



The influence of the science teaching methods course and the practicum course on self-efficacy of pre-service science teachers of middle and high schools in the State of Kuwait

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Abstract

Objectives: The aim of the present study was to examine self-efficacy among students who took Science Teaching Methods course and Teaching Practicum course in the College of Education at Kuwait University. **Method:** A quasi-experimental design was used in the study. The Science Teaching Efficacy Belief scale (Form B) was administered to pre-service science teachers of middle and high school (n=81), who were enrolled in practical teaching course and those enrolled in the science teaching methods. **Results:** The results showed that pre-service science teachers in the practicum course had no significant change in sense of self efficacy neither on the Personal Science Teaching Efficacy (PSTE) nor the Science Teaching Outcome Expectancy (STOE) scales. However, there was a high increase in PSTE and STOE scores by students who were enrolled in science teaching methods course which indicated reaching higher sense of self-efficacy. **Conclusion:** The study recommends that future research should be conducted to include different individuals in different contexts in the schools. This outcome will further inform researchers of related self-efficacy issues in Kuwait.

Keywords: middle and high school teachers, personal teaching self-efficacy, pre-service science teachers

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- Submitted: 12/7/2021, Revised: 7/10/2021, Accepted: 12/10/2021.

تأثير مقرر طرق تدريس العلوم ومقرر التربية العملية على الكفاءة الذاتية للطلبة المعلمين في المرحلتين المتوسطة والثانوية

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ملخص

الأهداف: سعت الدراسة إلى تعرّف فعالية الكفاءة الذاتية واستعداد الطلبة المعلمين في تخصص العلوم، للمرحلتين المتوسطة والثانوية ليصبحوا معلمين أكفاء بعد دراستهم لمقرر طرق تدريس العلوم ومقرر التربية العملية (الميداني) ومدى تأثير هذين المقررين على الكفاءة الذاتية وثقة الطلبة بأنفسهم. **المنهج:** استخدم الباحث المنهج الوصفي (المسحي) التحليلي الذي اتخذ من استبانة الكفاءة الذاتية أداة له، وذلك من خلال استخدام الاختبارين القبلي والبعدي لتحقيق الهدف من الدراسة، وقد طبقت على 81 من الطلبة المعلمين في تخصص العلوم للمرحلتين المتوسطة والثانوية في كلية التربية بجامعة الكويت. **النتائج:** أظهرت نتائج الدراسة أنها غير دالة بالنسبة للطلبة المعلمين في مقرر التربية العملية (الميداني) من حيث الشخصية والكفاءة الذاتية المتوقعة لأسباب فسّرت لاحقاً بالنتائج في هذه الدراسة، وأظهرت النتائج أيضاً وجود فروق ذات دلالة إحصائية وارتفاعاً في الكفاءة الذاتية بالنسبة للطلبة في مقرر طرق تدريس العلوم من حيث الشخصية، وكانت النتائج إيجابية في أثناء دراستهم للمقرر. **الخاتمة:** توصي الدراسة بضرورة القيام بالمزيد من الدراسات مستقبلاً على عينات مختلفة من حيث الكفاءة الذاتية للطلبة المعلمين في أثناء إعدادهم في كليات إعداد المعلمين.

الكلمات المفتاحية: معلمو المرحلتين المتوسطة والثانوية، الكفاءة الذاتية الشخصية، الطلبة المعلمون تخصص العلوم

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- تُسلّم البحث في: 2021/7/12، غُدِّل في: 2021/10/7، أُجيز للنشر في: 2021/10/12.

Introduction

The teacher is a fundamental component of any successful educational system; thus, it is essential to examine what aspects contribute to teacher success, which in return enhances the quality of the entire educational system. In science teaching: teachers' self-efficacy, locus of control, attitude toward science teaching, and teaching anxiety are affective attributes that influence the teaching practice; therefore, investigating these attributes should begin as early as a pre-service teacher starts his/her professional years in college (Senler, 2016). It is equally important as well that managers and professional teachers of the education programs that offer courses on how to teach, should themselves help reduce the fear of science teaching that many pre-service teachers have (Bergman & Morpew, 2015). It was suggested that these programs can achieve the goals of science teaching by utilizing and engaging related or key pedagogical strategies when teaching science.

