Jurnal Pendidikan Sains Universitas Muhammadiyah Semarang. Vol. 14(1) pp 14-23 ISSN:2339-0786
DOI: https://doi.org/10.26714/jps.14.1.2026.14-23

The Effect of the Make a Match Learning Model Assisted by Picture Card Media on Students' Self-Efficacy in the Human Respiratory System Material

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Article history

Submission : 2025-02-01
Revised : 2025-05-10
Accepted : 2025-11-26

Keyword

Make a Match
Learning Model
Picture Card Media
Self-Efficacy
Human Respiratory System

Abstract

Self-efficacy is a crucial psychological construct in education that significantly impacts students' confidence, motivation, and engagement in learning. However, observations in MAN 2 Kota Probolinggo revealed low self-efficacy among students during biology lessons, mainly because teacher-centred instruction failed to foster active participation and confidence. This study aimed to examine the effectiveness of the Make a Match learning model, supported by picture card media, in improving students' self-efficacy in learning the human respiratory system. A quasi-experimental design was employed, involving an experimental group taught with the intervention and a control group taught using conventional models. Pretest and posttest data were analyzed using statistical tests to assess the intervention's impact. The findings indicated that the experimental group showed a significant improvement in self-efficacy, with a mean posttest score of 102.44 compared to 90.67 in the control group ($t = -7.897$, $p < .000$). The Make a Match model combined with picture card media effectively fostered mastery experiences, vicarious learning, and social persuasion, aligning with Bandura's Social Learning Theory. This research highlights the importance of interactive, visually engaging teaching strategies for building students' confidence and participation, particularly in challenging biology topics such as the human respiratory system. The study enriches scientific knowledge by demonstrating how structured peer interaction and visual aids can enhance self-efficacy in science education. Nevertheless, the study was confined to a single school and a single biological issue, suggesting that future research should focus on broader settings and long-term implications across multiple scientific areas.

1. INTRODUCTION

Biology is integrally linked to human existence and significantly influences the acquisition of knowledge, values, and behaviours that foster environmental preservation and social responsibility. Biology is a fundamental science subject in schools (Bal-Taştan et al., 2018; Suryawati & Osman, 2017), encompassing various concepts and facts, including the human respiratory system. This subject encompasses the anatomy and physiology of the respiratory organs, lung capacities, respiratory rates, breathing mechanisms, and respiratory pathologies. Nonetheless, despite the significance of biology in promoting scientific understanding and practical application, the quality of education in Indonesia has faced difficulties in recent years (Jhon et al., 2021; Mutohhari et al., 2021; Sulisworo et al., 2016). Teacher-centred learning models and inadequate implementation of engaging pedagogical strategies may have impeded the practical cultivation of students' self-efficacy.

Self-efficacy, an essential psychological concept in education, refers to an individual's conviction in their capacity to succeed in specific tasks or situations (Corbu et al., 2021; Farmer et al., 2021; Lippke, 2020; Toledano-González et al., 2019). In education, self-efficacy affects students' emotions, cognition, and behaviour throughout the learning process (Hayat et al., 2020; Jeong et al., 2019). Students with elevated self-efficacy are more inclined to persist through difficulties, actively participate in learning, and attain their objectives. Conversely, diminished self-efficacy can hinder academic advancement (Talsma et al., 2019; Travis et al., 2020; Zhang et al., 2018), as students may avoid challenging tasks, exhibit low motivation, and question their capabilities.

Observations conducted at MAN 2 Kota Probolinggo on June 5, 2023, highlighted a prevalent issue of low self-efficacy among students. Many students lacked confidence in their abilities, avoided challenging tasks, and showed minimal engagement during biology lessons. The teaching models employed relied heavily on lectures and textbooks, leaving little room for active participation. This teacher-centred approach led to disengagement, with students frequently using their devices, neglecting explanations, and avoiding interaction with peers or teachers when they encountered difficulties. Such behaviours indicated a lack of self-efficacy, as students appeared unwilling to face academic challenges or seek assistance.

