**Artificial Intelligence Adoption in Social Studies Instruction: A Study of Universities in South-South Nigeria**

**Abstract**

*This study examined the adoption of Artificial Intelligence in Social Studies Instruction across Universities in South-South Nigeria. The study was guided by four research questions and three null hypotheses. A descriptive correlational survey research design was employed in the study. The population of study comprised of 120 Social Studies lecturers from public universities in the six states of the South-South geopolitical zone—Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers. Given the relatively small population size, no sampling was required; thus, the entire population was used. Data were collected using a structured, researcher-developed questionnaire titled ‘Artificial Intelligence Usage and Curriculum Implementation Questionnaire’ (AIUCI-Q). The instrument comprised three sections focusing on demographic variables, level of AI usage, and the extent of curriculum implementation. Content validity was ensured through expert review, and a pilot test yielded a reliability coefficient of 0.79 using the Cronbach Alpha method. Data were analyzed using descriptive statistics (frequency and percentage, mean and standard deviation) and inferential statistics including Pearson’s correlation coefficient and regression analysis. A benchmark mean of 2.50 was used to interpret usage levels. Findings revealed that the overall level of AI usage among lecturers was low, particularly in areas such as assessment, classroom management, and personalized learning. However, a weak but statistically significant positive relationship was found between AI usage and the implementation of the Social Studies curriculum. Teaching experience was not a significant factor, but technology literacy significantly influenced the relationship, with lecturers possessing higher technology literacy demonstrating more effective AI integration. The study recommends targeted professional development in AI tools, improved access to AI infrastructure, and policy support to promote effective integration of AI in Social Studies instruction.*

**Keywords**: Artificial Intelligence usage, Social Studies curriculum, technology literacy, curriculum implementation.

**Introduction**

Artificial Intelligence (AI) has emerged as a pivotal force in transforming global education, redefining how knowledge is created, delivered, and consumed. Its integration across academic disciplines has brought about profound changes in curriculum implementation through intelligent content generation, adaptive learning platforms, predictive assessments, and virtual assistants. In this evolving educational landscape, Social Studies education—which focuses on developing civic awareness, historical consciousness, socio-political understanding, and critical thinking—stands to benefit significantly from AI-driven pedagogical innovations.

Curriculum implementation, as noted by Ibeh (2022), refers to the process by which educational plans are translated into classroom practice, involving not only the transmission of content but also the application of instructional strategies, assessment tools, and learning technologies. In Nigerian universities, Social Studies curriculum implementation is designed to foster students' understanding of governance systems, global interdependence, environmental awareness, and democratic participation. Its interdisciplinary nature demands dynamic, technology-supported instructional methods that engage learners and connect academic content to real-world issues.

Despite the potential of AI to enhance the implementation of this curriculum, its integration into teaching practices among university lecturers in Nigeria—particularly in the South-South region—remains limited and inconsistent. While tools like ChatGPT, Grammarly, Paperpal, Mendeley, and ChatPDF offer functionalities that support teaching, assessment, and content development, empirical research suggests a gap between awareness and effective utilization (Ezenwoke & Eze, 2021; Adiguzel et al., 2023). Gasaymeh (2018) underscores that although lecturers may possess ICT tools such as smartphones and computers, ICT usage does not automatically translate to AI adoption, as many ICT tools do not incorporate true AI functionalities.

Several studies (Liang et al., 2021; Hwang & Tu, 2021) confirm that AI has improved teaching efficiency, forecasting student performance, enhancing engagement, and automating evaluation. Yet, challenges such as inadequate training, low technological literacy, and infrastructural deficits continue to hinder adoption in Nigerian universities (Ng et al., 2021; Seufert et al., 2020). Many lecturers exhibit positive attitudes toward AI due to its user-friendly interfaces and ability to support instructional planning and content delivery (Arguson et al., 2023), but this has not translated into consistent or widespread application in Social Studies education.

