Development of the FAP (Formative Assessment Platform) to Promote Holistic Student Competency Development: An Empirical Study in 100 Schools

Thanyawich Vicheanpant

School of Communication Arts Sripatum University, Chonburi province, Thailand
thanyawich1977@gmail.com

Abstract

This research aims to 1) develop the Formative Assessment Platform (FAP) to assess and enhance learners' competencies, and 2) evaluate the effectiveness of the FAP platform in fostering students' competencies across 100 schools in four provinces of Thailand: Surin, Sa Kaeo, Krabi, and Lampang. The FAP platform enables teachers to monitor student behaviors, record data, and provide personalized feedback, targeting four core competencies: critical thinking, creativity, collaboration, and communication. Using a mixed-methods approach, the study employed a pre-test and post-test design with quantitative data from 197 teachers and 2,454 students. Qualitative data were gathered through semi-structured interviews with teachers. The results show that teachers were highly satisfied with the FAP platform (average satisfaction score of 4.54 out of 5), particularly in terms of ease of use (4.71) and perceived benefits (4.65). Students demonstrated significant competency development, especially in collaboration (effect size = 0.71) and creativity (effect size = 0.65), with an overall effect size of 0.57. The study recommends scaling up the FAP platform to further enhance Thai education quality by improving teacher training, supporting the integration of the platform, and developing competency-focused curricula. Future research should explore the long-term impact of FAP on student outcomes, compare its effectiveness with other platforms, and investigate factors influencing its sustained use.

Keywords: formative assessment platform, learner competencies, critical thinking, creativity, collaboration, communication

Introduction

The contemporary educational landscape is profoundly affected by rapid advancements in technology and the fierce competition of the global economy. These forces necessitate that learners acquire a multifaceted skill set transcending traditional academic knowledge, including essential 21st-century skills such as critical thinking, creativity, collaboration, effective

communication, problem-solving, and a commitment to lifelong learning [1]. This alignment with educational policies globally, such as Thailand's National Education Policy, emphasizes nurturing "good, skilled, and happy individuals," equipping them with competencies fitting 21st-century demands [2].

Emerging literature underscores the inadequacy of traditional assessment methods, characterized by rote memorization and summative examinations, in capturing the complex competencies required in modern educational contexts [3]. As Clarke et al. [4] noted in their bibliometric analysis of medical research, traditional assessment strategies can lead to a misrepresentation of potential [5]. Consequently, these conventional methodologies often fail to facilitate the assessment of students' critical thinking and collaborative skills essential for success in an ever-evolving landscape [6]. This inadequacy indicates a palpable need to shift towards more effective assessment models, primarily formative assessment [7].

Formative assessment, which centers on continuous feedback and systematic tracking of student progress, has become increasingly recognized for its ability to transform educational experiences. Recent studies, including a comprehensive analysis by Obeidat et al. [8], demonstrate the significant impact of formative assessments on student learning outcomes, enhancing both academic performance and critical competencies [9]. Furthermore, integrating digital technologies into these assessments enhances the efficiency of data collection and permits a more granular analysis of complex skills, including teamwork and problem-solving capabilities [10]. For instance,

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[1] Daeng A Natuna, M J A Putra, and Azhar Azhar, "TEACHERS' PERFORMANCE IN ONLINE LEARNING DURING COVID-19 OUTBREAK: AN ANALYSIS BASED ON 21st CENTURY PROFICIENCY," *International Journal of Educational Best Practices* 5, no. 2 (2021): 197.

[2] Francesc M Esteve-Mon, M Á Llopis, and Jordi A Segura, "Digital Competence and Computational Thinking of Student Teachers," *International Journal of Emerging Technologies in Learning (Ijet)* 15, no. 02 (2020): 29.

