Pre-Service EFL Teachers' Research Attitudes and Critical Thinking Dispositions

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Abstract

Pre-service teachers (PSTs) usually tend to hold negative research attitudes and later display a low tendency to be research-engaged in their future career. Among the cognitive, behavioral, and attitudinal factors (pre)determining their research engagement might be their attitudes towards research (ATR) and critical thinking dispositions (CTDs). As there is also scant research on whether research engagement could have any impact on PSTs' research attitudes and critical thinking dispositions, this small-scale study sought if research engagement within the scope of a research methodology course at the undergraduate level would affect pre-service English as a Foreign Language (EFL) teachers' ATR and CTDs. Accordingly, 14 PSTs from a state university in Türkiye participated in this study. The study adopted a pre-experimental quantitative design, where data were elicited via two scales; namely an attitude towards research scale and a critical thinking dispositions scale. Findings highlighted the positive changes in PSTs' ATR and CTDs after their research engagement. After conducting research, their overall ATR improved. PSTs' research anxiety notably decreased besides the fact that they found research more useful and held more positive research dispositions. Correspondingly, their CTDs enhanced, too, particularly regarding their dispositions of searching for the truth and reasoning. Findings are interpreted, and the discussion highlights the key takeaways with specific reference to those of earlier studies.

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Introduction

Meeting and sustaining the demands of the contemporary as well as future dynamic educational landscape substantially lies in empowering teachers. The achievement of the Sustainable Development Goal 4 (SDG4) (United Nations, UN, n.d.), which aims for quality education in general terms, also hinges upon well-trained, qualified, and skilled teachers. As an evidence-based practice, the act of teaching demands teachers to possess the skills to pursue new knowledge, the experience to examine new methods and approaches, and the confidence to apply inquiry-based processes to bring solutions to problems—all of which could be possible through the professional development (PD) of teachers. Given that PD refers to "[...] structured professional learning that results in changes in teacher practices" (Darling-Hammond et al., p. v), one way to promote it—along with other methods—is teacher research (Ulvik, 2014). Additionally, commonly termed as action research, critical inquiry, self-study (Roulston, Legettre, DeLoach, & Pittman, 2005), or practitioner research (Yuan, Yang, & Stapleton, 2020), teacher research—as an umbrella term—fundamentally refers to the type of research teachers conduct either to enhance their teaching practices or to solve a classroom-based problem, with three major interrelated facets: reading, conducting, and using research (Hosseini, Bahrami, & Dikilitaş, 2024). Always at the core of such endeavors is promoting teachers' inquiry-based mindset and research-oriented (or informed) practices, helping them to transform into reflective practitioners (Schön, 1983) and teachers as researchers (Stenhouse, 1975). Research engagement of any kind, namely engagement with (i.e., reading/using) and in (i.e., doing/conducting) research (Borg, 2009, 2010), yields several benefits for teachers themselves, as evinced by a large volume of published studies (e.g., Borg, 2007, 2009, 2010; Cochran-Smith & Lytle, 1993, 1999). Indeed, teacher research is a fruitful continuing professional development (CPD) activity (Wyatt & Dikilitaş, 2015).

Notwithstanding its benefits, teacher research—at the same time— "remains a minority activity" (Borg, 2010, p. 391), though. Whether or not teachers are research engaged is generally affected by an array of personal, professional, and contextual factors (Borg, 2010). These factors, what Borg (2010) calls "barriers" (p. 408), include yet are not limited to non-collaborative school culture, limitations in teachers' awareness, beliefs, skills, and knowledge, and so forth (p. 409). Going beyond such "barriers", cognitive, behavioral, or attitudinal factors could also play a role in teachers' research engagement. In a sense, attitudes could also affect the extent to which teachers are research engaged given that they guide as well as predict behavior (Vogel & Wanke, 2016). As also indicated by Borg (2010), one of the major "barriers"

lies in teachers' negative attitudes to research. Besides attitudes, individual differences (IDs)—despite not being investigated much—could also affect the extent to which teachers are research-engaged (Bahrami & Hosseini, 2023). And one such influential factor could be their critical thinking (CT) in this regard, a fundamental thinking form widely referenced among the 21st century skills. As a form of higher-order thinking, CT is characterized as "[...]judging in a reflective way what to do or what to believe" (Facione, 2000, p. 61). As Sosu (2013) stated, the cognitive dimension of CT emphasizes reasoning and logical thinking and focuses on one's ability to understand problems and produce logical solutions, illustrating that critical thinking closely resembles the research process. With reference to this notion, it would be somewhat fair to claim that teacher researchers are—in some way—critical thinkers. Suter (2012) elucidates this line of reasoning by explaining that "[...]critical thinking involves keen observation and reflection plus the cognitive skills associated with analysis and evaluation" (p. 14). Suter then goes on with employing a metaphor to portray this relationship by arguing that "Teacher action researchers are scientists in their classrooms. They use critical thinking to test ideas by collecting data and revising their practice" (p. 15). Accordingly, as a component of their professional competence, teachers' CT development yields substantial importance (Wang & Jia, 2023), possibly (pre)determining their research engagement at the same time. However, concentrating on rather the CT "disposition" than the "skill", which are two distinct constructs, could be more explanatory since disposition is more comprehensive and concerned with one's motivation and willingness to employ CT skills. As Facione (2000) clearly noted, "being skilled does not assure one is disposed to use CT. And being disposed toward CT does not assure that one is skilled." (p. 81). Also, in the absence of "disposition", possessing the "skill" or "ability" is not enough for critical thinking to happen (Facione, 1990, 2000; Facione et al., 1995; Sosu, 2013).

Overall, while (in-service) teachers' research engagement is considered a substantial aspect of their PD, of equal importance is pre-service teachers' (PST) engagement. Although it is not an obligation for PSTs to conduct research—nor is it actually so for in-service teachers either, particularly in the Turkish educational context—it could be high time they become research engaged. As Kennedy (1999) remarked, pre-service teacher education is positioned between PSTs' "[...]past experiences as students in classrooms and their future experiences as teachers" (p. 57), underscoring it as the exact time for (re)shaping PSTs' own existing ideas. Otherwise, these ideas could fortify "[...]cementing them even more strongly into their apprehension of teaching and reducing the likelihood that these ideas might ever change" (p.

57). Therefore, investigating PSTs' research attitudes during their pre-service teacher education years could help understand their already existing ideas, which could also provide information about their future research orientations and practices. Like Damşa and Nerland (2016) indicated, engagement with inquiry-based tasks such as research can provide undergraduate students with specific benefits in terms of learning and development of their PD during higher professional education. Therefore, in higher education, inquiry-based learning which incorporates students' research engagement could indeed serve as an effective instrument in strengthening the teaching–research nexus (Spronken-Smith & Walker, 2010). Despite the confirmed benefits of teacher research, negative attitudes towards research are among the main reasons that prevent PSTs from doing research, though (Müjdeci, 2020). Although many studies emphasized the effect of meaningful, curricula-based research experiences on the improvement of PSTs' research skills, the number of studies which examined how these might change their attitudes towards research appears to be limited (Guilbert et al., 2016). Similarly, empirical data examining the potential effect of pre-service EFL teachers' research engagement on CTDs are very scarce. In response to these limitations and bearing also in mind the scant theoretical and empirical interest in the potential role of IDs in teachers' research engagement (Bahrami & Hosseini, 2023), this study aims to contribute to closing the gap arising from the lack of research on PSTs' research attitudes and critical thinking as a part of their research engagement.

Literature Review

Research Attitudes

As has been one of the most primary concepts in social psychology starting from the 1930s, attitude refers to "a summary evaluation of an object of thought" (Vogel & Wanke, 2016, p. 2). Attitudes comprise affective, behavioral, and cognitive responses (Vogel & Wanke, 2016) or outcomes (Fishbein & Ajzen, 1975), providing explanations for human behavior (Zimbardo et al., 1970). As Fishbein and Ajzen (1975) claimed, attitudes are critical in understanding and predicting people's reactions to a subject and in elaborating the influence of attitudes on behaviors. Like several studies have reported, these negative attitudes and feelings serve as great obstacles to learning (Waters et al., 1988; Wise, 1988). Additionally, evaluating students' attitudes toward the research related courses could prove useful to teachers in the way of enabling them to develop teaching techniques that would grant a more positive attitude toward the subject (Waters et al., 1988). Given that attitudes guide (and predict) behavior

(Vogel & Wanke, 2016), PSTs' research attitudes could be particularly important in (pre)determining their future research practices alike.

The review of literature on pre-service teacher research engagement as an undergraduate student activity embodies several empirical studies which investigated the interface between research engagement and research attitudes with pre-post designs in the international context (e.g., Ulvik, 2014; Van der Linden, 2012; Van der Linden et al., 2015; Van Katwijk et al., 2021) as well as in the Turkish context (e.g., Atak-Damar & Salı, 2022; Akyel, 2015; Savasci & Rets, 2021). Those conducted in other EFL contexts were from the Dutch and Norwegian contexts. The majority of these studies highlighted positive research attitudes after pre-service teachers' research engagement (i.e., Van der Linden, 2012; Van der Linden, 2015; Van Katwijk et al., 2021), all of which were conducted in Dutch primary teacher education programs. In their studies, participants who undertook research developed more positive attitudes towards research. In Van der Linden et al.'s (2015) study, for example, they reported that PSTs "positive beliefs about research became more positive, while their negative beliefs about research decreased" (p. 4).

