

## DECODE-based STEM workshop in improving academic resilience and teaching competency of pre-service teachers

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Received 06 November 2023 ▪ Accepted 29 January 2024

### Abstract

This study examines DECODE model and academic resilience to improve pre-service teachers' (PSTs) teaching abilities. Effective teaching in the changing context of education requires pedagogical skills and problem-solving. Teacher resilience is becoming more important to adapt and succeed in adversity. Development, inquiry, cooperation, observation, debate, and assessment make DECODE model a revolutionary teaching method. This study examines how DECODE adoption and academic resilience affect PSTs' progress to influence teacher preparation and training. DECODE paradigm, instructional competence, and academic resilience are contextualized in this literature review. STEM-based workshop for 97 PSTs from various academic levels. Linked samples JAMOVI t-test examines academic resilience changes post-workshop. Both t-values and p-values (<0.05) show a statistically significant improvement in academic resilience. DECODE model improves participant scores for teaching competency statistically significantly. Teaching effectiveness and resilience are linked, emphasizing the necessity for thorough teacher preparation. Results show DECODE model and the training improve teaching skills and academic resilience.

**Keywords:** DECODE model, academic resilience, pre-service teachers, teaching competency, STEM-based workshop

## INTRODUCTION

A constant goal in education is the development of more efficient methods of instruction, which are essential for inspiring interest and agency among students. Pre-service teachers (PSTs) on the cusp of their transformational journey are individuals now engaged in the critical process of preparing to join the professional teaching scene. Throughout their studies, they will focus heavily on improving their teaching competence. This broad quality includes pedagogical knowledge, instructional agility, classroom management abilities, and an unyielding dedication to student development. Nonetheless, being an effective teacher is rarely a smooth ride. Teachers require not just pedagogical expertise but also the resilience to deal with the challenges and uncertainties brought on by the ever-

changing nature of the educational scene and the wide variety of students' needs. This highlights the need for academic resilience among PSTs, which allows people to overcome obstacles, adjust to new learning environments, and ultimately become more well-rounded and effective due to adversity.

Recent years have seen the emergence of groundbreaking frameworks like DECODE (Cheng et al., 2022; Wahono et al., 2022) model, which aims to increase teachers' teaching competency. This model surpasses more traditional methods by combining a theoretical understanding of education with hands-on experience and self-reflection. DECODE model provides a revolutionary route for PSTs to increase their instructional effectiveness by including active learning, collaborative involvement, and continuous improvement. At the same time, the importance of

### Contribution to the literature

- This study provides preliminary evidence of positive relationship between the Academic Resilience and Teaching Competency of the Pre-Service teachers.
- This study proves that DECODE model improves the teaching competency of Pre-Service teachers.
- The study's findings reveal that Integrating DECODE and Academic Resilience is a potentially fruitful approach to cultivating competent and resilient instructors.

academic resilience has been highlighted as a key competency for teachers in the present educational climate. Academic resilience equips soon-to-be educators to persevere in the face of adversity, modify their teaching methods to accommodate their students' unique requirements, and keep their focus on the objective at hand. In order to have a long-lasting influence as a teacher, the ability to help students develop academic resilience is becoming more and more crucial.

A complicated and multifaceted relationship exists between PSTs' academic resilience and teaching competency (Romano et al., 2021). Academic resilience and teaching competency are two important components that go into an individual's overall performance and efficacy in the classroom. PSTs with solid teaching competencies may feel more confident in their ability to navigate challenges in the classroom. This confidence can contribute to greater academic resilience as they face the inevitable trials of the teaching profession (Jowkar et al., 2013). The interaction between teaching competency and academic resilience is influenced by various contextual circumstances, individual differences, and educational environments. It is crucial to remember that these relationships are not in one direction (Yang & Wang, 2022).

This study aims to combine two vital components:

- (1) improving PSTs' teaching competence using DECODE model and
- (2) investigating the significance of academic resilience in this context.

This research aims to contribute to educators' holistic growth by exploring how adopting DECODE model impacts teachers' competence in the classroom and how that relates to students' ability to bounce back from setbacks. The results will guide the design of teacher preparation programs, the formulation of policy, and the implementation of instructional practices that will help PSTs become successful classroom instructors and resilient school leaders. Subsequently, we examine the current literature on teaching competency, academic resilience, and DECODE model to clarify their conceptual foundations, importance, and linkages. We then analyze the findings in-depth and provide insight into the technique used to investigate the effect of DECODE model's deployment and measure academic resilience. The discussion deconstructs the results, adding to the ongoing debate on teacher training and

effective pedagogy. As a result of our findings, we want to shed light on how PSTs may greatly benefit from developing their teaching competence and academic resilience.

