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Digital Transformation in Lesson Planning: Automating Semester Learning Plans to Improve Pedagogical Effectiveness

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Abstract	Digital transformation in education has become crucial to improving effectiveness in academic processes. This study aims to develop the RTFAC application to enhance the efficiency of the Semester Learning Plan (Rencana Pembelajaran Semester) formulation. The research employs the research and development method with the Borg & Gall model. The subjects involved in this study include experts, PGMI and PAI lecturers, researchers, and the university's quality assurance institution. The study resulted in a product in the form of an RPS formulation application called RTFAC. Product testing results on aspects such as feature compatibility with RPS formulation needs, application functionality quality, user interface, application performance efficiency, curriculum alignment, and data reliability and security, as assessed by expert validators, are deemed highly feasible. Based on the effectiveness test using a one-sample t-test, it was found that the RTFAC application significantly improves the efficiency of RPS formulation. Therefore, the RTfac application at UIN Sayyid Ali Rahmatullah Tulungagung is expected to reduce lecturers' workload in formulating semester learning plans (RPS), which may contribute to enhanced pedagogical effectiveness.
Keywords	Digital Transformation; Pedagogical Effectiveness; R-Tfac; Semester Learning Plans

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1. INTRODUCTION

Higher education serves as the foundation for a nation's development. Universities play a strategic role in producing high-quality human resources capable of competing globally. To achieve this, higher education systems must adapt to technological advancements and societal demands (Ghufron, 2018; Rahman & Nuryana, 2019). One of the primary challenges in education is how to enhance the efficiency and effectiveness of teaching processes without compromising quality.

In today's digital era, information technology is central in modernizing higher education across various contexts and forms (Munandar et al., 2023). Technology integration facilitates a more structured, transparent, and accountable education system, contributing to achieving sustainable development goals (UNESCO, 2018). Within this framework, the importance of technology in learning planning becomes evident (Ghafar & Mohamedamin, 2022; Setiyawati et al., 2018). Learning planning is a key aspect that influences the quality of teaching (Haqiqi, 2019). Semester Learning Plans (RPS) not only

guide lecturers in preparing materials, methods, and assessment techniques but also provide students with a roadmap of the semester's learning process and expected outcomes (Ayyildiz et al., 2021).

Lecturers, therefore, hold a crucial role in determining the quality of education. They are responsible for designing and implementing curricula, developing innovative teaching methods, and evaluating and improving learning processes (Firdaus et al., 2023). Despite these significant responsibilities, lecturers are also burdened with administrative tasks such as preparing RPS, which can consume time that could otherwise be allocated to focus on the university's tri-dharma activities.

Manually performed teaching administration has become one of the main obstacles to achieving efficiency and quality in teaching activities (Putra, 2023). The manual process involves several complex steps, such as data collection, analyzing students' needs, and determining appropriate teaching strategies. Lecturers need to allocate significant time to detail each aspect of the RPS, which eventually reduces the time available for interacting with students or improving the quality of teaching materials (Chen, 2020).

The weaknesses in manual processes can also lead to human errors, especially in the technical aspects of RPS preparation (Syafarina & Setiawan, 2019). Preliminary research revealed discrepancies in RPS formats among lecturers, with some not preparing RPS before the semester began. This condition arises because lecturers have numerous other responsibilities apart from teaching. Therefore, a solution is needed to address the challenges of manual RPS preparation. Automating RPS preparation through the R-TFac application at UIN Sayyid Ali Rahmatullah Tulungagung offers an innovative solution to these challenges. The application is expected to transform the paradigm of curriculum development and RPS preparation, positively impacting efficiency, accuracy, and teaching quality.

The R-TFac application uses advanced technology, including artificial intelligence and data analysis. Its implementation at UIN Sayyid Ali Rahmatullah Tulungagung aims to reduce the workload of lecturers related to RPS (Semester Learning Plan) preparation. Automation enables this process to be completed more quickly, allowing lecturers to focus more on teaching and research. This convenience is expected to help lecturers better analyze students' needs and the latest scientific developments, improving teaching quality. Learning aligned with students' needs will provide a better learning experience (Stamov Roßnagel et al., 2020). Relevant teaching materials and innovative teaching methods can enhance students' absorption of information (Nurdin, 2016). Therefore, this study, titled "Automating RPS Preparation through the R-TFac Application to Enhance Efficiency and Teaching Quality at UIN Sayyid Ali Rahmatullah Tulungagung", is crucial as it reflects efforts to introduce innovation in RPS preparation through technological utilization.