Studies in the Turkish context similarly generally reported positive research attitudes of PSTs subsequent to their research engagement. One of the earlier studies was conducted by Atay (2006), where she employed pre (n= 6) (senior students) and in-service (n= 6) EFL teachers who undertook collaborative research projects. Analysis of data elicited via informal talks, journals, and research field notes illustrated that PSTs improved their research knowledge. They learned about and became encapsulated in research, by demonstrating positive attitudes towards the effect of such experience on their future teaching careers. In Cabaroğlu's (2014) study, pre-service EFL teachers (N= 60) in their senior year, conducted action research projects. Findings illustrated significant increases in their teaching self-efficacy, besides enhancements in their problem-solving skills, reflective learning, and deep thinking. Overall, they felt positive about undertaking action research. Likewise, pre-service EFL teachers (N= 24) conducted research within the scope of their senior-year practicum in Akyel's (2015) study. After their research engagement, they recognized the importance of research to promote classroom teaching and student learning as well as considered research an important aspect of PD. In Savasci and Rets's (2021) study, pre-service EFL teachers' (N= 32) attitudes towards research engagement improved; they furthermore felt more self-efficacious and overcame their research anxiety. Atak-Damar and Salı (2022) similarly investigated senior pre-service EFL teachers' (N= 85) perceptions of educational research and their own research

experiences in their research methodology courses. They held positive research attitudes, while some were not sure about the role of being research oriented.

On the contrary to all the positive enhancements, some earlier studies in the literature also reported mixed findings of negative attitudes besides positive ones (e.g., Tanış, 2019; Ulvik, 2014) although neither of them focused specifically on research attitudes. For example, Ulvik (2014) questioned the student-teacher research. In Ulvik's study, the participants, who were Norwegian student teachers in a secondary school teacher education program, verbalized both positive and negative aspects of research engagement. Although they learned from their experience, some of them reported negative attitudes, highlighting frustrations due to the challenging and unfamiliar nature of the research they needed to accomplish during a limited time. Ulvik (2014) concluded that student-teacher research comes with its costs, yet contributes to PD eventually. Similar issues were raised by Tanış (2019) in her study with Turkish pre-service EFL teachers. Subsequent to their research engagement, some noted the "irrelevance" of research engagement to practice and PD. She concluded that some PSTs may not have developed an awareness of teacher research.

From a critical standpoint, the review of literature points out some issues to consider. First, earlier empirical studies focusing specifically on PSTs' research engagement and research attitudes are comparatively fewer (e.g., Van der Linden et al., 2015). All of these studies in the international context employed PSTs from primary teacher education programs (i.e., Van der Linden, 2012; Van der Linden, 2015; Van Katwijk et al., 2021), whereas the studies in the Turkish context sampled pre-service EFL teachers. Besides, the fact that past studies employed distinct groups of PSTs, namely second grade and fourth grade student teachers, it might not be quite possible to make eloquent comparisons. Senior PSTs, in a way, have remarkable advantages over second-grade PSTs since they already took the introductory research methods course and have opportunities to observe the real-classroom environment within the scope of their teaching practicum. Therefore, studies employing senior PSTs (e.g., Akyel, 2015; Cabaroglu, 2014) are not comparable to those conducted with second-grade PSTs. In other words, comparing senior PSTs' attitudes to those of sophomores may not be fair. The literature comprises few studies of such kind (e.g., Van der Linden, 2012; Van der Linden et al., 2015; Savasci & Rets, 2021; Savasci & Atar, 2024). Also, almost all relevant studies resorted to qualitative instruments to identify research attitudes; none of them elicited data via a scale. Finally, none of them studied PSTs' research attitudes with critical thinking under the same research design.

Critical Thinking Dispositions

Building upon the seminal work of Dewey (1933), "How we think", different forms of thinking such as reflective and critical thinking have gained prominence over the years, particularly in the field of education. Critical thinking (CT), which also comprises the act of reflection, is generally defined as "[...]the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions." (Halpern, 1998, p. 70). As Facione (2000) noted, it "is a powerful tool in the search for knowledge" (p. 24), by fostering "[...] the objective, reasoned and evidence-based investigation of a very wide range of personal and social issues and concerns." (pp. 24-25).

Thinking critically embraces both cognitive skills and dispositions (Ennis, 1985; Lai, 2011). Disposition is discrete from being "able" to think critically (Ennis, 1985; Facione, 1990, 2000); CT demands the acknowledgment of when to employ critical thinking skills (CTS) and the enthusiasm to use those skills that refer to critical thinking dispositions (CTD) (Harrell & Wetzel, 2015). To illustrate, a person who is equipped with the ability and awareness of when to think critically may not be very willing to engage in such an endeavor; acting on this internal motivation is related to the person's predisposition to think critically (Halpern, 1998). CT disposition, accordingly, refers to "the consistent internal motivation to use CT skills to decide what to believe and what to do" (Facione, 2000, p. 73). In the lack of such dispositions for effortful thinking, student researchers can experience diverse tasks as enforced by others, prompting negative emotional reactions and disengagement towards research (Vansteenkiste et al., 2009). In a way, CT dispositions illustrate to what extent an individual is "positive, ambivalent, or negative towards the use of CT" (Facione, 2000, p. 73).

Also, considering that CT encompasses dispositions like "open- and fair-mindedness, inquisitiveness, flexibility, a propensity to seek reason, a desire to be well-informed, and a respect for and willingness to entertain diverse viewpoints." (Lai, 2011, p. 42), it can be suggested that critical thinking dispositions (CTDs) are not quite different from those required for undertaking research. In a sense, they have a bidirectional relationship: From one side, teachers' research engagement is likely to be fueled by the extent to which they can think critically. From the other side of the coin, research engagement offers students the opportunity to engage in a structured inquiry process through which they can develop their CT (Yuan et al., 2020). Overall, there appears to be an interface between the skills utilized to conduct research and the dispositions employed for CT.

When the literature on undergraduate research engagement is reviewed, although the potential link between CT and research engagement has been indicated by scholars in the field (e.g., Brew, 2013; Damşa & Nerland, 2016), there is—empirically speaking—only one study specifically linking research engagement to CT. In their qualitative study, Yuan et al. (2020) investigated Chinese university students' (N= 6) research engagement, who were senior undergraduate students in the English Language Program and worked as assistants in a project over one academic year. Data elicited via in-depth semi-structured interviews and their written reflections designated participants enhanced their CT skills and dispositions. However, they also reported the challenges of some participants as well as indicated the complex nature of the research process interwoven with cognitive, social, and emotional aspects.

Overall, the general review of literature on CT suggests certain drawbacks. To exemplify, some of the earlier studies on undergraduate student research focused on participants' CT skills, not dispositions. Also, these two terms have sometimes been used interchangeably, which in fact should not be the case. Therefore, studies from the dispositional perspective appear to be comparatively scarce. From a narrower perspective, there is only one empirical study (i.e., Yuan et al, 2020) to the best of the researchers' knowledge, which focused on the potential interface between research engagement and CTDs. They measured CTDs through self-reported data via qualitative instruments; namely, via in-depth semi-structured interviews and written reflections (Yuan et al., 2020). However, they did not employ scales as quantitative instruments to measure such a construct like CTD, which could provide more precise data without bias or subjectivity.

Significance, Aim, and Research Questions

Taken collectively, previous research has underscored the significance of PSTs' research engagement, yet they have—as discussed above—certain limitations and the results also ask for further empirical endeavors. As the literature also suggests, cognitive, behavioral, or attitudinal factors shaping research engagement haven't drawn much attention, either. Furthermore, none of the earlier studies focused on research attitudes and critical thinking under the same research design, embodying the ones in the international and Turkish context. Accordingly, scrutinizing the PSTs' research attitudes and critical thinking dispositions as well as seeking for potential changes in their CTDs and ATR before and after their engagement in research could be of great importance. Also, this decision was informed by Papanastasiou's (2005) suggestion; she recommended collecting data at various times during the semester to be

able to reflect the changes clearly. Therefore, this study comprised a collection of data before and after the students' engagement in research within the scope of the research methodology course. In sum, this study aimed to reveal if research engagement would have any effect on pre-service EFL teachers' research attitudes and critical thinking dispositions, specifically within the framework of language teacher education. The following research questions (RQ) guided this study:

1.   Is there a difference in pre-service EFL teachers' attitudes towards research (ATR) before and after engaging in research within the scope of the undergraduate research methodology course? If so, how??

2.   Is there a difference in pre-service EFL teachers' critical thinking dispositions (CTDs) before and after engaging in research within the scope of the undergraduate research methodology course? If so, how?

Methodology

Design

Since this study aims to examine and document students' ATR and CTDs at two time periods, namely before and after engaging in research, a pre-experimental design was adopted (Fraenkel et al., 2022). Given the lack of any comparison or control groups, a one-group pretest-posttest format was followed. Inasmuch as data were elicited via two scales, the study was quantitative in nature, too. A quantitative research design entails collecting numerical data and analyzing it with statistical methods (Mackey & Gass, 2022), enabling the systematic examination of social phenomena using mathematical and statistical techniques (Given, 2008). Participants were examined at two different points in time to provide a "snapshot" (Cohen et al., 2018, p. 348) of the participants at a specific moment in time.

