

## INTEGRATING SMART CLASSROOM TOOLS WITH METACOGNITIVE LANGUAGE LEARNING STRATEGIES TO IMPROVE STUDENTS' AUTONOMOUS LEARNING SKILLS

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### Abstract

The application of smart classroom technology has completely overhauled English as a Foreign Language (EFL) teaching. Nonetheless, relying on technology alone is insufficient in promoting autonomous learning skills because this is, at its core, ensured through metacognitive regulation. It is against this backdrop that this study explores whether or not metacognitive strategies in foreign language learning play a mediating function in smart classroom technology, with regards to autonomous skills in EFL in higher education. Utilizing a Sequential Exploratory Mixed-Methods study paradigm, data was gathered in a quantitative manner through surveys with 72 participants at an institution for teacher education in Indonesia answering English as a foreign language. Results were analyzed through regression and mediations. Thereafter, data was gathered in-depth through interviews with 12 participants chosen through purposeful sampling. Quantitative results illustrate smart classroom technology usage is significantly and positively related to strategies based on metacognitive regulation in foreign languages. There is evidence supporting partial mediation on smart classroom technology usage and foreign language autonomous skills based on metacognitive regulation. Nonetheless, qualitative evidence gathered through interviews further illustrated through Learning Management System analysis platforms, Learning analytics platforms, and AI analysis platforms, smart classroom technology in EFL significantly assisted foreign students in planning, controlling, and evaluating. Concurring with theoretical principles outlined at this study's commencement, this investigation thus terms smart classroom technology in higher education most efficiently when supplemented with the pedagogical aspect of specific usage based on metacognitive regulation.

## **1. INTRODUCTION**

The integration of digital technology into higher education institutions has radically changed the teaching of English as a Foreign Language through the use of smart classroom environments. Such a learning environment integrates learning management systems, learning analytics, AI-enabled feedback systems, and online digital platforms to facilitate flexible and personalized learning. Even though smart classrooms allow immense learning opportunities with immediate feedback support, the majority of EFL learners heavily depend on teacher support, having little scope of autonomy to control learning by themselves. Theoretically, autonomy in learning has always been strongly related to self-directed learning, which is primarily metacognitive in nature when dealing with planning, controlling, or evaluating learning procedures.

Existing studies have also found that smart technologies used in the classroom have a positive influence on learning engagement and motivation, as well as on vocabulary learning and speaking proficiency. On the other hand, studies of metacognitive strategies in language learning have shown that learners with advanced planning, controlling, and evaluation strategies are better at self-regulation and independent learning. However, almost all research on the issue of smart technologies in class is focused on technological aspects, with few studies having been conducted within a traditional learning setting.

Although research into smart classrooms and metacognitive learning strategies has developed side by side, very little research can be found where these two have been empirically studied in combination. Most research on the two concepts considers technology usage and metacognitive regulation to be two separate variables and not a relationship in a learning network. Therefore, neither is there sufficient research into how technology usage in smart classrooms affects metacognitive regulation in learners nor into how this regulation makes learners achieve autonomy in learning.

To fill this research gap, the present study aims to investigate the mediating role of metacognitive language learning strategies for linking smart classroom usage with autonomy learning capabilities in EFL learners. In this particular study, the relationship among smart classroom usage, the use of metacognitive learning strategies, and autonomy learning capabilities will be observed, and students' insights concerning how smart classroom technology assists them during their metacognitive learning phases will be explored. The novelty of this research study is embedded in employing a sequential explanatory mixed-methods research design and in emphasizing that metacognitive regulation should be a crucial mediator in linking technology-enhanced instruction and autonomy learning in higher education settings within EFL.

## **2. RESEARCH METHODS**

### **2.1. Research Design**

The design adopted for this research was the sequential explanatory mixed methods design. This design is appropriate for completing research on such inquiries. The initial phase of this mixed methods design research included developing relationships with regard to the use of smart classrooms, developing metacognitive strategies, and creating autonomous learning skills. The next phase of this research included the conduct of an explanation analysis utilizing an acceptable method for the research methodology for inquiries about metacognitive experiences among learners within smart learning environments.

