Emirate	Quantitative analysis	435 students	University	TAM	Descriptive and SEM
Blau and Shamir-Inbal (2016)	Israel	Quantitative analysis	Not Applicable	Not Applicable	Not Applicable	Descriptive and Inferential
Tarhini et al (2014)	Lebanon	Quantitative analysis	569 Students	University	TAM	SEM

Source: Authors

Distribution of articles by year of publication

Figure 2 illustrates the distribution of articles published between 2012 and 2022, showcasing a limited number between 2012 and 2015. Subsequently, there is a substantial increase in the number of articles from 2015, this could be due to academic interest on this subject. The years 2017 and 2020 particularly stood out, each recording six studies on this topic.

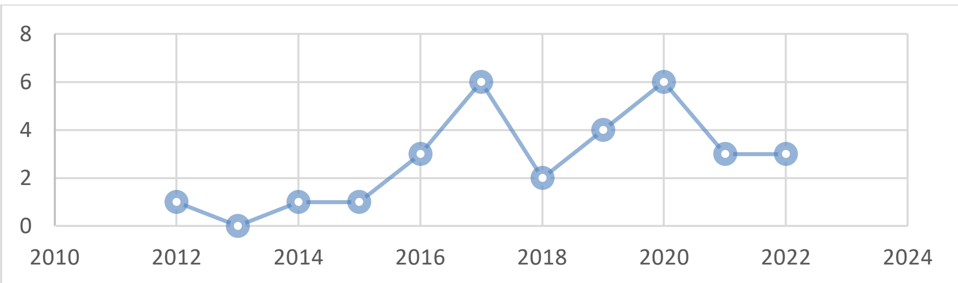

Figure 2: Distribution by Year

Distribution by school category

Analysis of reviewed papers based on school categories indicates a distribution across universities, secondary schools, colleges, and high schools, as illustrated in Figure 3. The depicted pattern suggests a growing interest among researchers across the various school categories. However, research on hackathons in education has focused more on higher education than on secondary schools and colleges. The not specified indicate studies that did not specify academic institutions their studies were conducted.

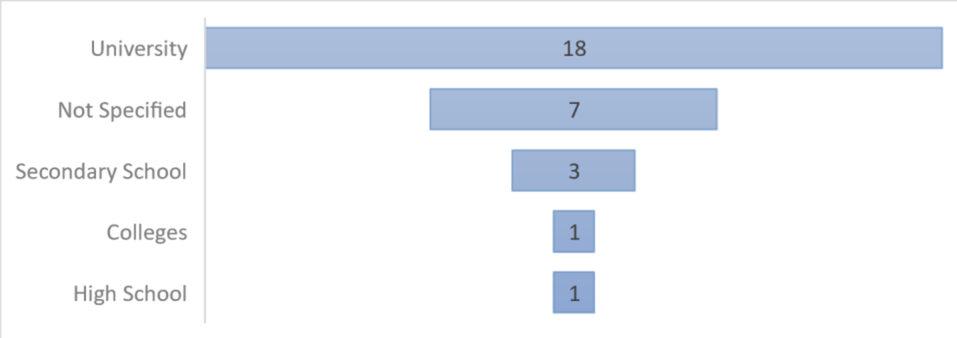

Figure 3: Distribution by school category

Research Design

The assessment of methodologies employed to investigate Hackathon adoption in response to research question two is outlined in Table 2, revealing three distinct categories. Among the 30 studies, critical information indicates that the majority (77%) employ a quantitative research design, followed by a mixed-method approach (16%). The use of qualitative methods (7%) was the least prevalent among the reviewed studies.

Table 2: Employed Methodologies

Methodology	No of studies	Percentage of studies
Quantitative	23	77%
Mixed Method	5	16%
Qualitative	2	7%
Total	30	100%

Significant factors determining Hackathon adoption.

The researchers organized the various factors of Hackathon adoption throughout the analyzed studies to address the study's third research question. The analysis of the 30 studies produced 109 factors with one or more frequency. Eighty-seven factors with only one occurrence in the examined papers were dropped from this investigation, leaving 22 factors with two or more frequency with the outcomes in Figure 4. As indicated in Figure 4, perceived usefulness has the highest frequency (15), followed by perceived ease of use (12), behavioral intention (12), self-efficacy, and collaborative learning, each occurring eight times. These five factors exhibit higher frequencies and notable significance in the reviewed studies, leading this study to consider them as influential in Hackathon adoption.