Several recent studies published in reputable, Scopus-indexed journals highlight the relevance and urgency of integrating technology into curriculum management and teaching in higher education. (Sodhi et al., 2024) Developed an automated syllabus generation model for computer science courses based on open curricula and industry needs. While their findings indicate improved efficiency and accuracy, the focus remains on content engineering rather than comprehensive AI integration as proposed in this study. The capacity of GPT-4 in generating learning objectives aligned with Bloom's taxonomy, yet their work addresses only a single curriculum component, whereas the present study proposes a full automation of the Semester Learning Plan (RPS) (Sridhar et al., 2023). A literature review demonstrated that AI can enhance curriculum flexibility and responsiveness to learners' needs. However, their work does not offer a practical application ready for university implementation (Yunus et al., 2025). In contrast, this research introduces R-TFac, a ready-to-use system that automates the entire RPS development process—from mapping learning outcomes to scheduling evaluations. AI-powered assistant to support personalized student learning, focusing on learner interaction. This differs from the current study, which targets academic staff as primary users, aiming to improve administrative efficiency (Sajja et al., 2023). Lastly, (Tavakoli et al., 2022) Proposed a human-AI hybrid approach to curriculum development in informal learning contexts, without addressing formal education or the

automation of academic documents like the RPS. Therefore, the present study offers a unique and underexplored contribution: developing an application designed to automate RPS preparation in higher education, thus supporting lecturer workload reduction and enhancing instructional quality.

In contrast, the R-TFac application introduced in this research offers a novel, applied solution with a practical and technical orientation currently underrepresented in the academic literature. This distinction not only underscores the uniqueness of this study but also contributes to the academic discourse on how AI-driven automation can directly alleviate routine academic tasks, thus fostering a more efficient and pedagogically focused academic environment.

2. METHODS

This study employs the Borg & Gall Research and Development (R&D) model, which consists of ten systematic steps to ensure the development of a valid and effective product. The first step, research and information gathering, involved a needs analysis through surveys and interviews with PGMI and PAI lecturers to identify challenges in preparing RPS. In the planning stage, the objectives and design of the R-TFac application were formulated based on curriculum standards. A prototype was developed in the third step, incorporating essential features like CPL-CPMK mapping and RPS generation. Preliminary field testing was conducted with a small group of lecturers to evaluate usability, followed by revisions to improve the interface and structure. Main field testing involved a larger group focused on functionality and accuracy, further refining the sixth and seventh steps. Operational field testing was conducted during actual RPS workshops to assess practical implementation, followed by final product revision to optimize performance and prepare supporting documentation. In the final step, dissemination and implementation were conducted through faculty workshops and training sessions, enabling wider institutional adoption of the R-TFac application at UIN Sayyid Ali Rahmatullah Tulungagung.

The instruments used in this research were validation sheets, questionnaires, and interview guidelines. The interview guidelines were used to gather information on (1) initial data about the problems or obstacles faced by lecturers in preparing the Semester Learning Plan (RPS), (2) the needs of lecturers in preparing the Semester Learning Plan, and (3) suggestions about the expected application. Information regarding the lecturers' needs for an RPS formulation application was a key consideration in designing the RTFAC application.

The Product Validation Sheet was used to obtain information about the validity of the developed product. There were two main validators, namely experts in educational technology and curriculum, including the head of the curriculum center and the quality assurance institution at UIN Sayyid Ali Rahmatullah Tulungagung. The validation criteria from the experts are based on Table 1 (Arya Arimbawa et al., 2024).

Table 1. Validity Criteria

Percentage (%)	Validity Level	Description
90-100	Very Valid	Highly feasible, no revision needed
75-89	Valid	Feasible, with minor revisions
60-74	Fairly Valid	Feasible, with many revisions
55-59	Less Valid	Not very feasible
0-54	Invalid	Not feasible

The validity of the RTFAC application was measured based on several evaluations by validators on the effectiveness indicators listed in Table 2, which includes compatibility of features with RPS formulation needs, application functionality quality, user interface, application performance efficiency, curriculum alignment, and data reliability and security in the RTFAC application.