Based on all these, the researcher formed the following research questions for this study,

1. How does PSTs' academic resiliencies change after taking part in DECODE-based STEM workshops?
2. How do student teachers' varying levels of academic resilience influence their ability to use DECODE model to improve their teaching competency?

## REVIEW OF LITERATURE

The idea of teaching competence is complex and covers several aspects, including a teacher's knowledge, abilities, attitudes, and capacity to support learning experiences successfully across multiple educational contexts. Numerous academics have highlighted the need for consistently improving teaching abilities in order to address the ever-changing demands of the educational landscape. According to Darling-Hammond (2006), the enhancement of student learning outcomes heavily relies on effective teaching, making it a critical aspect to consider. Consequently, teacher education programs should include comprehensive strategies to cultivate and enhance these competencies. Various models and frameworks have been offered in the literature for the purpose of teaching competence development. These models and frameworks include a wide range of approaches, including content-specific pedagogical tactics, as well as larger ideas on instructional design and classroom management. The present research aims to expand upon the existing knowledge by examining the effectiveness of DECODE model as a systematic framework for improving teaching abilities in PSTs. This study tries to add to the continuing dialogue on novel methods for teacher education by examining the potential of DECODE to combine multiple characteristics of successful teaching.

The area of interest is the examination of academic resilience among PSTs. The concept of academic resilience, which is based on positive psychology and developmental theories, has gained statistically significant recognition within the field of education. Resilience pertains to an individual's ability to endure

and flourish when confronted with academic obstacles, failures, and stress-inducing factors. Although its original investigation focused on student populations, current research has expanded its applicability to PSTs and in-service teachers. Scholars in education have emphasized the significance of academic resilience within teacher training programs, underscoring the need for teachers to demonstrate resilience to successfully manage the challenges and stresses inherent in their occupation. According to the research conducted by Day and Gu (2014), there is a strong correlation between teacher resilience and instructional quality, work happiness, and general well-being. The purpose of this literature review is to identify a knowledge gap pertaining to the correlation between academic resilience and the improvement of teaching competence among PSTs. Through the examination of this correlation, the research endeavors to reveal valuable knowledge about the possible impact of enhancing academic resilience on the comprehensive growth of PSTs' teaching aptitude.

DECODE model is a pedagogical framework designed to enhance teaching competency. The incorporation of novel teaching approaches has been an enduring endeavor in the field of teacher education. DECODE model, which helps with development, exploration, collaboration, observation, discussion, and evaluation, presents a complete framework that leverages active learning and reflective practices. DECODE paradigm, as outlined by Johnson et al. (2018a, 2018b, 2018c), places emphasis on the utilization of experiential learning, peer collaboration, and self-assessment as fundamental processes for cultivating teaching abilities. The existing body of research provides evidence in favor of the idea that teacher preparation programs must provide chances for prospective educators to actively participate in authentic classroom situations, critically evaluate their instructional methods, and get valuable input from their colleagues. DECODE model demonstrates adherence to these values via integrating actual teaching experiences, promoting reflective discourse, and recognizing the significance of cooperation in fostering pedagogical development. This research adds to the continuing discourse on the transformation of teacher education by examining the applicability and efficacy of DECODE model.

The notion of academic resilience transcends its impact on individual student performance, including the professional domain of teaching as well. In light of the increasing challenges educators face, including changes in curriculum, various student requirements, and administrative demands, it is crucial to prioritize the development of academic resilience to continue teaching effectiveness. The studies conducted by Richardson (2002a, 2002b, 2002c) emphasizes the correlation between the psychological well-being of teachers and their instructional performance. The research highlights

that instructors with resilience demonstrate higher flexibility, problem-solving abilities, and emotional control. Although there has been research conducted on the importance of teacher resilience, there is still a need to investigate the relationship between academic resilience and the development of PSTs. This study aims to fill the existing research vacuum by examining the possible correlation between the degrees of academic resilience among PSTs and their capacity to use DECODE model to improve their teaching proficiency effectively. Through the process of unravelling this relationship, the study endeavors to provide valuable insights that could guide the incorporation of interventions focused on resilience within teacher education programs.

## METHODOLOGY

The present study used a mixed-methods research design to investigate improving teaching competence in PSTs using DECODE model. The use of a mixed-methods methodology enabled a thorough investigation of both quantitative evaluations of teaching competence and qualitative perspectives derived from participants' experiences in a workshop centered on STEM education. The sample for this study included 97 PSTs who were at different levels of their education. Specifically, there were 31 participants in their second year of Bachelor of Education (B.Ed-II Year), 40 participants in their first year of Bachelor of Education (B.Ed-I Year), and 26 participants in their final year of Bachelor of Science and Bachelor of Education (B.Sc. and B.Ed. Final Year). A purposive sampling procedure was used to enable the inclusion of all educational levels within a single school renowned for its focus on innovative teaching methods and teacher growth. **Figure 1** shows DECODE model.