Setting and Participants

Data for this study were collected in a Turkish university context where students studied English as a foreign language (EFL). They were enrolled in a four-year 240-ECTS pre-service teacher education program where the course plan involves both theoretical and practical courses on foreign language education. Upon their graduation, they generally become in-service EFL teachers at private or state K-12 schools or language institutions affiliated with the Turkish Ministry of Education (MoNE). The participants of this study were pre-service EFL

teachers enrolled in a four-year undergraduate foreign language teacher education program at a state university in the Marmara Region, Türkiye. At the time of the data collection, they were sophomore (i.e., second year) students who took the "Research Methods in Education" course, which is a compulsory course in their fourth semester in their course plan. Participants were fourteen students (12 females, 2 males), whose ages range between 20 and 28 (M= 21.86, *SD*= 2.214). They were employed through convenience and purposive sampling, for they were conveniently accessible to the researchers and fit the criteria—which is taking the research course and engaging in research. Participants were invited to participate in the study on a voluntary basis after making sure they met the research participation criteria. Among 71 students who took the course, 14 of them provided their consent to participate in the study. Those who agreed to participate were asked to respond to a pre-test battery before engaging in research in the 8th week of the course, after the theoretical issues were covered. As their final assignment, they were required to find a research topic and conduct a small-scale research study collaboratively in groups (comprising a minimum of three and a maximum of five members) they had chosen. During their research engagement process, they initially started searching for a topic and were given six weeks to complete their study. Some of the research topics they investigated were as follow: Assessing peer feedback literacy level of EFL learners, High school teachers' perceptions towards teaching pronunciation in EFL classrooms, Engaging inclusivity in general education: Understanding the perceptions of pre-service English language teachers, Novice EFL teachers' challenges in their initial years, Pre-service EFL teachers' attitudes towards English varieties. After completing the research (i.e., conceptualization; data collection, analysis, and interpretation), they were asked to respond to the post-test battery of the study in the 15th week to track the potential changes in their previous attitudes and dispositions. Obtaining their voluntary consent, participants were specifically notified that participating in research would not by no means affect their course grade or performance.

The compulsory Research Methods in Education course in which the participants of this study were enrolled was designed to enable students to acquire theoretical knowledge about the concept of scientific research, different principles, methods, and stages of scientific research, as well as to learn practically how to conduct a scientific study through a small-scale research study. The course covers the following content: Basic concepts and principles related to research methods, data collection tools and procedure, analysis and evaluation of data, basic

paradigms in scientific research, quantitative and qualitative research patterns, sampling, and preparing a research report in accordance with research principles and ethics.

Instruments

Two quantitative instruments were used to elicit data: 1) the Revised Attitudes Towards Research Scale (R-ATR) (Papanastasiou, 2014) and 2) the Marmara Critical Thinking Dispositions Scale (MCTDS) (Özgenel & Çetin, 2018).

Considering RQ1, which sought to investigate participants' research attitudes, the Revised Attitudes Towards Research Scale (R-ATR) by Papanastasiou (2014) was administered. This scale was specifically selected since it yields strong psychometric properties and is one of the few tools created for measuring undergraduate student attitudes towards educational research methods in the field of education. It was administered in its original language English, given that participants had upper-intermediate to advanced level of English proficiency Overall, the scale comprises 13 items, which are divided into three factors, namely Research usefulness (4 items), Research anxiety (5 items- all reverse coded), and Positive research predispositions (4 items). Responses on the scale ranged from 1 (strongly disagree) to 7 (strongly agree). The maximum score on this scale is 91, whereas the minimum is 13—with higher scores displaying more positive research attitudes. The reliability coefficient of the three factors ranged between 0.86 and 0.92, indicating a very good to excellent range in terms of internal consistency.

To address RQ2, the Marmara Critical Thinking Dispositions Scale (MCTDS) developed by Özgenel and Çetin (2018) was used to elicit data about the participants' critical thinking dispositions. The scale, developed originally in Turkish, was also administered to the participants in this study in its original language, in Turkish. However, to ensure clarity and consistency in the presentation of findings, the items are presented in their translated versions in English in this manuscript. Therefore, researchers who tend to use this scale should not use these English versions of these items but use the original versions in Turkish. The MCTDS consists of 28 items, divided into six sub-dimensions: Reasoning (items 1-6, 6 items), Reaching judgment (items 7-12, 6 items), Searching for evidence (items 13-16, 4 items), Searching for the truth (items 17-20, 4 items), Open-mindedness (items 21-24, 4 items), and Systematicity (items 25-28, 4 items). The students rated each item on a 5-point Likert-type scale, ranging between 1 (never) and 5 (always). The MCTDS scores range from a minimum of 28 to a maximum of 140 points, with higher scores illustrating greater dispositions. While the sub-

dimensions of Reasoning and Reaching judgment constitute 30 points, the other four categories (i.e., Searching for evidence, Searching for the truth, Open-mindedness, and Systematicity) constitute 20 points each. This scale was particularly selected for this study since it was designed to measure the general critical thinking dispositions of teachers and administrators in a valid and reliable way. The scale's general reliability coefficient (Cronbach's alpha coefficient) was 0.91, indicating higher internal consistency levels. When the validity of the MCTDS is examined, it is seen that it is supported by its strong content validity, solid construct validity proven by factor analysis, significant criterion-related validity through correlation analysis, and high internal consistency reliability. This made the MCTDS a reliable and valid tool for assessing the CTDs of participants in this study.

Data Collection and Analysis

Data were collected at the end of the 2023-2024 academic year Spring semester. Initially, the consents of the scholars who developed the instruments, namely the R-ATR and MCTDS, were obtained via email, followed by researchers applying to the university's Educational Research and Publication Ethics Committee, where they are affiliated with. Having received the committee's approval, the participants were invited to participate in the study and those who provided their consent were sent the online instrument battery (through Google Forms). Before they engaged in research, they responded to the pretest (i.e., in Week 8), whereas they completed the posttest subsequent to the completion of the research methods course (i.e., in Week 15).

The quantitative data elicited via two scales were analyzed using the SPSS 21.0 statistical program (IBM, 2021). First, Kolmogorov-Smirnov and Shapiro-Wilk tests as well as Q-Q plots and Histograms were used to check the normality of the data and potential outliers. Results showed that the data were normally distributed on the R-ATR scale; however, the data in MCTDS did not meet the assumption of normality. First of all, descriptive statistics (mean, median, and standard deviation) and frequency analyses were employed to report the responses to pre-test and post-test in each scale separately. Besides descriptive statistics, inferential statistics were also administered. Due to data not being distributed normally and the small sample size, the non-parametric Wilcoxon signed-rank test was used to identify the potential differences between pre and post-test results to seek whether there was a significant change in students' CTDs and ATR.

Findings

With regard to participants' ATR, findings of the descriptive statistics analyses of the R-ATR scale, including mean, median, and standard deviation values (for both pre and post-test), are detailed in Table 1.

Table 1. Descriptive Statistics and Wilcoxon Signed-Rank Test Results for the R-ATR Scale

Factor	Point Range	Pre-Test			Post-Test			Tendency	Wilcoxon	
		M	Mdn	*SD*	M	Mdn	*SD*		Z	Sig. (*p*)
Research Usefulness	4-28	19.21	19.50	5.873	19.43	21	5.214	↑	-.070	.944
Research Anxiety**	5-35	28	28.50	4.279	23.71	23	6.707	↓	-1.926	.054
Positive Research Dispositions	4-28	12.57	12	4.603	15.71	16.50	5.511	↑	-1.854	.064
Overall	13-91	43.79	45	11.892	51.43	53.50	13.838	↑	-1.609	.108

Note. * denotes a statistically significant difference; ** comprises reverse-coded items; ↑ illustrates an increasing tendency; ↓ illustrates a decreasing tendency
M= Mean, Mdn= Median, *SD*= Standard Deviation

As presented in Table 1, analyses overall indicated that from the pre-test (namely, before research engagement) to post-test (namely, after research engagement), participants had more positive ATR overall and in all factors. In the pre-test, participants displayed comparatively higher levels of research anxiety (M= 28, *SD*= 4.279), yet it decreased noticeably (M= 23.71, *SD*= 6.707). Similarly, improvements in participants' attitudes both regarding research usefulness and positive research dispositions were found, with greater improvements in the latter. In other words, their positive research dispositions (M= 12.57 in the pre-test, M= 15.71 in the post-test) enhanced more than did their attitudes towards research usefulness (M= 19.21 in the pre-test, M= 19.43 in the post-test). As also provided in Table 1, the Wilcoxon signed-rank test results reflected that research engagement did not elicit a statistically significant change in participants' attitudes toward research in any of the factors (Research usefulness Z = -.070, p = .944, Research anxiety Z = -1.926, p = .054, Positive research dispositions Z = -1.854, p = .064, and Total Z = -1.609, p = .108). Nevertheless, their ATR overall improved considerably.

Corresponding to research usefulness, PSTs considered research to be above average in importance, and after their engagement, there was a slight increase in the post-test suggesting

that this view did not change much. Results of items before and after research engagement are presented in Table 2.

As shown in Table 2, pre-test results illustrated that before their engagement, the majority of PSTs considered that research was useful for their career (78.6%), the research skills would be helpful to them in the future (85.8%), and research was connected to their field of study (71.4%), whereas they did not consider research that indispensable for their professional training as their responses highly varied and only less than half of them (42.8%) agreed. Subsequent to their research engagement, on the other hand, post-test results illustrated a slight decrease in PSTs' attitudes towards the usefulness of research for their career (71.4%, with a -0.15 mean difference) and research skills (71.4%, with a -0.57 mean difference) as well as a slight increase in connection between research and the field (64.3%, with a +0.36 mean difference). Despite these slight decreases, the majority still agreed with the aforementioned statements. Yet more strikingly, there was a notable increase in their attitudes towards the criticality of research in their professional training as this time, more than half of them (57.2%) acknowledged its criticality.