Table 2. Application Validity Indicators

| Aspect Measured	Indicator
Compatibility of Features with RPS Needs	The RTFAC application provides features that support all components necessary for RPS formulation.
	RTFAC meets the standards for RPS formulation by the applicable curriculum.
	Features in RTFAC are easy to use and relevant to the RPS formulation process.
Application Functionality Quality	All functions and features of RTFAC work well and without errors.
	The RTFAC application enables users to systematically and structurally prepare RPS.
	RTFAC features support flexible and effective RPS revisions.
User Interface Quality	The RTFAC interface design is attractive, easy to understand, and intuitive.
	The application interface is easy to navigate, not complicating the RPS formulation process.
	The interface design supports clarity of information and readability on each feature.
Application Efficiency and Performance	The application runs smoothly without interruption, even when handling complex RPS formulations.
	The RTFAC application is responsive and does not take long to process user input.
	RTFAC efficiently uses storage and memory capacity.
Curriculum Alignment	Overall, the RTFAC application is ready to be implemented in an educational environment.
	The application features help ensure that essential pedagogical elements are included in the RPS.
	RTFAC provides sufficient guidance to ensure the RPS aligns with the applicable curriculum.
Data Reliability and Security	User data (e.g., formulated RPS information) is securely stored in RTFAC.
	The system reliability is maintained without disruptions or data loss.

After the product was verified through revisions, the RTFAC application was trialed with lecturers in the PGMI and PAI study programs at the Faculty of Tarbiyah and Teacher Education at UIN Sayyid Ali Rahmatullah Tulungagung. Based on the trial results, the researcher used a questionnaire instrument to obtain information on the lecturers' responses regarding the effectiveness of using the RTFAC application in formulating the Semester Learning Plan.

Data collection techniques were conducted through questionnaires, interviews, and documentation. Data analysis was performed using validity tests, reliability tests, and hypothesis testing with the one-sample test. This test was used because the effectiveness was only tested on a single group of users, namely the lecturers who used the RTFAC application to formulate the Semester Learning Plan (RPS), without comparing it to another group (e.g., those not using the application). Based on several studies (Field, 2024; McKillup, 2015; Miller, 2004)The recommended test is the one-sample test.

3. FINDINGS AND DISCUSSIONS

Findings

The R-TFac application was designed through a collaborative Focus Group Discussion (FGD) involving key stakeholders, including the Vice Dean for Academic Affairs, the Department Head, Study Program Coordinators, the Head of the Curriculum Center, the Quality Assurance Unit, and lecturers from the Faculty of Tarbiyah and Teacher Education. The FGD results recommended that the developed RTFC application feature important elements, including role-based access control. Access control defines user responsibilities, a user-friendly interface to enhance accessibility, and robust functionality for creating, editing, and efficiently saving RPS documents. The outcome of the RTFAC application development can be seen in Figure 1.
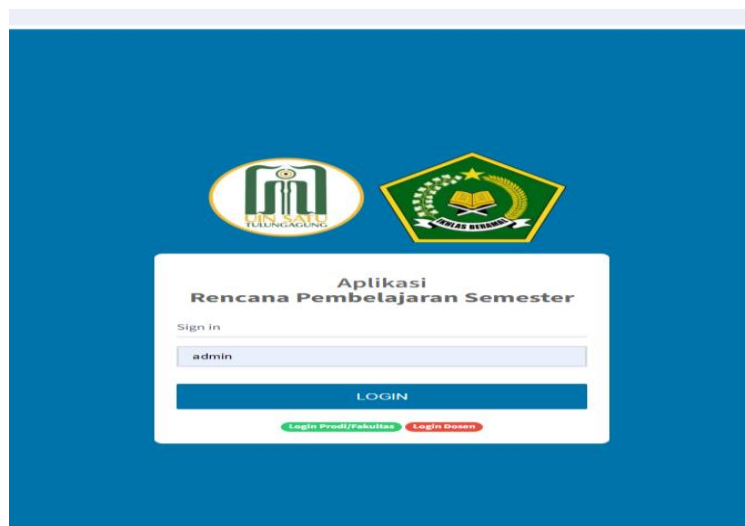
Figure 1. Homepage of the RTFAC Application

Figure 1 shows the homepage of the R-TFac application, which can be accessed at https://rpsuinsatu.com/. The homepage displays two logos: the UIN SATU Tulungagung logo and the Ministry of Religious Affairs logo. The homepage has fields for the username, password, and a login button, designed to facilitate users in accessing the RTFAC application.

