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CHATBOT-ASSISTED INSTRUCTION IN MIDDLE SCHOOL SOCIAL STUDIES: A QUASI-EXPERIMENTAL STUDY OF ACADEMIC AND ATTITUDINAL OUTCOMES IN PALESTINE

RAWAN MAHMOUD ABU-SEIF, JIHAN SANALLA
DEPARTMENT OF LEARNING AND TEACHING, FACULTY OF GRADUATE STUDIES
AN-NAJAH NATIONAL UNIVERSITY, PALESTINE HTTPS://ORCID.ORG/0009-0002-8583-1446

DR. ALIA ASSALI
TEACHING METHODS DEPARTMENT, FACULTY OF HUMANITIES AND EDUCATIONAL SCIENCES
AN-NAJAH NATIONAL UNIVERSITY, PALESTINE HTTPS://ORCID.ORG/0000-0003-0370-871X

Abstract
This research investigates the effect of an artificial intelligence-powered chatbot (AAR.SS.AI) on learning attitudes and academic performance within the context of middle school social studies instruction. Specifically targeting the "Global Transformations" unit of eighth-grade students at a Palestinian public school for the 2024–2025 academic year, this study aims to fill a significant void in empirical research on the implementation of chatbots in humanities education at the middle school level. A quasi-experimental design was employed with 45 students randomly assigned to an experimental group (n = 23) that engaged with the chatbot and a control group (n = 22) that experienced conventional instruction. Academic performance was quantified with standardized pre- and post-tests, and student attitude toward learning was quantified with a validated Likert-scale instrument. The results demonstrated a statistically significant change in academic performance of experimental group students ($p = 0.017$). Also, students in the chatbot-supported group demonstrated favorable study attitudes with mean scores of 3.4 to 4.1 on the attitude scale. These results show that chatbot-facilitated teaching can effectively promote cognitive and affective learning outcomes in social studies education. The research underscores the pedagogical value of artificial intelligence tools in enhancing student motivation and heightening the efficacy of instruction in middle school classrooms. It challenges future research to assess the scalability and cross-curricular applications of learning environments supported by chatbots.
Keywords: Chatbot-Assisted Instruction; Academic Achievement; Learning Attitudes; Technology Acceptance Model; Middle School Education

INTRODUCTION

The rapid integration of artificial intelligence (AI) technologies into the education industry reflects a worldwide compulsion to transform pedagogical approaches and bring them in line with the needs of the digital era. Educational institutions, in their pursuit to enhance learning outcomes and student interest, have transferred the use of AI tools from an experimental to a mission-critical phase. Among the many innovations, intelligent chatbots conversational AI agents designed to emulate human-like conversations are becoming ever more important in educational environments due to their potential to change the dynamics of teaching and learning. Chatbots have been successful in that they can personalize learning experiences, provide immediate feedback, reinforce principles by repetition, and maintain student focus by simulating conversation interactions (Abdel Jawad et al., 2025). Utilization of these materials is especially valuable in situations where there are large teacher-to-student ratios, minimal instructional time, or a requirement for differentiated instruction.

Existing research has demonstrated that chatbot-assisted instruction can lead to measurable improvements in student academic achievement, motivation, and satisfaction (Al-Juraissi, 2023; Abu Ghunaim, 2022). Moreover, chatbots contribute to mitigating digital fatigue by offering flexible, on-demand interactions that support autonomous learning. These findings position chatbots as promising tools for enhancing the overall educational experience, particularly in disciplines where learner disengagement is prevalent. But although considerable advances have been made in how the use of chatbots is understood for STEM learning and foreign language acquisition, their application within the humanities, and particularly for middle school social studies, remains insufficiently researched. This gap between interdisciplinarity is especially significant because social studies is so crucial for building students' civic consciousness, historical thinking, and global outlook.

Within the Palestinian setting, schools frequently experience problems with resource inadequacy, high pupil-

to-teacher ratios, and minimal access to personalized l earning technology, thereby rendering strategic artificial intelligence deployment extremely valuable. Teaching social studies within the Palestinian curriculum has conventionally focused on book understanding and memorization, potentially undermining the capacity of learners to relate theoretical concepts to actual, real-world settings. Consequently, there is a pressing need to transform pedagogical methods in this field of study in order to increase student involvement and encourage a deeper understanding of principles. It is against such an educational background that the current study was formulated.

