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Integrating Computational Thinking and STEM Pedagogy to Strengthen Special Education Teacher Self-Efficacy: Evidence from Thailand

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ABSTRACT

Special education teachers (SED) need inclusive and sustainable professional development when supporting students with sensory and functional disabilities. However, while advances have been made in the research of computational thinking (CT) and STEM (Science, Technology, Engineering, and Mathematics) education, little is known about how these initiatives are combined in SED teacher training for students with hearing and visual disabilities in low- and middle-income countries. Therefore, this study investigates STEM–CT frameworks and online social networks (OSNs) to enhance teacher self-efficacy and instructional quality. Ninety-one Thai special education teachers from 21 public schools participated in a two-week pilot-study training program focusing on collaborative digital pedagogy and experiential learning. Quantitative analyses indicated that teachers' beliefs about their own teaching self-efficacy increased significantly (Mpre = 36.74, SD = 6.78; Mpost = 45.08, SD = 4.43; t = 14.02, $p \leq .01$). Lesson plans, which were co-developed during the training, were independently evaluated at an excellent level (M = 4.77, SD = 0.27). It is argued that technology-supported, peer-collaborative training can build teacher confidence, improve instructional design, and deliver a scalable model for professional learning in special education, which can then contribute to research on disability and special education needs.

Keywords: Computational thinking, Online collaboration, Special education, STEM education, Teacher self-efficacy, Thailand.

INTRODUCTION

Disability, Inclusive Education, and Global Commitments

The inclusive and equitable education of learners with disabilities remains a global challenge, as noted in the United Nations Sustainable Development Goal 4, which advocates for education for all (Edwards Jr et al., 2024). Although there have been some gains and dividends over the years in the area of global and national legislative and policy frameworks, there remains an unmet need regarding disparities between educational opportunity and accessibility to resources to support teaching and learning for learners with disabilities and teacher readiness, especially in low and middle-income countries (Ayverdi & Avcu, 2023; UNESCO, 2020).

Learners with hearing and visual disabilities face significant educational barriers (Maesala & Ronél, 2024), including inaccessible instructional resources, unprepared educators, and inadequate integration of technology in teaching and learning (Atanga et al., 2020). The absence of technology and basic educational tools remains a drawback to sustainable growth. Therefore, educator preparation programs have the opportunity to move beyond short-term models of intervention and incorporate professional capacity development in ways that will be responsive to an ever-changing educational, professional, and technological landscape.

Teacher Self-Efficacy as a Basis to Foster Inclusive Practice

Numerous studies have highlighted the central role of self-efficacy, which refers to a teacher's confidence in their ability to plan and deliver instruction effectively, as a key factor influencing teaching quality, persistence, and student outcomes (Herzig & Johnson, 2023; Waddington, 2023). Evidence indicates that teachers' self-efficacy beliefs shape learners' motivation, engagement, and achievement (Ommering et al., 2021; Zheng et al., 2021). Moreover, self-efficacy has been identified as a critical indicator for evaluating teacher performance and the likelihood of success in implementing educational reforms (Herzig Johnson, 2023).

In special education, self-efficacy is even more crucial, as teachers' self-efficacy is critical in overcoming significant challenges to address the diverse needs of many learners (Alharbi & Iqtadar, 2024). However, Sharma and Loreman (Forlin et al., 2014) documented a self-efficacy deficit in developing nations, which presents a barrier to sustainable inclusive education (Selenius & Ginner Hau, 2024). This highlights the need to devise professional learning frameworks that go beyond merely transmitting information to focus on growing teachers' self-efficacy in implementing inclusive practices.

Special Education STEM and Computational Thinking (CT)

STEM (Science, Technology, Engineering, and Mathematics) education has now been recognized for its ability to develop problem-solving skills, creativity, and critical thinking skills (Enders & Kostewicz, 2023; So et al., 2022; Wannapiroon & Pimdee, 2022). While teaching computational practices has traditionally been linked to teaching computers, it has now matured into a multicultural cognitive approach that emphasizes the ability to logically break down problems and reason to formulate algorithms (Wing, 2006). The integration of STEM, along with the CT principles, into special education has the potential to enrich both teacher practice and learner outcomes, particularly through structured inquiry (Hayes & Proulx, 2024; Wang et al., 2022).

However, the vast majority of STEM–CT initiatives are still implemented primarily in general education and/or high-income contexts, with a notable lack of documentation on bridging the gap in special education realities in low- and middle-income countries (LMICs). There is a need to bridge this gap if we are to ensure that the evolution of techniques and pedagogies in teaching and learning will not increase the imbalance in the global inequities in education for people with disabilities.

Online Social Networks (OSNs) as Professional Learning Communities (PLCs)

Most professional learning systems now use digital technology in tandem with teaching innovations. Online social networks (OSNs) enable teachers to share teaching materials, collaborate on creating lessons, and participate in peer support, regardless of physical and organizational boundaries (Westwood, 2025). OSNs can serve as communities of practice for special education teachers, who often work alone in a school or region and share disability teaching with few colleagues, thereby facilitating the exchange and collaborative creation of professional practice (Alsowait et al., 2023).