Besides the changes in their attitudes towards the usefulness of research, PSTs' research anxiety also underwent some changes during the process. In fact, among three factors of the R-ATR scale, this is the one where the greatest improvement was observed (see Table 1). After research engagement, participants had comparatively lower anxiety levels in the post-test. Details regarding the research anxiety factor are provided in Table 3.

Table 2. Results of the Research Usefulness Factor

Items	Pre-Test										Post-Test										Wilcoxon	
	M	Mdn	SD	1	2	3	4	5	6	7	M	Mdn	SD	1	2	3	4	5	6	7	Z	Sig. (p)
4. Research is useful for my career.	5.36	6	2.098	2 14.3%	0 -	0 -	1 7.1%	3 21.4%	2 14.3%	6 42.9%	5.21	5.50	1.528	0 -	1 7.1%	1 7.1%	2 14.3%	3 21.4%	4 28.6%	3 21.4%	-.365	.715
10. The skills I have acquired in research will be helpful to me in the future.	5.36	6	1.499	1 7.1%	0 -	0 -	1 7.1%	4 28.6%	6 42.9%	2 14.3%	4.79	5	1.762	1 7.1%	1 7.1%	1 7.1%	1 7.1%	5 35.7%	3 21.4%	2 14.3%	-1.065	.287
7. Research is connected to my field of study.	4.64	5	1.737	2 14.3%	0 -	0 -	2 14.3%	6 42.9%	3 21.4%	1 7.1%	5	5.50	1.881	0 -	2 14.3%	2 14.3%	1 7.1%	2 14.3%	3 21.4%	4 28.6%	-.353	.724
11. Research should be indispensable in my professional training.	3.86	4	1.791	2 14.3%	1 7.1%	3 21.4%	2 14.3%	4 28.6%	1 7.1%	1 7.1%	4.43	5	1.158	0 -	1 7.1%	2 14.3%	3 21.4%	6 42.9%	2 14.3%	0 -	-1.081	.280

Note. * denotes a statistically significant difference
1= Strongly Disagree, 2= Disagree, 3= Somewhat Disagree, 4= Neutral, 5= Somewhat Agree, 6= Agree, 7= Strongly Agree.

Table 3. Results of the Research Anxiety Factor

Items	Pre-Test										Post-Test										Z	Sig. (*p*)
	M	Mdn	SD	1	2	3	4	5	6	7	M	Mdn	SD	1	2	3	4	5	6	7		
8. Research courses are stressful**	6.07	6	.829	0 -	0 -	0 -	0 -	4 28.6%	5 35.7%	5 35.7%	5	5	1.301	0 -	1 7.1%	0 -	3 21.4%	6 42.9%	2 14.3%	2 14.3%	-2.226	.026*
12. Research courses are difficult**	6	6	.961	0 -	0 -	0 -	1 7.1%	3 21.4%	5 35.7%	5 35.7%	5.50	6	1.401	0 -	1 7.1%	1 7.1%	0 -	2 14.3%	8 57.1%	2 14.3%	-.907	.365
9. Research courses make me nervous**	5.86	6	1.231	0 -	0 -	1 7.1%	0 -	5 35.7%	2 14.3%	6 42.9%	4.64	5	1.447	0 -	2 14.3%	0 -	4 28.6%	4 28.6%	3 21.4%	1 7.1%	-2.291	.022*
3. Research courses scare me**	5.07	5	1.542	0 -	1 7.1%	1 7.1%	3 21.4%	3 21.4%	3 21.4%	3 21.4%	4.29	3.50	1.939	0 -	3 21.4%	4 28.6%	1 7.1%	0 -	4 28.6%	2 14.3%	-1.552	.121
1. Research courses make me anxious**	5	5.50	1.664	1 7.1%	1 7.1%	0 -	1 7.1%	4 28.6%	6 42.9%	1 7.1%	4.29	4.50	1.978	1 7.1%	3 21.4%	1 7.1%	2 14.3%	1 7.1%	5 35.7%	1 7.1%	-1.141	.254

Note. * denotes a statistically significant difference; **denotes reverse-coded items.
1= Strongly Disagree, 2= Disagree, 3= Somewhat Disagree, 4= Neutral, 5= Somewhat Agree, 6= Agree, 7= Strongly Agree.

As documented in Table 3, before research engagement, PSTs mostly felt stressed (100%), nervous (92.9%), anxious (78.6%), and scared (64.2%) about the research course besides finding it highly difficult (92.8%) in the pre-test. Nonetheless, in the post-test, PSTs' anxiety level decreased moderately in two items, the ones regarding their anxiety (49.9%, with a -0.71 mean difference) and fright (42.9%, with a -0.78 mean difference). Their stress (71.5%, with a -1.07 mean difference) and nervousness (57.1%, with a -1.22 mean difference) also decreased, where decreases in their stress (Z= -2.226, p= .026) and nervousness (Z= -2.291, p= .022) were statistically significant, as the Wilcoxon signed-rank test results yielded. Albeit not significantly, a slight decrease was observed in their attitudes towards course difficulty, yet a considerable majority (85.7%) still found the research course difficult. Overall, these results suggest that research engagement helped them alleviate these negative attitudes to some extent.

Like in the previous two factors, increases were found in the final factor of the R-ATR scale, namely in Positive research dispositions. Results pertinent to this factor are provided in Table 4. As compared to the other factors in the scale, PSTs' research dispositions were not much positive before their engagement. In the pre-test, not more than a quarter of them found the research course interesting (28.6%), enjoyable (14.3%), pleasant (7.1%), or loved it (7.1%). In the post-test, however, they held more positive research dispositions. Notably, more PSTs started to think that the research course was enjoyable (57.1%, with a +1.21 mean difference), interesting (50%, with a +0.28 mean difference), and pleasant (42.8%, with a +0.79 mean difference), with the increase in their enjoyment being statistically significant (Z= -2.413, p= .016). However, a minority of PSTs indicated their love towards research (28.5%) after the course; even so, there was an increase from the pre-test to post-test. As the post-test results yielded, overall positive research dispositions moderately increased compared to the pre-test, indicating research engagement helped PSTs develop more positive attitudes towards research.

Table 4. Results of the Positive Research Dispositions Factor

Items	Pre-Test											Post-Test											Wilcoxon	
	M	Mdn	SD	1	2	3	4	5	6	7	M	Mdn	SD	1	2	3	4	5	6	7	Z	Sig. (p)
6. I find research courses interesting.	3.86	4	1.460	1 7.1%	2 14.3%	1 7.1%	6 42.9%	2 14.3%	2 14.3%	0 -	4.14	4.50	1.657	1 7.1%	1 7.1%	4 28.6%	1 7.1%	3 21.4%	4 28.6%	0 -	-.408	.683
13. Research courses are pleasant.	3	3	1.117	2 14.3%	2 14.3%	5 35.7%	4 28.6%	1 7.1%	0 -	0 -	3.79	4	1.528	1 7.1%	3 21.4%	1 7.1%	3 21.4%	5 35.7%	1 7.1%	0 -	-1.541	.123
2. I enjoy my research course(s).	2.93	3	1.328	2 14.3%	4 28.6%	3 21.4%	3 21.4%	2 14.3%	0 -	0 -	4.14	5	1.406	1 7.1%	1 7.1%	2 14.3%	2 14.3%	7 50%	1 7.1%	0 -	-2.413	.016*
5. I love research courses.	2.79	2.50	1.578	4 28.6%	3 21.4%	1 7.1%	5 35.7%	0 -	1 7.1%	0 -	3.64	3.50	1.692	1 7.1%	3 21.4%	3 21.4%	3 21.4%	2 14.3%	1 7.1%	1 7.1%	-1.749	.080

Note. * denotes a statistically significant difference
1= Strongly Disagree, 2= Disagree, 3= Somewhat Disagree, 4= Neutral, 5= Somewhat Agree, 6= Agree, 7= Strongly Agree.

Likewise their research attitudes, participants' CTDs also improved after their research engagement. Results of the descriptive statistics analyses of the MCTDS, embracing the mean, median, and standard deviation values (for both pre-test and post-test) as well as inferential statistics for Wilcoxon-signed rank test, are presented in Table 5 according to the mean score increases from largest to smallest.

As tabulated in Table 5, the total mean scores of participants' CTDs were above average before their research engagement (M= 107.07 out of 140 maximum points), yet also improved after their research engagement (M= 111.21, with +4.14 mean difference) with no significant differences (Z= -1.613, p= .107). With respect to the order of the average score differences between the pre-test and post-test, there were considerable gains in the sub-dimensions, particularly in Searching for the truth (M= 14.71 in the pre-test, M= 16.07 in the post-test), which was statistically significant (Z= -2.980, p= .003). Increases in other sub-dimensions, from largest to smallest, were also observed in Reasoning, Systematicity, Reaching judgment, and Searching for evidence with the exception of the sub-dimension Open-mindedness in which participants displayed a very slight decrease (M= 16.07 in the pre-test, M= 15.71 in the post-test, with a -.36 mean difference). When the total means of the MCTDS are compared, an overall growth is evident. Concerning the inferential statistics results, with the exception of one factor, the Wilcoxon signed-rank test demonstrated no statistically significant differences in PSTs' CTDs in any of the factors after research engagement. Searching for the truth sub-dimension was the sole factor that experienced a statistically significant change (Z= -2.980, p= 0.003), suggesting that research engagement had a positive and significant impact on PSTs' searching for the truth dispositions.