PSTs learned online technological pedagogical material via "DEMO-CO-design/teach-feedback-DEbriefing" as part of their professional development. In DECODE paradigm, teacher-student interactions, teaching-learning processes, and technology-embedded systems foster collaborative, active learning, resource sharing, and creative communication. Technical integration has helped online instructors overcome COVID-19 social alienation, create resilience, and enhance pedagogical and technical abilities (Dhawan, 2020). New educational challenges need platforms that promote learning resources to defend the right to education (Zhu & Liu, 2020). An international collaboration and innovation strategy and scientific and technological research may suggest e-learning-based STEM teacher development (Chang et al., 2021). Instructors may critically assess new technologies' affordances for subject matter selection, motivator empowerment, information presentation, activity design, and pedagogy transmission using DECODE model. DECODE may also assist educators in

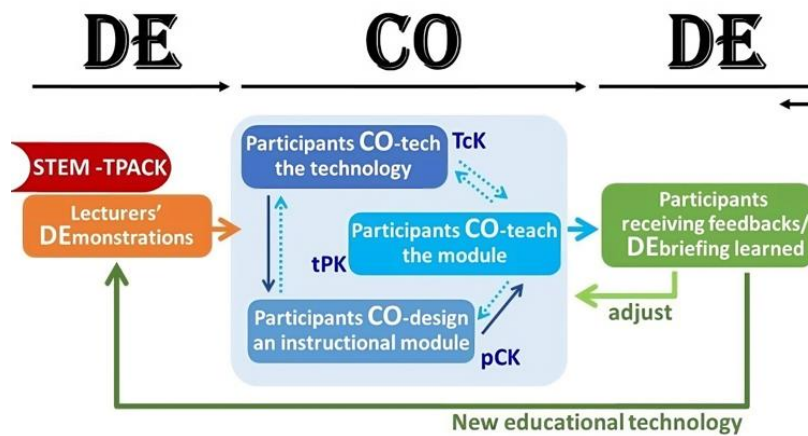


Figure 1. DECODE model (Adopted from Cheng et al.,2022)

integrating technology, pedagogy, and subject matter into their TPACK. DECODE has three stages.

1. **Stage-1.** Teachers' demonstrations,
2. **Stage-2.** CO: Students CO-train CloudClassRoom, CO-design an educational technology-integrated course, and
3. **Stage-3.** DE: Students obtain feedback and DEbrief their learning.

Run DECODE for each technology. DECODE runtime relies on technology and characteristics. For STEM technology instruction, DE-CO-DE- CO-DE will be done three times every DECODE.

### Phases of STEM-Based DECODE Model Workshop

The workshop's objective was to enhance the teaching competency of PSTs and assess their academic resilience. In this workshop the experts in DECODE model from Taiwan gave the training on DECODE MODEL to the preservice teacher trainees of Gandhigram Rural Institute of Tamil Nadu. The researcher has chosen STEM education approach as an intervention to enhance the teaching competencies are, as follows:

- (a) technology knowledge,
- (b) content knowledge,
- (c) pedagogical knowledge,
- (d) pedagogical content knowledge,
- (e) technological content knowledge,
- (f) technological pedagogical knowledge, and
- (g) technological pedagogical content knowledge.

The workshop was conducted using hybrid mode (both online and offline). The detailed descriptions of the four-day sessions of the workshop is given below.

#### Day 1 (DEmonstration-DE)

The facilitators presented STEM models lessons and Technology integration in the lesson. Also gave an idea about integrating new technology into the teaching-

learning process. This session was conducted online and focused on imparting the following skills: technology knowledge, content knowledge for teaching competency, along with composure and commitment for academic resilience.

#### Day 2 (CO-teach & CO-train)

The session introduced STEM lesson plan based on the Indian curriculum. After that, PSTs were divided into small groups (five to six members) based on their primary subjects like mathematics, physics, chemistry, life science, and language, so that everyone would understand different views from another subject. In off-line, the group discussed, came up with collective ideas and finalized the topic and clarified their queries. Content knowledge, pedagogical knowledge, pedagogical content knowledge, and technological content knowledge were focused along with adaptability, confidence, and coordination for enhancing academic resilience during this session.