This application has an operational system structure to support its functionality, including four account levels: superadmin, faculty quality assurance unit (GPMF), study program coordinators, and lecturers. Each account level has permissions and tasks tailored to ensure a smooth workflow. For example, the superadmin is responsible for managing the overall system configuration, while the GPMF and program coordinators focus on validating the RPS created by the lecturers. Lecturer accounts can effectively create and manage their own RPS documents. The user levels for each account can be seen in Figure 2.
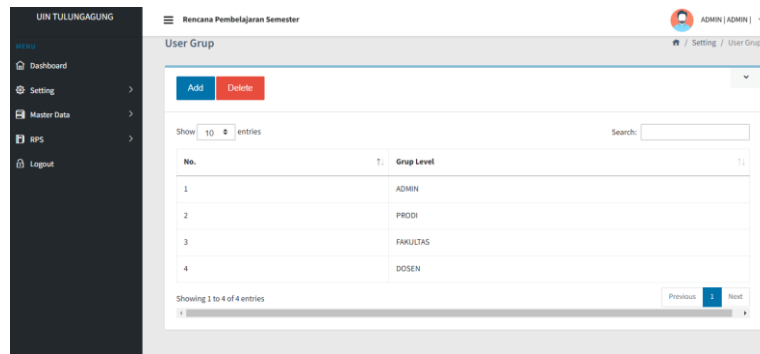
Figure 2. RTFAC Application User Levels

Upon logging into the RTFAC application at the lecturer user level, the menu consists of two submenus: "Input Semester Learning Plan" and "View Semester Learning Plan." The "View Semester Learning Plan" menu views previously created or ongoing RPS drafts. The "Input Semester Learning Plan" menu is for creating an RPS from scratch, as shown in Figure 3.
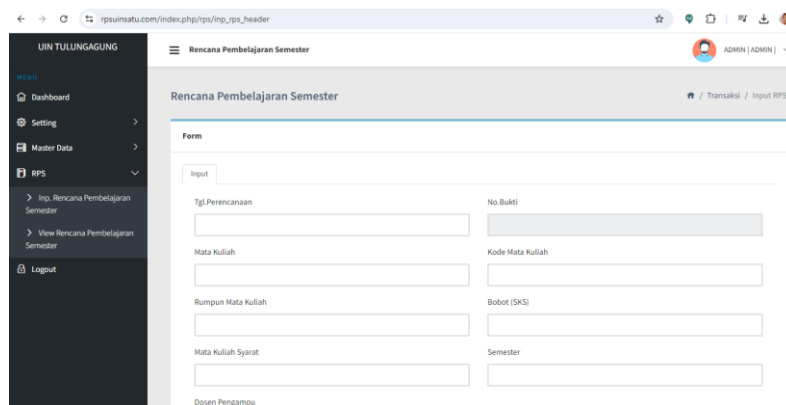