Results in connection with participants' Searching for the truth sub-dimension are given in Table 6.

Table 5. Descriptive Statistics and Wilcoxon Signed-Rank Test Results for the MCTDS Pre-test and Post-test Comparisons

Sub-dimensions	Point Range	Pre-Test			Post-Test			Tendency	Wilcoxon	
		M	Mdn	*SD*	M	Mdn	*SD*		Z	Sig. (*p*)
Searching for the truth	4-20	14.71	14.50	2.054	16.07	16.50	2.200	↑	-2.980	.003*
Reasoning	6-30	23.50	24.50	4.256	24.71	25	3.730	↑	-1.344	.179
Systematicity	4-20	15.57	15	2.766	16.50	16.50	2.139	↑	-1.264	.206
Reaching Judgment	6-30	21.43	21.50	4.380	22.14	23	3.416	↑	-.889	.374
Searching for evidence	4-20	15.79	15.50	2.636	16.07	16.50	3.149	↑	-.583	.560
Open-mindedness	4-20	16.07	16	2.645	15.71	16	2.614	↓	-.162	.871
Total	13-140	107.07	105.00	15.969	111.21	114.00	14.482	↑	-1.613	.107

Note. * denotes a statistically significant difference; ↑ illustrates an increasing tendency; ↓ illustrates a decreasing tendency
M= Mean, Mdn= Median, *SD*= Standard Deviation

Table 6. Results of Searching for the truth Sub-dimension

Items	Pre-Test								Post-Test								Wilcoxon	
	M	Mdn	*SD*	1	2	3	4	5	M	Mdn	*SD*	1	2	3	4	5	Z	Sig. (*p*)
17. I do not rush when evaluating the information or ideas I acquire.	3.07	3	.997	0 -	5 25.7%	4 28.6%	4 28.6%	1 7.1%	3.64	4	.745	0 -	1 7.1%	4 28.6%	8 57.1%	1 7.1%	-2.309	.021*
20. I handle problems or events realistically.	4.07	4	.730	0 -	0 -	3 21.4%	7 50%	4 28.6%	4.36	4	.633	0 -	0 -	1 7.1%	7 50%	6 42.9%	-1.414	.157
19. I use my mental and emotional skills to do or learn something new.	3.86	4	.663	0 -	0 -	4 28.6%	8 57.1%	2 14.3%	4.14	4	.864	0 -	0 -	4 28.6%	4 28.6%	6 42.9%	-1.265	.206
18. I investigate the reasons behind an idea, event, situation or problem.	3.71	4	.726	0 -	0 -	6 42.9%	6 42.9%	2 14.3%	3.93	4	.616	0 -	0 -	3 21.4%	9 64.3%	2 14.3%	-1.342	.180

Note. * denotes a statistically significant difference
         1= Never, 2= Rarely, 3= Sometimes, 4= Usually, 5= Always.

Findings illustrated that after their research engagement, PSTs improved their CT dispositions regarding handling problems or events realistically, using their mental and emotional skills to do or learn something new, and investigating the reasons behind an idea, event, situation, or problem. The major and the only significant gain was in the item regarding their rush while evaluating the information or ideas they acquired (M= 3.07 in the pre-test, M= 3.64 in the post-test, with a +.57 mean difference).

Besides gains in sub-dimension Searching for the truth, there were considerable (yet not statistically significant) gains in the Reasoning sub-dimension, as reported in Table 7. As Table 7 illustrates, there were improvements in PSTs' CT dispositions in almost all items, with the most noticeable ones in evaluating all aspects of a problem, situation, or event (M= 3.71 in the pre-test, M= 4.21 in the post-test, with a +.50 mean difference) and gathering sufficient information before evaluating an idea, problem, or situation (M= 3.64 in the pre-test, M= 4.07 in the post-test, with a +.43 mean difference). On the whole, when the mean scores of pre-test and post-test of the reasoning sub-dimension are considered, findings indicate that PSTs displayed higher levels of reasoning after their research engagement.

Another sub-dimension of the MCTDS where PSTs enhanced their dispositions was Systematicity. As illustrated in Table 8, there were increases in all the items.

Table 7. Results of Reasoning Sub-dimension

Items				Pre-Test								Post-Test						Wilcoxon	
	M	Mdn	*SD*	1	2	3	4	5	M	Mdn	*SD*	1	2	3	4	5	Z	Sig. (*p*)
3. I evaluate all aspects of a problem, situation or event.	3.71	4	.914	0 -	2 14.3%	2 14.3%	8 57.1%	2 14.3%	4.21	4	.802	0 -	0 -	3 21.4%	5 35.7%	6 42.9%	-1.897	.058
4. I gather sufficient information before evaluating an idea, problem, or situation.	3.64	4	.842	0 -	1 7.1%	5 35.7%	6 42.9%	2 14.3%	4.07	4	.917	0 -	1 7.1%	2 14.3%	6 42.9%	5 35.7%	-1.513	.130
2. I try to explain problems, situations or events.	3.86	4	.949	0 -	2 14.3%	1 7.1%	8 57.1%	2 14.3%	4.07	4	.917	0 -	1 7.1%	2 14.3%	6 42.9%	5 35.7%	-1.000	.317
1. I analyze the relationships between events, ideas or problems.	4.07	4	.730	0 -	0 -	3 21.4%	7 50%	4 28.6%	4.21	4	.579	0 -	0 -	1 7.1%	9 64.3%	4 28.6%	-.816	.414
6. I investigate the cause of events or problems.	4	4	.877	0 -	1 7.1%	2 14.3%	7 50%	4 28.6%	4	4	.877	0 -	1 7.1%	2 14.3%	7 50%	4 28.6%	.000	1.000
5. I question an idea, information, problem, event or situation I encounter.	4.21	4	.893	0 -	1 7.1%	1 7.1%	6 42.9%	6 42.9%	4.14	4	.535	0 -	0 -	1 7.1%	10 71.5%	3 21.4%	-.447	.655

Note. * denotes a statistically significant difference
1= Never, 2= Rarely, 3= Sometimes, 4= Usually, 5= Always.
M= Mean, Mdn= Median, *SD*= Standard Deviation

Table 8. Results of Systematicity Sub-dimension

Items	Pre-Test								Post-Test								Wilcoxon	
	M	Mdn	*SD*	1	2	3	4	5	M	Mdn	*SD*	1	2	3	4	5	Z	Sig. (*p*)
25. I draw conclusions from the events I experience or the information I obtain.	3.86	4	1.027	0 -	2 14.3%	2 14.3%	6 42.9%	4 28.6%	4.21	4	.579	0 -	0 -	1 7.1%	9 64.3%	4 28.6%	-1.299	.194
26. I plan when and how I will do something.	3.93	4	1.141	0 -	2 14.3%	3 21.4%	3 21.4%	6 42.9%	4.21	4	.893	0 -	1 7.1%	1 7.1%	6 42.9%	6 42.9%	-1.190	.234
27. I take my own values into account when evaluating ideas or events.	3.79	4	.893	0 -	1 7.1%	4 28.6%	6 42.9%	3 21.4%	4	4	.877	0 -	1 7.1%	2 14.3%	7 50%	4 28.6%	-1.134	.257
28. I make inferences about an idea, event, problem or situation.	4	4	.679	0 -	0 -	3 21.4%	8 57.1%	3 21.4%	4.07	4	.730	0 -	0 -	3 21.4%	7 50%	4 28.6%	-.378	.795

Note. * denotes a statistically significant difference
1= Never, 2= Rarely, 3= Sometimes, 4= Usually, 5= Always.
M= Mean, Mdn= Median, *SD*= Standard Deviation

According to results presented in Table 8, PSTs reported comparatively higher levels of systematicity after their research engagement. Specifically, the highest gains were concerned with their dispositions regarding drawing conclusions from the events they experience or the information they obtain (M= 3.86 in the pre-test, M= 4.21 in the post-test, with a +.35 mean difference) and planning when and how they would do something (M= 3.93 in the pre-test, M= 4.21 in the post-test, with a +.28 mean difference). Nevertheless, making inferences about an idea, event, problem or situation attained the smallest gain between pre and post-test mean scores, for PSTs did not enhance their relevant dispositions much. Overall, though, despite none of them being statistically significant, an increase in all items were observed.

Results of PSTs' Reaching Judgment sub-dimension are displayed in Table 9. Similar to the other sub-dimensions, the Reaching Judgment sub-dimension had an increase in the mean scores as well. As illustrated in Table 9, in Reaching judgment, PSTs generally had moderate to high mean scores in this sub-dimension. After research engagement, they displayed an increase in their disposition regarding classifying information (M= 2.79 in the pre-test, M= 3.29 in the post-test, with a +.50 mean difference), followed by evaluating the risks, drawing conclusions, and asking appropriate questions to understand a topic. However, in the post-test there was a slight yet nonsignificant decrease in reaching a new conclusion from the general information and trying to understand a problem or idea that they have encountered. Overall, almost all items demonstrated gains in mean scores.

Another sub-dimension in the scale was concerned with Searching for evidence sub-dimension, where participants experienced slight gains. Table 10 presents the results.