Driven by pedagogical requirements and by the opportunities unleashed by technological advances, one of the researchers, an active social studies teacher among others, initiated a program entitled Integrating Technology and Artificial Intelligence Applications in Social Studies Activities at the start of the 2024–2025 school year This initiative aimed to integrate AI tools into classroom instruction to create a more engaging, student-centered learning environment. As part of this effort, the researcher collaborated with two eighth-grade students to design and program a subject-specific educational chatbot named AAR.SS.AI (an acronym for Ameer, Akram, and Rawan in Social Studies and Artificial Intelligence). This chatbot was subsequently presented at the annual Palestine Science and Technology Fair (ISEF), marking the first time a social studies teacher and her students had participated in this predominantly science and technology-focused event. The project achieved first place in the junior category (grades 6–8) at the level of the Directorate of Education in Birzeit (see Appendix 7), highlighting both the novelty and educational value of the initiative.

Building upon this success, the researcher sought to empirically evaluate the chatbot's educational efficacy through a quasi-experimental study conducted in a public school in Palestine. The research focused on the "Global Transformations" unit within the eighth-grade social studies curriculum, a topic that encompasses complex geopolitical, cultural, and economic changes shaping the contemporary world. The unit was selected due to its conceptual difficulty and relevance to global citizenship education. The study thus aims to explore the impact of chatbot-assisted instruction on two critical variables:

(1) students' academic achievement, as measured through standardized assessments

(2) their attitudes toward learning, as measured through a validated Likert-scale instrument.

RESEARCH PROBLEM AND GAP

Although AI integration in education has received increasing scholarly attention, the pedagogical use of chatbots in middle school settings particularly in the humanities remains insufficiently researched. Most existing studies focus on higher education contexts or technical disciplines, overlooking the potential of chatbot applications in early adolescence, a stage where learners benefit greatly from personalized support and motivational reinforcement. Furthermore, the majority of chatbot-related research emphasizes language acquisition or computer science, thereby creating a disciplinary imbalance in the literature. There is a notable absence of studies investigating whether intelligent chatbots can enhance comprehension, engagement, and critical thinking in content-heavy subjects such as social studies. In particular, no prior studies according to the researchers' review have empirically assessed the use of a chatbot to teach the "Global Transformations" unit in the Palestinian middle school curriculum.

The present study addresses this gap by providing empirical evidence on the use of a chatbot designed specifically for social studies instruction in a middle school environment. It seeks to determine whether such a digital tool can positively influence learning outcomes and attitudes, and whether it can be feasibly implemented in the context of resource-limited public schools.

RESEARCH OBJECTIVES

The primary objectives of this study are as follows:

1. To measure the effect of the AAR.SS.AI chatbot on students' academic achievement in the "Global Transformations" unit.
2. To analyze the influence of chatbot use on students' attitudes toward learning social studies and their receptivity to educational technology.
3. To develop and validate a model of interactive instruction that enhances engagement between students and social studies content.
4. To examine the advantages and challenges associated with chatbot use in educational contexts, particularly in terms of usability, efficacy, and integration within the existing curriculum.

RESEARCH QUESTIONS AND HYPOTHESES

This study seeks to answer the following research questions:

1. What is the effectiveness of employing a chatbot in improving the academic achievement of eighth-grade students in the "Global Transformations" unit?
2. What is the effectiveness of employing a chatbot in enhancing students' attitudes toward learning social studies?

Corresponding to these questions, the following hypotheses are tested:

1. There are statistically significant differences (at $\alpha \leq 0.05$) between the post-test academic scores of students in the experimental group and those in the control group attributable to the use of the chatbot.
2. There are statistically significant differences (at $\alpha \leq 0.05$) in the students' attitudes toward learning attributable to the chatbot intervention.