[3] Eniel d. E Santo, Sara Dias-Trindade, and Rafaela S d. Reis, "Self-Assessment of Digital Competence for Educators: A Brazilian Study With University Professors," *Research Society and Development* 11, no. 9 (2022): e26311930725; Chen Siyi, Qi Yu, and Amjad Al-Samawi, "Effects of Digital Education on Human Resource Development," *Human Systems Management* 42, no. 6 (2023): 691–706.

[4] Cameron Clarke et al., "Demographic Correlations for 100 Most-Cited Authors in Ophthalmic Research; A Bibliometric Study," *Medical Hypothesis Discovery & Innovation in Ophthalmology* 9, no. 4 (2021).

[5] Ziya Bahadır, Zehra Certel, and Ramazan Topuz, "The Role of 21st Century Learner Skills of Physical Education and Sports Teachers and Teacher Candidates on Teacher Skills," *Turkish Journal of Sport and Exercise* (2019): 400–407.

[6] Steinar Thorvaldsen and Siri S Madsen, "Decoding the Digital Gap in Teacher Education: Three Perspectives Across the Globe" (2021).

[7] Abdullah M Al-Ghurbani et al., "The Impact of Internal Factors on the Use of Technology in Higher Education in Saudi Arabia During the COVID-19 Pandemic," *Human Systems Management* 41, no. 2 (2022): 283–302.

[8] Bilal F Obeidat, Saber Haimed, and Mohammad S AlKhaza'leh, "Students' Well-being and School Climate: A Bibliometric Analysis," *Review of Education* 12, no. 2 (2024).

[9] Atikah Mauluddiyah, "The Influences of Abraham Maslow's Hierarchy of Needs Theory, Field Practice Experience, and 21st Century Skills on Career Choice of Becoming a Vocational Teacher," *Teknologi Dan Kejuruan Jurnal Teknologi Kejuruan Dan Pengajarannya* 44, no. 2 (2021): 108.

[10] Ömer F Vural and Selma Vural, "An Examination of 5th Grade Mathematics Curriculum in Terms of 21st Century Skills," *International Journal of Educational Research Review* 6, no. 2 (2021): 82–92; Mariana-Daniela González-Zamar et al., "Managing ICT for Sustainable Education: Research Analysis in the Context of Higher Education," *Sustainability* 12, no. 19 (2020): 8254.

Santini et al. [11] argue that leveraging technology can create more effective environments for student engagement and skill development [12].

In light of these insights, we propose the development of a Formative Assessment Platform (FAP), a digital tool tailored to align competency-based learning outcomes with global educational trends emphasizing skill development. This platform offers educators the capacity to observe real-time student behaviors, record pertinent data, and receive analytical feedback to inform targeted interventions [13]. The significance of leveraging technology in educational assessment has been highlighted by many, including González-Zamar et al. [14], who posit that digital tools can enhance educational efficacy and address existing assessment gaps effectively [15].

The present research aims to rigorously evaluate the efficacy of the FAP in enhancing learners' competencies. Specifically, it will measure teacher satisfaction with the platform and assess changes in student competencies facilitated through its use. The methodology will employ a mixed-methods approach, integrating quantitative assessments of student performance alongside qualitative feedback from educators to form a comprehensive picture of the platform's impact [16]. This approach is particularly justified given the rise of educational technologies that have shaped contemporary teaching practices, as evidenced by productivity analyses [17].

Furthermore, this research contributes to the ongoing discourse on educational reform and competence development, particularly through the use of digital assessment tools. As Tamasiga et al. [18] suggest, the alignment of education with technological advancements is not only vital for enhancing learning outcomes but also for preparing students to meet the challenges of a rapidly changing world [19]. Moreover, the expectation that educational institutions will do more

[11] Kurniawan Dwi Saputra and Krismono Krismono, "The Reconstruction of Aligarh and Santiniketan Educational Philosophy: The Creative Ijtihad of Trimurti in Developing Islamic Education in Indonesia," *TSAQAFAH* (2021).

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[13] Endro D Hatmanto, "A Comparison Between an Indonesian and an English Journal Published in Indonesia" (2021).