Resolving this issue necessitates an innovative pedagogical strategy that promotes active engagement and enhances students' self-efficacy. Cooperative learning models, especially the Make a Match model, have shown potential to improve self-efficacy. The Make a Match model entails interactive exercises in which students match question cards with their corresponding answer cards within a designated time limit (Khakim et al., 2019; Wibowowati, 2022). This model fosters active participation, peer collaboration, and a sense of accomplishment, thereby cultivating a positive and supportive educational atmosphere (Khakim et al., 2019; Kusumaningtyas & Mirtasari, 2024; Sartika et al., 2024; Wibowowati, 2022). The Make a Match model diverges from conventional teacher-centred approaches by emphasizing student-centred learning, thereby fostering collaboration and higher thinking. These components are essential for cultivating self-efficacy, as students develop confidence through mastery experiences and vicarious learning.

To improve the effectiveness of the Make a Match model, picture card media was utilized. Picture cards function as visual tools that elucidate intricate concepts, rendering them more comprehensible and captivating for learners (Citra et al., 2023; Mashuri et al., 2021; Meilani & Aiman, 2021). For example, in instructing on the human respiratory system, illustrative cards that showcase the anatomy and function of organs such as the lungs and trachea provide tangible visual aids that enhance understanding. Picture cards facilitate students' comprehension of essential concepts by visually presenting information, thereby minimizing distractions from superfluous details.

The combination of the Make a Match model with picture card media encompasses the cognitive, social, and emotional facets of learning. The visual and interactive aspects of the activities improve comprehension and retention of biological concepts (Furtado et al., 2019; Guo et al., 2020; Weng et al., 2020). The collaborative nature of the model promotes peer interaction, facilitating mutual learning and support among students (Qureshi et al., 2023a; Van Ryzin & Roseth, 2018; Zhou, 2020). The interactive, gamified nature of the activities reduces anxiety and enhances confidence, thereby fostering self-efficacy.

This model's potential to augment self-efficacy is supported by Bandura's Social Learning Theory, which emphasises mastery experiences, vicarious learning, and social persuasion (Bandura &

Walters, 1977). Mastery experiences, attained through the successful execution of corresponding activities, may enhance students' confidence in their capabilities. Vicarious learning occurs when students witness their peers' successes, which may foster the belief that they can achieve comparable success. Social persuasion, manifested through affirmative reinforcement from educators and classmates, may enhance students' confidence and motivation. These elements foster a comprehensive learning environment that cultivates self-efficacy and equips students to confront academic challenges with resilience.

Although the Make a Match model has theoretical and practical potential, its classroom application requires careful planning and execution. Educators must design activities that align with the learning objectives and ensure that the materials are suitable for students' comprehension levels. The integration of picture card media into activities must be seamless, providing clear, precise visual representations of the concepts being taught. MAN 2 Kota Probolinggo was chosen as the research site due to observed challenges in fostering students' self-efficacy and the need for innovative teaching models. The biology teachers at the school expressed interest in exploring strategies to enhance student engagement and confidence, and in providing a conducive setting for implementing and evaluating the Make a Match model using picture card media. This research aims to measure the impact of this model on students' self-efficacy, providing insights into its effectiveness and applicability.

2. METHOD

This study employed a quantitative, quasi-experimental design (Creswell & Creswell, 2017) to investigate the effect of the Make a Match learning model, assisted by picture card media, on students' self-efficacy. The study used a pretest-posttest control-group design, in which students completed a self-efficacy questionnaire before and after the intervention to assess changes in self-efficacy. The research involved two groups: an experimental group that received the Make a Match learning model intervention and a control group that received conventional instruction.

The study population included all students in the eleventh-grade science classes (XI IPA) at MAN 2 Kota Probolinggo during the 2023/2024 academic year, totalling 180 students across 5 classes. For sampling, purposive probability sampling was applied, selecting XI IPA 5 as the experimental group and XI IPA 3 as the control group. These classes were chosen for their similar average scores on prior tests on human respiratory system material and for recommendations from biology teachers.

Data were collected through various methods: observation, questionnaires, and documentation. Observations were conducted systematically to record students' activities during the learning process, providing qualitative support to the quantitative findings. The primary instrument for quantitative data collection was a 24-item self-efficacy questionnaire developed using a Likert scale, with responses ranging from "strongly agree" to "strongly disagree." This instrument was adapted and modified from the self-efficacy scale developed by Nursilawati (2010), and refined based on relevant educational studies (e.g., Schunk & Pajares, 2009). It was reviewed by expert validators in science education and piloted for statistical validation. Six items were excluded following item validity testing using Pearson's product-moment correlation, resulting in 24 valid items for analysis.