Crucially, effective curriculum implementation requires more than positive attitudes—it demands a high level of AI usage supported by technical proficiency and pedagogical insight. Research indicates that variables such as teaching experience and technology literacy significantly influence lecturers' capacity to adopt and utilize AI tools (López-Meneses, 2023). While experienced lecturers may have deeper curricular knowledge, they may also show resistance to adopting new technologies without structured support. Conversely, tech-literate lecturers are more likely to incorporate simulation-based learning, automated feedback, and data-driven instruction into their teaching strategies. Pang et al. (2025) examines how features like voice, appearance, and interactivity influence students’ experiences. Results reveal that students appreciate natural and engaging virtual lecturers but desire more responsiveness and personalization. The study highlights digital teachers’ potential to transform learning through flexibility, accessibility, and tailored experiences.

Moreover, there are ethical and practical concerns about AI integration in education, including data privacy, academic dishonesty, algorithmic bias, and the erosion of human-centered teaching values (Elliott & Soifer, 2022; Yang, 2022). Nigerian institutions are beginning to address these concerns by developing policies for responsible AI use, but progress is slow and uneven (Ng et al., 2021). These concerns underscore the need for enhanced training and institutional frameworks that promote ethical and effective AI usage.

Against this backdrop, the present study seeks to investigate the utilization of Artificial Intelligence by Social Studies lecturers in the implementation of the curriculum in universities across South-South Nigeria. The study is guided by the belief that optimizing AI usage in curriculum delivery can enhance teaching effectiveness, promote learner engagement, and ensure the relevance of Social Studies education in an increasingly digital and globalized world.

**Theoretical Framework**

The Technology Acceptance Model (TAM) by Davis (1989) provides a suitable theoretical framework for this study. TAM posits that two primary factors—perceived usefulness and perceived ease of use—influence users’ acceptance and adoption of new technologies. In the context of this study, Social Studies lecturers’ adoption of AI tools is understood through their perceptions of AI’s usefulness in improving curriculum implementation and its ease of integration into teaching practices. In this study, TAM guides the exploration of how these perceptions affect lecturers' awareness, accessibility and usability of AI tools, offering valuable insights into their decision-making process regarding technology integration. Lecturers who find AI tools easy to use and compatible with their teaching goals are more likely to view them as accessible and viable resources for overcoming instructional challenges in Social Studies. Moreover, positive experiences with AI that streamline tasks, facilitate communication, or personalize learning reinforce lecturers' perceptions of both usefulness and ease of use, thereby encouraging continued adoption. The model also allows for the incorporation of external variables such as technology literacy, infrastructure availability, and institutional support, which can indirectly affect adoption through their impact on perceived usefulness and ease of use. By applying TAM, the study conceptualizes AI adoption as a behavioral intention influenced by both technical competence and attitudinal readiness, helping to explain the low but significant relationship between AI usage and curriculum implementation observed in the findings.

**Purpose of Study**

The main purpose of this study was to investigate lecturers’ use of artificial intelligence as a panacea to the implementation of Social Studies curriculum in universities in South-South Nigeria. Specifically, this study aims to:

1. assess the level of AI usage among lecturers in universities in South-South Nigeria.
2. investigate the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.
3. assess the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience.
4. explore the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on technology literacy.

**Research Questions**

The following research questions were raised to guide the study:

1. What is the level of AI usage among lecturers in universities in South-South Nigeria?
2. What is the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria?
3. What is the relationship between lecturers AI usage and the implementation of the Social Studies curriculum based on teaching experience?
4. What is the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on technology literacy?

**Hypotheses**

The following null hypotheses were formulated to guide the study:

HO1: There is no significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.

HO2: There is no significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience.

HO3: There is no significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on technology literacy.