[14] González-Zamar et al., "Managing ICT for Sustainable Education: Research Analysis in the Context of Higher Education."

[15] Clarke et al., "Demographic Correlations for 100 Most-Cited Authors in Ophthalmic Research; A Bibliometric Study."

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[17] Hande Yeşilbaş and Filiz Kantek, "Trends and Hot Topics in Nurse Empowerment Research: A Bibliometric Analysis," *Japan Journal of Nursing Science* 19, no. 2 (2021); Emerson Rogério de Oliveira and Adriano Pasqualotti, "Educational Process in E-Learning Activity for Elderly People: A Systematic Review," *Interactive Learning Environments*, 2023.

[18] Phemelo Tamasiga, Helen Onyeaka, and El h. Ouassou, "Unlocking the Green Economy in African Countries: An Integrated Framework of FinTech as an Enabler of the Transition to Sustainability," *Energies* 15, no. 22 (2022): 8658.

[19] Md. J Hossain and Uzzal A Pk, "A Systematic Review of Energy Demand, Technology, and Efficiency Nexus: Implications for Bangladeshi Food Processing Industry," *American Journal of Environmental Economics* 2, no. 1 (2023): 1–8.

than merely relay knowledge is supported by recent trends indicating that student competencies in critical thinking and collaboration are paramount [20].

Thus, this research endeavors to fill the existing gaps in educational assessment through the implementation of the FAP, ultimately reflecting a broader paradigm shift towards the development of well-rounded learners equipped to address the complexities of an increasingly interconnected global environment. The findings will have significant implications for educational practices by informing educators and policymakers of the potential for digital assessment technologies to improve learning outcomes and align educational practices with 21st-century skills.

Method

This research adopts an evaluative design utilizing a mixed-methods approach, combining both quantitative and qualitative methods to assess the effectiveness of the Formative Assessment Platform (FAP) in developing learners' competencies. The study uses a pre-test and post-test design, integrated with qualitative data from semi-structured teacher interviews, providing a comprehensive view of the impact of the platform on teaching practices and student development.

Participants
1. Primary Sample

The primary sample includes 197 teachers from 100 schools across four provinces in Thailand: Surin, Sa Kaeo, Krabi, and Lampang. The schools were selected using convenience sampling based on their willingness and readiness to participate in the project. Teachers within each school were chosen through simple random sampling or other suitable sampling methods, depending on the number of teachers at each school.

2. Secondary Sample

The secondary sample consists of students from the schools where the teachers are employed, totaling approximately 2,454 students. Data analysis will account for the number of students in each school to ensure that the results are statistically valid and meaningful.

Research Tools
1. Formative Assessment Platform (FAP)

The FAP is a digital tool designed to assess student competencies by tracking behaviors and providing personalized feedback. The platform includes an analytical engine that processes student data, generates competency reports, and offers recommendations for student improvement. This system also allows for real-time monitoring of student progress, facilitating targeted interventions by teachers. The platform's key features are visualized in the following figures:

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[20] Zaenul Muttaqien and Imam Mukhlis, "Bibliometric Analysis of Social Entrepreneurship (2018-2023)," *Formosa Journal of Science and Technology* 2, no. 11 (2023): 3133–3152.

Figure 1: Registration screen before access.

Figure 2: Screen displaying competency descriptions for each level, categorized by primary, upper primary, and lower secondary education.