The questionnaire addressed three dimensions of self-efficacy: magnitude, strength, and generality. Each dimension was broken into indicators such as the ability to complete tasks of varying difficulty, persistence, and consistency in facing challenges. The scoring ranged from 1 (strongly disagree) to 5 (strongly agree) for positively worded items, and the reverse scoring was applied to negatively worded items. The maximum possible score was 120, and the minimum was 24. Scores were categorized into five levels: very good (102–120), good (83–101), sufficient (64–82), poor (45–63), and very poor (<45).

Instrument reliability was tested using Cronbach's Alpha, which yielded a coefficient of 0.889, indicating high reliability. Data were analyzed using descriptive and inferential statistical methods. Descriptive analysis summarised the data using means, standard deviations, and frequencies. Inferential analysis involved hypothesis testing using an independent t-test to compare self-efficacy scores between the experimental and control groups.

Before hypothesis testing, the data were checked for normality and homogeneity. Normality was assessed using the Kolmogorov-Smirnov test, and Levene's test was used to ensure homogeneity of variances. Both tests confirmed that the data met the required assumptions for t-tests. The hypothesis tested whether there was a significant difference in self-efficacy levels between students taught with

the Make a Match model assisted by picture cards and those taught using conventional models. The null hypothesis (H0) posited no significant difference, while the alternative hypothesis (Ha) suggested a significant difference in favour of the experimental group.

The intervention was implemented over a series of lessons, during which the experimental group engaged in Make a Match activities using picture card media. Students were tasked with matching cards depicting concepts and explanations of the human respiratory system. This interactive model aimed to enhance students' confidence and self-efficacy through active participation and peer interaction. Meanwhile, the control group followed traditional lecture-based models, with conventional student engagement.

Documentation was also utilized to support the findings, including photographs and records of classroom activities. These materials provided contextual evidence of the learning processes in both groups. The hypothesis was tested through rigorous statistical analysis, with results expected to confirm the educational value of interactive, student-centred learning models in enhancing self-efficacy.

3. RESULTS AND DISCUSSION

The results of the self efficacy pretest analyzed using the Kolmogorov-Smirnov test, which revealed that the data for the two classes normally distributed (XI IPA 3 Sig = .068 > 0.05; XI IPA 5 Sig = .150 > 0.05), and also analyzed using the Levene's test for homogeneity, which revealed that the data for the two classes homogeneous (Sig = .229 > 0.05). The means and standard deviations of the self-efficacy pretest scores are displayed in Table 1.

Table 1. Mean and standard deviations of self-efficacy pretest scores

Class	N	Mean	Std. Deviation
XI IPA 3	36	80.75	5.453
XI IPA 5	36	80.81	4.816

As shown in Table 1, the students in XI IPA 3 had a slightly lower self-efficacy pretest score ($\bar{X}$=80.75, SD=5.453) than those in XI IPA 5 ($\bar{X}$=80.81, SD=4.816). We used parametric methods to determine whether the two classes' self-efficacy differed significantly before treatment. The independent-samples t-test results for the self-efficacy pretest are displayed in Table 2.

Table 2. The independent sample t-test result of the self-efficacy pretest

	Levene's Test for Equality of Variances		t-test			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	1.474	.229	-.046	70	.964	-.056
Equal variances not assumed			-.046	68.945	.964	-.056

As shown in Table 2, the obtained p (0.964) is higher than 0.05. This means that there is no significant difference in self-efficacy pretest results between the two classes, XI IPA 3 and XI IPA 5. Therefore, the two classes are assumed to have the same initial self-efficacy and can be used as the control and experimental classes. We classes. We then randomly assign XI IPA 3 as the control class and XI IPA 5 as the experimental class, and start the treatment.

The results of the self efficacy posttest analyzed using the Kolmogorov-Smirnov test, which revealed that the data for the two classes normally distributed (Control Class Sig = .2 > 0.05; Experiment Class Sig = .061 > 0.05), and also analyzed using the Levene's test for homogeneity, which revealed that the data for the two classes homogeneous (Sig = .366 > 0.05). Means and standard deviations of self-efficacy posttest scores are displayed in Table 3.