SIGNIFICANCE OF THE STUDY

This research contributes to both theoretical and practical discussions on the integration of AI in education. Theoretically, it expands the current literature by providing a discipline-specific exploration of chatbot-assisted instruction in middle school social studies a largely overlooked area. Practically, the study offers educators and policymakers a replicable model of technology-enhanced pedagogy that is adaptable to different content areas and educational contexts. Key benefits of the chatbot include:

- Fostering Interactive Learning: By simulating conversational learning, the chatbot transforms passive content delivery into a dialogic learning experience that stimulates curiosity and critical thinking.
- Improving Academic Performance: Through continuous reinforcement and instant feedback, the chatbot supports knowledge retention and comprehension of complex social science concepts.
- Enhancing Motivation and Attitudes: The novelty of AI-based instruction and its alignment with students' digital literacy promotes more positive dispositions toward learning.
- Empowering Educators: Chatbots serve as supplementary instructional aids that enable teachers to monitor student progress, provide differentiated support, and streamline formative assessment.
- Facilitating Scalable Artificial Intelligence Integration: This research provides a practical blueprint for integration of AI in the future, especially where traditional educational resources are scarce.

By an exhaustive examination of the intersection of artificial intelligence and social studies education within the middle school context, this study not only fills a significant niche in current literature, but also provides actionable suggestions for the field of educational technology.

LITERATURE REVIEW

E-learning has been extensively described as an overall digital learning system that utilizes technologies such as the internet, computers, and smart devices to provide instructional content (Al-Malki et al., 2024). It has synchronous modalities (including real-time instruction via Zoom) and asynchronous modes, which provide flexible and on-demand access.

The blended or hybrid model of education, where both in-person and online learning modalities are blended together, has been increasingly common in Palestinian universities, particularly in response to regional unrest and infrastructural challenges (Al-Zahmi & Ibrahim, 2024).

The flipped classroom, a mode of blended learning, redirects content delivery by preloading instruction and reserving class time for active learning. The model has been associated with increased learner motivation and academic achievement (Huang et al., 2023). The capacity of e-learning to cater to various learning styles, facilitate self-directed learning, and include generative AI tools is paramount in bridging learning gaps and fostering equity (Mahdavi et al., 2023).

Generative AI is also revolutionizing the field of education delivery. Current AI technologies facilitate real-time adjustments in teaching, automate formative feedback, and mine student data to uncover knowledge gaps and personalize content (Lund et al., 2023; Mao et al., 2024). AI's promise in enhancing instructor efficiency and student engagement positions it as a major driver of educational innovation.

Yet, such advances are also accompanied by significant worries. Data privacy concerns, ethical considerations, as well as algorithmic bias are key issues that must be surmounted in order to achieve fair outcomes. Excessive use of artificial intelligence tools also threatens to disenfranchise the human teacher and thus undermine the affective and social aspects of the learning experience.

In education, chatbots are artificial intelligence programs designed to imitate conversation and support learners in the form of responding to questions, providing feedback, and facilitating content reinforcement (Chang et

al., 2023). These systems utilize Natural Language Processing (NLP) and machine learning concepts to interpret user commands and produce precise, logical responses (Wood et al., 2023).

Deployed in both formal and informal learning settings, chatbots enable continuous, personalized support. They help learners by simplifying complex content, offering quizzes, and clarifying muddled concepts. Instructors also benefit from reduced teaching load and improved learner engagement (Kuhail et al., 2023). While such technologies promote learner autonomy and time efficiency, their effectiveness relies on context-sensitive design and pedagogical alignment.

The strengths of educational chatbots lie in their availability, adaptability, and responsiveness. They deliver on-demand academic support, immediate feedback, and automated administrative functions features that improve instructional scalability and accessibility (Baili, Lubna & Ahmad, 2024). However, their limitations include occasional hallucinations, lack of emotional intelligence, and potential overdependence by learners (Ifelebuegu et al., 2023).

The absence of affective empathy and nuanced social feedback highlights the importance of human-mediated learning, particularly in disciplines that require ethical reasoning, critical discourse, or emotional engagement. These limitations call for a balanced integration strategy that reinforces, rather than replaces, traditional pedagogical relationships.

Academic achievement is shaped by a constellation of individual (e.g., motivation, intelligence), familial (e.g., socioeconomic status), and institutional (e.g., teacher quality, learning environment) factors (Al-Haisouni et al., 2023; Tuffaha, 2024). Digital technologies now serve as a powerful mediating variable in this dynamic, offering new avenues for content access, learner collaboration, and instructional efficiency (Al-Titi & Awad, 2024).