Figure 3: Dashboard displaying student competency levels; those marked in red require special teacher attention and feedback.
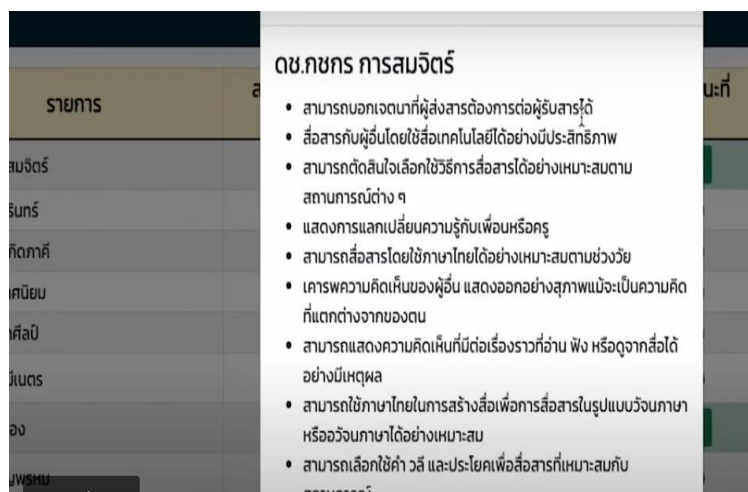
Figure 4: Detailed student behaviors and weaknesses needing improvement, ready for teacher feedback.
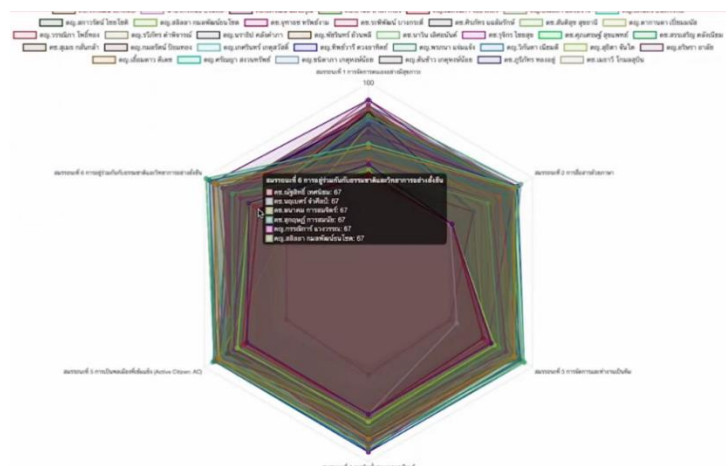

Figure 5: Spider charts for each student, allowing teachers to easily compare their strengths and weaknesses.

รายการ	สมรรถนะที่ 1	สมรรถนะที่ 2	สมรรถนะที่ 3	สมรรถนะที่ 4
กรุงเทพมหานคร	17.4	13.7	13.5	11.9
กาญจนบุรี	74.4	72.4	73.6	68.9
ขอนแก่น	74.3	75.3	61.5	52.9
จันทบุรี	15.4	17.6	4.8	5.4
ชลบุรี	65.0	61.1	63.0	56.8
เชียงราย	22.7	19.4	15.3	15.1
เชียงใหม่	47.7	43.8	44.7	38.1
ตรัง	37.5	34.5	37.0	23.0
นครศรีธรรมราช	46.0	22.3	19.3	18.7
นครสวรรค์	7.5	5.7	5.4	4.2
น่าน	21.6	8.6	8.4	7.8
พระนครศรีอยุธยา	66.4	66.7	67.3	64.8
เพชรบุรี	69.0	66.2	65.7	61.2

Figure 6: Summary screen displaying performance assessment results at the school and provincial levels.

Teacher Satisfaction Questionnaire

A 5-point Likert scale questionnaire (1 = Very Dissatisfied, 5 = Very Satisfied) was used to measure teacher satisfaction with the FAP platform. The questionnaire underwent validity and reliability testing, and the Cronbach's alpha coefficient was calculated to ensure internal consistency. The dimensions assessed included ease of use, benefits received, team support, and the appropriateness of the platform for the teaching context.

Competency Assessment

A four-dimensional competency assessment was used to measure student competencies in critical thinking, creativity, collaboration, and communication before and after the use of the FAP platform. The assessment included clear scoring criteria, and validity and reliability tests were conducted to ensure that it effectively measures the intended competencies.

