

# **A Safe Place for Productive Struggle: Using AI to Strengthen Year 6 Girls' Self-Efficacy in Mathematics**

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## **Abstract**

This action research project investigated the impact of an AI-generated problem-solving platform on the mathematical self-efficacy of 24 Year 6 girls at Notting Hill and Ealing High School over twelve weeks. To foster independent problem-solving, teacher intervention was deliberately minimised, and the platform's design omitted gamified metrics such as timers and scores; instead providing scaffolded discussion prompts for collaborative pairings and worked examples. Data were collected and triangulated through surveys, video interviews, focus groups, observations, and student reflections. Findings suggest an increase in self-efficacy, attributed to reduced social comparison, a shift from speed-based to perseverance-based success, and the development of autonomous problem-solving habits supported by collaborative practices. The results highlight that teacher-designed AI-generated learning environments can address gendered barriers to girls' self-efficacy in mathematics. Furthermore, this action research project offers broader pedagogical implications for mathematics teachers, highlighting how collaborative practice and activity design can create safer spaces for productive struggle to build girls' self-efficacy.

## Glossary

**AI-Generated:** Content, including text, images, audio, video, and computer code, that is produced by artificial intelligence models rather than directly created by a human.

**Artificial Intelligence:** A branch of computer science that develops systems capable of performing tasks that normally require human intelligence.

**CanvaAI:** Canva's artificial intelligence application.

**Dialogic Collaboration:** The process of joint inquiry and mutual understanding between students, rather than simple information exchange.

**GDST (Girls' Day School Trust):** A family of twenty-three independent schools and two academies across the UK.

**Key Stage 2 (KS2):** Referring to the UK National Curriculum for ages 7–11 in England.

**Key Stage 3 (KS3):** Referring to the UK National Curriculum for ages 11-14 in England.

**Productive Struggle:** The process of engaging in challenging, complex tasks that stretch a learner's thinking.

**Self-Confidence:** A feeling of trust in one's abilities, qualities, and judgment.

**Self-Efficacy:** The personal belief in one's capability to achieve specific goals within a specific context.

**Strengthen:** To become stronger. In this project, "strengthen" refers to the development of more stable and resilient self-efficacy beliefs when students encounter mathematical challenge.

**Transactional Collaboration:** Collaboration focused on exchanging answers or information rather than developing shared understanding.

**Upward Social Comparison:** When individuals compare themselves to others perceived as more successful as a measure of their own success.

## **A Safe Place for Productive Struggle: Using AI to Strengthen Year 6 Girls' Self-Efficacy in Mathematics**

The extent to which artificial intelligence (AI) is implemented in education is widely contested. In this evolving digital landscape, teachers at girls' schools are required to evaluate the effectiveness of AI tools, yet practical guidance for classroom implementation is limited. At the time this research project was conducted, the UK Government guidance on data consent and generative AI was yet to be released (UK Government, 2025), and within the Girls' Day School Trust, ongoing, careful evaluation was taking place to consider how AI may be utilised to enhance girls' education whilst minimising risk. Therefore, the International Coalition for Girls' Schools' action research topic, "Navigating the AI frontier in Girls' Schools," provided an invaluable opportunity to contribute to evidence-informed research on the impact of AI on girls' education.

In primary education settings, growing digital access offers significant potential for personalised learning, reduced teacher workload, and innovative teaching strategies (Awang et al., 2025). However, these benefits are balanced by concerns regarding safeguarding, data protection, and the potential impact on girls' socio-emotional development (Smith & Gajjar, 2024). My research involved Year 6 girls using a teacher designed platform to strengthen their self-efficacy in mathematical problem-solving. This focus emerged from reflection on two evolving themes in my teaching practice: a recognition of the gendered factors that undermine girls' self-efficacy in mathematical problem-solving (Good et al., 2012; Scala et al., 2025) and how educators might counteract the potential decline in collaborative skills as learning becomes increasingly digitised and gamified (Bohrnstedt et al., 2024).