Cross-national research suggests that OSNs may support sustainable peer-collaborative professional development, a trend increasingly documented in the research literature, particularly within specific course-based instruction (Luo et al., 2020). Nonetheless, research is absent concerning the use of OSNs for the professional development of special education teachers in Southeast Asia, a region with increasing digital barriers and gaps in professional development.

Cross-Cultural Gaps, Thai Context, and Study Aim

Thailand provides a relevant context for this investigation. Despite 2008 legislation supporting inclusive education (Vorapanya & Dunlap, 2014), teachers of students with sensory disabilities often lack opportunities for professional development in digital pedagogy and CT-embedded STEM (Klibthong & Agbenyega, 2018), reflecting global trends of low teacher confidence. Thailand's growing digital infrastructure, however, offers a chance to implement scalable, technology-supported training models relevant to other LMICs.

Globally, little is known about adapting CT and STEM education for teachers of students with sensory disabilities in LMICs (So et al., 2022). This study, therefore, investigates whether a CT-integrated STEM training program, scaffolded by online social networks (OSNs) (Westwood, 2025), can enhance teacher self-efficacy and instructional design in special education classrooms (Ayverdi & Avcu, 2023). The intervention involved 91 Thai teachers of students with hearing and visual impairments across 21 schools. Participants engaged in a two-week program of collaborative lesson planning, CT pedagogy, and digital peer collaboration (Sothayapetch & Lavonen, 2022). The study employs a multi-level analysis, using pre- and post-surveys to measure self-efficacy and independent evaluations of lesson plans and classroom videos to assess instructional quality.

Contribution and Significance

This research makes a threefold contribution:

1) Expanding teacher self-efficacy research in under-resourced, disability-centered contexts;
2) Advancing instructional design theory through CT- and STEM-integrated frameworks;
3) Offering a cross-cultural model of OSN-mediated professional development for LMICs.

By analyzing both self-efficacy and instructional outputs, this study provides evidence that technology-supported, peer-driven learning can foster sustainable development in special education.

Research Objectives (ROs)

Three research objectives guided the study:

RO1: To develop CT-integrated STEM lesson plans through collaborative design supported by OSNs;

RO2: To compare teachers' perceived self-efficacy in instructional practice before and after the training program;

RO3: To evaluate teachers' instructional quality against a pre-defined benchmark using expert ratings of lesson plans and classroom practice.

Hypotheses

Based on these objectives, three hypotheses were tested:

H1: CT-integrated STEM lesson plans developed with OSN support will achieve high-quality ratings.

H2: Teachers' perceived self-efficacy in instructional practice will be significantly higher after the training compared to before.

H3: As evaluated by expert raters, teachers' instructional practice will exceed the benchmark quality level (≥ 75%).

RESEARCH METHODS

Research Design

A quasi-experimental, pre–posttest design (Madadizadeh, 2022; Stratton, 2019) was used to analyze the effect of a CT-integrated STEM training program (Valenzuela, 2025) on special education teachers' self-efficacy (Barni et al., 2019; Binammar et al., 2023) and instructional design (Ayverdi & Avcu, 2023). Online social networks (OSNs) were utilized to facilitate collaboration among peers and support them in sharing resources during the intervention (Ho et al., 2023; Westwood, 2025).

Participants

Ninety-one high school special education teachers who teach secondary students with disabilities in 21 public schools across Thailand participated in this study. All teachers were selected by random sampling to increase the probability of recruiting participants from different regions of Thailand, specifically those with hearing or visual impairments. G*Power was used to verify that the sample size was adequate for t-test analysis (Cohen, 2013; Kang, 2021).

Instruments

Teaching Self-Efficacy Scale

The study's self-efficacy scale was adopted from Bandura (2003), which the authors then used to evaluate each teacher's self-efficacy related to 10 facets of instructional practice. These included lesson design, material selection, inquiry facilitation, and student-centered teaching. The items were then rated on a 5-level Likert scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree." Summed scores ranged from 10–50, such that higher scores indicated stronger self-efficacy.

Lesson Plan Evaluation Rubric

Three subject experts developed the rubric to assess the quality of CT-integrated STEM lesson plans. The quality of lesson plans was evaluated based on: (1) the teaching objectives; (2) the content; (3) the teaching and learning activities; (4) the teaching and learning media; (5) the assessment methods; and (6) the lesson plan consistency. The rubric provides five levels for rating each of the assessment aspects. Finally, we computed the average scores and ranked the quality of lesson plans into four categories: excellent, good, fair, and poor.

Teaching Capability Assessment

The teachers submitted video-recorded lessons for evaluation, while two coders independently rated the lessons. The rubric addressed items on the lesson activity's design (Ayverdi & Avcu, 2023), the rationale for selecting media, and how well the lesson aligns with the learning objective(s). The inter-rater reliability (IRR) was high (Pearson correlation = 0.959, $p < .01$) (Pimdee et al., 2023).

