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Application of STEAM (Science, Technology, Engineering, Art, Mathematics) Approach in Improving Critical Thinking in Political Science Study Programme Students

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A B S T R A C T

This study examined the implementation of the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach in learning to improve the critical thinking skills of Political Science Study Program students. The interdisciplinary STEAM approach enriches students' thinking processes by integrating scientific logic, creativity, technology, and problem-solving. This research used qualitative methods with data collection techniques in the form of interviews, observations, and documentation of lecturers and students involved in the STEAM-based learning process. This research was conducted in the Politics and Technology course of the class of 2024. The selection of materials and classes was based on the research team's discussions on crucial topics and characteristics relevant to technology utilization. The results showed that applying the STEAM approach encourages students to think analytically, creatively, and reflectively in understanding contemporary political phenomena. Collaboration between science, technology, art, and political analysis elements helps students formulate logical arguments, critically evaluate information, and make decisions based on data and ethics. This research recommends the application of STEAM as an innovative pedagogical strategy in political science curriculum development in the digital era.

1. Introduction

Education plays a vital role in shaping the future. Transformative learning, therefore, becomes essential as it fosters collaboration and critical thinking (Akmal Mundiri, 2023). Meanwhile, transformation can be understood as change, not all changes amount to transformation. Change often remains superficial, whereas transformation implies a more profound, substantial shift (Arif, 2021). The development of skills today and in the future is marked by constant competition and rapid change. This condition requires the preparation of highly qualified human resources who are able to adapt and remain resilient (Saihu, 2019). In higher

education, students' competencies should be cultivated in a comprehensive and multidisciplinary way so that graduates are ready to face cultural shifts, innovative trends, workplace demands, social challenges, and technological advancements (Abror, 2025).

Universities, therefore, must design and implement learning processes that are responsive to technological progress and the changing needs of society. According to data from the Central Statistics Agency (2022), young people between the ages of 15 and 29 make up 59% of the unemployed in Indonesia, with a total of 4.98 million individuals. This high rate of youth unemployment indicates the serious challenges graduates encounter when entering the labor market (Agusdianita et al., 2023). The challenges faced by graduates, especially students of the political science study programme of Raden Fatah State Islamic University Palembang, include the lack of skills, knowledge, and competencies needed in the world of work, the lack of job opportunities compared to the number of graduates each year, and the limited world of work, which is concentrated in certain regions. Of course, to overcome these problems, the support of academics involved in the learning process, followed by students, is needed. The Political Science Study Programme has Politics and Technology courses. Politics and technology courses are the answer for political science students to achieve their learning in higher education.

Flexible and quality to create a new, interesting, innovative, and student-friendly culture to improve the skills of higher education graduates (Kholil et al., 2025). Students are expected to become agents of change who contribute to improving the economic quality of society and become social controllers by providing innovative solutions to open employment opportunities through scientific opportunities and development (Nasukah & Winarti, 2021). This course is hoped to support preparing students for the world of work in the 4.0 era of the industrial revolution. Transformative education through the development of learning by utilising technology requires learning techniques that are more integrated with empirical data in the field.

The STEAM approach aims to help students understand the concepts being introduced. Students can discover their potential and develop creative thinking skills (Muntamah et al., 2023). The following steps outline the STEAM learning process: Step 1: Reflection. The purpose of this step is to familiarize students with the context of the problem. Step 2: Research. The second step involves student research. The speaker will provide learning on policy and technology, selecting reference sources. Learning occurs during this research phase, during which the lecturer guides the discussion. Step 3: Discovery. Matching research with existing data and project development. The lecturer will divide the students into small groups to encourage peer cooperation. Step 4: Implementation. This phase aims to test the product or solution to solve the problem. During this phase, students will study politics and technology. The final step is to create or implement the solution (Frisco Fernando, Fambrio Siletty & Rasji, 2024).