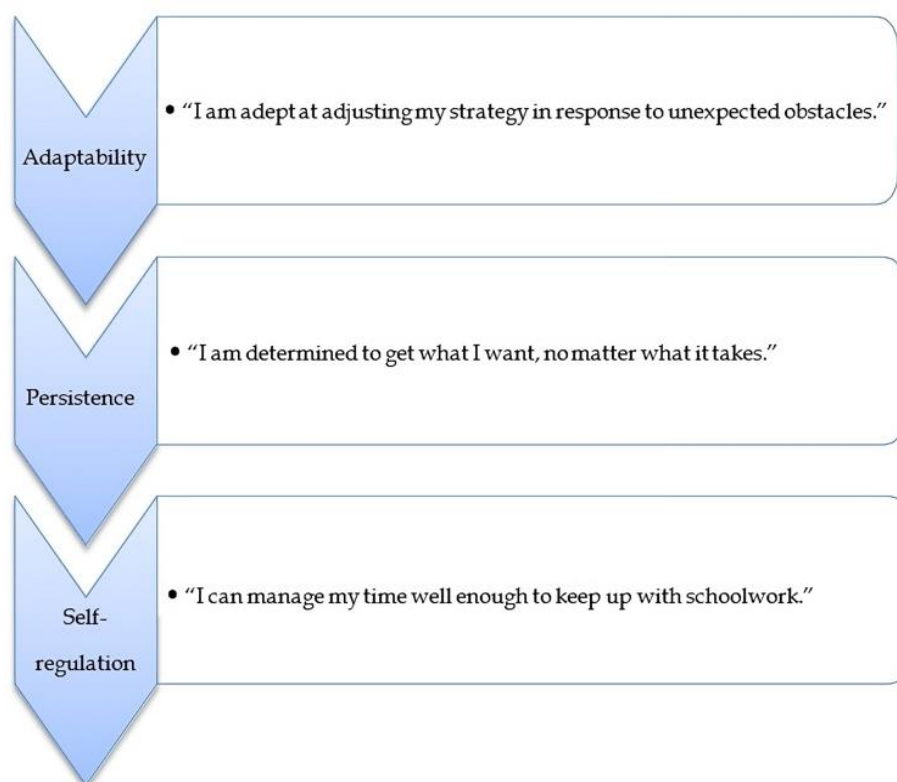
#### Day 3 (CO-teach & CO-train)

The finalized topic was brainstormed offline, and the respective groups started planning for their STEM-based lesson plan. Each one took responsibility for the preparation and presentation of the lesson focusing the skills namely, technology knowledge, content knowledge, pedagogical knowledge, pedagogical content knowledge, technological content knowledge, and technological pedagogical knowledge along with perseverance, empathy, and self-regulation for academic resilience.

#### Day 4 (DE brief-DE)

The prepared topics were presented online to the large group in the presence of experts. The experts gave comments and feedback to improve their lesson plans and teaching competencies. This session focused on enhancing technological pedagogical content knowledge along with control and coordination for academic resilience.





**Figure 2.** Correlation between academic resilience dimension & adapted scale items (Source: Authors' own elaboration)

The adaption of the academic resilience measure was vital to measuring participants' abilities to overcome academic hurdles and failures throughout STEM-based workshop (Figure 2). The scale assessed academic resilience in three areas: "adaptability," "persistence," and "self-regulation." "Adaptability" measured participants' ability to adapt and react to unanticipated academic obstacles. Participants' "persistence" measured their will to overcome barriers to achieve their educational objectives. Finally, the "self-regulation" factor assessed participants' time and resource management skills, indicating their ability to balance academic and personal lives. Thus, the customized academic resilience measure illuminated how workshop participants handled obstacles and adversity, highlighting resilience's importance in teaching competence development.

The investigation's central focus revolved around a STEM-oriented workshop that aimed to improve the level of teaching proficiency. DECODE model guided the workshop, an acronym representing the key components of development, exploration, collaboration, observation, discussion, and evaluation. Incorporating this paradigm into the workshop framework was carefully considered, offering a systematic method for developing teaching proficiency. The program included interactive learning opportunities and hands-on teaching situations that fostered active participant involvement and facilitated a profound engagement with the pedagogical process. A modified iteration of the academic resilience scale was used to assess academic

resilience. This study adapted the academic resilience scale. This instrument was developed by Dalimunthe et al. (2021).

The scale used in prior studies has been validated and effectively measures key aspects of academic resilience, including flexibility, perseverance, and self-regulation. The purpose of the scale was to evaluate participants' capacity to handle hurdles encountered during the session and their general propensity to overcome academic barriers. The data-gathering methodologies used in this study comprised a combination of quantitative and qualitative approaches. The study collected quantitative data on teaching competence using the assessment instrument for PSTs. This study adapted the assessment instrument for preservice teachers. This instrument was developed by Schmidt et al. (2009), which was given both before and after the workshop to assess any changes in teaching competency. Additional qualitative data were acquired via focus group discussions and open-ended questionnaires conducted after the training. The qualitative methods used in this study were designed to gather participants' perspectives on the workshop's impact on their teaching abilities and their encounters with DECODE model.