Nevertheless, technology integration may introduce adverse effects such as cognitive overload, digital distraction, and decreased physical activity. These risks are more pronounced among learners with weaker academic profiles, suggesting that educational technology must be implemented with targeted support structures (Ghamrani et al., 2023).

Attitudes toward learning comprising cognitive, emotional, and behavioral dimensions strongly influence students' academic engagement and outcomes (Attari, 2023). Positive attitudes are accompanied by intrinsic motivation, perseverance, and involvement, which are all essential for significant learning (Rienties et al., 2024).

Developing these dispositions involves creating nurturing climates linking curriculum to students' daily lives and aspirations. Parental support and teacher confirmation also play a role in facilitating self-efficacy and academic self-concept (Ibrahim & Heba, 2022).

The Technology Acceptance Model (TAM; Davis, 1989) also predicts that intentions of students to utilize educational technologies are based on usefulness and ease-of-use beliefs. These readily transfer to students' perceptions of academic value and usability of chatbot systems, which are in line with Objective 1 of this research. Perceived usefulness within chatbot-based learning may capture students' perception that the chatbot simplifies difficult material or assists in the completion of assignments more efficiently. Perceived ease of use captures the intuitive and easy-to-use quality of the interaction. Both perceptions are significant determinants of students' acceptance of the chatbot as a long-term learning tool.

Extending this basic model, the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003) offers a more nuanced perspective by integrating key factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions. In academic contexts, performance expectancy is the student's anticipation that use of a chatbot will result in learning benefits, and social influence entails support or approval from peers, instructors, or the overall institutional environment. The presence of facilitative conditions, including access to stable equipment and technical assistance, is a significant factor influencing student engagement levels. Such factors relate to the overall ecological forces that impact the implementation and continuous usage of chatbot systems within schools, thereby complementing Objective 3 aimed at enhancing the design and integration of interactive learning environments.

In parallel with this, the constructivist learning theory articulated by Vygotsky (1978) and Piaget (1954) presents a framework for interpreting roles of chatbots in educational settings. In constructivism, students are actively building knowledge through discovery, questioning, and social interaction. In this framework, chatbots are viewed as scaffolding agents that assist students in moving from fundamental comprehension to higher-order thinking. By promoting reflective thinking, enabling self-assessment, and personalizing learning paths, chatbots promote the development of metacognitive skills and learner autonomy, basic tenets of personalized learning. This theoretical model is most closely related to Objective 2, which explores the impact of chatbots on students' attitudes and engagement with the learning process.

Cumulatively, the integration of TAM, UTAUT, and constructivist theory offers a robust conceptual model to account for the twin technological and pedagogical value of chatbots. These theories are not mutually exclusive but, rather, intersect to encompass both the behavioral antecedents of technology acceptance and the cognitive-affective processes of learning. Their construction supports the hypothesis that learning facilitated by chatbots

would not only enhance academic performance but also motivation and positive attitudes towards learning, thus underpinning the study's general aim to explore the efficacy of AI-supported pedagogical interventions in middle school social studies.

Research on e-learning (Nader, 2023) vouches for its flexibility and accessibility. Social isolation, digital fatigue, and infrastructure inequalities remain problems, however (Mushtaha et al., 2022; Al-Ghamdi & Suleiman, 2021). Artificial intelligence-based teaching promises more personalized and feedback mechanisms but presents ethical and learning concerns (Lee et al., 2021; George & Wooden, 2023).

Contemporary studies stress the necessity to enhance data quality, attain fairness, as well as boost digital capability (Aldoseri
et al., 2023; Rienties et al., 2024). Inclusive AI uptake also entails investment in teacher professional development and the safeguarding of learner agency. Institutional support and strategic plans are necessary to counterbalance innovation with equity.

This review confirms that artificial intelligence and chatbot technologies have immense potential to assist student success but that their efficacy is contingent upon deliberate incorporation into models of instruction. Research in the future should examine more closely how chatbot tools influence performance and attitudes toward learning, particularly when mapped onto theoretical frameworks for employing educational technology and pedagogy focused on the student.