Table 3. Mean and standard deviations of self-efficacy posttest scores

Class	N	Mean	Std. Deviation
Experiment Class	36	102.44	6.622
Control Class	36	90.67	6.019

As shown in Table 3, the students in the Experiment Class had a higher posttest self-efficacy score ($\bar{X}$=102.44, SD=6.622) than those in the control Class ($\bar{X}$=90.67, SD=6.019). We used parametric methods to determine whether the self-efficacy of the two classes differed significantly after treatment. The independent-samples t-test results for the self-efficacy posttest are displayed in Table 4.

Table 4. The independent sample t-test result of the self-efficacy posttest

	Levene's Test for Equality of Variances		t-test			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Equal variances assumed	.828	.366	- 7.897	70	.000	-11.778
Equal variances not assumed			- 7.897	69.371	.000	-11.778

As shown in Table 4, the obtained p (0.000) is smaller than 0.01. Thus, the test is significant at the 0.01 level. This means there is a significant difference in self-efficacy post-test scores between the two classes: the experimental and the control.

This study investigated the effect of the Make a Match learning model, enhanced with picture card media, on students' self-efficacy in understanding the human respiratory system. The focus was on self-efficacy, defined as students' confidence in their capacity to complete certain activities (Corbu et al., 2021; Farmer et al., 2021; Lippke, 2020; Toledano-González et al., 2019). The findings indicated a significant increase in self-efficacy among students taught using this model compared with those taught through traditional models. The statistical analysis corroborated this improvement, demonstrating the intervention's considerable impact on students' self-efficacy.

The Make a Match learning model actively involves students in a collaborative and participatory exercise that requires them to pair cards representing related concepts (Khakim et al., 2019; Wibowowati, 2022). This model corresponds with Bandura's Social Learning Theory, which asserts that mastery experiences, vicarious learning, and social persuasion are essential for developing self-efficacy (Bandura & Walters, 1977). This model enables students to consistently achieve results by accurately matching cards, thereby strengthening their self-efficacy. For example, when students in the experimental group effectively associated concepts like the lungs with their role in oxygen exchange, they developed confidence in their ability to comprehend and retain intricate material.

Additionally, due to its collaborative nature, the activity offers opportunities for learning-by-doing (Khakim et al., 2019; Kusumaningtyas & Mirtasari, 2024; Sartika et al., 2024; Wibowowati, 2022). Students can internalize the belief that they can achieve similar success by observing their peers succeed (Muenks et al., 2018; Schunk & DiBenedetto, 2021). During the matching activities, students in the experimental class demonstrated teamwork by discussing, debating, and collectively resolving challenges. This interaction also increased their self-efficacy by fostering a supportive, positive learning environment. The experimental class was significantly influenced by social persuasion, which is another critical component of Bandura and Walters's (1977) theory. Positive reinforcement was provided through the visible success of matching pairs and feedback from peers and teachers. Students were motivated to persevere in the face of adversity, which instilled a sense of resilience and confidence in their capacity to surmount obstacles.

The Make a Match model was enhanced with picture cards, which provided a visual and tangible representation of abstract concepts. The human respiratory system, with its complex structures and functions, can be complicated for students to comprehend (Mago et al., 2022; Wahyuni et al., 2021; Waruwu et al., 2024). The use of picture cards simplified this complexity, enabling students to connect visual cues to conceptual knowledge (Citra et al., 2023; Mashuri et al., 2021; Meilani &

Aiman, 2021). For example, students were able to comprehend and retain information more effectively when presented with cards featuring labelled diagrams of the alveoli and their role in gas exchange.

The use of visual aids aligns with Cognitive Load Theory (Castro-Alonso et al., 2019; Haryana et al., 2022), which underscores the importance of minimising unnecessary cognitive effort to improve learning. Students were able to focus on comprehending and mastering the material by reducing the cognitive demands imposed by picture cards that presented information visually. This ease of comprehension directly improved their confidence by enabling them to understand better difficult material (Ahmad, 2022; Hasanah & Supriansyah, 2022; Saputra, 2024). In addition, the picture cards were designed to accommodate a variety of learning styles, ensuring a comprehensive learning process. Visual learners benefited particularly from the rich illustrations, while kinesthetic learners were captivated by the hands-on card-matching activity. In addition to making the learning process more engaging, this multi-sensory model also bolstered students' confidence in their ability to learn effectively, regardless of their preferred learning style.