2. Methodology

This type of research was a field study with descriptive qualitative analysis research methods (Faisal Adi Negara, 2023). In this study, classroom observations were made to sources related to problems in classroom learning, based on descriptions, and to facilitate measurement of the data collected (Muntamah et al., 2023). Then, to answer the formulation of the problem, researchers examined more deeply policy and technology, and some reviews of the STEAM learning integration model related to policy and technology learning. Data collection techniques in this study were observation, interviews, and documentation. Data analysis techniques were: 1) Data Condensation, 2) Presentation of Data (Data Display), 3) Data Verification. The STEAM approach was used in this study as described in Table 1:

Table 1. Forms of Learning Activities in Research

No	Approach	Description	Activity Form
1	Science	Students develop scientific critical thinking skills	Interactive Discussion
2	Technology	The use of educational technology, such as digital media, in the learning process	Socialization of politics and technology through digital media
3	Engineering	Transformative learning that integrates politics and technology issues	Interactive video on politics and technology
4	Arts	Analyze socio-political issues and public policy	Audiences to political parties by means of scientific speeches
5	Mathematics	Analyze social data	Presentation of data from the hearing was presented at the forum

A systematic research proposal was divided into four sections. The first was the essential reasons for conducting this research. The second section was the discussion of the research method. The steps involved in the process of collecting, processing, and presenting data until a conclusion drawn are: (1) primary data, namely students of the Politics and Technology Study Programme of FISIP UIN Raden Fatah Palembang, and (2) secondary data in the form of written sources, documents from activities, and other sources. Third, the data: (a) STEAM approach, (b) learning of politics and technology courses, (c) Tasks in learning politics and technology, (d) Linkages between lecturers and students in the output of politics and technology courses (Irsyad et al., 2022). In this section, data analysis was carried out, as well as validating data, deepening the study of the results of interviews and observation, with the description of the research plan as described in Table 2:

Table 2. Forms of Assignments in Research

No	Description	Activity Form	Form of Assignment
1	Students develop scientific critical thinking skills (Interactive discussion) =Division of groups based on the chosen theme	Interactive discussion	Division of groups based on the chosen theme
2	The use of educational technology, such as digital media, in the learning process that supports critical thinking	Socialization through digital media	Presentation of group discussion results
3	Transformative learning that integrates politics and technology	Interactive video of politics and technology	Individual assignment to make a video based on the selected video
4	Analyze socio-political issues and public policy	Audience to political parties by means of scientific oration	Scientific oration to the secretariat of political parties
5	Analyze social data	Presentation of data from hearing results	Focus Group Discussion

The fourth section was the final part of the research. This paper contains conclusions and suggestions related to the summarized research results, namely the relationship between lecturers and students in transmitting the mindset and skills of political science students through politics and technology courses. The findings of this activity could contribute to universities, especially political science program students, in developing post-campus preparation policies.

3. Results and Discussion

STEAM Approach in Politics and Technology Course Learning

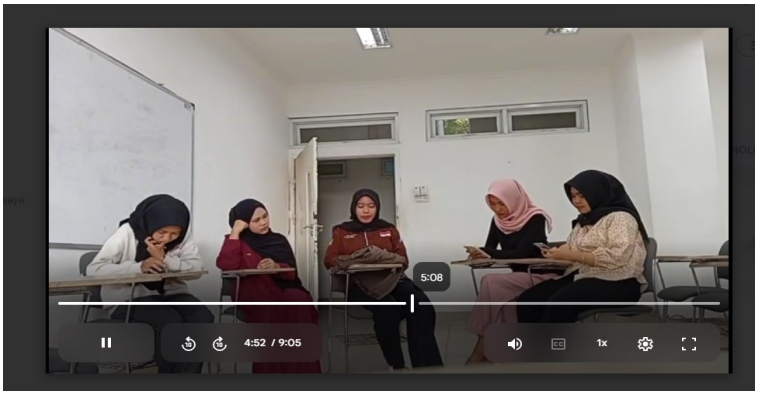
This study was conducted in four classes of the Politics and Technology course of the class of 2024 at the Political Science Study Program, Faculty of Social and Political Sciences, Raden Fatah State Islamic University, Palembang. Each class consisted of 25 students, resulting in a total of 100 participants. The learning process was implemented through the integration of the STEAM approach. This integrative model combined technology as an interactive learning medium to enhance student engagement and critical awareness of contemporary socio-political contexts. The use of digital technology facilitated access to a wide range of information resources, enabling students to conduct deeper, data-driven analyses in understanding political phenomena. Through dialogical and collaborative learning, students were encouraged to develop structured and applicable critical thinking skills in addressing the challenges of the digital era and modern democracy.