Teacher self-efficacy is an extremely powerful predictor of instructional behavior. Thus, the self-efficacy of pre-service science teachers should help enormously in directing science pre-service teachers to overcome any occupational or personal inability that may be present. As Rimm-Kaufman and Sawyer (2004) mentioned, teachers who are not confident are more likely to feel uncomfortable when handling discipline concerns. In contrast, students are more disciplined and accomplished with teachers with high self-efficacy. Therefore, self-efficacy beliefs are important topics for which researchers have developed demonstrated, valid and reliable scales and tests for measuring changes that take place in teachers' perceptions of their self-efficacy when teaching science.

Using Banduras' self-efficacy theory, Enochs and Riggs (1990) studied pre-service teachers' beliefs about science teaching and

learning and developed an instrument by assessing self-efficacy and the outcome expectancy beliefs of both in-service and pre-service elementary teachers by using the Science Teaching Efficacy Belief Instrument–Pre-service (STEBI-B). They presumed that early discovery of low self-efficacy in science teaching is crucial for any teacher involved in preparation programs. Schunk et al. (2013) argued that self-efficacy helps determine not only the amount of effort students are willing to expend, but also their tenacity, even while facing the most difficult obstacles.

Koksai (2018) stated that science knowledge is comprised of theory and practical work; being studied either in part or in isolation. But that is not enough to understand the whole sum. In recent years, many researchers have engaged in remodeling science teaching at both the middle & high school levels. For that, they have recommended boosting science content training by implementing methods courses based on inquiry and a constructivist curriculum while maintaining state and national science standards in this kind of learning. Bergman and Morpew (2015) pointed out that a teacher's positive or negative attitude toward science is reflective because these teachers can easily transfer these attitudes to students who can be easily affected. Thereby, their attitudes influence the students' engagement with the subject matter. Their conclusion highlights the fact that teacher commitment is based on the values they hold, their attitudes toward the subject, and their confidence when dealing with unfamiliar issues (Cronje, 2011). Aydin & Boz (2010) further stated that teachers' self-efficacy beliefs help us predict their motivation and choices while also ascertaining their actions in classrooms. Consequently, it is very important to determine new teachers' self-efficacy beliefs, once they relate to science teaching to become science teachers in the future. Azar as well (2010) confirmed that

a teacher's self-efficacy can positively affect the achievements and attitudes of their students.

A study by Bandura (1997), pointed out that self-efficacy is a useful instrumental in a teacher's level of motivational performance across the entire educational spectrum. Bandura (1997) made it clear that people are motivated to carry out an action if they believe that the same action will have an approved sequel (outcome expectation) and if they are fully confident that they will succeed (self-efficacy expectations). Thus, the STEBI-B was chosen to take measurements on both components. Bandura further stated that "Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p.3). That person believes that he or she can create a specific desired after-effect, namely, "a given behavior will lead to certain outcomes" (Bandura, 1997, p.79).

As we have mentioned earlier, the concept of teacher self-efficacy in most studies has relied on Bandura's (1977) theory, and the most attitudinal abstract ideas, and self-efficacy is considered context-specific (Bandura, 1982; Pajares, 1996). Koballa & Glynn (2007) further reported that teachers' attitudes toward science should incorporate self-esteem, focused interest, successful experience, as well as self-efficacy.

Hence, Bandura (1997) characterized four associated cardinal factors regarding self-efficacy: Mastery of experiences, physiological and emotional cues, vicarious experiences, and verbal persuasion. If these interrelated sources are perfectly presented, they can occupy a very important place in a person's life, significantly for the perceptions of self-efficacy as well as the mastery of experience and are often considered to be the most powerful contributors to self-efficacy (see Tschannen-Moran et al., 1998). In an article written by

Bandura (2012), he suggested that the foundation of self-efficacy is triadic in its approach, thereby shapes the individual's performance through the interaction of personal, environmental, and behavioral influences. Many researchers have organized studies to measure the application of experiences based on the impacts of these same factors, which have demonstrated improvements in pre-service science teacher's self-efficacy in a variety of contexts, such as their behaviors and attitudes (Wara, 2012).