The statistical analyses confirmed that the intervention significantly increased students' self-efficacy in the experimental group. The pretest results showed no significant difference between the experimental and control groups, ensuring that both groups started on an equal footing. However, posttest results revealed a marked increase in self-efficacy scores for the experimental group (mean = 102.44) compared to the control group (mean = 90.67). The t-test results ($t = -7.897$, $p < .000$) further validated this difference, indicating the effectiveness of the "Make a Match" model in fostering self-efficacy. The intervention's interactive, collaborative, and visually engaging nature can be credited with this substantial enhancement. In contrast to the control group, which used a lecture-based model, the experimental group received supportive learning environments, immediate feedback, and active participation.

A comprehension of the intricate anatomical structures and physiological processes is necessary when discussing the human respiratory system. This comprehension was facilitated by the Make a Match model, which prompted students to engage with the material actively. For instance, students reinforced their understanding of the trachea by matching cards depicting its role in air passage, a process that involved repetition and interaction. The activity also encouraged students to ask questions and clarify their doubts, resulting in a dynamic and collaborative learning experience (Qureshi et al., 2023b; van de Rijt et al., 2020; Zhou, 2020).

Students developed their understanding of the respiratory system by actively engaging in these activities rather than passively receiving information. This constructivist approach, which was facilitated by the interactive use of picture cards, enabled students to assume responsibility for their education (Rajendra, 2019; Steffe & Ulrich, 2020). Their self-efficacy improved as they developed a more comprehensive understanding of the material, which in turn bolstered their confidence in their ability to succeed in comparable tasks.

This study's observation of increased self-efficacy underscores the importance of employing student-centred, innovative teaching models. The Make a Match model, when combined with picture card media, addresses a variety of self-efficacy dimensions: Observing their peers complete tasks encouraged students to believe in their own abilities, and positive reinforcement from teachers and peers motivated students to persevere and build resilience. Additionally, the successful matching of cards provided students with a sense of achievement, reinforcing their belief in their capabilities. The efficacy of this model in cultivating self-belief and confidence among students is demonstrated by its alignment with Bandura's (1977) theoretical framework.

The results of this study are consistent with prior research, including Sudiani's (2019) work, which has shown the efficacy of the Make a Match model in improving self-efficacy in other contexts. Sudiani's research, similar to the current study, underscored the importance of interactive and engaging learning activities in enhancing students' motivation and confidence. These results emphasize the adaptability and effectiveness of the Make a Match model across a variety of educational environments. Additionally, the constructivist principles that underpin this model underscore its capacity to foster active and meaningful learning. The Make a Match model establishes a learning environment that not only improves comprehension but also instils confidence in one's capabilities by involving students in hands-on activities and encouraging collaboration (Hamida, 2024; Simanjuntak et al., 2023; Siregar et al., 2023). Many prior studies have also indicated that a model based on student

actions can make learning more effective (Jamallika et al., 2024; Hasanah & Mayarni, 2024; Muntaz et al., 2024).

Therefore, the Make a Match learning model, facilitated by picture card media, has been demonstrated to be a potent tool for enhancing students' self-efficacy in acquiring knowledge of the human respiratory system. This model addresses the cognitive, social, and motivational aspects of self-efficacy development by promoting active engagement, collaboration, and visual learning. The study's results underscore the importance of implementing innovative, student-centred teaching strategies to foster resilience and confidence. Future research should investigate the potential application of these interventions to other subjects and educational contexts, as well as their long-term impact on students' self-efficacy.

4. CONCLUSION

The study concluded that the Make a Match learning model, facilitated by picture card media, markedly enhances students' self-efficacy in biology instruction. The intervention promoted active participation, collaboration, and engagement through an interactive, student-centred approach. By elucidating intricate concepts with visual aids and fostering a nurturing educational atmosphere, the model empowered students to build confidence in their learning and achievement. Statistical evidence demonstrated a substantial disparity in self-efficacy between the experimental and control groups ($p=0.000$), underscoring the intervention's efficacy. This study highlights the efficacy of creative instructional models, such as the Make a Match model, in mitigating low self-efficacy. The findings indicate that integrating these models can enhance the learning experience, providing students with the confidence and motivation necessary to succeed academically and beyond.

ACKNOWLEDGMENT

The authors express their sincere appreciation to the principal, biology teachers, and students of XI IPA at MAN 2 Kota Probolinggo for their cooperation and support in facilitating the implementation of this research.

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