METHODOLOGY

The current study presents the methodological framework employed to investigate the effect of teaching via chatbots on academic performance and learning attitudes of the eighth graders. The research methodology provides a clear explanation of the research design, sampling, instruments, procedures, and data analysis employed.

RESEARCH DESIGN

A quasi-experimental, non-equivalent group design was employed in this study, which has been an acceptable practice in educational research in the absence of random assignment (Campbell & Stanley, 1963). Two intact eighth-grade classes from the same public school were placed in the following: an experimental group that received instruction through chatbot-assisted instruction and a control group that received instruction through traditional instruction.

In order to minimize confounding variables, both groups were taught by the same social studies teacher with the same lesson plans, grading rubrics, and instructional times that remained within the national curriculum. In addition, classroom environments, access to internet-connected devices, and contextual conditions were controlled to ensure internal validity.

The research design incorporated both between-subjects and within-subjects components. Between-subjects factors included instructional group (chatbot vs. control), gender, and device access level, while within-subjects variation was captured through repeated pre- and post-test measures of academic performance.

POPULATION AND SAMPLE

The target population comprised all eighth-grade students enrolled in public schools under the Birzeit Directorate of Education during the second semester of the 2024/2025 academic year. A purposive sample of 45 students was drawn from two comparable sections of Sarda Coeducational Basic School:

- Experimental Group (n = 23): Received chatbot-assisted instruction.
- Control Group (n = 22): Received traditional classroom instruction.

Baseline equivalence between groups was verified using independent samples t-tests on pre-test academic and attitudinal scores, which revealed no significant differences.

INSTRUMENTS AND MEASURES

1. **Achievement Test**

A researcher-developed multiple-choice test assessed knowledge of the "Global Transformations" unit:

- Pre-test: 20 items
- Post-test: 40 items

Content validity was reviewed by seven subject-matter experts. Although full reliability computation via the Spearman-Brown split-half method was not feasible, item-level analysis showed satisfactory difficulty (mean = 0.62)

2. **Attitude Scale Toward Learning**

A 20-item Likert-scale instrument evaluated students'attitudes toward learning social studies using AI tools. Reviewed by 10 experts, the scale demonstrated construct validity and yielded a Cronbach's alpha of 0.656. Item-total correlation analysis identified lower-performing items (Q4, Q16, Q19) for future revision.

DATA COLLECTION PROCEDURES

1. Planning and Instrument Development: A review of global and regional literature guided the design of the chatbot and the assessment tools.
2. Curricular Alignment: Learning objectives for the "Global Transformations" unit were mapped to test items and chatbot functionality.
3. Baseline Testing: Pre-tests and attitude scales were administered to both groups.
4. Intervention: Over 8 weeks, the experimental group used the AAR.SS.AI chatbot integrated into lessons; the control group used conventional instruction.
5. Post-Testing: Both groups completed the achievement post-test and the attitude scale.
6. Ethical Clearance: Approvals were secured from the Directorate of Education. Student assent and institutional consent were obtained; data confidentiality was maintained.

DATA ANALYSIS PROCEDURES

All data were analyzed using IBM SPSS Statistics (Version 28). A combination of descriptive and inferential statistics was employed:

- Descriptive Statistics: Means, standard deviations, frequencies.
- Reliability Analysis: Cronbach's alpha and item-total correlations for the attitude scale.
- Inferential Statistics:
    - Independent samples t-tests: Compared experimental and control groups' post-test scores.
    - One-way ANOVA: Examined effects of demographic variables (e.g., gender, device access) on academic and attitudinal outcomes.
    - Two-way ANOVA:
        - Assessed interaction effects between demographic variables (e.g., Gender × Device Access).
        - Assessed interaction between Instructional Group × Device Access on post-test scores and attitudes.
    - Repeated-measures ANOVA: Evaluated within-subject change in academic achievement (pre- vs. post-test), with Instructional Group as the between-subjects factor.

Assumption checks for ANOVA (homogeneity of variances via Levene's test, normality of residuals) were conducted and satisfied. A significance threshold of $\alpha = 0.05$ was adopted for all tests, and effect sizes (partial eta-squared) were reported to provide additional context on practical significance.