Self-Efficacy Scale

Teachers' self-efficacy was measured using a 10-item Likert-type scale (Bandura, 2003) and later applications in teacher education (Farrow et al., 2024). Each item was rated on a scale from 1 (strongly disagree) to 5 (strongly agree), resulting in scores ranging from 10 to 50. Scores were interpreted across four levels of self-efficacy, as outlined in Table 1.

Table 1. Teacher self-efficacy assessment scale.

Score range	Teaching self-efficacy level
41 - 50	Very high teaching self-efficacy – Level 4
31 - 40	High teaching self-efficacy – Level 3.
21 - 30	Moderate teaching self-efficacy – Level 2.
10 - 20	Low teaching self-efficacy – Level 1.

Intervention Procedures

The intervention was conducted in three stages:

Development and Validation

CT-integrated STEM lesson plans were designed and reviewed by experts for content validity (Saritepeci, 2025).

Training and Implementation

Teachers completed a two-week training program that combined unplugged CT activities, hands-on use of tools such as BeeBot robots and Micro: bit boards (Georgiev et al., 2023; Paraskevopoulou-Kollia et al., 2025), and interdisciplinary STEM projects.

Collaboration via OSNs

Teachers participated in dedicated Line and Facebook groups where they collaboratively designed lesson plans, exchanged classroom videos, and provided peer feedback. To evaluate outcomes, pre- and post-training surveys measured changes in teaching self-efficacy. Both the co-developed lesson plans and teaching videos were submitted for expert review. The STEM-based lesson designs were grounded in computational thinking (CT) frameworks (Hurt et al., 2023; Izquierdo-Álvarez & Pinto-Llorente, 2025) and were independently evaluated by three subject-matter specialists. Lesson content emphasized logical reasoning, introductory programming, and integrated STEM activities tailored for educators working with students who have hearing or visual impairments.

Training Modules on STEM and CT

The professional development was structured around three units, focusing on supporting different dimensions of integrating CT within STEM-based teaching and peer-supported collaboration.

Unit 1: Foundational Knowledge

The introductory module provides teachers with the concepts of CT and explores various approaches in teaching strategies for students with hearing impairments and visual impairments. This stage focused on raising awareness of CT concepts and strategies for adapting teaching to meet the needs of diverse learners.

Unit 2: STEM-Integrated Activities

The second unit focused on designing interdisciplinary STEM lessons based on CT practices. Four STEM domains were covered:

Science: Teachers employed logical reasoning, sequencing, comparisons, creativity, and problem-solving skills. Example activities included storytelling with imaginative scenarios and constructing simple models such as vehicles for space travel, supported by hands-on kits (e.g., geometry media, IdeaKit).

Technology: Instruction included spatial awareness, describing outputs after executing code, debugging, and programming using the Micro: Bit boards. Activities included symbol-based coding activities and games that utilized error-checking using BeeBot robots, as well as designing simple programs to solve everyday problems.

Engineering: Teachers engaged in systematic problem-solving and invention via designing and building 2D and 3D structures.

Mathematics: Focus was on shape, Arabic and Thai number systems, counting, and symbolic pattern making. Learners engaged in geometry puzzles, calculated the nutrition of various food items, and strengthened their skills with wooden boards to enhance numeracy and symbolic pattern making.

Unit 3: Online Knowledge Exchange

The final unit of the course focused on effective ways to utilize online social networks for facilitating peer-to-peer knowledge exchange. Teachers engaged in activities such as joint planning, sharing videos, and providing feedback to each other in designated Line and Facebook groups, which helped strengthen the sustainability of professional exchange.

Data Analysis

The quantitative data were analyzed using paired-sample t-tests to examine changes in teachers' self-efficacy from pre- to post-testing (Weißenfels et al., 2022), and one-sample t-tests to determine whether teaching performance met pre-defined quality standards. Additionally, effect sizes were calculated to assess the practical significance of the changes. To complement the quantitative findings, qualitative evidence from video observations was summarized descriptively to reveal episode-specific classroom practices.

Scoring Rubric for Lesson Quality

Activity design, media presentation, and content-aligned assessment were the major dimensions that defined the quality of teaching. Situating them within three sections on the checklist, reviewers rated each item on a four-point rubric (Taylor et al., 2024), ranging from "excellent" to "needs improvement," and the summed points were translated into quality categories.

Activity Techniques: Each lesson was allocated 30 minutes, which was designed to follow a logical sequence and inspire creativity. Ratings ranged from "fully met" (excellent) to "not met" (update), with scores between 13 and 16 considered "excellent" and 9 and 12 indicating "good performance".

Problem-Solving Media: Materials for learning suitability were evaluated on their ability to enhance problem-solving and use across different tasks. Scores of 7–8 reflected ‘fair quality’, while 0–6 signaled ‘improvement needed’.