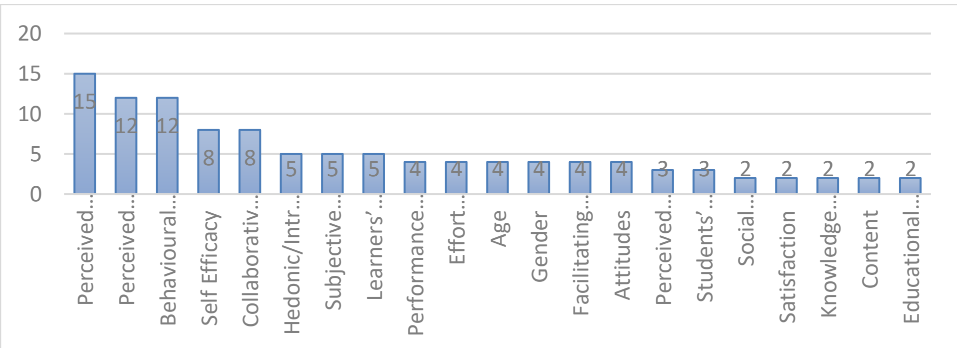

Figure 4: Factors determining Hackathon adoption.

Moreover, the examination of the reviewed studies led to the identification of eight theoretical frameworks, as presented in Table 3. Most of the studies (40%) utilized the Technology Acceptance Model (TAM) in their investigations, with 10% not explicitly identifying the theoretical framework employed. TAM was either modified, extended, or used in conjunction with other models in seven of these studies, while the original model was employed in five studies. Project-based learning (13%) ranked second in preference among the reviewed studies. Other theories, such as UTAUT and collaborative learning, were evenly distributed (10%), while the community of inquiry model, POSTT, and the ARCS model of motivation each accounted for 3% of the theories used.

Table 3: Models applied in reviewed studies.

Models	Studies	Percentage of Studies	Main Model	Revised Model
TAM	12	40%	5	7
PBL	4	13%		
UTAUT	3	10%	2	1
Collaborative learning models	3	10%		
No model	3	10%		
social cognitive theory	2	7%	1	1
Community of Enquiry Model	1	3%		
Pedagogy of Science Teaching Test (POSTT)	1	3%		
ARCS model of motivation	1	3%		
Total	**30**			

Technology Adoption Model

The Technology Adoption (TAM) framework is used to describe how users embrace and use new technology. The TAM model suggests that perceived usefulness (PU) and perceived ease of use (PEOU) are the two main elements that affect users' adoption of new technologies which depend on a variety of external factors such as social influence, perceived system compatibility, and perceived cost (Venkatesh et al, 2003). Perceived usefulness refers to the extent to which users believe a specific technology will improve their performance or productivity is known as perceived usefulness. On the other side, perceived ease of use relates to the degree to which consumers think the technology is simple to use and comprehend. To better understand complex user behavior in various technological environments, the TAM model has been extended to include additional factors, such as trust, security, and perceived risk (Wang et al, 2021). It also contends that user behavior is influenced by the individual's own beliefs and attitudes toward technology, known as technology acceptance beliefs (Mullins & Cronan, 2021).

Project Based Learning

This is a method of teaching that places a strong emphasis on using real-world projects to get students involved in active and collaborative learning (Krajcik & Czerniak, 2018). It encourages deeper learning by giving students the chance to connect various concepts and ideas. By doing this, it encourages the growth of critical thinking, problem-solving, and collaborative abilities (Kingston, 2018). According to Crespi et al (2022), PBL enables students to learn via inquiry and discovery which is one of PBL's core characteristics. PBL has been shown to be excellent at fostering student learning and participation in studies. For instance, PBL was proven to be successful in enhancing student engagement and critical thinking abilities in a STEM classroom by Albion et al (2018). Also, PBL was shown to be successful in fostering teamwork and problem-solving abilities among students in an engineering program (Warnock & Jean, 2016). PBL is a promising teaching strategy with the ability to improve students' deep and meaningful learning. It does, however, necessitate adequate teacher training and support, as well as meticulous planning and preparation.