These factors led me to my research question: How does the use of an AI-generated problem-solving platform strengthen the mathematical self-efficacy of Year 6 girls? Over 12 weeks, girls participated in collaborative problem-solving sessions on the AI-generated platform. Metacognitive strategies, including discussion prompts, worked examples, and iterative attempts, were intentionally integrated into the platform's design. Simultaneously, competitive elements such as timers and scoreboards were removed to limit opportunities

for girls to compare themselves with others, and teacher scaffolding through intervention was deliberately minimised to foster autonomous problem-solving practice.

Mertler's (2025) action research process provided a suitable methodological framework for this investigation, providing a rigorous structure for collecting, triangulating, and analysing qualitative data and prioritising the girls' voices in response to the AI space.

### **Literature Review**

The developments in artificial intelligence (AI) are driving a transformative shift in traditional pedagogical methods, with AI tools providing customised, interactive learning experiences, and immediate feedback (Awang et al., 2025). However, this shift occurs amid the continued underrepresentation of women in AI fields (Bohrnstedt et al., 2024; Haydarova, 2025; Smith et al., 2025). Despite similar levels of attainment between genders in mathematics, the self-efficacy gap widens as girls progress through education (Scala et al., 2025). Given the link between the development of a positive mathematical identity and reported self-efficacy, where girls' belief in their abilities directly affects their motivation to participate in mathematics (Bohrnstedt et al., 2024), educators need to investigate the potential of AI in early education to strengthen girls' confidence in mathematical problem-solving.

Although girls achieve similarly to boys in mathematics, their reported self-efficacy is often lower (Bohrnstedt et al., 2024). Stereotypes that assert mathematical ability is more innate in boys contribute to a gendered confidence gap (Smith et al., 2025), with Zander et al. (2020) arguing that societal assumptions reduce girls' likelihood of seeing themselves as capable problem-solvers and, in turn, contribute to the long-term underrepresentation of women in STEM fields. Given beliefs in gendered ability become prevalent in early secondary education (Scala et al., 2025; Smith et al., 2025), primary education is, therefore, a vital stage for intervention. Consequently, investigating the potential of AI to build girls' mathematical self-efficacy may help mitigate the impact of persistent gendered stereotypes.

Problem-solving is central to deepening mathematical understanding; however, many pupils struggle to decode the actions required by a problem, which can damage confidence

and weaken students' mathematical identity, particularly in girls (Bohrnstedt et al., 2024; Klang et al., 2021). Bohrnstedt et al. emphasise that effective problem-solving requires both the skill to decode challenging problems and the will to persevere with them. Teachers, therefore, play a vital role in supporting students by delivering dual scaffolding that models both the process and content of problem-solving (Klang et al., 2021). With the ability to personalise learning, purposeful AI-designed environments open opportunities for teachers to develop both skills and resilience in the girls they teach through problem-solving tasks.

For girls, problem-solving poses emotional challenges, requiring perseverance and self-regulation when solutions are not easily attainable (Klang et al., 2021). Zander et al. (2020) found that girls reported lower self-esteem than boys after completing mathematics assessments when they did not know their results, suggesting that a heightened sensitivity to failure and delayed feedback may negatively affect a girl's willingness to approach problem-solving. Peer collaboration, timely feedback, and the presence of supportive role models, particularly female ones, may help foster resilience in shared problem-solving environments (Bohrnstedt et al., 2024; Klang et al., 2025). Teachers should thus design AI platforms with girls' emotional responses in mind, creating spaces that reduce anxiety and nurture self-efficacy in mathematics.

While AI is often viewed as a transformative tool in education (Awang et al., 2025), teachers must approach its integration into girls' learning with reasonable caution. Since the AI sector remains male-dominated, there is a risk that existing gender inequities will be replicated if educators do not facilitate girls' participation in AI fields (Haydarova, 2025). Haydarova argues that, due to the underrepresentation of women in AI, girls' sense of belonging in the field may be low. Furthermore, many educators face personal barriers to their engagement with AI, including limited digital competence and data protection concerns (Li, 2025). Teachers are, however, critical in modelling inclusive uses of AI and in demonstrating AI as a tool that can extend learning rather than replace a girl's own effort (Smith & Gajjar, 2024). Therefore, inclusive uses of AI in STEM education are essential, not

only to inspire participation but also to signal that AI can be an inclusive and empowering resource for girls.