## **2.2. Participants**

Participants included 72 English Foreign Language learners pursuing English education at an institution for teacher education in Indonesia involved in smart class learning. Convenience sampling was employed due to simplicity of participation. Purposive sampling of the remaining 12 subjects who scored highly and lowly on the metacognitive strategy questionnaire was employed for the qualitative study.

## **2.3. Methods employed during Collecting Data**

The quantitative data was gathered using the following three questionnaires:

1. Usage of the Smart Classroom Questionnaire, focusing on the use of LMS, AI-based feedback, awareness of learning analytics, and collaborative learning;
2. Metacognitive Strategy Inventory, planning, monitoring, and evaluation strategies
3. Autonomous Learning Questionnaire, concerning autonomous behavior, self-evaluation, persistence.

These scales were administered in a five-point Likert format and were reliable with a high Cronbach alpha of more than 0.80. Data from the LMS learning analytics system were also obtained. Qualitative data were obtained by conducting an interview based on metacognitive learning.

## **2.4. Data Analysis Techniques**

The quantitative datasets were analyzed by means of descriptive stats, correlation analysis, and regression analysis to investigate mediation. The qualitative datasets were analyzed by means of thematic analysis to investigate metacognitive regulation and autonomy.

# **3. RESULTS AND DISCUSSION**

## **3.1. Result**

This chapter discussed and analyzed the findings in a proper manner and as per the aims of the research. The findings would consist of data gathered from the statistical analysis of responses gathered using the questionnaire and thematical analysis of information gathered using the researcher-administered interview. The findings would then be explained in the next chapter, which would be the “Discussion” chapter.

### **Descriptive Statistics**

Descriptive statistics were used to determine the use of the smart class room by the students, use of metacognitive strategies, and autonomy for learning. The results showed an impressive use of the smart class room, especially the use of learning management systems, getting auto-responses, and collaborating online. The mean score acquired for the use of the smart class room was 3.84, with a standard deviation of 0.51.

The usage level of the metacognitive strategy was generally moderate to high with a mean value of 3.76 and standard deviation at 0.47. In the three facets of the metacognitive strategy, the usage level of planning strategy was relatively higher in terms of mean than the other two facets. For the autonomous learning abilities, results indicated moderate to high levels with a mean value of 3.79 and standard deviation at 0.49.

### **Correlation Analysis**

Pearson Correlation analysis results have identified the correlation between the smart classroom usage, metacognition strategy, and autonomous learning capabilities.

**Table 1:** Correlation between the Usage of Smart Classrooms, Metacognitive Strategies, and Autonomous Learning Skills

NO.	VARIABLES	1	2	3
1	Use of Smartclassroom	1		
2	Metacognitive	0.62	1	
3	Autonomous Learning Skills	0.57	0.68	1

Note.  $p < .01$

The observations reveal that all the variables are positively correlated with each other. The utilization of smart classrooms is increasing along with the implementation of metacognitive strategies, having a correlation coefficient of 0.62. The implementation of metacognitive strategies is increasing along with autonomous learning skills, having a very high correlation coefficient of 0.68. The utilization of smart classrooms is increasing along with autonomous learning skills, having a correlation coefficient of 0.57.

### Regression and Mediation Analysis

Multiple regression analysis was employed to explore the prediction relationships between variables. The results showed that the usage of smart class in the room had great effects on metacognitive strategy application ( $\beta = 0.49, p < 0.01$ ). The metacognitive strategies significantly affected autonomous learning abilities ( $\beta = 0.54, p < 0.01$ ).

The addition of smart classroom usage and metacognitive strategies to a regression model predicting autonomous learning skill usage led to a reduction in the standard regression coefficient for smart classroom usage ( $\beta = 0.21, P < 0.05$ ), with metacognitive strategies still serving as a significant predictor. This pattern of result shows a partial mediation by metacognitive strategies.

### Qualitative Findings

The semi-structured interview data gathered was coded on the themes. The themes created were not literature-review-based; they were irrevocably interwoven with themes including learning activity planning through the use of digital technology, learning process through learning analytics, and learning outcome through digital feedback.

Students reported utilizing LMS components such as managing learning schedules and doing assignments. Utilization of learning analytics learning portals to track achievements of tasks and determine regions of amendment was also indicated. Computerized feedback and reflection tasks were also indicated to assist in evaluating and modifying learning practices.