Unified Theory of Acceptance and use of Technology

Venkatesh et al (2003) developed the model that aims to explain and understand people's adoption and use of technology based on four fundamental constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. The degree to which an individual believes that adopting technology will increase their performance is referred to as performance expectancy, whereas effort expectancy refers to the perceived ease of use of the technology. The influence of people on an individual's use of technology is referred to as social influence, whereas enabling conditions refer to the amount to which an individual believes that the required resources and support are available for efficiently using technology. Several studies have shown that UTAUT is useful at explaining people's adoption and use of technology in a range of contexts. For example, Alkhuwaylidee (2019) reports UTAUT clarified university students' adoption of e-learning technologies. In another study, Ye et al (2020) found that UTAUT was helpful in predicting the adoption of mobile data services. UTAUT has also evolved over time to better account for specific factors that may influence technology uptake and usage. Hu et al (2020) modified UTAUT to incorporate hedonic drive and price value as new elements influencing technology adoption.

Collaborative Learning

Collaborative learning approaches have grown in popularity in educational settings because they provide a more student-centered approach to learning that emphasizes teamwork, communication, and critical thinking abilities. Peer tutoring, project-based learning, and online learning communities are just a few examples. Aronson's Jigsaw Classroom concept serves as an illustration of a collaborative learning methodology. Under this Jigsaw Classroom approach, students are organized into smaller teams, and each team member is assigned a particular topic or area of expertise. The students collaborate within their respective groups to become specialists in their assigned fields before reconvening as a larger group to collectively showcase their acquired knowledge, also leading to greater academic achievement and more favorable attitudes about learning (Aronson, 2002). Moreover, another collaborative learning strategy is online learning communities where students collaborate in a virtual setting to complete coursework and assignment from anywhere in the world with an internet connection, increasing flexibility and accessibility. Research has shown that online learning communities can improve academic achievement and promote student engagement (Zhang & Liu, 2019). Collaborative learning models provide a promising educational method that stresses teamwork, communication, and critical thinking skills, thereby boosting academic performance, critical thinking abilities, and willingness to study.

Social Cognitive Theory

Albert Bandura's framework, commonly known as the Social Cognitive Theory (SCT), suggests that human behavior results from the dynamic interplay among personal, environmental, and behavioral factors (Bandura, 1991; Rumjaun & Narod, 2020). This theory underscores the role of observational learning, self-efficacy, and cognitive processes in shaping human behavior. It suggests that individuals are not merely passive recipients of information, but active agents in their own development (Bandura, 1997; Bandura 2023). Observational learning involves cognitive functions like attention, retention, reproduction, and motivation, enabling individuals to acquire new skills, attitudes, and behaviors. For example, a student might observe a teacher's teaching method and try to replicate it. Another crucial aspect of Social Cognitive Theory (SCT) is self-efficacy, where higher levels correlate with a greater inclination to engage in tasks one believes they can accomplish, while lower levels may lead to avoidance of challenging tasks (Bandura, 2004). SCT has been utilized in education to improve teaching practices, student motivation, and academic accomplishment.

Community of Inquiry Model

The Community of Inquiry (CoI) framework is a widely recognized theoretical model that emphasizes the importance of three interrelated presences: social presence, cognitive presence, and teaching presence, in creating an engaging and collaborative learning environment. This model has been extensively adopted and applied in online learning research and practice, underscoring its significance in the field (Garrison et al, 1999; Popescu et al, 2020). The ability of learners to perceive each other as real and engaged in meaningful engagement is referred to as social presence, whereas cognitive presence refers to the ability of learners to generate and confirm meaning through continuous contemplation and speech. The design, facilitation, and direction of educational events is referred to as teaching presence (Garrison et al, 1999; Moore & Miller, 2022). Research on the CoI model indicates that the three presences (social, cognitive, and teaching) correlate with student involvement, satisfaction, and learning outcomes. Courses with high levels of these presences are associated with increased student satisfaction and perceived learning, emphasizing their critical role in enhancing the overall educational experience and outcomes (Guo et al, 2020; Taghizade et al, 2020). The concept has proven beneficial across diverse educational settings, enhancing student involvement, satisfaction, and learning outcomes, while also supporting teacher professional development in blended learning environments.