Table 9. Results of Reaching Judgment Sub-dimension

Items	Pre-Test								Post-Test								Wilcoxon	
	M	Mdn	*SD*	1	2	3	4	5	M	Mdn	*SD*	1	2	3	4	5	Z	Sig. (*p*)
7. I classify information about an event, idea or problem according to their similarities and differences.	2.79	3	1.051	2 14.3%	2 14.3%	8 57.1%	1 7.1%	1 7.1%	3.29	3	.914	0 -	3 21.4%	5 35.7%	5 35.7%	1 7.1%	-1.658	.097
11. I draw a general conclusion from an idea, event or situation that I consider individually.	3.50	3.50	.941	0 -	2 14.3%	5 35.75%	5 35.7%	2 14.3%	3.71	4	.726	0 -	0 -	6 42.9%	6 42.9%	2 14.3%	-.879	.380
9. I evaluate the risks I identify regarding a situation, problem or event.	3.43	3.50	1.222	1 7.1%	2 14.3%	4 28.6%	4 28.6%	3 21.4%	3.64	4	.929	0 -	2 14.3%	3 21.4%	7 50%	2 14.3%	-.965	.335
12. I ask appropriate questions to understand a topic or idea.	3.71	4	.914	0 -	1 7.1%	5 35.7%	5 35.7%	3 21.4%	3.86	4	.663	0 -	0 -	4 28.6%	8 57.1%	2 14.3%	-.632	.527
8. I reach a new conclusion from the general information I have learned.	3.71	4	.825	0 -	1 7.1%	4 28.6%	7 50%	2 14.3%	3.64	4	.929	0 -	2 14.3%	3 21.4%	7 50%	2 14.3%	-.447	.655
10. I try to understand a problem, idea or event I encounter.	4.29	4	.825	0 -	1 7.1%	0 -	7 50%	6 42.9%	4	4	.784	0 -	1 7.1%	1 7.1%	9 64.3%	3 21.4%	-1.633	.102

Note. * denotes a statistically significant difference
1= Never, 2= Rarely, 3= Sometimes, 4= Usually, 5= Always.
M= Mean, Mdn= Median, *SD*= Standard Deviation

Table 10. Results of Searching for evidence Sub-dimension

Items	Pre-Test								Post-Test								Wilcoxon	
	M	Mdn	*SD*	1	2	3	4	5	M	Mdn	*SD*	1	2	3	4	5	Z	Sig. (*p*)
16. I evaluate the rightness or wrongness of my thoughts and actions.	3.93	4	.730	0 -	0 -	4 28.6%	7 50%	3 21.4%	4.07	4	.829	0 -	1 7.1%	1 7.1%	8 57.1%	4 28.6%	-.632	.527
15. I look for strong evidence to accept the truth of an idea or information I encounter.	4.07	4	.917	0 -	1 7.1%	2 14.3%	6 42.9%	5 35.7%	4.14	4	.864	0 -	1 7.1%	1 7.1%	7 50%	5 35.7%	-.378	.705
14. I obtain information from reliable and different sources.	3.86	4	1.099	0 -	2 14.3%	3 21.4%	4 28.6%	5 35.7%	3.93	4	.917	0 -	1 7.1%	3 21.4%	6 42.9%	4 28.6%	-.333	.739
13. I support my opinions with reliable information and strong evidence.	3.93	4	.917	0 -	1 7.1%	3 21.4%	6 42.9%	4 28.6%	3.93	4	.997	0 -	2 14.3%	1 7.1%	7 50%	4 28.6%	-.087	.931

Note. * denotes a statistically significant difference
1= Never, 2= Rarely, 3= Sometimes, 4= Usually, 5= Always.
M= Mean, Mdn= Median, *SD*= Standard Deviation.

As reported in detail in Table 10, results showed slight increases in all items, except for one. The largest gain among all was in evaluating the rightness or wrongness of thoughts and actions (M= 3.93 in the pre-test, M= 4.07 in the post-test, with a +.14 mean difference). Besides, participants ameliorated their disposition regarding looking for strong evidence and obtaining information from reliable and different sources, while they still needed to experience the change in supporting their opinions with reliable information and strong evidence.

Lastly, the sub-dimension where the smallest increase among others was observed is Open-mindedness. Table 11 displays the results of this sub-dimension. As the results suggest, the items in the Open-mindedness sub-dimension displayed either slight increases or decreases, or were the same, yet none of them were statistically significant. The only item with a slight increase was explaining the reason for a mistake or behavior they made (M= 4.14 in the pre-test, M= 4.21 in the post-test, with a +.07 mean difference). Although there were slight (and non-significant) decreases in two items regarding their dispositions about respecting people having different ideas and considering other people's opinions in problem-solving and decision-making, the percentage of participants who "usually" and "always" do so was almost the same or even higher (78.6% in the pre-test-78.5% in the post-test, 64.3% in the pre-test-71.4% in the post-test, respectively). Overall, item 23 attained the highest mean gain, representing that PSTs tend to explain the reason for a mistake or behavior they made.

Table 11. Results of Open-Mindedness Sub-dimension

Items	Pre-Test								Post-Test								Wilcoxon	
	M	Mdn	*SD*	1	2	3	4	5	M	Mdn	*SD*	1	2	3	4	5	Z	Sig. (*p*)
23. I explain the reason for a mistake or behavior I made.	4.14	4	.864	0 -	1 7.1%	1 7.1.6%	7 50%	5 35.7%	4.21	4	.699	0 -	0 -	2 14.3%	7 50%	5 35.7%	-.277	.782
24. I look at situations, ideas or events from different perspectives when dealing with them.	3.86	4.00	.770	0 -	0 -	5 35.7%	6 42.9%	3 21.4%	3.86	4.00	.864	0 -	1 7.1%	3 21.4%	7 50%	3 21.4%	.000	1.000
22. I respect people who have different ideas.	4.14	4	.949	0 -	1 7.1%	2 14.3%	5 35.7%	6 42.9%	3.93	4	.829	0 -	1 7.1%	2 14.3%	8 57.1%	3 21.4%	- 1.000	.317
21. I take other people's opinions into account when solving problems or making decisions.	3.93	4	.829	0 -	0 -	5 35.7%	5 35.7%	4 28.6%	3.71	4	.726	0 -	1 7.1%	3 21.4%	9 64.3%	1 7.1%	- 1.000	.317

Note. * denotes a statistically significant difference
1= Never, 2= Rarely, 3= Sometimes, 4= Usually, 5= Always.
M= Mean, Mdn= Median, *SD*= Standard Deviation.

Discussion

This study sought to explore whether research engagement within the scope of an undergraduate research methodology course would make any difference in pre-service EFL teachers' research attitudes and critical thinking dispositions. Analysis of data collected through scales revealed improvements in both research attitudes and critical thinking dispositions subsequent to their research engagement. The first research question, seeking pre-service EFL teachers' attitudes towards research, provided insights into their research attitudes. The analyses yielded considerable positive changes, which concur with the findings of Van der Linden (2012) and Van der Linden et al. (2015). In their studies with Dutch second-year student teachers, they similarly reported improvements in positive research attitudes and regressions in negative ones. Findings of this study illustrated positive changes particularly in participants' research anxiety, followed by the improvements in positive research dispositions and research usefulness (see Table 1). Although they still found the research course difficult echoing the findings of Ulvik (2014), Tanış (2019), and Savasci and Rets (2021), their stress and nervousness significantly decreased as in Van der Linden et al.'s (2015) and Savasci and Rets's (2021) studies and they started to find research much more enjoyable. Before their engagement, they felt stressed, anxious, and scared, all of which were alleviated to some extent after their research engagement. This finding is consistent with that of Lombard and Kloppers (2015), who also noted that the majority of PSTs felt insecure and nervous before engaging in research. Given that participants in this study needed to conduct their study in a considerably short time period (i.e., six weeks), they might have suffered from those negative attitudes at the onset but later on could surpass them to a moderate degree because the research anxiety level went through a moderate level of decrease after research engagement. A few reasons can be suggested for this positive change: One of them is the fact that participants worked on their research projects collaboratively (i.e., in groups). As working collaboratively is often more comforting than taking on the entire task alone, particularly while undertaking tasks for the first time, such collaboration might have caused a decrease in their anxiety levels and an increase in their research attitudes overall. In Atak-Damar and Salı's (2022) study, fourth-year Turkish EFL pre-service teachers found collaboration as a critical aspect of the research process. From another perspective, after research engagement, they might have gained confidence in their research skills as in Van Katwijk et al.'s (2021) study, which might have caused a decrease in their anxiety; similar findings were reported in Müjdeci's (2020) study as well.

The most striking finding regarding their research attitudes was that PSTs acknowledged the criticality of research for their profession, who had not substantially considered this to be the case before their engagement. This finding aligns with those of earlier studies (e.g., Akyel, 2015; Van der Linden, 2012; Van der Linden et al., 2015; Savasci & Atar, 2024), who similarly reported that PSTs found research prominent and useful for their profession. After their research engagement, PSTs might have realized the substantial impact that research might have on their profession. Overall, there was an increase in participants' positive research dispositions after engaging in research. This increase might be because of the same reason mentioned earlier, which is gaining confidence in their ability to conduct research (Müjdeci, 2020). Once their self-confidence improved, they might have started to feel more positive about doing research.