In fact, this study aimed to put forward chances for mastering teaching, offering verbal persuasion from trusted sources, while attending program experiences to always help keep students in advancing stages. Such data will provide beneficial details and directions for science training. In a conjoined example of teaching self-efficacy, Tschannen-Moran et al. (1998) described academic performance and the assessment of personal teaching capacity as being chief to teachers' perceptions of self-efficacy. As education processes are typically reflective, self-reflection skill development is as well reflective, thus needed to be there in most ideal programs.

Gibson & Dembo (1984) developed a "Teacher Efficacy" Likert scale survey which was used as our instrument for this study, and it is systematically arranged to condition self-efficacy teaching and included a developed 30-item Likert type efficacy scale for items that measured the respondents' beliefs about their capabilities (Personal Teaching Efficacy [PTE]) and those considering the outcome of their efforts (General Teaching Efficacy [GTE]). Pajares (2002) further mentioned that training pre-service teachers is important in order to gather basic information, learn new skills, sense their competency, and determine any occupational inability of these individuals. Moreover, Pajares noted (1996) that formal investigations into self-efficacy will make the most sense in terms of their perceived abilities

as they relate to narrowly defined activities. Self-efficacy tests were elaborated for this reason; these tests also usually relate to a single subject. A popular and common test is used in science education as well is the STEBI (Riggs & Enochs, 1990), and it was later adapted to evaluate the science teaching efficacy beliefs of pre-service teachers (Enochs & Riggs, 1990).

However, questions still remain concerning the measurement of variables related to self-efficacy based on the past 25 years of research in this field. Hoy and Woolfolk (1990) rightly pointed out that self-efficacy hypotheses are changeable during the education process, and yet these changes are more difficult to being about in employed teachers. Thus, not much is known about what kinds of experiences have the greatest impact, nor are these impacts fully understood. In essence, researchers were devoted to enhancing the science teaching self-efficacy of pre-service primary teachers (Avery & Meyer, 2012; Ford et al., 2013; Liang & Richardson, 2009; Watters & Ginns, 2000).

It has also been found that methods determined to be specifically used for teaching science courses as well as field placements that include chances to practice science teaching, are always very successful regarding self-efficiency (Settlage et al., 2009). While, content-specific training by itself has not shown any growth in terms of science teaching self-efficacy, in the contrary methods of teaching science has delivered different positive results (Cronin-Jones & Shaw, 1992; Ginns & Watters, 1994). As Cajanding (2017) observed, experiential education is the process to use, to construct knowledge through experience transfer. Reddick and Holland (2015) regarded experiential education as having contact with the real environment, the process of acquiring learning through personal perception and

experience, and an emphasis on learners' comprehensive participation in knowledge, emotion, and behavior. Cajanding (2017), who agreed with the best teaching effects of experiential learning, also discovered the positive benefits of knowledge, behavior, and psychology.

Similarly, Aksoy et al. (2014) proposed that experiential education on the self-efficacy reinforcement process could help adolescents enhance their own self-confidence when facing difficulties, dealing with peer interactions thus having problem-solving capabilities, as well as having greater confidence in the cultivation of active learning and successful self-adaptation. Zhu et al. (2015) pointed out the remarkable effects of experiential science learning on students' scientific attitudes and scientific self-efficacy. On this basis, it is likely that applying experiential learning to subjects, skills of education could result in learners' self-efficacy acquisition as well.

Purpose and Questions of the Study

This study explored and examined the key factors that positively influence changes that take place in middle and high school pre-service science teachers in terms of self-efficacy belief. It compared the impact of science teaching methods courses as well as the practicum courses (practical teaching training course) on pre-service middle and high school science teachers' self-efficacy at Kuwait University. The study problem can be identified by answering the following questions:

Q 1: What is the impact of science teaching methods on pre-service teachers in terms of self-efficacy?

Q 2: And does this course promote their self-efficacy?

Methodology

Participants

The population of this study was the undergraduate pre-service science teachers of the education program in the College of Education at Kuwait University in the academic year 2018-2019 where they were supposed to complete 135 credits over four years in the College of Education. Additionally, they were required to take 60 credit hours of science content courses at the College of Science.