The present study used a research technique to examine the improvement of teaching competence via the implementation of DECODE model and assess its influence on the academic resilience of PSTs. The sample for this research included 97 PSTs currently enrolled in different education programs, such as Bachelor of Education (B.Ed), Bachelor of Science, and Bachelor of

**Table 1.** Participant demographics

Name	Gender	Age	Institution	Course	Major	Year	Locality
S1	Female	21	GRI	1	3	2	3
S2	Female	22	GRI	1	5	2	1
S3	Female	23	GRI	1	2	2	3
S4	Female	22	GRI	1	2	2	1

Note. S: Sample

**Table 2.** Teaching competency assessment

Name	TK-PR	TK-PO	CK-PR	CK-PO	PK-PR	PK-PO	PCK-PR	PCK-PO	TCK-PR	TCK-PO	TPK-PR	TPK-PO	TPACK-PR	TPACK-PO
S1	30	32	34	41	31	32	16	19	16	20	23	23	31	34
S2	25	30	40	41	28	30	16	17	15	18	18	23	33	36
S3	32	30	42	40	34	34	20	19	20	20	24	21	40	37
S4	26	29	37	36	29	26	16	14	16	15	20	20	33	33

Note. S: Sample

Education (B.Sc and B.Ed), at various stages of their academic journey. **Table 1** presents the collected demographic information of the participants, including gender, age, institution, course, major, year, and area.

**Table 2** focuses its attention on the evaluation of teaching proficiency among PSTs. The document enumerates a range of teaching competencies, including technological knowledge in pedagogy and content knowledge (TK-PR), technological knowledge in pedagogy and operations (TK-PO), content knowledge in pedagogy and content knowledge (CK-PR), among others. **Table 2** presents the results of each participant across many categories, demonstrating their respective degrees of ability in different dimensions of teaching competency. To assess the efficacy of DECODE methodology in improving teaching proficiency, a workshop centered on STEM subjects was implemented. The evaluation of the participants' teaching abilities was conducted using a thorough assessment instrument modified specifically for PSTs. **Table 2** displays the results achieved by participants across several areas of teaching abilities before and after the workshop. The evaluation yielded valuable information about the particular domains of teaching competence that exhibited improvement due to the intervention.

The present research investigated the effects of DECODE model on the academic resilience of individuals in pre-service teaching profession. The assessment of academic resilience was conducted using a scale specifically created for this particular study. The recorded scores for academic resilience pre-assessment (AR-PR) and academic resilience post-assessment (AR-PO) have been tabulated and are shown in **Table 3**. The evaluation provided insights into the participants' capacity to manage academic difficulties and setbacks, revealing the impact of DECODE model on their overall academic resilience.

The evaluation measures for each participant are shown in **Table 4**, which provides a comprehensive overview of the alterations seen in teaching competence

**Table 3.** Academic resilience assessment

Name	AR-PR	AR-PO
S1	44	60
S2	57	59
S3	66	56
S4	47	35

Note. S: Sample

**Table 4.** Summary of assessment measures

Name	TCC	ARC
S1	+9.4	+23
S2	+9.1	+2
S3	+10.5	-10
S4	+8.7	-12

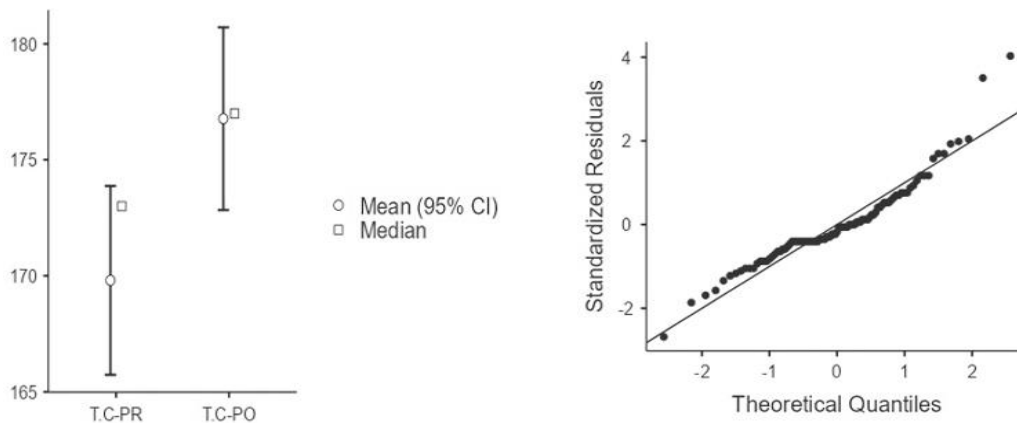
Note. S: Sample; TCC: Teaching competency change; & ARC: Academic resilience change

and academic resilience ratings from the first assessment to the final evaluation. The summary presents numbers that show the extent of progress or decrease in participants' teaching ability and academic resilience, with positive values representing improvement and negative ones representing deterioration. The results presented in this study provide a full overview of the research methods used, enabling a detailed examination of DECODE model's impact on improving teaching competence and academic resilience among PSTs.