Content Design and Evaluation: Lesson content was assessed for accuracy, relevance to objectives, and appropriateness of evaluation methods. Higher scores reflected strong alignment with these standards, while lower scores indicated partial or no alignment with them.

RESULTS

Teacher Characteristics

Table 2 displays demographic information for the teachers in this study. Most teachers were female (74.73%). In education, 87.91% of teachers held a bachelor's degree, and 12.09% held a master's degree. There was also a relatively even distribution of teaching experience, with 39.56% of the participants having less than five years of teaching experience, 36.27% having five to ten years of experience, and 24.17% having more than ten years of experience.

The teachers came from a wide range of academic fields. Just under half (48.35%) majored in computer science. Others specified science (21.98%), special education (9.89%), business administration (5.48%), engineering (4.40%), education (3.30%), psychology (1.10%), liberal arts (1.10%), political science (1.10%), and Thai dance (1.10%).

Table 2. Participant personal characteristics.

Characteristic	Teachers	%
Gender		
- Male	23	25.27
- Female	68	74.73

Educational Level - Bachelor's Degree - Master's Degree	 80 11	 87.91 12.09
Teaching Experience - Less than 5 years - 5-10 years - More than 10 years	 36 33 22	 39.56 36.27 24.17
Field of Study - Computer Science - Special Education - Science - Mathematics - Education - Psychology - Business Administration - Thai Dance - Political Science - Engineering - Liberal Arts	 44 9 20 2 3 1 5 1 1 4 1	 48.35 9.89 21.98 2.20 3.30 1.10 5.48 1.10 1.10 4.40 1.10

Lesson Plan Quality (RO1 / H1)

First, we aimed to investigate whether the lesson plans, co-designed during the intervention, resulted in high instructional quality. Based on the six developed dimensions (objectives, content, teaching and learning activities, instructional media, measurement and evaluation, and internal consistency), the independent expert ratings validated the lesson plans as 'excellent.'

The mean scores for the six evaluation categories ranged from 4.56 to 5.00 on a 5-point scale, with a grand mean of 4.77 (*SD* = 0.27). These scores verified that the lesson plans reached the hypothesized threshold of "very good to excellent quality." Reviewers frequently commented on the consistency between instructional objectives, activities, and assessments, as well as the intentionality of integrating both unplugged activities (e.g., storytelling, geometric puzzles) and plugged-in tools (e.g., Bee-Bot robots, Micro: Bit boards) (Borowczak & Borowczak, 2025). This finding verifies Hypothesis 1, which states that lesson plans co-designed in CT–STEM teams with OSN support would meet a high-quality lesson plan standard.

Teacher Self-Efficacy (RO2 / H2)

The second research objective examined changes in teachers' perceived self-efficacy in instructional practice before and after the intervention. Pretest scores averaged 36.8 (*SD* = 4.70), placing most teachers in the “high” category of self-efficacy. Posttest scores increased to 42.1 (*SD* = 3.90), representing a shift into the "very high" category.

A paired-sample t-test indicated that this gain was statistically significant, $t(90) = 12.42, p < .001$, with a large effect size (Cohen’s $d = 0.92$) (Cohen, 2013). Therefore, the hypothesis that teachers would demonstrate significantly higher self-efficacy following the program (H2) was supported. These results suggest that exposure to CT-integrated STEM pedagogy, combined with collaboration in OSN-based communities of practice (Tongal et al., 2024; Wu et al., 2023; Zamiri & Esmaeili, 2024), meaningfully enhanced teachers’ confidence in lesson design, media selection, and classroom practice for students with disabilities.

Instructional Quality in Practice (RO3 / H3)

The third research objective assessed whether teachers’ instructional practice, as evaluated through video-recorded lessons, exceeded the quality benchmark set by the rubric (75%). Expert ratings of the pre-training teaching videos averaged 3.74 (*SD* = 0.56), while post-training videos averaged 4.31 (*SD* = 0.48). This improvement was statistically significant, $t(90) = 9.87, p < .001$. Inter-rater reliability between the two expert coders was very high ($r = 0.959, p < 0.01$), indicating strong agreement in their evaluations.

Beyond the numeric gains, reviewers observed qualitative improvements:

1) Teachers demonstrated greater adaptation of lessons to students’ sensory needs;
2) Use of technology tools (e.g., BeeBot, Micro: bit) became more purposeful and consistent (Borowczak & Borowczak, 2025).

3) Lesson objectives, instructional activities, and evaluation methods showed greater coherence.

Together, these results confirm Hypothesis 3, that instructional performance after the program would exceed the pre-defined quality benchmark.

DISCUSSION

This study demonstrates that STEM–CT training, supported by OSNs, can enhance teacher capacity in special education across three domains (Kruskopf et al., 2024). These include instructional design, professional self-efficacy, and classroom practice. The findings carry theoretical, practical, and cross-cultural significance.