The participants were middle and high schools pre-service teachers who were enrolled in a science teaching methods course and from those who were enrolled in a practicum course for the Fall 2018/2019 grade. Both courses were taught by Middle-grade male instructors with science teaching experience in public schools and colleges. The students were instructed to integrate theory and practice by studying the most recent science teaching methods and strategies and practice these methods by participating in microteaching, early field experiences, as well as individual and group activities, whereas, in the practicum course, students were required to practice teaching science in real schools outside the university during their fieldwork. The students were guided by both expert supervisors and head teachers of the school during their learning journey.

It is worth knowing though that students of the nine-hour practicum field course were required also to undertake a graduation project and would meet with their instructor three times a week for an hour each time at the college of Education where students would discuss their teaching obstacles and difficulties that they might have in their practicum course with their colleagues and their teachers if they were asked for their input and possible solutions.

Measures

An Arabic version of STEBI-B survey developed by Ebrahim (2012) was administered since it was the version recommended to be used with pre-service teachers. The original version of the survey was developed by Enochs and Riggs (1990) and it is comprised of two subscales. The Personal Science Teaching Efficacy (PSTE) subscale (14 items) (2, 3, 5, 6, 8, 12, 14, 17, 18, 19, 20, 21, 22, 23) and the Science Teaching Outcome Expectancy (STOE) subscale (9 items) (1, 4, 7, 9, 10, 11, 13, 15, 16) thus the whole survey consisted of 23 items. This instrument was modified for middle and high schools pre-service teachers and has a 5-point Likert scale, ranging from strongly agree to strongly disagree. The STEBI-B has been widely used in the educational field to assess pre-service teacher self-efficacy. Prior to completing the two courses, the participants in this study were asked to fill out the instrument items. A post-survey was then sent to them to fill out upon their completion of the semester. The instructor collected all responses personally.

Measures' Validity and Reliability

Face validity and content validity were conducted using panel of judges. Validity is defined as the extent to which appropriateness, meaningfulness, and usefulness of the inferences a researcher makes (Heale & Twycross, 2015). According to the purpose of this current study and the participants' responses which came from middle and high schools pre-service teachers, this data was examined for its validity, specifically regarding language and relevance to the actual construct. The instrument was checked by five professors at the College of Education from the Department of Curriculum and Instruction, who recommended small changes for three items (3, 12, and 20), which then were performed accordingly to ensure full validity of the test.

Reliability relates to the consistency of scores for the sample completing an instrument, by producing approximately the same responses each time the test is completed (Heale & Twycross, 2015). In order to check whether the STEBI-B test leads to consistent measurement results, the researcher conducted a reliability analysis for the scale and for each of the two domains in a pilot study. The study survey was distributed to 38 pre-service teachers of middle and high schools at Kuwait University. The reliability of the test was rated as having a coefficient value of $\alpha = 0.79$ for internal consistency using Cronbach as measures of consistency. The researcher administered the STEBI-B test as a main tool, and that test was used as a pre- and post-test for the current study.

Data Analysis

One of the samples of dependent t-tests was considered to be used in order to acquire the essential data for the study. The tests were done step by step on the students of each course during the pre-survey and post-survey to review the fundamental dissimilarities between the pre-test and post-test data of the dependent variables (i.e., PSTE and STOE). The PSTE and STOE scores of students' personal observations of the practicum course (practical teaching course) and the science teaching methods course were analyzed separately. In the analysis the estimated size of the sample in the science teaching methods course was 40 respondents; however, for the practicum course, it was 41. According to Hoy & Woolfolk, (1990), self-efficacy rise-and-fall score results were unforeseeable at different stages of pre-service teachers' development. Based on this review, the analysis of the differences in means of the two groups was done by using two-tailed tests.

Results

This study administrated the STEBI-B to 85 pre-service middle and high schools science teachers. 81 had matching pre-/post-surveys and were viewed as suitable for analysis. Means and standard deviations in the analysis results of the surveys are presented in Tables 1 and 2.