The STEAM-based learning process was carried out through the following stages. Stage 1: Reflection. The objective of this initial stage was to situate students within the context of the problem. This phase was also intended to connect prior knowledge with the knowledge that needs to be acquired. Stage 2: Research. The second stage involved student-led research activities. The lecturer provided

instruction on politics and technology, selects relevant reference sources, and applies various methods to collect pertinent information. The majority of the learning process occurred at this stage. During the research phase, the lecturer facilitated discussions to assess whether students had developed a conceptual and relevant understanding based on the project. Stage 3: Discovery. The discovery stage generally involved bridging research findings with existing knowledge in the development of the project. The lecturer divided students into small groups to present potential problem-solving strategies, collaborate, and build teamwork within the group. Stage 4: Application. The purpose of the application stage was to test the product or solution in addressing the identified problem. At this stage, students explored broader contexts or establish connections between politics and technology. The final stage of each project involved producing a product or solution and communicating the results through peer interaction and class-wide presentations.

The STEAM approach (Science, Technology, Engineering, Arts, and Mathematics) has become a new paradigm in education today that emphasizes the importance of interdisciplinary integration to create more contextual, creative, and critical thinking learning. In the context of learning Politics and Technology courses, applying the STEAM approach offers a new dimension that can bridge students' understanding of the dynamic relationship between technological developments and contemporary political dynamics. The results showed that integrating STEAM into this course encouraged students to understand political theory in the abstract and analyze the real impact of technology on power structures, public policies, and public participation in the political system. In applying the Science element, students developed scientific critical thinking skills through interactive discussions in class by determining the theme of choice they will discuss.

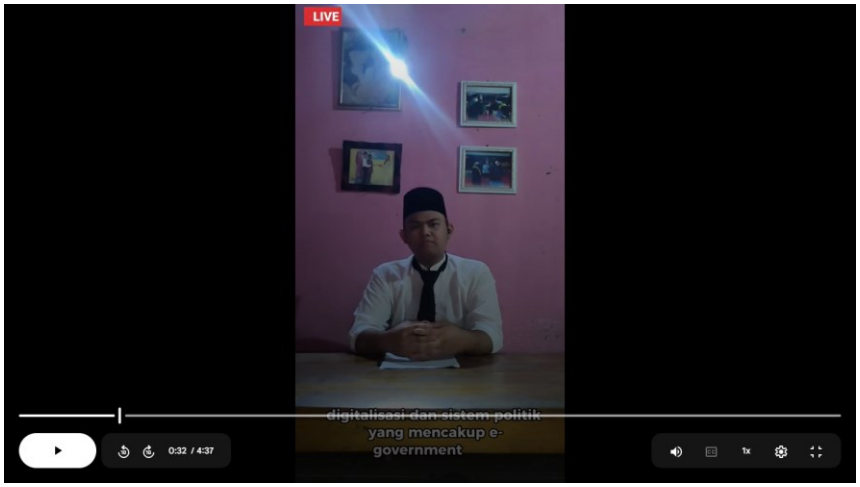
The use of educational technology, such as digital media, in the learning process is highly effective in supporting the development of critical thinking in students. Interactive digital media—such as learning apps, educational videos, online quiz platforms (e.g., Quizizz), and augmented reality—provide a more engaging and challenging learning experience. The use of these media encourages students to actively seek, analyze, and evaluate information critically and reflectively. Learning models that integrate digital technology, such as Problem-Based Learning (PBL) supported by digital literacy, have been proven to facilitate students in honing their critical thinking skills. Lecturers providing guidance enable students to question and evaluate the digital information sources they use, rather than simply accepting them at face value. This enhances the ability to analyze, synthesize, and verify information, thus fostering scientific and structured critical thinking skills. Furthermore, educational technology expands access to a variety of relevant learning resources and enables collaborative learning that enriches the critical thinking process. Portable and flexible digital media enable learning anytime and anywhere, thus supporting the development of critical thinking skills in a sustainable and contextual manner in today's digital era. The implementation of interactive discussion was seen on Figure 1.



Source: Researcher Documentation, 2025

Figure 1. Student Interactive Discussion

In applying the Technology element, educational technology, such as digital media, was used in the learning process, namely, students socializing the chosen theme discussed through social media. In applying engineering elements, students integrated political and technological issues regarding the chosen theme, which was discussed through interactive videos they designed as seen in Figure 2.