Strengthening Teacher Self-Efficacy in Special Education

The significant gain in teachers' self-efficacy aligns with Bandura's (2003) theory, which posits that mastery experiences and vicarious learning are crucial for developing efficacy beliefs. The increase in confidence is significant for teachers of students with hearing and visual impairments (Phutane et al., 2022), who often face limited resources and isolation. Consistent with prior studies (Klang, 2025; Tschannen-Moran & Hoy, 2001; Sharma & Loreman, 2014), stronger self-efficacy beliefs can enhance persistence and creativity in addressing diverse learner needs.

Lesson Plan Quality and Instructional Design Creativity

Expert evaluations showed that co-designed lesson plans reached an "excellent" quality threshold across all assessment dimensions. This demonstrates the effectiveness of combining CT principles with collaborative STEM frameworks for lesson design in special education. Teachers were applying strategies and engaging as co-developers of instructional resources, echoing findings from Voogt et al. (2015) that participatory co-design fosters ownership and sustainability of innovative practices.

Role of OSNs as Communities of Practice

The OSN-supported collaboration among 21 schools proved critical in sustaining teacher engagement and facilitating the sharing of resources (Yaser et al., 2022). The collaboration fostered by the OSN among educators from 21 schools was particularly valuable in maintaining teacher engagement and promoting resource sharing (Yaser et al., 2022). Teachers could provide feedback to one another, co-create lessons, and engage in distributed mentoring that extends beyond and across their siloed settings. These findings strongly support Wenger's (2022) theorizing of the community of practice and align with recent research, which reveals that the co-design of inclusive education is the product of a collective negotiation process between teachers and notional others (Weiss et al., 2025). In LMIC contexts, OSNs might represent a highly scalable solution to the issues of professional isolation and limited access to training resources.

Cross-Cultural and Developmental Significance

Research on teacher professional development in disability education has primarily emerged from high-income countries (Hopp et al., 2020). By conducting this research in the context of Thailand, the present study offers an LMIC-oriented perspective to ongoing international debates. It also illustrates how CT, STEM pedagogy, and OSNs can be successfully adapted and reappropriated in low-resource contexts in ways that generate observable improvements in instructional quality and teacher confidence. This aligns with Klang's (2025) observations that teacher enactments of the curriculum are inflected by their contexts for practice in disability education.

Sustainability and Capacity-Building

Ultimately, our findings demonstrate the sustainability of peer-driven, digitally mediated professional development. Teachers involved in the model not only grew in their practice across the program duration but also established patterns of working together to reflect upon and exchange ideas that may persist long after the training concludes. This supports ongoing calls from UNESCO (2020) for disability education to account for the instructional, social, and technological dimensions of capacity-building. By embedding development within OSNs, this model not only moves beyond top-down workshops but also contributes to ongoing system-leveling, enhancing teacher professional expertise.

CONCLUSION

This study provides empirical insights into how integrating STEM–CT lesson planning with OSN-supported collaboration enhances teacher self-efficacy and learning for instructional design in special education settings. Situated in the context of Thailand, this study contributes to international scholarship on disability, development, and education with a replicable and scalable framework for professional development in LMICs. It suggests sustainable capacity-building practices for special education teachers that embrace content-rich, digitally networked, peer-generated, and culturally transferable strategies.

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REFERENCES

Ahmed, A. (2018). Perceptions of using assistive technology for students with disabilities in the classroom. *International Journal of Special Education*, *33*(1), 129-139. https://eric.ed.gov/?id=EJ1184079

Alharbi, H., & Iqtadar, S. (2024). 'I never feel like I am prepared enough': Teachers' self-efficacy, challenges and experiences teaching students with disabilities. *Journal of Research in Special Educational Needs*, *24*(3), 758-770. https://doi.org/10.1111/1471-3802.12666

Alsowait, M. M., Obeidat, S. S., Obeidat, L. M., Ayasrah, M. N., & Khasawneh, M. A. (2023). Navigating the social media landscape: A guide for special education teachers and parents. *Studies in Media and Communication*, *12*(1), 102. https://doi.org/10.11114/smc.v12i1.6573

Atanga, C., Jones, B. A., Krueger, L. E., & Lu, S. (2020). Teachers of students with learning disabilities: Assistive technology knowledge, perceptions, interests, and barriers. *Journal of Special Education Technology*, *35*(4), 236-248. https://doi.org/10.1177/0162643419864858

Ayverdi, L., Avcu, Y.E. (2023). Design and implementation of a STEM activity for the education of students with mild intellectual disabilities. *Journal of Research İn Informal Environments, 8*(2), 134-158. https://dergipark.org.tr/en/pub/jrinen/issue/82249/1286636

Bandura, A. (2003). Social cognitive theory for personal and social change by enabling media. In *Entertainment-education and social change* (pp. 97-118). Routledge.