Semi-Structured Interviews

Interviews were conducted with sample teachers to collect qualitative data regarding their experiences and perceptions of using the FAP platform. The interviews were semi-structured, allowing for flexibility while ensuring that the research objectives were met. Qualitative data from the interviews were analyzed using content analysis techniques to identify key themes and patterns.

Research Steps

1. **Training**

   Teachers received detailed training on using the FAP platform, including the various assessment tools available. The training duration and content were designed to ensure that teachers were fully equipped to use the platform effectively. A support system was set up to address any issues that arose during the implementation phase.

2. **Implementation**

   The platform was used by teachers for one semester. During this period, teachers applied the FAP platform in their teaching practices, with ongoing monitoring and support through regular consultations. The duration of this phase was critical to ensure that teachers had ample opportunity to integrate the platform into their teaching processes.

3. **Data Collection**

   Data were collected through several instruments: teacher satisfaction questionnaires, pre-test and post-test competency assessments of students, and semi-structured teacher interviews. The data collection period was defined, and methods for ensuring data accuracy, such as cross-checking and ensuring the consistency of responses, were implemented.

4. **Data Analysis**

   Quantitative data were analyzed using descriptive statistics to summarize the results, and effect sizes were calculated to assess the impact of the FAP platform on student competencies. Qualitative data from the teacher interviews were analyzed through content analysis, using coding techniques to identify major themes and patterns in the responses.

Data were analyzed using software such as SPSS for quantitative analysis and NVivo for qualitative content analysis.

Limitations of the Study

The study has several limitations. First, the use of convenience sampling for school selection may reduce the generalizability of the results. Additionally, the reliance on self-reported data from teachers may introduce response bias. Finally, the data collection period was limited to one semester, which may not capture the long-term effects of the FAP platform on student competencies.

Reliability and Validity

The reliability of the instruments was ensured through pre-testing and validation. The teacher satisfaction questionnaire and competency assessments were validated through expert review and tested for internal consistency using Cronbach's alpha. The mixed-methods design allowed for triangulation of data, increasing the robustness of the findings and improving the overall validity of the study.

Results and Discussion

The results of this study are presented in two primary sections: the quantitative data analysis related to teacher satisfaction and student competency development, and the qualitative analysis derived from teacher interviews. Together, these provide a comprehensive overview of the impact of the Formative Assessment Platform (FAP) on teaching and learning practices.

Teacher Satisfaction with the Use of the FAP Platform

Quantitative analysis of the teacher satisfaction questionnaires (N = 197) revealed that teachers were highly satisfied with the use of the FAP platform. The results show that most teachers found the platform to be useful in improving teaching management and facilitating student competency assessment. The statistical analysis of teacher satisfaction, summarized in Table 1, highlights the following findings:

Table 1: Quantitative Analysis of Teacher Satisfaction (N = 197 teachers)

Satisfaction Dimensions	Average	SD	p-value
Ease of use	4.71	0.55	< 0.001
Benefits received	4.65	0.58	< 0.001
Team support	4.38	0.71	< 0.001
Design and aesthetics of the system	4.45	0.65	< 0.001
Overall satisfaction with the platform	4.54	0.62	< 0.001

The analysis indicates that all dimensions of teacher satisfaction are statistically significant (p < 0.001), demonstrating that the results are not due to chance. The average satisfaction score in all dimensions exceeded 4 out of a maximum of 5, signifying a high level of teacher satisfaction with the platform. Ease of use (4.71) and benefits received (4.65) were the highest-rated dimensions, suggesting that teachers found the platform intuitive and beneficial for their teaching practices. These findings emphasize the user-friendliness of the system and its perceived value in

supporting teaching management and assessment tasks.