**Methodology**

This study adopted a correlational survey research design, which was considered appropriate for gathering data on lecturers’ usage of Artificial Intelligence (AI) and its relationship with the implementation of the Social Studies curriculum in universities across South-South Nigeria. The design allowed the researcher to collect quantitative data concerning the extent of AI usage, explore its association with curriculum implementation, and examine how variables such as teaching experience and technology literacy influence this relationship.

The population of the study comprised all Social Studies lecturers in public universities across the six states that constitute the South-South geopolitical zone of Nigeria: Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers States. Due to the manageable population size, the study adopted a census approach in which all 120 lecturers who met the inclusion criteria participated. This strategy ensured comprehensive data coverage and increased the reliability and generalizability of the results.

A structured, researcher-developed questionnaire titled Artificial Intelligence Usage and Curriculum Implementation Questionnaire (AIUCI-Q) was used for data collection. The instrument was divided into three major sections. Section A collected demographic data such as state of employment, teaching experience, and level of technology literacy. Section B assessed the level of AI usage among lecturers, comprising 10 items that captured their engagement with AI for lesson planning, content delivery, classroom management, research, and assessment. Section C focused on how lecturers’ use of AI influenced their implementation of the Social Studies curriculum, including items on practical integration of AI tools into teaching strategies, classroom activities, and curriculum support. All items in Sections B and C were measured on a four-point Likert scale ranging from Very High (4), High (3), Low (2), to Very Low (1). This allowed for the quantification of the frequency and extent of AI usage and its practical impact. Technology literacy scores were later categorized into low, moderate, and high levels based on respondents' aggregate scores to allow for comparative analysis. To establish the content validity of the instrument, the questionnaire was reviewed by three academic experts—two from the Department of Social Science Education and one from the Department of Educational Measurement and Evaluation at Delta State University, Abraka. Their suggestions on clarity, item structure, and alignment with research objectives were incorporated before the instrument was finalized.

The reliability of the instrument was tested through a pilot study conducted with 20 lecturers from a South-South university not involved in the main study. The responses were analyzed using the Cronbach Alpha method, and the instrument yielded a reliability coefficient of 0.79, indicating acceptable internal consistency.

Prior to data collection, the researcher obtained ethical clearance and institutional approval from the relevant authorities. Participants were fully informed of the study’s objectives, assured of the confidentiality of their responses, and informed of their right to participate voluntarily. Questionnaires were distributed both physically and electronically, depending on the accessibility of participants, with trained research assistants supporting the administration and ensuring prompt retrieval of completed copies to maintain data quality.

Data collected were analyzed using both descriptive and inferential statistical methods. Descriptive statistics such as mean and standard deviation were used to assess the level of AI usage, and a benchmark mean of 2.50 was applied to interpret whether AI usage was high or low. Inferential analyses were performed using Pearson’s correlation coefficient (r) to test the relationship between AI usage and curriculum implementation. Additionally, regression analysis was used to determine whether teaching experience and technology literacy moderated the relationship between AI usage and the implementation of the Social Studies curriculum.

All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) version 25. This methodological framework provided a structured approach to answering the research questions, testing the hypotheses, and offering evidence-based insights into the influence of lecturers' AI usage on the effective implementation of the Social Studies curriculum in universities across South-South Nigeria.

**Result and Discussion:**

**Demographic Data**

 The demographic data in the study was categorized according to states in the South-South geopolitical zone of Nigeria.

**Table 1: Demographic Data According to States**

| **States** |  **Number** |  **Percentage (%)** |
| --- | --- | --- |
| Akwa Ibom State |  23 |  19.2 |
| Bayelsa State |  9 |  7.5 |
| Cross River State |  25 |  20.8 |
| Delta State |  19 |  15.8 |
| Edo State |  21 |  17.5 |
| Rivers State |  23 |  19.2 |
| **Total** |  **120** |  **100.0** |

Table 1 presents the demographic distribution of lecturers across six states in South-South Nigeria. Out of a total of 120 respondents, Cross River State had the highest number of lecturers (25 or 20.8%), while Bayelsa State had the fewest (9 or 7.5%). Akwa Ibom and Rivers States each contributed 23 respondents (19.2%), Edo State contributed 21 (17.5%), and Delta State accounted for 19 (15.8%).