Barni, D., Danioni, F., & Benevene, P. (2019). Teachers' self-efficacy: The role of personal values and motivations for teaching. *Frontiers in Psychology*, *10*, 465388. https://doi.org/10.3389/fpsyg.2019.01645

Binammar, S., Alqahtani, A., & Alnahdi, G. H. (2023). Factors influencing special education teachers' self-efficacy to provide transitional services for students with disabilities. *Frontiers in Psychology*, *14*, 1140566. https://doi.org/10.3389/fpsyg.2023.1140566

Borowczak, M., & Borowczak, A. (2025, March). Integrating Micro: bits for Cross-Disciplinary Computer Science Instruction: A Virtual Collaborative Model for STEM and Beyond. In *Society for Information Technology & Teacher Education International Conference* (pp. 1836-1848). Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/p/225738/

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences* (e-book). Routledge.

Edwards Jr, D. B., Asadullah, M. N., & Webb, A. (2024). Critical perspectives at the mid-point of Sustainable Development Goal 4: Quality education for all—progress, persistent gaps, problematic paradigms, and the path to 2030. *International Journal of Educational Development*, *107*, 103031. https://doi.org/10.1016/j.ijedudev.2024.103031

Enders, O. G., & Kostewicz, D. (2023). Secondary teachers' remote instructional practices in mathematics for students with disabilities. *Journal of Special Education Technology*, *38*(1), 50-60. https://doi.org/10.1177/01626434211059486

Farrow, J., Kavanagh, S. S., Samudra, P., & Dean, C. P. (2024). The promise of the project to student-centered learning: Connections between elements, curricular design, and practices of project-based learning. *Teaching and Teacher Education*, *152*, 104776. https://doi.org/10.1016/j.tate.2024.104776

Forlin, C., Loreman, T., & Sharma, U. (2014). A system-wide professional learning approach about inclusion for teachers in Hong Kong. *Asia-Pacific Journal of Teacher Education*, *42*(3), 247-260. https://doi.org/10.1080/1359866X.2014.906564
Georgiev, G., Hristov, G., Zahariev, P., & Kinaneva, D. (2023, November). Robotics in Education: A Comparative analysis of robotic platforms across educational levels. In *2023 31st National Conference with International Participation (TELECOM)* (pp. 1-4). IEEE. https://doi.org/10.1109/TELECOM59629.2023.10409749
Hayes, C., & Proulx, M. J. (2024). Turning a blind eye? Removing barriers to science and mathematics education for students with visual impairments. *British Journal of Visual Impairment*, *42*(2), 544-556. https://doi.org/10.1177/02646196221149561
Herzig Johnson, S. (2023). The role of teacher self-efficacy in the implementation of inclusive practices. *Journal of School Leadership*, *33*(5), 516-534. https://doi.org/10.1177/10526846231174147
Ho, H. C., Poon, K. T., Chan, K. K. S., Cheung, S. K., Datu, J. A. D., & Tse, C. Y. A. (2023). Promoting pre-service teachers' psychological and pedagogical competencies for online learning and teaching: The TEACH program. *Computers & Education*, *195*, 104725. https://doi.org/10.1016/j.compedu.2023.104725
Hopp, M. D., Stoeger, H., & Ziegler, A. (2020). The supporting role of mentees' peers in online mentoring: a longitudinal social network analysis of peer influence. *Frontiers in Psychology*, *11*, 1929. https://doi.org/10.3389/fpsyg.2020.01929
Hurt, T., Greenwald, E., Allan, S., Cannady, M. A., Krakowski, A., Brodsky, L., ... & Dorph, R. (2023). The computational thinking for science (CT-S) framework: Operationalizing CT-S for K–12 science education researchers and educators. *International Journal of STEM Education*, *10*(1), 1. https://doi.org/10.1186/s40594-022-00391-7
Ingersoll, R., Merrill, E., Stuckey, D., Collins, G., & Harrison, B. (2021). The demographic transformation of the teaching force in the United States. *Education Sciences*, *11*(5), 234. https://doi.org/10.3390/educsci11050234
Izquierdo-Álvarez, V., & Pinto-Llorente, A. M. (2025). Exploring pre-service teachers' perceptions of the educational value and benefits of computational thinking and programming. *Sustainability*, *17*(5), 2164. https://doi.org/10.3390/su17052164
Jang, Y., Choi, S., Kim, S., & Kim, H. (2023). The SNS-based e-mentoring and development of computational thinking for undergraduate students in an online course. *Educational Technology & Society*, *26*(2), 147-164.
Kang, H. (2021). Sample size determination and power analysis using the G* Power software. *Journal of Educational Evaluation for Health Professions*, *18*. https://doi.org/10.3352%2Fjeehp.2021.18.17
Klang, N. (2025). Teachers' Understandings and Enactments of Academically Focused Curriculum for Students with an Intellectual Disability. *International Journal of Disability, Development and Education*, 1-17. https://doi.org/10.1080/1034912X.2025.2529461
Klibthong, S., & Agbenyega, J. S. (2018). Exploring professional knowing, being and becoming through Inclusive Pedagogical Approach in Action (IPAA) framework. *Australian Journal of Teacher Education (Online)*, *43*(3), 109-123. https://doi.org/10.3316/ielapa.477406747613063
Kruskopf, M., Abdulhamed, R., Ranta, M., Lammassaari, H., & Lonka, K. (2024). Future teachers' self-efficacy in teaching practical and algorithmic ICT competencies–does background matter? *Teaching and Teacher Education*, *144*, 104574. https://doi.org/10.1016/j.tate.2024.104574
Kurt, A., & Erden, M.K. (2024). Investigation of the opinions of pre-service special education teachers on the use of assistive technologies in special education. *Education and Information Technologies, 29*, 51–76. https://doi.org/10.1007/s10639-023-12278-3
Luo, T., Freeman, C., & Stefaniak, J. (2020). "Like, comment, and share"—professional development through social media in higher education: A systematic review. *Educational Technology Research and Development*, *68*(4), 1659-1683. https://doi.org/10.1007/s11423-020-09790-5
Madadizadeh, F. (2022). A tutorial on Quasi-experimental designs. *Journal of Community Health Research*, *11*(1), 3-4. http://jhr.ssu.ac.ir/article-1-780-en.html
Maesala, M., & Ronél, F. (2024). Overcoming the challenges of including learners with visual impairments through teacher collaborations. *Education Sciences*, *14*(11), 1217. https://doi.org/10.3390/educsci14111217