Likewise, their research attitudes, their critical thinking dispositions (CDTs) addressed in the light of second research question also improved considerably (see Table 5) after PSTs' research engagement. The finding that CTDs improved after research engagement concurs with that of an earlier study conducted with students at the undergraduate level (i.e., Yuan et al., 2020). In Yuan et al.'s (2020) study similarly, participants reported enhanced critical thinking dispositions after their experience as student assistants in a research project, particularly regarding "independence and persistence in resolving challenges; willingness to consider different perspectives; self-correction; and open-mindedness about uncertainty" (p. 7). Improvements in the CDTs could also be interpreted considering the in-classroom activities and assignments that were a part of the course. They learned how to search for information by using research databases, read between and beyond the lines, and critically evaluate credibility of studies. Furthermore, since they worked in groups for their research projects, collaborative efforts could have played a significant role in the improvement of reasoning and judgment skills. Also, previous research has shown that collaborative and/or cooperative activities are strongly associated with critical thinking skills or the development of essential thinking skills (Chen & Swan, 2020; Fisher, 2003).

Among the six sub-dimensions of the MCTDS, there was only one specific sub-dimension, Searching for the truth, which yielded a significant increase. This crucial finding indicates that PSTs became more committed to seeking accurate and objective information through a detailed investigation and evaluation. Also, as Chamizo and Garcia-Franco (2013) stated, when teachers carry out research, they become more critical. Based on this, in a way, it can be said that after research engagement, they learned how to seek and evaluate information.

Regarding Reasoning and Systematicity, findings indicated that PSTs demonstrated higher levels, enabling them to improve their dispositions of versatile thinking, gathering adequate information before evaluation, and drawing conclusions. Since within the scope of the course, the participants found a research problem to investigate; designed a study in groups; collected, analyzed, and interpreted data trying to find answers to the research questions, it is possible that they improved their reasoning and systematicity dispositions collaterally. After PSTs' research engagement, except for Open-mindedness, all sub-dimensions, namely Searching for the truth, Reasoning, Systematicity, Reaching judgment, Searching for evidence yielded enhancements. If we were to speculate the reason behind the slight regression in open-mindedness, rigid guidelines of the research engagement process and the credibility of ideas might have contributed to this. There were slight decreases in items concerned with respecting people having different ideas and considering other people's opinions in problem solving and decision making. Since PSTs learned to carefully consider (in)credibility of sources of information, this could have resulted in decreases. From another perspective, since research engagement requires PSTs to become much more critical and skeptical, it is possible such skepticism decreased their reliance on "other people's" opinions as long as they are not from credible sources or scholars.

Overall, neither ATR nor CTDs improved significantly after research engagement, but slight increases were found overall. It is possible that some PSTs might not have conceptualized research in such a short time period, a finding that is also echoed by Tanış (2019). Indeed, as Yuan et al. (2020) noted, "CT development is a complex and idiosyncratic process for individual students" (p. 9). Therefore, although slight increases or decreases with a sample size like the one employed in this study may not mean much, they tend to reflect tendencies and could guide future studies.

Conclusion

This quantitative pre-experimental small-scale study confirmed the positive effects of research engagement on Turkish pre-service EFL teachers' research attitudes and critical thinking dispositions, highlighting enhancements in both constructs. Findings also underscored that being research engaged could indeed result in improvements in critical thinking dispositions which teachers of the 21st century skill highly need to possess. To the best of our knowledge, the trajectory of critical thinking dispositions *per se* has not been investigated in

earlier teacher research studies. Therefore, this study, albeit being small-scale, is considered to establish a scientific rigor in the field.

Nevertheless, results should be interpreted acknowledging the limitations of this study, highlighting more elaborate designs for future studies. To start with, since the PSTs in this study took the research methodology course and conducted research within its scope, the increases in ATR and CTDs might be due to the course activities to promote research knowledge and skills. However, course activities to foster research knowledge and skills are not exactly separable from research engagement and rather components of them. Furthermore, this study was a small-scale study with a small sample size, limiting the generalizability of the results. Nevertheless, because participation in the study was voluntary, only fourteen of them gave their consent. Also, the fact that the participants were not selected randomly and consisted only of pre-service teachers from one university might lead to the results being specific to this specific group, again limiting the generalizability of the findings. Moreover, the study adopted a pre-experimental research design, meaning that there was no control group. Future studies could compare an experimental group with a control group. What is more, the participants in this study worked collaboratively on their research projects. In other words, we cannot precisely tell what the results would have been if participants had worked individually since collaboration might have affected the results. Therefore, future studies could design experiments where they can investigate the potential changes in participants' research attitudes and/or critical thinking skills in two different cases, namely where they work either individually or collaboratively for their research projects. Another limitation concerns the data collection. Data for this quantitative study were collected by means of two scales and lacked qualitative data collection methods (e.g., interviews and focus groups), making it challenging to fully understand the reasons behind results as well as limiting the in-depth interpretation of the quantitative findings. Therefore, future studies could meticulously examine the research engagement processes of PSTs through rich qualitative data. Furthermore, future studies could integrate qualitative methods to gain an in-depth understanding of the results. Looking towards the future, further studies can also enrich their data by using a combination of data collection methods such as interviews and focus groups.

Despite these limitations, the results of the study bear educational significance for teacher education programs, highlighting several key implications. In this study, positive developments after research engagement specifies the necessity to integrate research into undergraduate education. Even after their first engagement, which was a considerably short

time period, participants could improve their ATR and CTDs. Accordingly, research could be integrated into teacher education programs in a more holistic way rather than just within the scope of a single research methodology course. Also, considering that PSTs' anxiety may have decreased because they did research collaboratively, it might be worthwhile to allow (pre/in)-service to start their research journey in groups. When research is first included in educational programs, they can be guided to engage in research in groups. If anxiety can be reduced in this way, an increase in engagement rates might also be observed.

For long years, a myriad of obstacles to the research-practice dialogue (or "(link, interface, or nexus" so to say) (p. 509), which can be categorized as epistemological and practical ones (Sato & Loewen, 2022), have been reported. Likewise, several scholars have spotlighted the problem of the research-practice gap or that teachers are not research engaged. As much as it is important for in-service education and training (INSET) programs to promote research, undergraduate teacher education programs should also share the responsibility— without thinking it might be a bit too "early" to introduce research. If we would like our teachers to be research engaged, they should understand the philosophy of teacher research and set to work as early as possible. As stated clearly in UNESCO's Global Report on Teachers (2023), teacher education and professional development need to be transformed in a way that teachers become "knowledge producers" (p. 31), rather than being passive recipients of knowledge (Atay, 2006, p. 2). In our humble opinion, it could be realized through their research engagement to some extent. As the findings of this study illustrated, even shorter time periods could result in positive changes. Accordingly, university instructors in teacher education programs should make sure that they integrate research into all the program courses to promote future teachers to be research engaged as well as foster their CT so that they can become "future-proof" (Van Katwijk et al., 2021, p. 435) teachers. Given that universities are responsible for making students ready for professional life by training them to be ready to expect changes in their knowledges, handle diverse knowledge, and manage ambiguities and super-complexities of the twenty-first century (Brew, 2013), they can deal with such challenges by being research-engaged. As Yuan et al. (2020) noted, it is essential to "[...]provide continuing and contextualized support to facilitate undergraduates' research engagement and transform them from consumers of knowledge into active producers with a high level of CT." (p. 3). It must be the case particularly in contexts where there is no research culture because research in education, which was once considered "scientific" has expanded beyond a scientific

understanding in the past few decades and moved towards a more embracive mindset where teaching is considered a research-informed practice demanding critical thinking.

Ethics Statement

Ethical approval for this study was obtained from the Sakarya University Rectorate Ethics Committee with the identification number E-61923333-050.99-376327.

The Conflict of Interest Statement

In line with the statement of Committee on Publication Ethics (COPE), we hereby declare that we had no conflicting interests regarding any parties of this study.

References

Akyel, A. (2015). Research engagement in the EFL pre-service practicum. *Language in Focus*, *1*(1), 1-14. https://doi.org/10.1515/lifijsal-2015-0001

Atak-Damar, E., & Salı, P. (2022). Pre-service EFL teachers as future professionals and researchers. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 35*(3), 763-784. https://doi.org/10.19171/uefad.1171718

Atay D. (2006). Teachers' professional development: Partnerships in research. *TESL-EJ*, *10*(2), 1-14. https://www.tesl-ej.org/pdf/ej38/a8.pdf

Atay, D. (2008). Teacher research for professional development. *ELT Journal*, *62*(2), 137-147. https://doi.org/10.1093/elt/ccl053

Bahrami, V., & Hosseini, M. (2023). Individual differences in teacher research involvement? Factoring in language teachers' big five personality traits and motivation to conduct research. *Journal of Teacher Education, 74*(1), 85-100. https://doi.org/10.1177/00224871221105799

Borg, S. (2007). Research engagement in English language teaching. *Teaching and Teacher Education*, *23*(5), 731-747. https://doi.org/10.1016/j.tate.2006.03.012

Borg, S. (2009). English language teachers' conceptions of research. *Applied Linguistics*, *30*(3), 358-388. https://doi.org/10.1093/applin/amp007

Borg, S. (2010). Language teacher research engagement. *Language Teaching, 43*(4), 391-429. https://doi.org/10.1017/S0261444810000170

Brew, A. (2013). Understanding the scope of undergraduate research: A framework for curricular and pedagogical decision-making. *Higher Education, 66*, 603–618. https://doi.org/10.1007/s10734-013-9624-x

Cabaroglu, N. (2014). Professional development through action research: Impact on self-efficacy. *System*, *44,* 79-88. https://doi.org/10.1016/j.system.2014.03.003

Chamizo, J. A., & García-Franco, A. (2013). Heuristics diagrams as a tool to formatively assess teachers' research. *Teachers and Teaching, 19*(2), 135-149. https://doi.org/10.1080/13540602.2013.741841

Chen, C. C., & Swan, K. (2020). Using innovative and scientifically-based debate to build e-learning community. *Online Learning, 24*(3), 67-80. https://doi.org/10.24059/olj.v24i3.2345

Cochran-Smith, M., & Lytle, S. (1993). *Inside/outside: Teacher research and knowledge.* Teachers College Press.