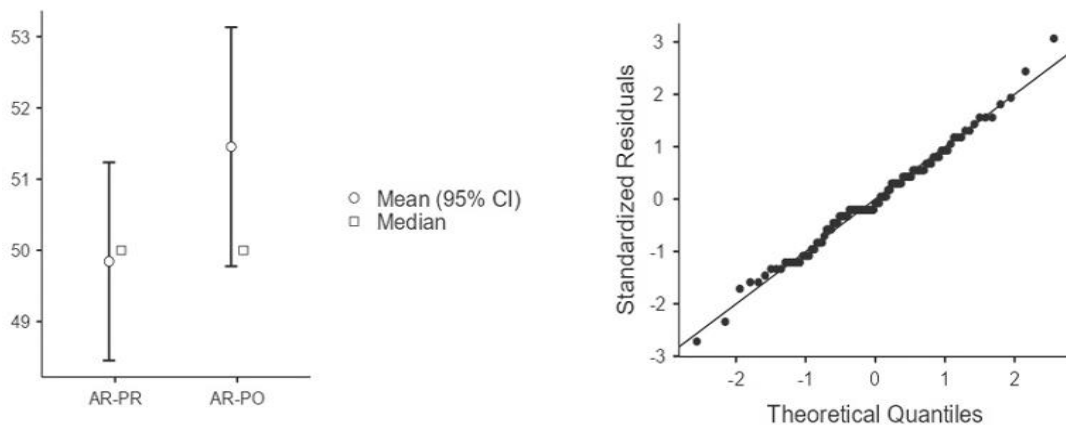
#### Data Analysis for Assessing Academic Resilience

The evaluation of academic resilience among PSTs constituted a pivotal component of the present study's examination of the efficacy of STEM-based workshop and DECODE model. The academic resilience scale, adopted for this study, was used to gain insight into the strategies employed by participants in managing obstacles and difficulties experienced during the workshop. This assessment provided valuable information on their capacity to persist and adjust within an academic environment.

The data analysis for this study used JAMOVI (version 2.3.21.0) statistical software. A paired samples t-



**Figure 3.** Teaching competency pre- & post-test score & Q-Q plot (Source: Authors’ own elaboration, using JAMOVI version 2.3.21.0)



**Figure 4.** Academic resilience pre- & post-test score & Q-Q plot (Source: Authors’ own elaboration, using JAMOVI version 2.3.21.0)

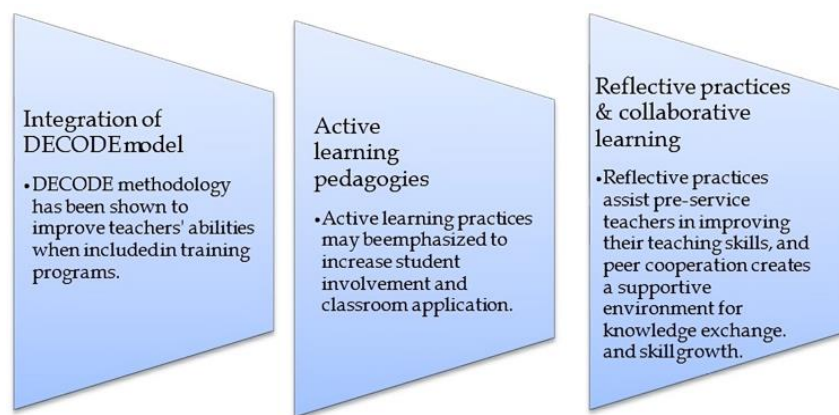
test was conducted to assess the variations in academic resilience ratings between measures 1, taken before STEM-based workshop, and measure 2, taken after the workshop. The researchers used the paired sample t-test to assess if there was a statistically significant disparity in the means of the two measurements. The null hypothesis ( $H_0: \mu \text{ measure 1} - \mu \text{ measure 2} = 0$ ) posited that there was no statistically significant change in academic resilience after the workshop. JAMOVI is a statistical software program that offers diverse analytical tools to cater to the needs of academics and data analysts while prioritizing user-friendliness. The statistical program JAMOVI was used in this research to perform a paired sample t-test to analyze the data. The paired sample t-test is a statistical procedure used to assess the means of two correlated groups on a shared dependent variable. In this instance, the tool evaluated the disparities in academic resilience ratings before and after STEM-based workshop.

In this study, the results of the paired samples t-test run by JAMOVI software showed that the ratings of academic resilience changed statistically significantly between the pre-workshop and post-workshop measurements. Based on the obtained t-value and corresponding p-value ( $<0.05$ ), it can be inferred that the

observed disparities are unlikely to have arisen only due to random variability. This suggests the workshop’s statistically significant influence on enhancing academic resilience among the participants. The descriptive statistics yielded valuable information about the academic resilience scores of the participants.