Ommering, B. W., van Blankenstein, F. M., van Diepen, M., & Dekker, F. W. (2021). Academic success experiences: Promoting research motivation and self-efficacy beliefs among medical students. *Teaching and Learning in Medicine*, *33*(4), 423-433.
Paraskevopoulou-Kollia, E. A., Michalakopoulos, C. A., Zygouris, N. C., & Bagos, P. G. (2025). Computational Thinking in Primary and Pre-School Children: A Systematic Review of the Literature. *Education Sciences*, *15*(8), 985. https://doi.org/10.3390/educsci15080985
Phuangsuwan, P., Limna, P., & Siripipatthanakul, S. (2024). Ethics in the Social Sciences Research. *Advance Knowledge for Executives, 3*(4), No. 49. https://tinyurl.com/4a8b2e34
Phutane, M., Wright, J., Castro, B. V., Shi, L., Stern, S. R., Lawson, H. M., & Azenkot, S. (2022). Tactile materials in practice: Understanding the experiences of teachers of the visually impaired. *ACM Transactions on Accessible Computing (TACCESS)*, *15*(3), 1-34. https://doi.org/10.1145/3508364
Pimdee, P., Ridhikerd, A., Moto, S., Siripongdee, S., & Bengthong, S. (2023). How social media and peer learning influence student-teacher self-directed learning in an online world under the 'New Normal'. *Heliyon*, *9*(3), e13769. https://doi.org/10.1016/j.heliyon.2023.e13769
Prommun, P., Kantathanawat, T., Pimdee, P., & Sukkamart, T. (2022). An integrated design-based learning management model to promote Thai undergraduate computational thinking skills and programming proficiency. *International Journal of Engineering Pedagogy*, *12*(1), 75-94. https://doi.org/10.3991/ijep.v12i1.27603
Saritepeci, M. (2025). Integrating computational thinking into education: A study on CT-PACK framework and teacher development. *Journal of Research on Technology in Education*, 1-25. https://doi.org/10.1080/15391523.2025.2547177
Selenius, H., & Ginner Hau, H. (2024). A scoping review on the psychometric properties of the teacher efficacy for inclusive practices (TEIP) scale. *Scandinavian Journal of Educational Research*, *68*(4), 792-802. https://doi.org/10.1080/00313831.2023.2185811
Sharimova, A., & Wilson, E. (2025). Informal learning through social media: exploring the experiences of teachers in virtual professional communities in Kazakhstan. *Professional Development in Education*, *51*(2), 292-304. https://doi.org/10.1080/19415257.2022.2097291
Sharma, U., Loreman, T., & Forlin, C. (2012). Measuring teacher efficacy to implement inclusive practices. *Journal of Research in Special Educational Needs*, *12*(1), 12-21. https://doi.org/10.1111/j.1471-3802.2011.01200.x
So, W. W. M., He, Q., Chen, Y., Li, W. C., Cheng, I. N. Y., & Lee, T. T. H. (2022). Engaging students with intellectual disability in science, technology, engineering, and mathematics learning. *Science Education International*, *33*(1), 25-37. https://doi.org/10.33828/sei.v33.i1.3
Sothayapetch, P., & Lavonen, J. (2022). Technological pedagogical content knowledge of primary school science teachers during the COVID-19 in Thailand and Finland. *Eurasia Journal of Mathematics Science and Technology Education*, *18*(7), em2124. https://doi.org/10.29333/ejmste/12118
Stratton, S. J. (2019). Quasi-experimental design (pre-test and post-test studies) in prehospital and disaster research. *Prehospital and Disaster Medicine*, *34*(6), 573-574. https://doi.org/10.1017/S1049023X19005053
Taylor, B., Kisby, F., & Reedy, A. (2024). Rubrics in higher education: an exploration of undergraduate students' understanding and perspectives. *Assessment & Evaluation in Higher Education*, *49*(6), 799-809. https://doi.org/10.1080/02602938.2023.2299330
Tongal, A., Yıldırım, F. S., Özkara, Y., Say, S., & Erdoğan, Ş. (2024). Examining teachers' computational thinking skills, collaborative learning, and creativity within the framework of sustainable education. *Sustainability*, *16*(22), 9839. https://doi.org/10.3390/su16229839
Tripon, C. (2022). Supporting future teachers to promote computational thinking skills in teaching stem—a case study. *Sustainability*, *14*(19), 12663. https://doi.org/10.3390/su141912663
Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education*, *17*(7), 783-805. https://doi.org/10.1016/S0742-051X(01)00036-1
UNESCO. (2020). Global education monitoring report 2020: Inclusion and education all means all. https://unesdoc.unesco.org/ark:/48223/pf0000373718
Valenzuela, J. (2025). *Integrating Computational Thinking into K–12 Classroom Instruction* (Doctoral dissertation, Old Dominion University). Virginia. https://tinyurl.com/mvajfxed
Voogt, J., Fisser, P., Good, J., Mishra, P., & Yadav, A. (2015). Computational thinking in compulsory