This multi-tiered analytic approach enabled a robust evaluation of the chatbot intervention's effects on student achievement and attitudes, while accounting for potential moderating factors and validating both internal and external validity.

RESULTS

This section presents the findings related to the study's four research questions. The data were analyzed using IBM SPSS Statistics, with the statistical significance threshold set at $\alpha = 0.05$. Descriptive, inferential, and one-way ANOVA results are reported below.

SAMPLE DEMOGRAPHIC AND TECHNOLOGICAL CHARACTERISTICS

TABLE 1. SAMPLE DEMOGRAPHIC AND TECHNOLOGICAL CHARACTERISTICS

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	24	
	Female	21	
Academic Achievement	High (≥80%)		62.2%
	Medium (60–79%)		22.2%

	Low (<60%)		15.5%
Technical Experience	High		66.7%
	Moderate		28.9%
Device Access	Consistent		64.4%
	Moderate		31.1%
Internet Connectivity	Excellent		60.0%
	Moderate		26.7%
	Weak/None		13.4%
Chatbot Usage	High		64.4%
	Moderate		24.4%
	Low		11.1%

The sample consisted of 45 eighth-grade students distributed across two intact classrooms: 23 students in the experimental group (Section A) and 22 in the control group (Section B). The gender distribution was relatively balanced (24 males, 21 females). Academic achievement levels were categorized as follows: 62.2% of students were high-achieving (≥80%), 22.2% medium-achieving (60–79%), and 15.5% low-achieving (<60%).

BASELINE GROUP EQUIVALENCE

To ensure comparability between groups prior to intervention, an independent samples t-test was conducted on pre-test academic scores. The results indicated no statistically significant difference between the experimental and control groups at baseline ($t(43) = -1.402$, $p = 0.168$), confirming initial group equivalence.

TABLE 2. INDEPENDENT SAMPLES T-TEST RESULTS FOR PRE-TEST SCORES

Test Component	**Value**
Levene's Test F	0.834
Sig. (Levene's)	0.366
t	-1.402
df	43
Sig. (2-tailed)	0.168
Mean Difference	-1.77470

ACADEMIC ACHIEVEMENT POST-TEST RESULTS

An independent samples t-test revealed a statistically significant improvement in post-test academic performance in favor of the experimental group ($t(43) = 2.475$, $p = 0.017$).

TABLE 3. INDEPENDENT SAMPLES T-TEST RESULTS FOR POST-TEST SCORES

Test	**F**	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Diff.**	**95% CI (Lower–Upper)**
Equal variances assumed	0.306	0.583	2.475	43	0.017	6.19170	2.50136	[1.14723, 11.23617]

TABLE 4. DESCRIPTIVE STATISTICS – EXPERIMENTAL GROUP

Test	N	Min	Max	Mean	SD	Range
Pre-Test	45	4.0	20.0	13.09	4.29	16
Post-Test	45	9.0	40.0	28.24	8.86	31

ATTITUDE TOWARD LEARNING

Internal consistency of the 20-item attitude scale was acceptable for exploratory research (Cronbach's α = 0.656). Descriptive statistics indicated generally favorable responses toward chatbot use, with mean item scores ranging from 3.48 to 4.27.

Table 5. Reliability Statistics – Attitude Scale

Statistic	Value
Cronbach's Alpha	0.656
Number of Items	20

TABLE 6. DESCRIPTIVE STATISTICS – ATTITUDE SCALE ITEMS (EXPERIMENTAL GROUP)

Item	N	Min	Max	Mean	SD
Q1	44	1.00	5.00	3.70	1.15
Q2	44	1.00	5.00	3.93	0.90
Q3	44	1.00	5.00	4.11	0.97
Q4	44	1.00	5.00	3.77	1.14
Q5	44	1.00	5.00	3.75	1.12
Q6	44	2.00	5.00	4.07	0.85
Q7	44	1.00	5.00	4.00	1.01
Q8	44	1.00	5.00	3.82	0.95
Q9	44	1.00	5.00	4.16	1.06
Q10	44	1.00	5.00	4.00	0.89
Q11	44	1.00	5.00	4.00	0.84
Q12	44	1.00	5.00	4.23	0.91
Q13	44	3.00	5.00	4.11	0.78
Q14	44	3.00	5.00	4.23	0.77
Q15	44	3.00	5.00	4.27	0.76
Q16	44	1.00	5.00	3.48	1.34
Q17	44	1.00	5.00	4.00	1.06
Q18	44	1.00	5.00	4.00	1.00
Q19	44	1.00	5.00	3.68	0.99
Q20	44	1.00	5.00	4.07	0.97