Pedagogy of Science Teaching Test

The Pedagogy of Science Teaching Test (POSTT) is a measurement instrument used to assess science instructors' pedagogical subject knowledge (Abell and Bryan, 1997). It assesses teachers' knowledge of the nature of science, scientific inquiry, and competence to integrate scientific subjects with pedagogy. Cakir (2011) used the POST to detect knowledge gaps in science teachers and to construct effective professional development programs. The POSTT is built on a constructivist approach to science education and emphasizes the value of inquiry-based learning. Professional development programs for science teachers have also been created using the POSTT. In one study, for example, science teachers completed the POSTT, and their results were utilized to create personalized professional development programs (Gess-Newsome et al, 2003). The POSTT is an excellent resource for science education researchers, teacher educators, and school administrators who want to improve scientific instruction.

ARCS Model of Motivation

John Keller's ARCS model (Attention, Relevance, Confidence, Satisfaction) enhances learner motivation in teaching. It focuses on capturing attention, establishing relevance, boosting confidence, and delivering satisfaction. Attention involves methods like novelty, variety, and ambiguity. Relevance connects training to learners' needs through examples and case studies. Confidence is fostered by clear goals, practice, feedback, and positive reinforcement. Satisfaction results from learner engagement and achievement, encouraged by providing control, choice, and ownership over their learning (Keller, 1987). The ARCS concept has been implemented in a variety of educational settings, including K-12, higher education, and professional development. Durrani and Kamal (2021) used the blended learning approaches that are based on the ARCS model, procedures, and strategies has been shown to be beneficial in promoting and/or preserving students' motivation, keeping them interested in the subject matter in an online setting, and ultimately improving learning outcomes. Kuo et al (2014) employed the ARCS model in higher education online learning environments, leading to greater satisfaction and learning outcomes. Instructors can build effective and enjoyable learning experiences by paying attention to learners' attention, relevance, confidence, and satisfaction.

Discussion

Thirty-two factors were identified by the study from where five factors were considered by this study to influence Hackathon adoption. The increase in articles published after 2015 points to a growing understanding of the value and effects of hackathons in learning environments. With six studies each, the years 2017 and 2020 saw a surge in academic activity, indicating critical times when researchers focused on comprehending and investigating the aspects that contribute to hackathon adoption. This historical trend lays the groundwork for future researchers to contextualize the expansion and development of hackathon-related studies in education by offering insightful information about the dynamic nature of research interest. Researchers' areas of interest are becoming more and more distributed throughout universities, secondary schools, colleges, and high schools. The preference for universities implies a primary concentration, but the distribution among different categories points to an expanding field of inquiry. The large percentage of quantitative study designs (77%) suggests a significant preference for empirical studies, emphasizing the need for a quantitative framework to comprehend hackathon adoption. A recognition of the need for deeper insights beyond quantitative metrics is demonstrated by the prevalence of mixed methods (16%) and qualitative approaches (7%). Future researchers can use this methodological breakdown as a guide, as it provides insights into the dominant research paradigms and highlights the importance of using a variety of scientific approaches while examining technological adoption in education. According to Creswell and Creswell (2017), one of the limitations of using a purely quantitative approach in research is the lack of depth and understanding of the complexity of the phenomenon being studied. This approach tends to focus on numerical data and statistical analysis, which may not provide a full understanding of the experiences, feelings, and perceptions of individuals or groups. To address these limitations, researchers often use mixed methods approaches that combine both quantitative and qualitative methods to give a more thorough knowledge of the topic under investigation.