Table 1

Analysis of Teaching Methods Course for PSTE and STOE

Practicum Course	Pre-test		Post-test		<i>df</i>	<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
PSTE	4.05	.32	4.23	.36	39	3.38	.002
STOE	4.05	.31	4.11	.33	39	1.09	.281

Note. PSTE is the Personal Science Teaching Efficacy, the independent variable computed mean for 14 survey questions (2, 3, 5, 6, 8, 12, 14, 17, 18, 19, 20, 21, 22, 23), after reversing the negative questions (3, 6, 8, 17, 19, 20, 21, 23); STOE is the Science Teaching Outcome Expectancy, the independent variable computed mean from 9 survey questions (1, 4, 7, 9, 10, 11, 13, 15, 16); $n=40$.

As shown in Table 1 the students of methods of teaching science course witnessed a remarkable difference; at .05 in the pre-/post-shifts in PSTE and STOE scores. The highest mean score was obtained for the results of PSTE on the post-test ($M=4.23$, $SD=.36$) and it was significantly greater than those on the pre-test ($M=4.05$, $SD=.32$), $t(39)=3.38$, $p<.05$ ($p=.002$). The results also revealed that the mean score of STOE was significantly greater on the post-test ($M=4.11$, $SD=.33$) than on the pre-test ($M=4.05$, $SD=.31$), $t(39)=1.09$, $p<.05$ ($p=.281$).

Table 2*Analysis of the Practicum Course for PSTE and STOE*

Practicum Course	Pre-test		Post-test		<i>df</i>	<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
PSTE	3.85	.45	3.92	.45	40	.93	.358
STOE	4.16	.33	4.22	.37	40	1.06	.296

Note. PSTE is the Personal Science Teaching Efficacy, the independent variable computed mean from 14 survey questions (2, 3, 5, 6, 8, 12, 14, 17, 18, 19, 20, 21, 22, 23), after reversing the negative questions (3, 6, 8, 17, 19, 20, 21, 23); STOE is the Science Teaching Outcome Expectancy, the independent variable computed mean from 9 survey questions (1, 4, 7, 9, 10, 11, 13, 15, 16); $n=40$.

As Table 2 shows there was no significant difference. It was at .05 in pre-/post-shifts of PSTE and STOE scores for the students of practicum teaching courses. These results indicate that the mean score of PSTE was greater on the post-test ($M=3.92$, $SD=.45$) than on the pre-test ($M=3.85$, $SD=.45$), but the difference was not remarkable at .05, $t(40) = .93$, $p > .05$ ($p = .358$). The results also indicated that the mean score of STOE on the post-test ($M=4.22$, $SD=.37$) was greater than on the pre-test ($M=4.16$, $SD=.33$); still, that difference was not remarkable; at .05, $t(40) = 1.06$, $p > .05$ ($p = .296$).

Discussion

This study results drew our attention to the fact that the science teaching methods course influenced middle and high schools pre-service teachers' PSTE to a great extent. The scores went up on this scale during the science methods course which goes along with Bandura's (1986) theoretical components. Their environment of learning possibly played a big role in offering a convenient environment setting to students so that they could get over their

initial fears of delivering science lessons once they come to their field placement. On the other hand, students of practicum course, learned from senior teachers how to teach science lessons in real life experiences. This experience helped students explore the modeling offered by the teacher of the course and watched their exemplary efforts in their field school. Additionally, the course instructor, the helpful school teachers, as well as the college supervisors who used verbal persuasion, indeed benefited the students. Throughout the course, students gave microteaching lectures to their course peers. This environment played a big role in offering a convenient setting to students, so that they could get over their primary fears of delivering science lessons in real life experiences.

Only the science teaching methods course group displayed significantly higher scores on the outcome expectancy portion (STOE) of the post-surveys. Concerns over this scale were voiced by other researchers (Roberts et al., 2001). Most of the instruments were designed to gauge teaching self-efficacy, including the STEBI-B, which shares similar interpretations to the PTE, or what teachers believe they are capable of doing. The GTE interpretation was more problematic. On the STEBI-B, the STOE scale corresponds to the GTE. Many concerns about the GTE have centered on the distinction between the expectations for teacher performance and the predictions of the influence of external factors (Pajares, 1996; Tschannen-Moran et al., 1998). Enochs et al. (1995) offered their description of the STEBI outcome expectancy data as “reflecting teachers’ beliefs in students’ ability to learn, given effective teaching” (p.67). Riggs and Enochs (1990) acknowledged that outcome expectancy is such a complicated subjective for measuring construct because of the countless number of changeable features it contains.