A developing use of generative AI is the design of tailored game-based learning programmes by teachers for specific goals. Such platforms can be designed to enhance mathematical confidence by fostering reasoning, metacognition, and self-regulation, while mitigating the anxiety typically associated with traditional learning (Ergül & Doğan, 2022). Hamari et al.'s (2016) research indicated that when challenge and skill are well balanced, learners are more likely to persevere and feel capable. For girls, who often report higher levels of maths anxiety, AI-designed platforms that provide structured, immediate feedback and adaptive levels of challenge may help nurture confidence and a sense of control over their learning (Scala et al., 2025). While Smith and Gajjar (2024) caution that AI learning risks reducing independence and development of collaborative skills, Awang et al. (2025) emphasise the need to explore further how generative AI tools for gamification can complement instructional AI systems designed for scaffolding and feedback. Future research should investigate how teachers can utilise AI to develop game-based learning that incorporates the collaborative and emotional aspects of mathematical problem-solving, thereby reducing competitive metrics between girls and enhancing girls' self-efficacy.

Ultimately, AI holds considerable potential to enhance girls' self-efficacy in mathematics by providing adaptive scaffolding, supportive feedback, and inclusive learning environments (Awang et al., 2025; Scala et al., 2025). Such tools can strengthen resilience during problem-solving and reduce anxiety, particularly when designed to require peer collaboration (Ergül & Dogan, 2022; Hamari et al., 2016; Klang et al., 2021). The challenge remains in ensuring that AI use in the classroom supports the socio-emotional foundations of problem-solving and actively challenges stereotypes that discourage girls from identifying as capable mathematicians. On this basis, my action research investigated the impact of a teacher-designed AI-platform on the self-efficacy of Year 6 girls' mathematical problem-solving.

## **Research Context**

Notting Hill & Ealing High School (NHEHS) is an independent girls' day school located in West London. NHEHS promotes a "no either-or" ethos, balancing high academic ambition and a supportive, nurturing environment in which girls can succeed. The school is part of the Girls' Day School Trust, which aims to provide a progressive, girls-first approach to education.

This study was conducted over 12 weeks during the 2025 autumn term at NHEHS, where I am currently a Year 6 class teacher and Junior School Digital Strategy Lead. The participants comprised my form group of 24 students aged 10–11 years old. Although the cohort was new to me, my role as their class teacher facilitated the rapid development of strong pastoral relationships, which were necessary for conducting action research. The research took place alongside the implementation of a new mathematics curriculum across the Junior School in response to pupil and teacher feedback. As the conclusion of KS2, Year 6 offered a critical period to investigate girls' mathematical self-efficacy before gender gaps typically emerge in KS3.

The project was conducted across the entire Year 6 cohort to mitigate potential advantages or disadvantages between student groups. Permission to participate was gained from parents through an "opt-out" letter. A further "opt-in" letter was sent for photo and video permission in line with NHEHS policy. All data collected from students were anonymised.

### **The Action**

The problem-solving sessions took place on a custom digital platform developed using CanvaAI's "code" feature. To ensure curricular alignment, the platform's content was updated weekly, informed by the KS2 National Curriculum (Department for Education, 2013) and formative assessment data from the students' mathematics lessons. I conducted whole-class discussions on artificial intelligence to prepare students for their problem-solving sessions. These discussions appeared to reframe the girls' perception of AI from a way to avoid cognitive effort towards a valuable tool for enhancing their learning.

Each session was structured to prioritise scaffolding and self-regulation, both of which are key to strengthening self-efficacy in problem-solving. The programme provided

four structured discussion prompts for each question, alongside multiple-choice options. To support independent learning, the platform utilised an iterative, tiered feedback system: an initial incorrect response triggered a “hint” or “method” prompt, while a second incorrect attempt provided a fully worked example and the correct solution. In accordance with school policy, students self-assessed their progress through a “tick or fix” process. To foster a safe space for productive struggle, questions were randomised, and the platform withheld data regarding timing or scores from pupils.