The theoretical landscape supporting hackathon adoption research is demonstrated by the identification and classification of theoretical frameworks and models. The majority's (40%) usage of TAM indicates a fundamental reliance on theories of technological acceptance. This is not surprising as several studies have explored the factors that influence technology adoption in various contexts, including education. The TAM is a widely used theoretical framework that explains how users perceive and adopt technology. According to TAM, perceived usefulness and perceived ease of use are the two primary factors that influence technology adoption (Davis, 1989). A rich theoretical variety in the investigation of hackathon uptake is reflected in the range of models used, such as project-based learning and UTAUT. For instance, Affia et al (2022) defined the following themes as part of elements in integrating Hackathon in an online cybersecurity course: team familiarity, team goal clarity, team participation, and team procedure. Wang et al (2018) highlight themes of diversity in collaboration, professional development, interest in medical innovation, and educational value from responses to a post-healthcare Hackathon survey conducted by Stanford University. Oyetade et al (2022) used a qualitative technique to study the advantages of hackathons in education and came up with the following themes: improvement of technical and soft skills, acquisition of novel items, and efficient networking. By showcasing the adaptability of theoretical frameworks and opening the door for additional in-depth studies that draw from a variety of theoretical bases, this synthesis advances the theoretical consolidation in hackathon research.

The careful examination of the variables affecting the uptake of hackathons reduces a complicated range to 22 recurring factors. Researchers and educators looking at traversing the complex terrain of hackathon integration in educational contexts might use the identification of these elements as a guide. This detailed breakdown of each factor offers a deeper understanding of the factors influencing hackathon adoption and serves as a reference for both scholars and practitioners. In summary, this systematic review summarizes the body of knowledge and provides guidance for future research on the dynamic and changing field of hackathon adoption in education. Through the provision of detailed insights spanning methodological, theoretical, institutional, time-based, and factor dimensions, academic discussion is enriched and a deeper knowledge of the factors influencing the integration of hackathons in educational environments is promoted.

It is interesting to note the education sector is experiencing a surge in the adoption of hackathons, characterized by several emerging trends. These include the incorporation of hackathons into academic curricula, fostering interdisciplinary collaboration, and an emphasis on STEM subjects. Industry partnerships are being formed to support these initiatives, and hackathons are increasingly recognized as effective learning tools. There's also a growing trend of including non-technical tracks in hackathons, catering to a broader range of skills and interests. The format of hackathons is evolving too, with a shift towards remote and virtual platforms. This change is driven by the rise in student-led initiatives that aim to foster innovation and entrepreneurship. Moreover, educational hackathons are placing a greater emphasis on social impact, reflecting a broader societal trend towards responsible and sustainable development. Lastly, there's a growing trend of recognizing participation in hackathons in academic records or through certificates. This recognition serves to acknowledge the practical problem-solving abilities that participants develop during these events (Garcia, 2023; Heller et al, 2023; Oyetade et al, 2022). These trends highlight the evolving role of hackathons in education, demonstrating their potential as powerful tools for learning, innovation, and skill development.

Conclusion

Numerous factors impact a student's ability to effectively engage in academic tasks. Enhancing academic performance necessitates a thorough examination of these influential factors. This study, utilizing the PRISMA framework, identified key elements shaping the adoption of Hackathons in education. The study revealed five pivotal factors with substantial impacts on Hackathon adoption: perceived usefulness, perceived ease of use, behavioral intention, self-efficacy, and collaborative learning. Additionally, the study scrutinized existing literature on Hackathon adoption, evaluating the models, designs, and significant factors employed by students. The findings delineated effective approaches for integrating Hackathons into educational settings. This study contributes to the current state of literature, setting the groundwork for future inquiries. Notably, it represents one of the first systematic literature reviews on the adoption of Hackathons among frontline IT students. The identified factors underscore the need for tailored curricula aligned with the academic requirements of twenty-first-century students, accommodating variations in their strengths and weaknesses. Furthermore, these factors will serve as the basis for constructing a model to empirically test their influence on students' adoption of Hackathons in academic and other contexts. This research introduces a distinctive composition of items, marking a departure from previous studies. Future studies will explore empirical testing methodologies for these factors.

The SLR study's nature presented certain limitations. For example, the use of databases like EBSCOhost, Scopus, and Google Scholar may result in publication bias. This can be addressed by expanding search strategy to include non-indexed databases to provide a more comprehensive information source. Also, because factors are derived from many studies, it may be difficult to generalize findings across different educational environments. This can be overcome by recognizing context-specific details and recommending targeted reviews customized to certain educational settings.

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