As perceptively stated, by Roberts et al. (2001), only one study has produced a difference in the STOE scale of the STEBI-B. In an article by Henson (2001), only two studies found a change in the STOE scale of the STEBI-A (the version used with in-service teachers) but only at intervals of 8 to 12 months. Further study is still needed to exert a clearer influence on how the GTE should be defined and measured.

As maintained by the participants' involvement in this theme, science teaching self-efficacy of pre-service middle and high schools teachers was inferred as being effortlessly rectified. Increased science content does not automatically presuppose high efficacy. Yet an increase in scientific knowledge may have a positive marked effect on the students' perceptions of their teaching skills. Individual teaching for students may impact participants' self-efficacy. It is relevant as well to note that this sample was small, and the participants already possessed a high sense of self-efficacy. Although some of the existing research has been undertaken in the area of student teaching and self-efficacy (Azar, 2010), the results of the current study do suggest that additional investigation is still warranted. Previous studies (Cannon, 2001; Wingfield & Ramsey, 1999) have argued that increased time spent in field classrooms seems to have a positive impact on this effect. Also, Wingfield and Ramsey (1999) felt that methods courses could enrich self-efficacy, but Cannon (2001) remarked that including field experience for the methods courses neither produced a supplemental change nor had a conspicuous impact on self-efficacy. Nevertheless, this study paper actually sides with the positive impacts of field experiences on self-efficacy as well as the positive advantages that can be gained from science teaching methods courses despite of the results that the study have reached. Regardless, this study was not designed to indicate which course unit is most likely to inspire self-efficacy nor

to conduct an inquiry into the composition of these teaching courses and methods.

On the other hand, the survey results of the study sample of the practicum course was non-significant. The reason behind the decrease in self-efficacy is possibly that these students experienced teaching in an actual real-life teaching situations which were not similar to their teaching experiences in their training virtual teaching experiences where they learnt how to teach. Thus, sometimes, accumulative bad teaching experience can make student teachers lose their confidence, especially if supervisors complain about any weakness issues while training. Moreover, the practicum period was set for only one semester and this could possibly have been insufficient to increase student teachers' ability and proficiency. At the top of these issues, however, as well is the presence of the head teacher and the supervisor inside the classroom and that could also have upset the trainee teachers and caused them to experience anxiety while training. Their teaching proficiency could have then been affected and they would have then lost some of their self-confidence. Plus, most importantly, the fear of receiving poor evaluation from their supervisors could have prevented them from earning good scores as their focus was on the evaluation report more than on benefiting from the practical training of skills of teaching they received in the practicum course.

In the interest of identifying the key connecting elements, there must be a closer inspection of the methods courses in this program. The question of the degree to which middle and high methods science courses should be integrated with content areas also remains an issue. King and Wiseman (2001) discovered that integrated teacher preparation courses were no more effective at improving science-teaching self-efficacy than pure science methods courses.

The methods course in this study was an integrated science methods course. For one semester, it also used an integrated math, science, art, physical, educational method course, thereby contradicting King and Wiseman's (2001) findings. Because the systematic organization of the course and the process used for transferring the methods were consistent, the researcher believes this aspect offers encouraging evidence that the inclusion of Bandura's theories on the sources of self-efficacy perception can contribute to the self-efficacy that can be gained from practical methods experiences. Teaching self-efficacy has been consonant with teaching behavior; thus, research on this topic should continue. The means of measuring teaching self-efficacy are indeed being improved (Henson, 2001), and evaluation of outcome expectations is receiving major attention.

Finally, this study evaluated the impact of teachers' self-efficacy reflecting on their students' learning, and I think that educators must carefully think about the methods the science content instructors, and teacher preparation programs should incorporate to increase positive self-efficacy perception of pre-service middle and high schools science teachers. Future research should be done on pre-service teachers as they pass through their preparation programs until they reach the actual professional teaching practice.

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To cite:

Ebrahim, A. H. (2023). The influence of the science teaching methods course and the practicum course on self-efficacy of pre-service science teachers of middle and high schools in the State of Kuwait. *Journal of the Gulf and Arabian Peninsula Studies*, 49(190), 405- 426. <https://www.doi.org/10.34120/0382-049-190-010>