### 3.2. Discussion

In this research, correlations between the usage of the smart class room, metacognitive strategies in language learning, and autonomy learning skills in EFL at all higher education institutions were investigated. The results of this research with a quantitative paradigm make it crystal clear that the usage of the smart class room is a positive contribution with regard to metacognitive strategies in learning and autonomy learning skills. Moreover, in this research, it is made crystal clear that metacognitive strategies partially mediate the usage of the smart

class room and autonomy. The aforementioned research tries to answer research-oriented questions by taking into consideration the learning environment supported by technology with regard to autonomy, with a focus on control in terms of planning, control, and evaluation.

To gain a clearer understanding regarding how smart classroom technology aids in the metacognitive regulation of learning, the results provided by qualitative research can be referenced. The tools used by students were learning analytics systems for learning progress, AI learning analytics systems for learning weaknesses, and learning analytics systems for reflection. The findings provided by qualitative research are able to highlight how smart classroom technology is not only used as a learning aid but also for controlling learning.

### **Basis for Comparison**

This study offers evidence supporting other literature on this topic on the potential of smart classroom technology for increasing learning engagement and learning achievement in EFL contexts. Like other research studies on this topic, this study provided evidence on the positive effects of learning management systems and automated educational feedback on learning engagement. The effect of using technology in smart classroom environments, therefore, varies from other research studies because this study confirms the relationship between smart classroom technology effectiveness and the application of metacognitive strategy learning.

In alignment with the findings from the previous studies mentioned above from the literature review about the use of metacognitive strategies when learning a second language, the significance of planning, control, and evaluation is verified and integrated when practicing self-regulated learning. On the one hand, learning studies were mostly carried out according to a conventional learning context, and thus, the present study will demonstrate the efficacy of using metacognitive strategies also when learning through technology-rich environments. On the other hand, the effectiveness of metacognitive strategies when mediating self-regulated learning validates the theory of self-regulated learning, where the emphasis is mainly put on the use of metacognitive control.

### **Implications**

The implications of this study could be considered important to a certain extent. To meet the implications of this study, if the smart classroom facility is to be used, teaching metacognitive practices could be considered important in this context too. Teaching the use of learning analytics, decision-making regarding the use of AI-created feedback, and critical thinking regarding learning outcomes could be important, failing which the purpose of using the smart classrooms to develop autonomy in the students may not be fulfilled. From a theoretical standpoint, this study contributes to existing literature because it places emphasis on the importance of metacognitive strategies in technology usage as a pivotal process. Also, this study supports self-regulation-based models with technology as an enabler but not something that determines results.

### **Research Limitations**

However, this study has its own set of limitations. First, this study has a small sample population. This is considered a limitation from the perspective of generalizing findings. Secondly, the format of this study is self-reported. It is quantitative in nature. This is likely to be confronted by response bias. Thirdly, the framework of this study is based on cross-sectional design. This does not consider any changes in the use of metacognitive strategies and autonomy.

## Recommendations for Future Research

In future studies, longitudinal research or experimental designs might benefit if they are able to specialize in investigating the effect of incorporating metacognitive strategy instruction in smart class environments. Research studies involving a larger population might also be recommended, as it would aid in raising the level of generality. Some other variables that might help in mediating or moderating technology usage and autonomous learning are digital literacy, motivation, and scaffolding by teachers.

## 4. CONCLUSION

In this mixed methods study, integration of smart classroom technology and metacognitive strategies in language learning played an important role in achieving autonomy for EFL learners. The findings have revealed that there exists a strong positive correlation between the usage of smart classroom technology and autonomy in learning. Furthermore, this correlation is mediate influenced by the autonomy of EFL learners towards the use of metacognitive strategies for learning. From the qualitative results, one can understand the significance of learning analytics, AI-based feedback tools, and reflective learning for EFL learners in learning planning, control, and evaluation.

The study contributes to existing literature on technology-enhanced language learning by providing evidence for a condition of insufficient autonomy in learning when technology is used alone in a learning process. The importance of the study in enhancing autonomy in learning can, therefore, be seen in highlighting the need to adopt a strategy of metacognitive instruction in smart classes for accomplishing autonomy in EFL learning.

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