Implementation of the platform followed a consistent weekly routine. Students were randomly assigned a new partner for each 40-minute, student-led session. To record the collaborative process, each student maintained a workbook with a split-page layout: one side for recording their peer discussion in response to the prompts, and the other for solving the primary mathematical questions. Students also recorded their reflections after each session in the workbooks; therefore, the workbooks were anonymised. During these sessions, teacher intervention was systematically withdrawn, ensuring the focus remained on student autonomy and peer interaction.

While the platform was designed for autonomy, the AI-generated content occasionally produced inconsistencies or inaccurate methods. Rather than hindering the sessions, these instances were leveraged as critical learning moments. Students were encouraged to evaluate the epistemic reliability of AI and were required to cross-reference the AI’s suggestion with their own mathematical reasoning, thereby furthering their self-efficacy.

### **Data Collection**

Throughout the twelve-week research project, a mixed-methods approach was employed to gather both qualitative and quantitative data. In line with Mertler (2025), triangulation was utilised to ensure data consistency across multiple data collection methods, including surveys, video interviews, classroom observations, and pupil reflections.

Quantitative data were collected to assess changes in girls’ self-efficacy and attitudes towards problem-solving in mathematics, while qualitative data focused on students’

perceptions of self-efficacy and emotional responses to problem-solving. Baseline data were collected prior to the intervention through a survey comprising closed- and open-ended questions. These questions explored girls' enjoyment of mathematics, self-efficacy in independent and collaborative problem-solving, and self-identification as mathematicians.

During the implementation phase, students maintained anonymised problem-solving workbooks to record mathematical discussions and their reflective entries. These journals served as a continuous source of qualitative data to track progress in self-efficacy and pupil attitudes. A midpoint survey was conducted in Week 6 to monitor interim trends in pupil attitudes. Simultaneously, classroom observations were used to document student engagement, persistence, and collaboration for comparison against journal entries. Semi-structured focus groups and video interviews were conducted to examine girls' responses to the problem-solving sessions. A post-intervention survey was administered alongside closing pupil-voice interviews to allow the girls to express their views on the project and to directly compare levels of self-efficacy in mathematical problem-solving to the baseline data.

Reflexivity was maintained throughout the project by obtaining colleagues' feedback and revisiting early interpretations of the data with a critical friend to ensure the data analysis remained credible.

### **Data Analysis**

Data were analysed using Mertler's (2025) inductive "organise, describe, interpret" framework. Quantitative survey data were compared across pre-, mid-, and post-action stages using descriptive statistics. Open-ended responses were analysed thematically to enrich the numerical findings. Qualitative data from journals, interviews, focus groups, and observations were coded and analysed thematically. Data from the pre-, mid-, and post-action stages of the intervention were used to track changes in girls' self-efficacy, attitudes towards problem-solving, and engagement in collaborative work.

## Discussion of Findings

From my data analysis, I identified key findings, which I developed into four themes.

### **AI-Mediated Learning Mitigates Social Comparison to Build Girls' Self-Efficacy**

The AI platform mitigated peer-to-peer comparison by creating a learning environment focused on personal growth. Before the intervention, many girls utilised upward social comparison by using peers' speed of completion as a metric of their own ability. When Student I was problem-solving, for example, she felt “sad and worried [because] everyone else looks like they can do it.” Being “slower” was equated with being “bad” at mathematics, whilst participation in an “extension group” correlated with success. Consistent with Smith et al.'s (2025) research, the girls' identities as mathematicians appeared to be shaped less by conceptual understanding than by their perceptions of their standing within class hierarchies.

The introduction of a semi-anonymous AI-mediated learning space disrupted such a comparison. During problem-solving sessions, many girls reported that they felt “relaxed,” indicating a reduction in performance anxiety. Survey responses attributed this to an absence of time pressure, the decoupling of tasks from formal mark collection, and randomised questions. Anonymity removed visible indicators of progress that typically trigger peer-to-peer judgement, creating psychologically safe conditions for productive struggle (Scala et al., 2025). Classroom interactions shifted from competitive to collaborative, where partners felt “metaphorically in the same boat” (Student W). Reduced competitive pressure increased cognitive engagement and girls reported feeling less “judged” during sessions.