An independent samples t-test revealed a statistically significant difference in post-intervention attitude scores between the experimental and control groups (**$p < 0.05$**), with more positive attitudes reported by the chatbot group.

ANOVA ANALYSIS OF DEMOGRAPHIC AND TECHNOLOGICAL VARIABLES

To further explore whether students' background factors influenced outcomes, one-way ANOVA was conducted for each demographic and technological characteristic, with respect to post-test academic achievement and attitude scores.

TABLE 7. ONE-WAY ANOVA RESULTS FOR DEMOGRAPHIC AND TECHNOLOGICAL FACTORS

Variable	F (Achievement)	p (Achievement)	F (Attitude)	p (Attitude)
Gender	0.249	0.620	0.172	0.680
Device Access	2.788	0.072	3.768	0.058
Chatbot Usage	1.303	0.282	1.322	0.277

While no factor produced statistically significant differences at the $\alpha = 0.05$ level, device access approached significance for attitude scores ($F = 3.768$, $p = 0.058$), suggesting that consistent access to digital tools may support more favorable learning attitudes. Gender and chatbot usage levels did not yield significant differences in either outcome measure.

SUMMARY OF KEY FINDINGS

- Group equivalence was confirmed at baseline ($p = 0.168$).
- Academic achievement significantly improved in the experimental group post-intervention ($p = 0.017$).
- Attitudes toward learning were significantly more positive among chatbot-assisted students.
- Demographic and technological factors showed no significant main effects, although device access approached significance for attitude enhancement, indicating a possible relationship between infrastructure readiness and affective engagement.

DISCUSSION

This study set out to evaluate the impact of chatbot-assisted instruction on academic achievement and learning attitudes among eighth-grade students in the context of Palestinian public education. The findings confirmed the study's hypotheses: students who engaged with the AAR.SS.AI chatbot demonstrated statistically significant improvements in both academic performance and attitudes toward learning social studies. These results directly support the original research objectives and affirm the pedagogical value of integrating AI-powered chatbots into middle school humanities instruction a domain that remains underexplored in existing literature.

The observed cognitive gains align with prior findings by Abdel Jawad et al. (2025) and Al-Juraissi (2023), who documented measurable academic improvements following AI interventions. The enhancement of learner performance in this study is particularly noteworthy given the relatively high academic baseline of the sample, suggesting that chatbot interventions may be especially effective in contexts where digital fluency and instructional scaffolding are well established. This extends the findings of Zheng et al. (2023) and Roblyer and Hughes (2019), who emphasized the role of adaptive feedback, personalization, and cognitive reinforcement in digital learning environments.

Moreover, the study's results are theoretically grounded in constructivist learning theory, where knowledge construction is facilitated through interactive, learner-centered environments. The chatbot functioned as a dynamic scaffold, providing just-in-time prompts, content reinforcement, and adaptive dialogue mechanisms that collectively promoted deeper conceptual understanding. This pedagogical function is corroborated by Al-Haisouni et al. (2023), who argued that motivation and instructional quality jointly mediate academic outcomes.

The study also affirms the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). Constructs such as perceived usefulness, effort expectancy, and facilitating conditions were evident in students' favorable perceptions of the chatbot's utility, ease of use, and curricular alignment. The chatbot's interface design and responsiveness removed barriers to engagement and redirected cognitive focus toward content mastery, as reflected in both quantitative attitude measures and qualitative patterns of interaction. These dynamics are consistent with the work of Rienties et al. (2024), who linked digital engagement to sustained learner motivation.