education: Towards an agenda for research and practice. *Education and Information Technologies*, *20*(4), 715-728. https://doi.org/10.1007/s10639-015-9412-6
Vorapanya, S., & Dunlap, D. (2014). Inclusive education in Thailand: Practices and challenges. *International Journal of Inclusive Education*, *18*(10), 1014-1028. https://doi.org/10.1080/13603116.2012.693400
Waddington, J. (2023). Self-efficacy. *ELT Journal*, *77*(2), 237-240. https://doi.org/10.1093/elt/ccac046
Wang, J., Bai, X., Xiang, Q., An, L., Cai, M., & He, C. (2022, January). Research on the improvement of teachers' computational thinking teaching ability based on STEM86 Platform. In *Proceedings of the 2022 13th International Conference on E-Education, E-Business, E-Management, and E-Learning* (pp. 173-177). https://doi.org/10.1145/3514262.3514311
Wang, C., Shen, J., & Chao, J. (2022). Integrating computational thinking in STEM education: A literature review. *International Journal of Science and Mathematics Education*, *20*(8), 1949-1972. https://doi.org/10.1007/s10763-021-10227-5
Wannapiroon, N., & Pimdee, P. (2022). Thai undergraduate science, technology, engineering, arts, and math (STEAM) creative thinking and innovation skill development: a conceptual model using a digital virtual classroom learning environment. *Education and Information Technologies*, *27*(4), 5689-5716. https://doi.org/10.1007/s10639-021-10849-w
Weiss, S., Lindner, J., & Kiel, E. (2025). Classmates as Co-Creators of Inclusive Education: How Teachers and Classmates Negotiate Special Treatment Through Acceptance and Rejection. *International Journal of Disability, Development and Education*, 1-16. https://doi.org/10.1080/1034912X.2025.2528191
Weißenfels, M., Klopp, E., & Perels, F. (2022). Changes in teacher burnout and self-efficacy during the COVID-19 pandemic: Interrelations and e-learning variables related to change. *Frontiers in Education, 6,* 736992. https://doi.org/10.3389/feduc.2021.736992
Wenger, E. (2022). Jean Lave and Etienne Wenger. In *Understanding and Using Educational Theories*, 257. Sage.
Westwood, J. (Ed.). (2025). *Social media in social work education*. Taylor & Francis. https://doi.org/10.4324/9781041056898
Wing, J. M. (2006). Computational thinking. *Communications of the ACM, 49*(3), 33–35. https://doi.org/10.1145/1118178.1118215
Wu, T. T., Lee, H. Y., Wang, W. S., Lin, C. J., & Huang, Y. M. (2023). Leveraging computer vision for adaptive learning in STEM education: Effect of engagement and self-efficacy. *International Journal of Educational Technology in Higher Education*, *20*(1), 53. https://doi.org/10.1186/s41239-023-00422-5
Yaser, N. A. S., Samar, A. J., Firas, A. S. A. T., & Mohamad, A. S. K. (2022). Using Social Media Network by Special Education Teachers. *International Journal of Cognitive Research in Science, Engineering and Education*, *10*(2), 39-50. http://dx.doi.org/10.23947/2334-8496-2022-10-2-39-50
Zamiri, M., & Esmaeili, A. (2024). Methods and technologies for supporting knowledge sharing within learning communities: A systematic literature review. *Administrative Sciences*, *14*(1), 17. https://doi.org/10.3390/admsci14010017
Zheng, B., Chang, C., Lin, C. H., & Zhang, Y. (2021). Self-efficacy, academic motivation, and self-regulation: how do they predict academic achievement for medical students? *Medical Science Educator*, *31*(1), 125-130. https://doi.org/10.1007/s40670-020-01143-4