Student Competency Development

Quantitative analysis of the impact of the FAP platform on student competencies revealed significant improvements in all measured competencies. The overall effect size for student competency development was 0.57, indicating a moderate to large effect. The results, presented in Table 2, show the effect sizes for each competency dimension:

Table 2: Quantitative Analysis of Student Competency Development (N = 2,454 students)

Competency	Effect Size	SD
Critical Thinking	0.36	0.53
Creativity	0.65	0.39
Collaboration	0.71	0.27
Communication	0.67	0.41

1. Critical Thinking: The effect size of 0.36 is moderate, indicating some improvement but suggesting that more time or targeted interventions might be required to significantly boost critical thinking skills.
2. Creativity: With an effect size of 0.65, creativity saw substantial growth, suggesting that the platform has a positive impact on fostering creative problem-solving skills.
3. Collaboration: The highest effect size of 0.71 for collaboration reflects the FAP's significant role in enhancing students' ability to work together effectively.
4. Communication: An effect size of 0.67 suggests considerable improvement in students' communication skills, aligning with the importance of these competencies in 21st-century education.

The results show that the FAP platform was particularly effective in developing collaboration and creativity, both of which are critical skills in the modern workforce. The platform's structure appears to facilitate collaborative learning and creativity through its interactive feedback mechanisms, real-time data collection, and personalized guidance. However, critical thinking demonstrated a moderate effect size, which could be attributed to the more complex nature of this competency and its requirement for deeper, sustained engagement.

Discussion

The results of this study highlight the significant impact of the Formative Assessment Platform (FAP) in enhancing both teacher satisfaction and student competency development. In this section, we will delve deeper into the findings, exploring their implications in the context of existing literature, theoretical frameworks, and current educational practices. This discussion will critically engage with the results, compare them with similar studies, and provide insights into the broader implications for the future of education, particularly in the context of formative assessment and educational technology.

Teacher Satisfaction and Usability of the FAP Platform

The high levels of teacher satisfaction, as reflected in the statistical results, demonstrate that the FAP platform is well-received by educators. The platform's ease of use and the clear benefits

it provides for teaching management were the most highly rated features. These results align with previous studies, which emphasize the importance of user-friendly educational technologies in facilitating adoption and successful implementation [21]. In particular, the ease of use (4.71) and perceived benefits (4.65) are consistent with the findings of Clarke et al. [22], who found that platforms that streamline teacher workflow and provide actionable insights into student progress lead to increased teacher satisfaction and engagement. These dimensions of satisfaction are critical for the long-term success of any educational tool, as teachers' willingness to adopt and integrate new technologies often hinges on the perceived ease of use and the tangible benefits they offer.

The results suggest that the FAP platform's design and interface effectively meet the needs of teachers, making it an efficient tool for formative assessment. This aligns with Hollebeek et al. (2021), who argue that successful educational technologies must not only offer functionality but also enhance the overall user experience. The platform's focus on user-friendly features that reduce administrative burdens for teachers is a key strength, as it allows educators to focus more on instructional practices rather than on the technical aspects of data collection and analysis.

However, one area for potential improvement is the team support dimension, which scored lower than the other categories (4.38). While still statistically significant ($p < 0.001$), this result suggests that teachers may benefit from more structured support mechanisms, such as dedicated technical assistance or professional development opportunities that enable them to maximize the platform's potential. This finding aligns with the literature, which stresses the importance of continuous professional development in the successful integration of digital tools into teaching practices (Santo et al., 2022).

Impact on Student Competency Development

The quantitative results indicate that the FAP platform significantly contributed to the development of student competencies, particularly in collaboration, creativity, and communication, with high effect sizes (0.71, 0.65, and 0.67, respectively). These findings underscore the platform's effectiveness in fostering key 21st-century skills, which have been widely recognized as essential for student success in both academic and professional settings [23]. The high effect sizes in collaboration and creativity are especially notable, as these competencies are often difficult to assess using traditional assessment methods. The FAP's ability to provide real-time, data-driven insights into these competencies suggests that formative assessment platforms can effectively support the development of skills that are central to modern education [24].

The focus on collaboration is particularly timely, given the growing emphasis on teamwork in today's interconnected and globalized world. The results of this study support previous research

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[21] González-Zamar et al., "Managing ICT for Sustainable Education: Research Analysis in the Context of Higher Education."