Source: Researcher Documentation, 2025

Figure 2. Video discussion of politics and technology

Each group was assigned to create a video that comprehensively explored the close relationship between politics and technology, particularly in the context of students' role as agents of change in the digital age. The video explained how advances in digital technology had brought about significant transformations in politics, from campaign methods and political participation to political education itself. Digital technology allows for broader and faster access to information, enabling students to be more critical and active in following contemporary political dynamics. The video was uploaded to the students' social media accounts, namely Instagram, TikTok, and Facebook.

Applying Arts elements in the STEAM approach also plays a crucial role in developing students' critical thinking and empathy. Students could establish

reflective thinking on technology ethics, digital privacy, and political disinformation through artistic techniques such as visual design, digital storytelling, or making technology-based political campaign videos. Through technology-based projects, students were invited to design how to conduct scientific speeches to small forums in a political capacity. In applying the Mathematics element, students presented data from the audience in a Forum Group Discussion.

Students tasked with analyzing socio-political issues and public policy in the digital era require a comprehensive approach, taking into account the dynamics of information and communication technology that influence how society participates and interacts in the political sphere. In Indonesia, digitalization has significantly transformed the political landscape, particularly through the emergence of social media, which has become a new public space for the expression of opinions, discussion, and political activism. Social media enables the public, especially the younger generation, to actively participate in the political process, from election monitoring to advocacy on social issues.

In analyzing socio-political issues, it is crucial to identify factors such as economic inequality, political polarization, disinformation, and the manipulation of public opinion that impact political stability and democratic dynamics. Formulated public policies need to be responsive to these changes to address societal needs in an inclusive and sustainable manner. Digital technology also plays a role in increasing transparency, accountability, and public participation in government through digital platforms for reporting, oversight, and public consultation.

However, emerging challenges such as the spread of hoaxes, hate speech, and echo chambers that reinforce polarization must be managed with wise political communication strategies and digital literacy education. Collaboration between government, civil society, and the private sector is key to creating a healthy and democratic political environment in the digital age. The use of digital data and analysis facilitates fact-finding, corruption monitoring, and the development of innovative policies that adapt to social and technological change. Students were divided into groups, each of which discussed their chosen material. The material was compiled and designed collaboratively, presented in class, and disseminated on social media. Learning took place interactively between lecturers and students. To further foster critical thinking in students, each group was assigned to deliver an open scientific speech within a defined scope. The lecturer provided options for conducting scientific operations within an internal or external campus organization, as well as visiting and delivering scientific speeches within a broader organization.

A scientific oration delivered to a political forum involved a systematic and structured speech aimed at presenting an in-depth analysis of political issues, challenged to democracy, public policy, or contemporary socio-political phenomena before an academic or public audience with a keen interest and capacity in politics. An effective scientific oration typically consisted of an introduction, body, and closing. In the opening, the speaker introduced the topic to be discussed, explained its relevance to the current political context, and stated the purpose of the oration. The body of the oration presented a strong argument supported by data,

political theory, research findings, and concrete examples of the political issues raised. In delivering the oration, the speaker used clear language, persuasive rhetoric, and expressiveness and body language to capture the attention and convince the audience. The closing typically included a summary of the main points and relevant calls or recommendations for action.

Scientific orations in political forums are often used as a means to inspire change, provide critical understanding of policies or political systems, and stimulate constructive intellectual discourse. In an academic context, such as at the Faculty of Social and Political Sciences, Andalas University, scientific orations provided a strategic opportunity to raise strategic issues using an academic approach based on research and valid data. These orations contributed significantly to shaping the political insight and capacity of forum participants, including students, lecturers, and political practitioners. The output of these scientific orations was the sharpening of critical thinking skills, analytical skills, and communicative delivery, which were key to the success of scientific orations with political capacity. The persuasive and inspiring power of orations could open up space for dialogue, encourage active participation, and drive positive change in the complex and dynamic political landscape.