**Question 1:**

What is the level of AI usage among lecturers in universities in South-South Nigeria?

**Table 2: Mean score on the level of AI usage among lecturers in universities in South-South Nigeria**

| **S/N** | **Level of Artificial Intelligence Usage** | **Mean** | **SD** | **Remark** |
| --- | --- | --- | --- | --- |
| 1 | Incorporation of AI-based tools in your teaching of Social Studies | 2.70 | 0.82 | High |
| 2 | AI applications for lesson planning and content delivery in Social Studies | 2.75 | 0.98 | High |
| 3 | Extent of relying on AI for assessing students in Social Studies | 2.30 | 1.07 | Low |
| 4 | Usage of AI for interactive learning activities in Social Studies | 2.10 | 1.02 | Low |
| 5 | Usage of AI for grading and feedback in Social Studies courses | 2.40 | 0.85 | Low |
| 6 | Application of AI tools for research purposes in Social Studies | 2.20 | 0.82 | Low |
| 7 | Integration of AI into classroom management in Social Studies lessons | 2.10 | 0.91 | Low |
| 8 | Usage of AI for personalizing students’ learning experiences in Social Studies | 2.30 | 0.88 | Low |
| 9 | Extent of usage of AI for creating simulation-based activities in Social Studies | 2.40 | 0.92 | Low |
| 10 | Usage of AI-powered tools for data analysis in Social Studies research | 2.50 | 0.82 | Low |
| **Average Mean Score** |  | **2.35** | 0.92 | Low |

Data in Table 2 revealed the mean score on the level of AI usage among lecturers in universities in South-South Nigeria. The result shows that respondents rated high on two items with mean scores of 2.70 and 2.75, while the remaining eight items were rated low. The mean scores for these items are 2.30, 2.10, 2.40, 2.20, 2.10, 2.30, 2.40, and 2.50. With an average mean score of 2.35, it can be concluded that the level of AI usage among lecturers in universities in South-South Nigeria is low.

**Question 2**

What is the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria?

**Table 3: Relationship between Lecturers' AI Usage and Implementation of the Social Studies Curriculum in South-South Nigeria**

| **Variables** | **South-South Nigeria** |  |  | **r** | **r²** | **r²%** | **Remark** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | SD |  |  |  |  |  |
| Lecturers' AI Usage | 2.91 | 0.71 |  | .212 | .045 | 4.5 | Weak Positive Relationship |
| Implementation of Social Studies Curriculum | 2.84 | 0.69 |  |  |  |  |  |

Table 3 shows the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria. The result shows that lecturers have a mean of 2.91, SD = 0.71 on AI usage and a mean of 2.84, SD = 0.69 on implementation of the Social Studies curriculum. The relationship between the two variables was r = .212, which shows a weak positive relationship. r² of .045 shows that lecturers' AI usage accounts for 4.5% of the implementation of the Social Studies curriculum. Thus, there is a weak positive relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.

**Question 3**

What is the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience?

**Table 4: Relationship among Lecturers AI Usage and Implementation of the Social Studies Curriculum Based on Teaching Experience**

| **Variables** | **0–5 years** | **6–10 years** |  **11+ years** |  **R** |  **r²** |  **r%** |  **Remark** |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean SD | Mean SD |  Mean SD |  |  |  |  |
| Lecturers' AI Usage | 2.78 0.77 | 2.89 0.73 | 2.92 0.69 |  .021 |  .0004 |  0.04 |  No relationship |
| Implementation of Social Studies Curriculum | 2.81 0.69 | 2.88 0.68 | 2.85 0.69 |  |  |  |  |