[22] Clarke et al., "Demographic Correlations for 100 Most-Cited Authors in Ophthalmic Research; A Bibliometric Study."

[23] Esteve-Mon, Llopis, and Segura, "Digital Competence and Computational Thinking of Student Teachers"; Thorvaldsen and Madsen, "Decoding the Digital Gap in Teacher Education: Three Perspectives Across the Globe."

[24] Siyi, Yu, and Al-Samawi, "Effects of Digital Education on Human Resource Development."

by Vural & Vural [25], who found that digital formative assessment tools can facilitate collaborative learning by enabling students to engage with peers in structured, feedback-driven environments. The high effect size for collaboration in this study reflects the ability of the FAP platform to create environments where students work together, reflect on their learning, and engage in problem-solving tasks. This suggests that the FAP platform is an effective tool for promoting collaborative competencies, which are crucial for students' future success in the workplace.

Creativity, another high-effect-size competency, also aligns with the increasing focus on creative problem-solving in education. The ability to foster creativity is critical in a world where innovation is key to addressing complex global challenges. The FAP platform's design, which offers personalized feedback and allows for self-reflection, likely contributed to the enhancement of students' creative thinking and problem-solving abilities. These findings support the assertions of Santini et al. [26], who argue that educational technologies that provide immediate feedback and opportunities for self-directed learning can help students develop higher-order thinking skills like creativity.

However, the effect size for critical thinking (0.36) was moderate, indicating that while the FAP platform had some impact on critical thinking, it may not have been as effective in this domain as in others. Critical thinking is often considered a complex competency that requires sustained instructional interventions over time. This finding is consistent with prior studies, which have noted that fostering critical thinking requires deliberate, long-term efforts and more intensive engagement with challenging, higher-order cognitive tasks [27]. The moderate effect size for critical thinking suggests that further development of the FAP platform, possibly through the incorporation of more targeted activities focused on critical thinking, could lead to stronger outcomes in this area.

The Role of Technology in Formative Assessment

The integration of digital technology in formative assessment, as exemplified by the FAP platform, represents a significant shift from traditional assessment models that primarily focus on summative evaluation. The FAP platform's ability to provide real-time, personalized feedback is one of its most significant advantages, as it enables both teachers and students to track progress continuously and make adjustments as needed. This aligns with the work of Mauluddiyah [28] and Obeidat et al. [29], who have highlighted the transformative potential of digital formative assessment tools in improving both teaching and learning outcomes. By providing detailed, actionable feedback, the FAP platform not only enhances student competencies but also empowers students to take ownership of their learning journey.

The study's findings underscore the growing importance of digital tools in modern

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[25] Vural and Vural, "An Examination of 5th Grade Mathematics Curriculum in Terms of 21st Century Skills."

[26] Saputra and Krismono, "The Reconstruction of Aligarh and Santiniketan Educational Philosophy: The Creative Ijtihad of Trimurti in Developing Islamic Education in Indonesia."

[27] Siyi, Yu, and Al-Samawi, "Effects of Digital Education on Human Resource Development."

[28] Mauluddiyah, "The Influences of Abraham Maslow's Hierarchy of Needs Theory, Field Practice Experience, and 21st Century Skills on Career Choice of Becoming a Vocational Teacher."

[29] Obeidat, Haimed, and AlKhaza'leh, "Students' Well-being and School Climate: A Bibliometric Analysis."

education, particularly in the context of competency-based education, where the focus is on developing specific skills rather than simply measuring academic knowledge. The ability to track and assess competencies such as collaboration, creativity, and critical thinking in real-time makes the FAP platform an invaluable resource for teachers aiming to foster 21st-century skills. However, the effectiveness of such platforms depends on their ability to adapt to the specific needs of students and the teaching context, which requires ongoing development and refinement of the tools.