Figure 3. RPS Menu Page

In the "Input Semester Learning Plan" submenu, lecturers must fill in several fields related to the description of the RPS being prepared, including information on the planning date, course, course cluster, prerequisite course, instructor, course code, credit weight/SKS, and semester. Once the lecturer completes the RPS identity, they can click the "SAVE" button, and the application will direct them to the next page, where they will enter the CPL (Capaian Pembelajaran), CPMK (Capaian Pembelajaran Mata Kuliah), and Sub-CPMK. The input menu for CPL can be seen in Figure 4.
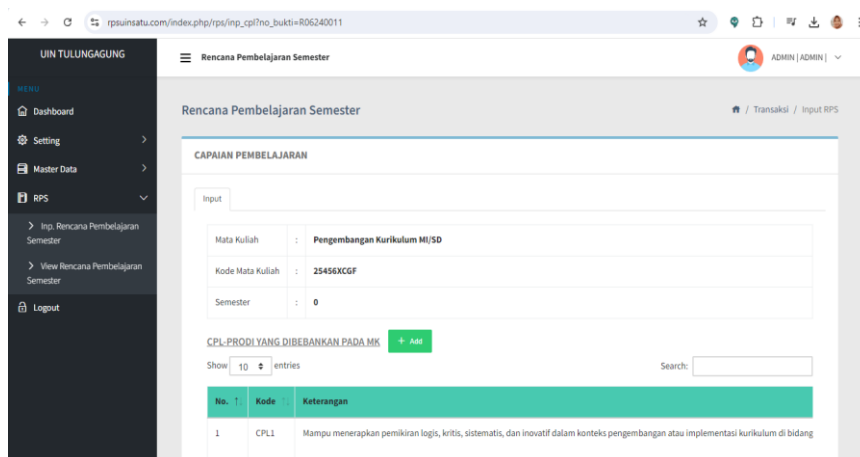

Figure 4. Input CPL, CPMK, and Sub-CPMK

The R-TFAC application demonstrated promising results in improving the effectiveness of RPS

preparation. The system's role-based structure effectively accommodates users' diverse needs, and the automation of routine tasks has reduced the administrative burden. Validator testing results are based on the following aspects. The percentage results from validator assessments are detailed in Table 3. Based on expert judgment evaluations, it can be concluded that the R-TFac application is ready for use after revisions based on validator feedback.

Table 3. Expert Judgment Validation Results

Aspect	Percentage
Suitability of features with RPS preparation needs	100%
Quality of application functionality	86,67%
User interface	93,33%
Application efficiency and performance	100%
Curriculum Alignment	100%
Reliability and data security assurance	90%
Average	**95%**

Before presenting the effectiveness testing results, a research instrument plays a vital role and must adhere to standards, ensuring validity and reliability. In the validity test for the effectiveness variable, the r-table value used for 20 respondents is 0.444 with a significance level of 0.05. The results of the instrument validity test are shown in Table 4.

Table 4. Validity Test Results of the Questionnaire

No.	r Table Value	Significance Value	Noted
1	0,735	0,000	Valid
2	0,615	0,004	Valid
3	0,676	0,001	Valid
4	0,843	0,000	Valid
5	0,582	0,007	Valid
6	0,557	0,011	Valid
7	0,787	0,000	Valid
8	0,627	0,003	Valid
9	0,676	0,001	Valid

A detailed validity test result of the self-efficacy questionnaire can be found in Appendix 3. As shown in Table 4, all items in the questionnaire were declared valid with r table values greater than 0.444 and significance values smaller than 0.05.

A Cronbach's Alpha value of 0.734 indicates good reliability, suggesting that the items used in the study have strong internal consistency in measuring the effectiveness of preparing Semester Learning Plans (RPS) using the RTfac application. The results of the instrument reliability test are shown in Table 5.

Table 5. Reliability Statistics

Cronbach's Alpha	N of Items
.734	9

These results demonstrate consistent participant responses to the nine items in the instrument, making it a reliable tool for measuring the investigated variable. With a good reliability score (0.734), the research instrument can be confidently used for further data collection without concerns about instability arising from inconsistent items.

The effectiveness test was conducted using a One-Sample t-test. This method was chosen because the study focused on measuring the effectiveness within a single group of users, lecturers using the RTfac application to prepare RPS without comparing it to a control group. The One-Sample t-test is suitable for testing a single sample against a predetermined value. The results of the effectiveness test are presented in Table 6.

Table 6. Results of the One-Sample Test

	T	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
RESULT	48.296	19	.000	40.80000	39.0318	42.5682

Description. 95% Confidence Interval of the Difference

The results of the One-Sample Test show that the RTfac application significantly enhances the effectiveness of preparing Semester Learning Plans (RPS) at UIN Sayyid Ali Rahmatullah Tulungagung. A very high t-value of 48.296, a very small significance value (p = 0.000), and a positive mean difference of 40.8 indicate that using the RTfac application significantly facilitates and improves the preparation of learning devices based on OBE principles.