Table 4 shows the relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience. The result reveals that lecturers with 0–5 years of teaching experience have a mean of 2.78, SD = 0.77 on AI usage, and 2.81, SD = 0.69 on the implementation of the Social Studies curriculum. Lecturers with 6–10 years of experience recorded a mean of 2.89, SD = 0.73 on AI usage, and 2.88, SD = 0.68 on curriculum implementation. Those with over 11 years of teaching experience had a mean of 2.92, SD = 0.69 on AI usage, and 2.85, SD = 0.69 on implementation of the curriculum. When all teaching experience groups were combined, the correlation coefficient was r = .021, indicating no relationship between lecturers’ AI usage and the implementation of the Social Studies curriculum based on teaching experience. The coefficient of determination, r² = .0004, shows that lecturers’ AI usage accounts for only 0.04% of the variance in curriculum implementation across teaching experience levels.Thus, there is no significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience.

**Hypothesis 1**

 There is no significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.

**Table 5: Pearson r on AI usage and implementation of Social Studies curriculum**

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| --- | --- | --- |
|  |  Artificial intelligence usage | Implementation of Social Studies curriculum |
| Artificial intelligence usage | Pearson Correlation | 1 | .189 |
| Sig. (2-tailed) |  | .039 |
| N | 120 | 120 |
| Implementation of Social Studies curriculum | Pearson Correlation | .189 | 1 |
| Sig. (2-tailed) | .039 |  |
| N | 120 | 120 |

Table 5 shows the results of a Pearson correlation analysis between lecturers' Artificial Intelligence (AI) usage and the implementation of the Social Studies curriculum. The Pearson correlation coefficient (r) between these two variables is .189. This positive value indicates a weak positive correlation between lecturers' AI usage and the implementation of the Social Studies curriculum. The significance value (Sig. 2-tailed) is 0.039, which means that the correlation is statistically significant at the 0.05 level. Thus, there is a significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.

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| **Table 6: Regression analysis among lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.** |
| Model | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 150.738 | 2 | 75.369 | 3.485 | .034b |
| Residual | 2530.152 | 117 | 21.625 |  |  |
| Total | 2680.890 | 119 |  |  |  |

Table 6 shows an F value of 3.485 and a p value of 0.034. Testing at an alpha level of 0.05, the p value is less than the alpha level. Therefore, the null hypothesis which states that there is no significant relationship among lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria is rejected. This implies that there is a significant relationship between lecturers' AI usage and the implementation of the Social Studies curriculum in universities in South-South Nigeria.

**Hypothesis 2**

There is no significant relationship amongst lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience.

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| **Table 7: Regression analysis among lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience** |
| Model | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 155.640 | 3 | 51.880 | 2.383 | .073b |
| Residual | 2525.250 | 116 | 21.769 |  |  |
| Total | 2680.890 | 119 |  |  |  |

Table 7 shows an F value of 2.383 and a p value of 0.073. Testing at an alpha level of **0.05**, the p value is higher than the alpha level. Therefore, the null hypothesis which states that there is no significant relationship amongst lecturers' AI usage and the implementation of the Social Studies curriculum based on teaching experience is retained.

**Hypothesis 3**

There is no significant relationship among lecturers' AI usage and the implementation of the Social Studies curriculum based on technology literacy

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| --- |
| **Table 8: Regression analysis among lecturers' AI usage and the implementation of the Social Studies curriculum based on technology literacy** |
| Model | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 151.213 | 3 | 50.404 | 2.311 | .030b |
| Residual | 2529.677 | 116 | 21.808 |  |  |
| Total | 2680.890 | 119 |  |  |  |

Table 8 shows an F value of 2.311 and a p-value of 0.030. Testing at an alpha level of 0.05, the p-value is lower than the alpha level. Therefore, the null hypothesis which states that there is no significant relationship among lecturers' AI usage and the implementation of the Social Studies curriculum based on technology literacy was rejected. This implies that a significant relationship exists among lecturers' AI usage and the implementation of the Social Studies curriculum based on their level of technology literacy.