Over time, a semi-anonymous AI-mediated learning space facilitated a transition toward more internalised forms of self-efficacy. In the final survey, 21 girls reported feeling confident in problem-solving, noting the AI was “not judging [them]” (Student I). The platform became a “safe” space for risk-taking, with success increasingly defined by “willing[ness] to try” (Student D). The ability to “try again” (Student P) without external monitoring normalised iterative attempts and reframed mistakes as part of the learning process. In this way, the intentional design of AI-mediated spaces to mitigate social comparison supported the development of resilient mathematical self-efficacy among the girls.

### **Process Over Product: AI-Mediated Scaffolding Shifts Girls' Perceptions of Success**

AI hints and methods reshaped how pupils defined success in mathematics, shifting the focus from speed to greater metacognition. Initially, many girls operated within a performance-oriented framework in which success was equated with “not making too many mistakes” and “working stuff out quickly” (Student X). Only four girls originally identified themselves as “good” at mathematics, highlighting fragile efficacy beliefs tied to error avoidance. Consistent with Bohrnstedt et al., (2024), challenge was perceived as a threat to emerging mathematical identities rather than as an opportunity for growth.

AI scaffolding mitigated this “fear of failure” by fostering the self-regulation vital to problem-solving (Ergül & Doğan, 2022). Journal reflections and surveys indicated that a “willingness to have a go” increasingly replaced speed as a marker of success. Girls reported reduced “panic and stress” (Student H) as the platform created a safe place for error, and nine girls noted AI-generated hints and methods that encouraged risk-taking. Scaffolding support functioned as a “safety net,” reframing errors as informative rather than evaluative.

Consequently, success was framed as a process rather than a single outcome. Girls described “trying before asking” (Student T), signalling greater autonomy and persistence. Aligning with Hamari et al.’s (2016) research, girls increasingly valued methodological exploration over speed, using the platform’s iterative structure to “try out different methods” (Student W). Participant perspectives shifted from a focus on substantive knowledge toward metacognitive perseverance, with 14 girls reporting attempting complex problems they would have previously avoided. By decoupling speed from ability, the pressure of “not being last” was replaced with the reflective self-efficacy of knowing “that I can try” (Student U).

### **AI-Sponsored Dialogic Collaboration Strengthens Girls' Self-Efficacy**

Structured AI discussion prompts shifted collaboration from transactional “finding the answer” to deepening mathematical thinking. Before the intervention, girls held contradictory attitudes towards collaborative problem-solving. While all but one girl reported higher confidence when solving problems with peers, written reflections indicated that this

confidence was contingent on their partner's perceived confidence. Student K and Student Q both expressed frustration when “slower” partners required support. Girls who entered the project with high levels of self-efficacy reported disliking pair-work, with journal reflections disclosing that discussion “slowed them down”. Collaboration was transactional; partners were either a resource or a hindrance.

AI prompts reframed mathematical agency as collective, directly challenging concerns that AI may limit collaborative skills (Smith & Gajjar, 2024). Success became associated with “listen[ing] and collaborat[ing]” (Student X). Student F articulated collective efficacy as “having two minds” to “conquer all of maths.” Effective prompts encouraged reflection and metacognitive thinking; when prompts were unclear, discussion quality decreased. Nevertheless, AI enabled multiple simultaneous high-level discussions, which a single teacher could not have scaffolded. Prompts served as a metacognitive scaffold, encouraging students to “ponder” questions they would previously have answered “briskly” (Student D).

Dialogic collaboration strengthened individual self-efficacy. As predicted by Klang et al. (2021), peer discussion supported resilience in problem-solving. Both joint and individual self-efficacy rose during the study, with the number of “extremely confident” solo learners tripling by the end of the project. By embedding dialogic peer collaboration, the AI learning environment fostered a culture where debating ideas and “diving deeper” (Student P) became a key marker of self-efficacy in problem-solving.