Discussion

This study shows that the R-TFac application significantly enhances the effectiveness of preparing the Semester Learning Plan (RPS) based on Outcome-Based Education (OBE) principles. This is evidenced by the expert validation results, which gave an average score of 95%. This score includes evaluations of aspects such as the alignment of features with the RPS preparation needs, application quality, user interface, application performance efficiency, alignment with the curriculum, and data reliability and security. Among these aspects, the highest scores were in feature alignment with RPS preparation needs and application efficiency, both achieving 100%. These findings are consistent with research (Alenezi et al., 2023; Blankesteijn et al., 2024; Bygstad et al., 2022)Digitizing academic processes can improve user efficiency and work quality.

The RTFAC application ensures well-organized workflows, using role-based access control involving the superadmin, the Faculty Quality Assurance Unit (GPMF), program study coordinators, and lecturers. This role-based structure aligns with the theory (Asbari & Novitasari, 2024) A clear role division in OBE-based education management enhances accountability and quality of learning outcomes. This research also supports studies (Alfauzan & Tarchouna, 2017; Ali, 2018; Kabier et al., 2023)Highlighting technology's importance in aligning the curriculum with learning outcomes.

The user-friendly interface of the RTFAC application is one of its key strengths, with an expert validation score of 93.33%. This supports the study by (Dwivedi et al., 2019) The Technology Acceptance Model (TAM) states that perceived ease of use and perceived usefulness are primary predictors of technology acceptance. (Legramante et al., 2023) Also explained that perceived ease of use significantly affects user satisfaction and intention to continue using the system. This research strengthens the finding that an intuitive interface encourages technology adoption by users.

From the effectiveness test using a One-Sample t-test, a t-value of 48.296 with a p-value of 0.000 was obtained, indicating that this application significantly improved the efficiency of RPS preparation. This finding is consistent with previous research (Abdulrahaman et al., 2020; Rocque, 2022)That application-based technology significantly enhances the effectiveness of learning management compared to manual methods. Furthermore, this success also demonstrates how the R-TFac application reduces lecturers' administrative burden, as reported in the study by (Hidayati & Imama, 2024; Zahurin

et al., 2024) Automating academic processes can minimize administrative workload, save time, and improve satisfaction and productivity for educators.

The integration of CPL (Capaian Pembelajaran Lulusan), CPMK (Capaian Pembelajaran Mata Kuliah), and Sub-CPMK (Sub-Capaian Pembelajaran Mata Kuliah) input features within the RPS (Rencana Pembelajaran Semester) preparation system represents a significant advancement in aligning curriculum design with outcome-based education (OBE). These features facilitate a structured and systematic approach to ensure that every course component contributes directly to attaining graduate competencies. According to Preeti Oza (2021), embedding learning outcomes into curriculum development is central to effective education management. This approach ensures that teaching strategies, learning activities, and assessment methods are coherently aligned with intended learning outcomes, a foundational principle of OBE.

From a pedagogical perspective, this alignment contributes to pedagogical effectiveness by promoting transparency, consistency, and intentionality in course delivery. When educators define outcomes clearly and map them to specific learning activities and assessments, students better understand expectations and learning trajectories (Yan, 2023). This enhances student engagement and autonomy, as learners are more likely to take responsibility for their progress when learning objectives are explicitly stated and integrated into the curriculum structure. Moreover, the CPL, CPMK, and Sub-CPMK features support instructional planning and facilitate curriculum evaluation and continuous improvement. As noted by Deeley et al., curriculum mapping tools that align intended outcomes with teaching and assessment practices can be used as diagnostic instruments to identify gaps, redundancies, or misalignments, thus enhancing the overall quality of instruction and learning.

In addition to the structural alignment of the curriculum, the validation and reliability of the research instrument used to evaluate these features add empirical strength to the study. A Cronbach's Alpha value of 0.734 indicates acceptable internal consistency, suggesting the instrument reliably measures the intended constructs. According to (Creswell & Creswell, 2018)Instrument validity and reliability are indispensable in ensuring that findings are credible and replicable. A Cronbach's Alpha above 0.7 is generally considered acceptable in social science research, indicating that the items on the instrument are sufficiently correlated and measure the same underlying concept (El-Amin, 2017).