On the other hand, the STEAM approach also encourages teachers to design a more flexible and collaborative curriculum. Using digital media, project-based learning, and interdisciplinary teamwork opens up spaces for collaboration between students from social science, engineering, and arts backgrounds. This collaboration had been proven to holistically enrich students' perspectives on solving political-technological problems. In addition to providing information, resource persons also play a role in clarifying potentially complex or abstract issues, facilitating focused discussions, and avoiding the dominance of a single position to ensure a dynamic and inclusive discussion. Effective moderation ensures that resource persons contribute proportionally without overshadowing the views of other participants.

Throughout the FGD process, resource persons are part of the systematic empirical data collection process, helping to develop arguments, test social hypotheses, and enrich thematic analysis. The validity of FGD results is greatly influenced by the resource persons' skill in conveying accurate and relevant information in accordance with the research objectives. Therefore, selecting resource persons who are credible and relevant to the discussion topic is crucial in organizing FGDs to ensure valid and in-depth data collection. The resource persons for this activity were Dr. Taufik Akhyar, M.Si., Vice Dean I of the Faculty of Social and Political Sciences; Mr. Komaruddin, M.Si., Vice Dean II of the Faculty of Social and Political Sciences; and Mr. Ryllian Chandra Eka Viana, M.A., Head of the Political Science Study Program.

The role of resource persons in social data analysis through Focus Group Discussions (FGDs) is crucial as information providers, discussion facilitators, and sources of in-depth insights into the topic at hand. Resource persons are tasked with providing specific and relevant perspectives, experiences, and knowledge, thereby helping the group gain a rich and diverse picture and understanding of the

discussion. They influence the quality of the data collected through substantive contributions that stimulate the active participation of other FGD members.

The Role of Lecturers in Improving Critical Thinking Skills in Political Science Study Programme Students

Critical thinking skills are among the essential competencies that students of the Political Science Study Programme must possess, given the complexity of socio-political dynamics that demand analytical skills, logical argumentation, and data—and value-based decision-making. In this context, the lecturers' role is key in shaping and developing these skills through the right pedagogical approach. The results showed that lecturers who consistently applied learning methods that encouraged open dialogue, analytical discussions, and actual case studies could create an environment that stimulates students' critical thinking. Students were trained to evaluate various perspectives, construct arguments, and question assumptions through structured debates, parliamentary session simulations, and public policy analysis assignments.

Lecturers also acted as facilitators who encouraged students to receive information passively and process it actively. This approach effectively built students' awareness of source validity, data relevance, and logical thinking in responding to contemporary political issues. Then, lecturers who could link political theory with actual events tend to be more successful in arousing students' interest and intellectual engagement. In addition to teaching methods, interpersonal interaction between lecturers and students is also essential. Lecturers who are open to questions, encourage students to express their opinions freely, and provide constructive feedback have been proven to increase students' confidence and courage to think and express ideas critically.

However, the research also revealed challenges, such as the persistence of conventional teaching patterns focusing on one-way lectures and memorization. This obstacle in developing critical thinking skills required space for dialogue, exploration of ideas, and opportunities to evaluate various points of view. Overall, the role of lecturers in improving students' critical thinking skills lied in their mastery of the material and their pedagogical abilities, sensitivity to classroom dynamics, and commitment to creating reflective, participatory, and meaningful learning. The application of this approach encourages students to not only understand political theory but also apply it practically and creatively.

4. Conclusion

Based on the research results, it could be concluded that the application of the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach significantly contributes to improving the critical thinking skills of Political Science Study Programme students. Integrating science and technology elements into the socio-political context allows students to view political issues from a broader, data-based, and analytical perspective. This approach encourages

students to understand the theoretical conceptually and apply it in a real context through project-based activities, political data analysis, utilization of information technology, and creative representation in the form of visuals, digital media, or argumentative presentations.

The use of interdisciplinary methods such as policy simulations, debates, and the creation of digital products based on political issues has proven effective in shaping critical, reflective, and solutive mindsets. In addition, the application of STEAM also stimulates cross-field collaboration, improves problem-solving skills, and develops students' ethical and aesthetic sensitivity to the complexity of contemporary political issues. Based on the results of observation and documentation, it could be seen that the students who took part in STEAM-based learning showed improvement in the aspects of Analysis, Collaboration, and Communication Skills. Furthermore, mastery of digital technology through STEAM Projects carried out in groups had improved communication, negotiation, and argumentation skills that were important in political science. This makes the STEAM approach a more active, contextual, and meaningful strategic alternative in learning politics.

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