Cochran-Smith, M., & Lytle, S. L. (1999). The teacher research movement: A decade later. *Educational Researcher*, *28*(7), 15-25. https://doi.org/10.3102/0013189X028007015

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Damşa, C. I., & Nerland, M. (2016). Student learning through participation in inquiry activities: Two case studies in teacher and computer engineering education. *Vocations and Learning, 9*(3), 275–294. https://doi.org/10.1007/s12186-016-9152-9

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. *Learning Policy Institute*. https://learningpolicyinstitute.org/product/effective-teacher-professional-development-report

Davies, M. (2015). A model of critical thinking in higher education. In Michael B. Paulsen (Ed.), *Higher education: Handbook of theory and research* (pp. 41-92). Springer, Cham. https://doi.org/10.1007/978-3-319-12835-1_2

Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership, 43*(2), 44-48.

Facione, P. (1990). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction (The Delphi Report).

Facione, P. A. (2000). The disposition toward critical thinking: Its character, measurement, and relationship to critical thinking skill. *Informal Logic, 20*(1), 61-84. https://doi.org/10.22329/il.v20i1.2254

Facione, P. A., Sánchez, C. A., Facione, N. C., & Gainen, J. (1995). The disposition toward critical thinking. *The Journal of General Education*, *44*(1), 1-25.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Addison-Wesley.

Fisher, K. (2003). Demystifying critical reflection: Defining criteria for assessment. *Higher Education Research & Development, 22*(3), 313–325. https://doi.org/10.1080/0729436032000145167

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2022). *How to design and evaluate research in* education (11th ed.). McGraw-Hill.

Given, L. M. (Ed.). (2008). *The Sage encyclopedia of qualitative research methods*. Sage Publications.

Guilbert, D., Lane, R., & Van Bergen, P. (2016). Understanding student engagement with research: A study of pre-service teachers' research perceptions, research experience, and motivation. *Asia-Pacific Journal of Teacher Education*, *44*(2), 172-187. https://doi.org/10.1080/1359866X.2015.1070118

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist*, *53*(4), 449- 455. https://doi.org/10.1037/0003-066X.53.4.449

Harrell, M., & Wetzel, D. (2015). Using argument diagramming to teach critical thinking in a first-year writing course. In M. Davies & R. Barnett (Eds.), *The Palgrave handbook of critical thinking in higher education* (pp. 213-232). Palgrave Macmillan.

Hosseini, M., Bahrami, V., & Dikilitaş, K. (2024). From research reading and doing to research use: Tracking trajectories of becoming research-informed second language teachers. *System*, *125*, 103445. https://doi.org/10.1016/j.system.2024.103445

Kennedy, M. M. (1999). The role of preservice teacher education. In L. Darling-Hammond & G. Sykes, (Eds), *Teaching as the learning profession: Handbook of policy and practice* (pp. 54-86). Jossey Bass.

Lai, E. R. (2011). Critical thinking: A literature review. *Pearson's Research Reports*, *6*(1), 40-41. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=b42cffa5a2ad63a31fcf99869e7cb8ef72b44374

Lombard, B. J. J., & Kloppers, M. (2015). Undergraduate student teachers' views and experiences of a compulsory course in research methods. *South African Journal of Education, 35*(1), 1-14. https://doi.org/10.15700/201503070032

Mackey, A., & Gass, S. M. (2022). *Second language research: Methodology and design* (3rd ed). Routledge.

Müjdeci, S. (2020). *Student teachers of English as researchers: Beliefs, attitudes, and practices* [Unpublished doctoral dissertation]. Gazi University.

Özgenel, M., & Çetin, M. (2018). Development of the Marmara critical thinking dispositions scale: Validity and reliability analysis. *International Journal of Eurasia Social Sciences, 9*(32), 991-1015.

Papanastasiou, E. C. (2005). Factor structure of the "Attitudes Toward Research" scale. *Statistics Education Research Journal*, *4*(1), 16-26. https://doi.org/10.52041/serj.v4i1.523

Papanastasiou, E. C. (2014). Revised-Attitudes Toward Research Scale (R-ATR): A first look at its psychometric properties. *Journal of Research in Education*, *24*(2), 146-159.

Roulston, K., Legette, R., Deloach, M., & Pitman, C. B. (2005). What is 'research' for teacher-researchers? *Educational Action Research*, *13*(2), 169-190. https://doi.org/10.1080/09650790500200283

Savasci, M., & Rets, I. (2021). "As the Twig is bent, so is the Tree Inclined": Research engagement among pre-service EFL teachers. *Journal of Language Teaching and Learning, 11*(2), 114-137. https://www.jltl.com.tr/index.php/jltl/article/view/353/159

Savasci, M., & Atar, C. (2024). Metaphorically speaking: Pre-service EFL teachers' understanding and conceptions of (teacher) research. *Journal of Language Teaching and Learning, 14*(1), 24-51. https://www.jltl.com.tr/index.php/jltl/article/view/554

Sato, M. (2023). Navigating the research–practice relationship: Professional goals and constraints. *Language Teaching*, 1-16. https://doi.org/10.1017/S0261444823000423

Sato, M., & Loewen, S. (2022). The research–practice dialogue in second language learning and teaching: Past, present, and future. *The Modern Language Journal, 106*(3), 509-527. https://doi.org/10.1111/modl.12791

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action.* Basic Books.

Sosu, E. M. (2013). The development and psychometric validation of a Critical Thinking Disposition Scale. *Thinking Skills and Creativity*, *9*, 107-119. https://doi.org/10.1016/j.tsc.2012.09.002

Spronken-Smith, R., & Walker, R. (2010). Can inquiry-based learning strengthen the links between teaching and disciplinary research? *Studies in Higher Education, 35*(6), 723–740. https://doi.org/10.1080/03075070903315502

Stenhouse, L. (1975). *An introduction to curriculum research and development*. Heinemann Educational.

Suter, W. N. (2012). *Introduction to educational research: A critical thinking approach* (2nd ed.). Sage.

Tanış, S. (2019). *Research engagement in and beyond pre-service teacher education: A case study of an English language teacher education program in Turkey* [Unpublished master's thesis]. Middle East Technical University. https://open.metu.edu.tr/handle/11511/45457

Ulvik, M. (2014). Student-teachers doing action research in their practicum: Why and how?. *Educational Action Research, 22*(4), 518-533. https://doi.org/10.1080/09650792.2014.918901

UNESCO https://unesdoc.unesco.org/ark:/48223/pf0000387400/PDF/387400eng.pdf.multi

United Nations. (n.d.). *4-Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*. https://sdgs.un.org/goals/goal4

Van der Linden, W. (2012). *A design-based approach to introducing student teachers in conducting and using research* [Unpublished doctoral dissertation]. Eindhoven University of Technology.

Van der Linden, W., Bakx, A., Ros, A., Beijaard, D., & Van den Bergh, L. (2015). The development of student teachers' research knowledge, beliefs and attitude. *Journal of Education for Teaching, 41*(1), 4-18. https://doi.org/10.1080/02607476.2014.992631

Van Katwijk, L., Jansen, E., & Van Veen, K. (2021). Pre-service teacher research: A way to future-proof teachers?. *European Journal of Teacher Education, 46*(3), 435-455. https://doi.org/10.1080/02619768.2021.1928070

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology*, *101*(3), 671. https://doi.org/10.1037/a0015083

Vogel, T., & Wanke, M. (2016). *Attitudes and attitude change* (2nd ed.). Psychology Press. https://doi.org/10.4324/9781315754185

Wang, D., & Jia, Q. (2023). Twenty years of research development on teachers' critical thinking: Current status and future implications——A bibliometric analysis of research articles collected in WOS. *Thinking Skills and Creativity, 48*, 101252. https://doi.org/10.1016/j.tsc.2023.101252

Waters, L. K., Martelli, T. A., Zakrajsek, T., & Popovich, P. M. (1988). Attitudes toward statistics: An evaluation of multiple measures. *Educational and Psychological Measurement*, *48*(2), 513-516. https://doi.org/10.1177/0013164488482026

Wise, S. L. (1985). The development and validation of a scale measuring attitudes toward statistics. *Educational and Psychological Measurement*, *45*(2), 401-405. https://doi.org/10.1177/001316448504500226

Wyatt, M., & Dikilitaş, K. (2015). English language teachers becoming more efficacious through research engagement at their Turkish university. *Educational Action Research, 24*(4), 550-570. https://doi.org/10.1080/09650792.2015.1076731

Yuan, R., Yang, M., & Stapleton, P. (2020). Enhancing undergraduates' critical thinking through research engagement: A practitioner research approach. *Thinking Skills and Creativity, 38*, 100737. https://doi.org/10.1016/j.tsc.2020.100737

Zimbardo, P., & Ebbesen, E. B. (1970). *Influencing attitudes and changing behavior: A basic introduction to relevant methodology, theory, and applications*. Addison-Wesley.