Furthermore, the validity results, where all items have r-table values greater than 0.444, reinforce the robustness of the measurement. These results suggest that each questionnaire item significantly correlates with the total score, confirming the instrument's construct validity. This strong validity is critical in pedagogical research, as it ensures that the evaluation reflects actual pedagogical practices and outcomes rather than extraneous variables.

In summary, including CPL, CPMK, and Sub-CPMK input features in RPS development supports the operationalization of outcome-based education, improving curriculum coherence and pedagogical effectiveness. The rigorous validation of the instrument used to evaluate these features further ensures the reliability and trustworthiness of the study's findings. This integrated approach aligns well with contemporary educational quality frameworks, emphasizing transparency, accountability, and alignment in higher education curriculum design.

The research findings indicate that the R-TFac application significantly improves the effectiveness of Semester Learning Plan (RPS) preparation at UIN Sayyid Ali Rahmatullah Tulungagung. The very high t-test value (t = 48.296) with a very small significance value (p = 0.000) and an average positive difference of 40.8 indicates the strong impact of using this application in facilitating and improving the RPS preparation process based on Outcome-Based Education (OBE) principles. It also shows that the R-TFac application supports operational efficiency in higher education environments. This is consistent with research by Christopoulos & Sprangers, which stated that digital technology can increase the efficiency of educational institutions while providing direct benefits to educators and students. By simplifying administrative processes like RPS preparation, educators can focus more on strategic

aspects of teaching, including material development and teaching innovations (Jabar et al., 2024). The RPS templates created by lecturers also become standardized, as the final result of filling in RPS items using the RTFAC application will appear in the same template format.

The flexibility of the R-TFac application, which allows lecturers to create and edit RPS as needed, reflects the importance of providing adaptive and dynamic tools in the educational environment. This aligns with the findings of (Munna & Kalam, 2021), which stated that technology responsive to user needs can encourage active participation and better decision-making in learning management. From a practical implementation perspective, this application significantly supports program accreditation. The integrated data-based system enables program managers and the Faculty Quality Assurance Unit (GPMF) to monitor and evaluate the alignment of RPS with the established curriculum standards. Moreover, using the R-TFac application in preparing RPS facilitates program coordinators in coordinating the collection of RPS documents. The application addresses the problem of delayed RPS submission by lecturers to the study program, as all RPS documents prepared by lecturers are automatically saved in the study program's account. Thus, collecting RPS does not need to be done manually or through online forms such as Google Forms.

The implementation of automation in higher education has been shown to significantly improve the operational efficiency of institutions, particularly in data management and academic administration (Sabir et al., 2018). In addition to providing practical benefits, such as reducing administrative burden and speeding up processes, the R-TFac application offers great potential for further development. One potential development direction is integrating this application with a more comprehensive digital quality assurance system. Furthermore, integration with a digital quality assurance system could provide stakeholders, such as the Faculty Quality Assurance Unit (GPMF) and the University Quality Assurance Institution, direct access to evaluate and provide feedback on uploaded documents. This would reduce the risk of manual errors in document evaluation while accelerating the RPS validation process.

Such an implementation aligns with the trend of education digitalization, which emphasizes the importance of utilizing technology to support holistic academic quality management. (Sabir et al., 2018) Demonstrated that automation systems improve efficiency and contribute significantly to the accuracy of accreditation reporting. Therefore, developing the R-TFac application in this direction provides practical contributions to improving the effectiveness of RPS preparation and adds value in supporting the achievement of higher education institutions' vision and mission.

4.   CONCLUSION

This study shows that the R-TFac application significantly enhances the effectiveness of preparing the Semester Learning Plan (RPS) based on Outcome-Based Education (OBE) principles. Through collaborative FGD-based development, this application provides features such as role-based access control, a user-friendly interface, and efficient automation functions. The expert validation results, with an average score of 95%, confirm the application's readiness for use, while effectiveness testing demonstrates its positive impact on reducing lecturers' administrative burden. In addition to its practical benefits, this application contributes to the literature on educational technology, particularly in outcome-based curriculum management. The study also shows high instrument validity and reliability, ensuring the validity of the findings. The success of this application opens opportunities for further integration with academic information systems to support data-driven decision-making.

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