### **Strategic Teacher Withdrawal When Using AI Increases Girls' Self-Efficacy**

Reduced teacher proximity catalysed a shift from dependence to resilient self-efficacy. In contrast to Smith and Gajjar's (2024) findings, AI integration strengthened student agency. Initially, many girls relied on the teacher's presence for support in completing challenging tasks. For these girls, help-seeking was primarily a stress-regulation strategy rather than a cognitive intervention. Student B noted she would simply “put my hand up and the teacher, um, helps me.” This attitude was compounded by distrust of the AI's epistemic reliability, with Student J fearing that the “[AI] could make mistakes.”

As the intervention progressed, reassurance-seeking transitioned to self-regulation. By the final survey, 15 girls viewed AI hints as dual scaffolds (Klang et al., 2021) for independent learning rather than as a replacement for teachers. Girls became active agents: working without the support of a teacher was “challenging at times but ... made me feel really independent” (Student Q). Classroom culture moved from a space where the “teacher help[s] us with everything” to one defined by “independence and collaboration” (Student I).

Autonomy enabled pupils to authenticate self-efficacy. Student S progressed from feeling “upset” by the absence of support to “more confident” in her abilities, reflecting a strengthening of self-efficacy when skill and challenge are appropriately balanced (Hamari et al., 2016). Independence was no longer interpreted as abandonment, but as an opportunity to exercise agency over cognitive processes. Girls increasingly described this autonomy as “freedom” (Student L), signalling a reframing of mathematical identity in which self-efficacy emerged from self-directed problem-solving rather than external validation.

### **Conclusions**

The findings of this study indicate that a teacher-designed AI-mediated learning environment strengthens girls’ mathematical self-efficacy by developing growth-oriented mathematical identities. By disrupting ingrained assumptions of self-efficacy and mitigating the anxieties caused by upward social comparison, the AI-environment created a ‘psychologically safe’ space for productive struggle. The shift from prioritising speed to valuing metacognitive processes, coupled with the transition from teacher-dependence to autonomous agency, highlights how teacher-designed AI platforms can foster self-efficacy. Ultimately, the data suggest that when AI is used to scaffold both dialogic collaboration and strategic independence, it empowers girls to redefine success as a collective and iterative journey rather than a singular, high-stakes outcome.

While this research provides valuable insights into how AI can be used to develop self-efficacy in the mathematics classroom, several limitations must be acknowledged to provide a realistic framework for understanding the girls’ progress. First, the epistemic reliability of the AI-platform posed a technical constraint; while programme errors

occasionally fostered critical thinking, they also risked disrupting the scaffolding necessary for some learners. Second, the sample size and duration of the action research project mean that while the shift in self-efficacy was significant, its long-term stability remains to be seen. Furthermore, because students were simultaneously participating in their regular mathematics curriculum, their growing self-efficacy cannot be viewed in isolation from other pedagogical influence or external classroom variables.

Any future iterations of this project will be conducted with careful consideration of GDST guidance and frameworks. By aligning with the Trust's evolving digital and pedagogical strategies, teachers can utilise AI to create safe learning environments for productive struggle. Reframing definitions of success in maths for girls is essential to narrowing the gendered self-efficacy gap. Although the learning environment for this project was facilitated by AI, the implications for increasing mathematical confidence are not tied exclusively to a digital space. Intentionally structuring girls' discussions, limiting metrics for social comparison, and reducing teacher-led problem-solving are principles that will be replicated in my future teaching practice.

In my future classrooms, I will continue exploring how activity design and educational technology can support girls' socio-emotional responses to learning. However, several unresolved questions remain outside the scope of this research, including the impact of AI platforms on the pupil-teacher relations and the long-reliability of automated assessment. As AI becomes more embedded in education, it is essential that the specific needs and experiences of girls remain at the centre of the debate regarding the role of AI in the classroom.

### **Reflection Statement**

Being involved in research that positions girls at the centre of the AI debate has been a significant professional milestone. This project was conducted against a backdrop of emerging government guidance and ongoing GDST consultations regarding AI's role in schools. Within this shifting landscape, I remain committed to ensuring girls are not merely passive consumers of AI, but critical evaluators of its impact. By demystifying the

technology, I hope to have provided them with the agency required to participate in the debate over an equitable digital future.