From **Figure 3**, the measure known as “T.C-PR” (teaching competency–pre-workshop) yielded a mean score of 49.80. The median score was 50, indicating a balanced distribution of scores. The standard deviation of the scores was calculated to be 6.99, reflecting the degree of variability in the data. Additionally, the standard error was determined to be 0.70, representing the precision of the mean estimate. The measure known as “T.C-PO” (teaching competency–post-workshop) had a mean score of 51.50, a median of 50, a standard deviation of 8.42, and a standard error of 0.85.

**Figure 4** shows the evaluation of academic resilience, the measure known as “AR-PR” (academic resilience: Pre-workshop) produced an average score of 169.80, with a middle value of 173, a measure of variability of 20.44, and a measure of precision of 2.07. The measure known as “AR-PO” (academic resilience: Post-workshop) had a mean score of 176.80, a median score of



**Figure 5.** Example aspects & implications for teacher education (Source: Authors' own elaboration)

177, a standard deviation of 19.79, and a standard error of 2.01.

The above statistics were used as the basis for a more thorough study. Paired samples t-tests were used to look at the academic resilience measures called "AR-PR" and "AR-PO", and the teaching competence measures called "T.C-PR" and "T.C-PO." The t-values obtained for the two sets of paired samples were -1.99 and -4.01, respectively. The calculated p-values were determined to be 0.049 and less than 0.001, showing statistical significance. This study's findings indicate a notable improvement in academic resilience and teaching competence after STEM-based workshop, providing evidence for the effectiveness of the intervention in enhancing participants' resilience and teaching skills. The use of plots was provided as a means to graphically depict the fluctuations in academic resilience (AR-PR-AR-PO) and teaching competence (T.C-PR-T.C-PO) scores, therefore providing a lucid representation of the patterns discerned before and after the workshop.

In brief, the evaluation of academic resilience utilizing the modified scale, in conjunction with the paired samples t-tests and descriptive statistics, yielded statistically significant findings regarding the transformative impact of the workshop on participants' capacity to navigate academic obstacles and their resilience in the presence of adversity.

### Implications for Teacher Education & Resilience Enhancement

The study examining the efficacy of STEM-based workshop and DECODE model in improving teaching competence and promoting academic resilience among PSTs produced noteworthy findings. The findings revealed a statistically significant difference in statistical terms ( $t=-1.99$ ,  $df=96$ ,  $p=0.049$ ), highlighting the workshop's influence on the participants' academic resilience.

This discovery has statistical significance. The t-value, when considered with the corresponding p-value, indicates that the observed increase in academic resilience scores is unlikely to be attributed to random

variability. Instead, it indicates a statistically significant improvement that may be attributed to the involvement of the workshop. PSTs participating in STEM-based workshop have shown a notable improvement in their capacity to address academic difficulties and overcome obstacles. This aligns with the workshop's primary goal, which is to enhance teaching skills and strengthen participants' resilience, a crucial attribute for effectively navigating the complex field of education.

The observed increase in academic resilience, which has reached statistical significance, is consistent with the fundamental assumptions of DECODE model. The methodology used a scaffolded approach that included development, exploration, collaboration, observation, discussion, and evaluation, therefore fostering teaching competency and academic resilience comprehensively. Including interactive and reflective components in the workshop is believed to have played a statistically significant role in fostering improved self-regulation, flexibility, and determination among the participants within the academic domain. **Figure 5** shows the aspects and implications for teacher education.

This approach aligns with previous scholarly investigations emphasizing the interconnectedness of educational effectiveness and personal resilience. Teachers who possess resilience are more capable of effectively handling the ever-changing demands of their jobs, positively impacting the quality of education and the results of their students. The workshop's efficacy in enhancing academic resilience aligns with the notion that comprehensive teacher preparation should cover both pedagogical competencies and psychological resilience. Within the wider education framework, these results provide valuable insights for enhancing the effectiveness of teacher training programs. Incorporating models such as DECODE into educational curricula has the potential to enhance teaching effectiveness and foster the necessary resilience for long-term and sustainable careers in education. In the context of evolving educational contexts, the capacity to adapt and endure has a heightened significance level.



In brief, the outcomes of this research highlighted the concrete advantages of a STEM-based workshop led by DECODE model. The findings of the paired sample t-test, provide preliminary evidence of positive impact of the workshop on the development of academic resilience. PSTs who took part in the study showed a notable increase in their capacity to address and overcome effectively academic obstacles, as evidenced by statistically significant findings. The aforementioned results emphasize the crucial link between proficient instruction and individual resilience, hence highlighting the need for comprehensive teacher training. In light of the ongoing transformation of the educational environment, the ideas that underlie this research provide valuable insights that can reformulate techniques for teacher development.