**Discussion of Findings**

The results reveal that the level of AI usage among lecturers is generally low. Although lecturers reported relatively higher engagement with AI tools for teaching and lesson planning, they demonstrated minimal use of AI for assessment, feedback, personalization, research, classroom management, and simulation activities. This finding aligns with the observation of Ibrahim (2024), who noted that while educators increasingly acknowledge the potential of AI, their practical application remains limited due to lack of training, infrastructure, or institutional support. Similarly, Holmes et al. (2022) reported that lecturers often lack the digital competencies required to integrate AI meaningfully into various aspects of pedagogy, leading to underutilization despite increased awareness.

The findings indicate a significant, albeit weak, positive relationship between AI usage and the implementation of the Social Studies curriculum. The weak relationship imply that other factors would be needed to combine with AI usage to make implementation of Social Studies curriculum effective. This suggests that lecturers who use AI tools, even to a limited extent, are more likely to implement curriculum content more effectively. This finding supports the argument of Sanusi et al. (2022), who emphasized that AI technologies, when applied even modestly, can foster curriculum innovation, improve content delivery, and enhance learning outcomes. Similarly, Zawacki-Richter et al. (2019) noted that the integration of AI in education is significantly associated with improved instructional methods and more efficient content management.

The findings shows that there is no significant relationship between AI usage and the implementation of the curriculum based on teaching experience. This finding implies that the number of years a lecturer has spent teaching does not significantly influence how they use AI in implementing the curriculum. This result corroborates the findings of Seufert et al. (2021), who found that while experience contributes to pedagogical wisdom, it does not necessarily translate to proficiency with emerging technologies unless supported by professional development. Likewise, Thomas (2022) emphasized that technological competence related to AI and pedagogical innovation often depend more on access and training than years of experience.

Conversely, Table 8 reveals a significant relationship between AI usage and curriculum implementation based on technology literacy. Lecturers with higher levels of technology literacy were more likely to effectively implement AI tools in the teaching of Social Studies. This result is consistent with the view of Ottenbreit-Leftwich et al. (2021), who asserted that technology integration in the classroom is largely determined by the educator’s confidence and competence in using digital tools. Also, Tseng et al. (2022) emphasized the role of technological pedagogical content knowledge (TPACK) in bridging the gap between technology use and effective curriculum delivery.

**Conclusion**

This study investigated the level of AI usage and its relationship with the implementation of the Social Studies curriculum among lecturers in universities in South-South Nigeria. Findings indicated a generally low level of AI usage, especially in areas such as assessment, personalized learning, and interactive classroom management. However, a significant relationship was found between AI usage and curriculum implementation, suggesting that AI integration, even when limited, positively influences how the curriculum is delivered. While teaching experience was not a significant factor, technology literacy emerged as a key determinant of effective AI usage. These findings underscore the need for capacity building in AI-related competencies among university lecturers to fully harness the benefits of AI for curriculum enhancement.

**Recommendations**

1. Universities should invest in targeted training programs to improve lecturers’ technological literacy and competence in applying AI tools in curriculum delivery.
2. AI-based tools and infrastructure should be made available and accessible across departments to encourage wider usage in lesson planning, assessment, and classroom engagement.
3. Curriculum developers should incorporate AI awareness and practical modules into teacher education programs to prepare future lecturers for AI-integrated instruction.
4. Institutions should provide incentives, grants, or recognition for lecturers who engage in innovative AI-driven teaching and research practices.
5. Continuous professional development workshops focused on AI integration should be organized regularly, with emphasis on practical application in Social Studies.
6. Further research should explore the specific barriers to AI adoption among lecturers, such as institutional policy, cost, or lack of technical support, to inform more nuanced intervention strategies.

**Ethical Approval:**

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

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