Implications for Educational Practice and Future Research

The results of this study suggest that the FAP platform has significant potential to improve educational practices, particularly in fostering essential 21st-century competencies. The platform's high effectiveness in promoting collaboration and creativity aligns with global trends in education that prioritize these skills. However, the moderate effect size for critical thinking indicates that additional efforts may be required to enhance the platform's ability to foster higher-order cognitive skills. This finding suggests the need for further research into the specific features and functionalities that could strengthen the platform's support for critical thinking development.

Furthermore, the high levels of teacher satisfaction with the FAP platform suggest that educational technologies can be a valuable tool in improving teaching management and providing targeted feedback. However, the concerns raised by teachers about the sustainability of the platform and the need for continuous support highlight the importance of creating robust professional development programs for educators. To ensure the long-term success of digital formative assessment tools like the FAP platform, continuous teacher training, support, and system updates will be essential.

Future research should aim to explore the long-term impact of the FAP platform on student competencies, particularly in areas like critical thinking. Longitudinal studies could provide valuable insights into how the platform influences the development of skills over time. Additionally, further research should focus on the factors that contribute to the effectiveness of the platform, such as the role of teacher training, institutional support, and student engagement. Comparative studies that evaluate the FAP platform against other educational technologies could help identify the unique advantages and limitations of the platform, contributing to the broader conversation on the role of digital tools in education.

Conclusion

This study highlights the substantial potential of the Formative Assessment Platform (FAP) in enhancing both teacher satisfaction and student competency development. The findings underscore the platform's efficacy in fostering key 21st-century competencies, particularly collaboration, creativity, and communication, which are essential for preparing students for future success in an increasingly complex and dynamic workforce. Teachers expressed high satisfaction with the platform's usability, benefits, and the support it provided, suggesting that digital formative assessment tools can significantly improve teaching practices and student learning outcomes.

The study also demonstrated that the FAP platform effectively addresses critical gaps in traditional educational assessment methods by offering personalized feedback, tracking student progress in real-time, and focusing on the development of competencies beyond academic knowledge. These findings are consistent with current trends in competency-based education, which prioritize skills such as collaboration and creativity, alongside traditional academic achievement. The positive results, particularly in fostering collaboration and creativity, offer valuable insights into how educational technology can be used to support modern learning objectives, ensuring that students are equipped with the skills required to thrive in the 21st century.

However, the moderate effect size for critical thinking suggests that more targeted interventions or longer periods of use may be needed to see significant improvement in this area. This finding indicates that while digital tools like FAP can provide a solid foundation for competency development, further refinement and more comprehensive strategies are required to foster higher-order cognitive skills.

In terms of practical implications, the study points to several policy and practice recommendations that could enhance the integration of digital formative assessment tools into the educational system. Firstly, the Ministry of Education should consider piloting and expanding the FAP platform across schools, particularly in underserved areas, ensuring that teachers are provided with the necessary training and resources to maximize the platform's potential. Additionally, ongoing teacher support and the creation of learning networks among educators using the platform could facilitate knowledge exchange and further improve its effectiveness.

Looking ahead, future research should explore the long-term effects of the FAP platform on student competencies, particularly in areas like critical thinking and problem-solving. Longitudinal studies could provide valuable insights into the sustained impact of the platform on student development. Furthermore, research should examine the factors that influence the effectiveness of digital formative assessment tools, such as the role of teacher training, school infrastructure, and the cultural context within which these platforms are implemented. Comparative studies between different digital assessment platforms could also offer valuable insights into the strengths and weaknesses of various tools, providing guidance for the optimal selection and use of these technologies in diverse educational settings.

This research contributes to the growing body of evidence on the effectiveness of digital formative assessment tools in modern education. The FAP platform, with its focus on competency-based learning and real-time feedback, offers significant potential for improving both teaching practices and student outcomes. As education continues to evolve in response to global challenges and technological advancements, tools like the FAP platform represent an important step toward preparing students for the demands of the future.

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