## RESULTS

The research results reveal noteworthy observations about the impact of STEM-focused workshop and the implementation of DECODE model on the teaching proficiency and academic resilience of PSTs. Statistically significant results were obtained using quantitative analysis, specifically paired sample t-tests.

Concerning the assessment of teaching competence, the participants showed a statistically significant enhancement, as seen by the paired samples t-test findings ( $t=4.01$ ,  $df=96$ ,  $p<0.001$ ) for "T.C-PR" and "T.C-PO" measures. The notable disparity underscores the workshop's effectiveness in augmenting the participants' teaching abilities and methodologies. Moreover, the evaluation of academic resilience revealed noteworthy alterations supported by the findings of the paired samples t-test ( $t=-1.99$ ,  $df=96$ ,  $p=0.049$ ) for the "AR-PR" and "AR-PO" assessments. The result indicates that the workshop benefited the participants' capacity to handle academic obstacles and failures effectively.

## DISCUSSION

The findings of this research highlighted the potential benefits of incorporating DECODE model into teacher education programs. The statistically significant increase in teaching proficiency is by the model's holistic approach to cultivating skills. DECODE model, including the components of development, exploration, collaboration, observation, discussion, and evaluation, was effectively integrated to provide PSTs with a structured learning experience that facilitated the development of practical competence. Equally noteworthy is the enhancement of academic resilience. The workshop's influence on the Participants' flexibility, perseverance, and self-regulation suggests that it played a crucial role in enhancing their capacity to negotiate the intricate and sometimes demanding academic milieu. This statement aligns with the present state of the educational environment, which requires instructors

who possess resilience and the ability to adapt to changing pedagogical requirements.

## Future Research

Although this study provides statistically significant insights, areas still need more investigation in future research. Further exploration of the underlying processes that contribute to the efficacy of DECODE model might provide valuable insights into the specific components that play a key role in enhancing teaching competence. Furthermore, it is recommended that a randomized control trial be used as a next step to understand the causal impact of the workshop better. Also, conducting a longitudinal study to examine the enduring impacts of the workshop on teaching competence and academic resilience as PSTs move into in-service jobs would provide useful insights into the long-term sustainability of these outcomes. Moreover, examining the applicability of academic resilience abilities in areas outside of schooling might provide a more comprehensive comprehension of the ramifications of this research (Karabiyik, 2020). In addition, examining the workshop's effects on individuals with varying degrees of teaching skill and academic resilience at the outset may provide valuable and nuanced insights.

## CONCLUSIONS

This study primarily started with the assumption that DECODE model will be a practical framework for improving PSTs' teaching competency and academic resilience through the four days workshops, where the selected PSTs represent the homogenous group who are highly motivated and prepared to be an active participant of this STEM-based workshop.

In conclusion, this research highlights the capacity of DECODE model to augment teaching proficiency. It emphasizes the statistically significant influence of academic resilience on the comprehensive development of PSTs. The workshop, which was centered on STEM subjects and directed by the ideas of DECODE, resulted in notable enhancements in pedagogical proficiency and scholarly fortitude. The results validate the effectiveness of DECODE model in developing diverse teaching abilities via its systematic methodology (e.g., Johnson et al., 2017). Additionally, the workshop's observed influence on academic resilience is evidence of its efficacy in enhancing participants' capacity to traverse obstacles encountered in an academic setting. The results highlighted the interconnectedness between teaching efficacy and personal resilience, underscoring the need for a complete teacher training program incorporating pedagogical proficiency and psychological flexibility (e.g., Day & Gu, 2014).

The findings of the research have significant implications for educational policy, curriculum

development, and teacher training initiatives. Integrating DECODE and academic resilience is a potentially fruitful approach to cultivating competent and resilient instructors. Subsequent investigations may further examine the underlying mechanisms contributing to the effectiveness of DECODE model, examine its enduring impacts, and study the applicability of academic resilience skills in domains outside the educational context.

**Author contributions:** All authors have sufficiently contributed to the study and agreed with the results and conclusions.

**Funding:** This work was financially supported by the National Science Council of Taiwan under contracts the MOST 111-2410-H003-032-MY3, and the NSTC 111-2423-H-003-004 and the "Institute for Research Excellence in Learning Sciences" of National Taiwan Normal University (NTNU) from The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project by the Ministry of Education (MOE) in Taiwan and 113-2923-H-003 -001 -MY2 Professional Development of STEM Teachers Using the DECODE in India and Taiwan & Joint Research project under ICSSR(India)-NSTC(Taiwan)/JRP4/2024-25/IC).

**Ethical statement:** The authors stated that the study was approved by the institutional ethics committee of NTNU on 20th June, 2023 (Approval code: 202205HS038). Written informed consents were obtained from the participants.

**Declaration of interest:** No conflict of interest is declared by the authors.

**Data sharing statement:** Data supporting the findings and conclusions are available upon request from the corresponding author.

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