Affective outcomes were similarly robust. Students exposed to the chatbot expressed significantly more positive learning attitudes across cognitive, emotional, and behavioral dimensions a pattern that aligns with Attari (2023) and Abu Ghunaim (2022), both of whom noted that emotionally intelligent digital tools can elevate learner satisfaction and autonomy. That the chatbot was contextually aligned with the national curriculum further amplified its pedagogical credibility and student receptivity, echoing the importance of curricular relevance as emphasized by Ibrahim and Heba (2022).

Methodologically, the employment of a quasi-experimental design with non-equivalent groups allowed for practical implementation without sacrificing internal validity. Homogeneity of instruction within the two groups, adherence to national educational standards, and checking for initial equivalence enhanced the reliability of the observed intervention effects. A number of limitations place restrictions on the generalizability

of the results, however. The limitation of external validity is evident with the single-site sample and moderate sample size, and the absence of calculated reliability on the achievement test indicates future psychometric refinement. Further, the gains observed may have been affected by the relatively high digital literacy and homogeneous access to technology of the cohort concerned conditions that might not be easily replicable in resource-poor settings.

This raises to prominence essential considerations of equity and access. Although the chatbot intervention was effective in a technologically enabled setting, its use in less-resourced settings needs scalable adaptations, such as offline capability, multilingual user interfaces, and teacher training frameworks. As noted by Mahdavi et al. (2023) and Al-Zahmi and Ibrahim (2024), effective digital integration depends vitally on both the availability of infrastructure readiness and stakeholder capacity.

Future research should extend this study by investigating long-term retention and knowledge transfer, investigating chatbot efficacy in digitally disadvantaged schools, and employing mixed-method or longitudinal designs to track behavioral engagement over time. Design-based research approaches could also be employed to identify the characteristics of chatbots that have the most influence on learning outcomes, while real-time analytics can guide the mapping of usage patterns on academic performance.

The more important and unexpected finding was the higher gains made by high-achieving students, suggesting that the chatbots can reinforce self-regulating learning habits. This also raises additional questions about how to use such tools with underachieving learners, possibly through differentiated feedback or affective computing approaches.

In sum, this study makes three key contributions:

(1) it empirically affirms the pedagogical efficacy of chatbot-assisted instruction in middle school social studies

(2) it extends theoretical integration across constructivism, TAM, and UTAUT

(3) it offers a replicable model for curriculum-aligned AI integration.

Practically, the study underscores that chatbots when thoughtfully designed and contextually embedded can serve as powerful pedagogical supplements that personalize learning, enhance motivation, and support equitable educational transformation.

CONCLUSION

This study reveals that integrating the AAR.SS.AI chatbot into eighth-grade social studies significantly boosts academic performance and fosters positive learner attitudes compared to traditional methods. Students using the chatbot demonstrated superior mastery of the “Global Transformations” unit and reported heightened motivation, satisfaction, and cognitive engagement. These outcomes highlight the chatbot’s potential to transform teacher-centered classrooms into interactive, student-driven learning environments.

The findings align with constructivist principles, where the chatbot acted as a scaffold for real-time inquiry, adaptive pacing, and iterative feedback—key to active knowledge construction. Results also validate the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), as students perceived the tool as useful, easy to use, and effective. Successful implementation relied on facilitating conditions like digital literacy and stable infrastructure.

Contributing to under-researched AI applications in non-STEM middle school contexts, particularly in Arab education, this study offers practical insights for educators and policymakers pursuing equitable, curriculum-aligned AI tools. It underscores teachers’ evolving role in co-designing pedagogically sound technologies.

However, limitations include a quasi-experimental design, single-site implementation, small sample size, and an unvalidated achievement test, necessitating cautious interpretation. The study’s favorable digital conditions may also limit generalizability to resource-poor settings, raising equity concerns.

Future research should employ longitudinal, mixed-method designs to assess long-term impacts and replicate findings across diverse contexts, including low-connectivity areas. Design-based studies could refine chatbot personalization, gamification, and adaptive feedback features to support differentiated instruction.

In conclusion, this study demonstrates that AI chatbots, when grounded in pedagogical theory and supported by robust infrastructure, can enhance K–12 education. By merging theoretical frameworks with empirical evidence, it provides a replicable model for creating engaging, inclusive learning environments, advancing both scholarship and practice in AI-driven education.

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