The GARC fellowship has strengthened my capacity, both as a class teacher and as the Junior School Digital Strategy Lead, to contribute to research-informed policy. Navigating this study during a period of national and Trust-wide transition has been invaluable, allowing me to share practical, AI-driven approaches with GDST colleagues and collaborate with peers on the AI frontier.

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## References

- Awang, L. A., Yusop, F. D., & Danaee, M. (2025). Current practices and future direction of artificial intelligence in mathematics education: A systematic review. *International Electronic Journal of Mathematics Education*, 20(2), em0823. <https://doi.org/10.29333/iejme/16006>
- Bohrnstedt, G. W., Zhang, J., Li, M., Ikoma, S., Park, B. J., & Broer, M. (2024). Mathematics motivation and mathematics performance: Does gender play a role? *AERA Open*, 10, 23328584241298272. <https://doi.org/10.1177/23328584241298272>
- Department for Education. (2013, September 11). *Mathematics programmes of study: key stages 1 and 2. National Curriculum in England*. [https://assets.publishing.service.gov.uk/media/5a7da548ed915d2ac884cb07/PRIMARY\\_national\\_curriculum\\_-\\_Mathematics\\_220714.pdf](https://assets.publishing.service.gov.uk/media/5a7da548ed915d2ac884cb07/PRIMARY_national_curriculum_-_Mathematics_220714.pdf)
- Department for Education. (2025, August 12). *Generative artificial intelligence (AI) in education*. <https://www.gov.uk/government/publications/generative-artificial-intelligence-in-education/generative-artificial-intelligence-ai-in-education>
- Ergül, E., & Doğan, M. (2022). Using game-based learning in place value teaching in primary school: A mixed-methods Study. *International Journal of Progressive Education*, 18(5), 1–17. <https://doi.org/10.29329/ijpe.2022.478.1>
- Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology*, 102(4), 700–717. <https://doi.org/10.1037/a0026659>
- Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2016). Challenging games help students learn: An empirical study on engagement, flow, and learning. *Computers in Human Behavior*, 54, 170–179. <https://doi.org/10.1016/j.chb.2015.07.045>
- Haydarova, K. (2025). The role of women in modern artificial intelligence and robotics. *International Journal of Artificial Intelligence*, 1(3), 716–721. <https://inlibrary.uz/index.php/ijai/article/view/81069>

- Klang, N., Karlsson, N., Kilborn, W., Eriksson, P., & Karlberg, M. (2021, August). Mathematical problem-solving through cooperative learning—the importance of peer acceptance and friendships. *Frontiers in Education*, 6, 710296. <https://doi.org/10.3389/feduc.2021.710296>
- Li, M. (2025). Integrating artificial intelligence in primary mathematics education: Investigating internal and external influences on teacher adoption. *International Journal of Science and Mathematics Education*, 23(5), 1283–1308. <https://doi.org/10.1007/s10763-024-10515-w>
- Mertler, C. A. (2025). *Action research: Improving schools and empowering educators* (7th edition). SAGE.
- Scala, G., Di Palma, D., & Romano, G. (2025). Exploring the use of a mixed AI and embodiment teaching approach to promote self-esteem in primary students. *Journal of Inclusive Methodology and Technology in Learning and Teaching*, 5(1). <https://inclusiveteaching.it/index.php/inclusiveteaching/article/view/255>
- Smith, B., & Gajjar, D. (2024, October 7). *Artificial intelligence: Education and impacts on children and young people*. POST (UK Parliament). <https://post.parliament.uk/artificial-intelligence-education-and-impacts-on-children-and-young-people/>
- Smith, J., Fotou, N., & Sharpe, R. (2025). Changes in mathematics anxiety and mathematics confidence. *International Journal of Mathematical Education in Science and Technology*, 1–19. <https://doi.org/10.1080/0020739X.2025.2475928>
- Zander, L., Höhne, E., Harms, S., Pfof, M., & Hornsey, M. J. (2020). When grades are high but self-efficacy is low: Unpacking the confidence gap between girls and boys in mathematics. *Frontiers in Psychology*, 11, 552355. <https://doi.org/10.3389/fpsyg.2020.552355>