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# Future Problem-Solving Skills and Its Relationship with Research Self-Efficacy in Post-Graduate students

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**Abstract**. Research self-efficacy (RSE) and future problem-solving skills (FPSS) are considered essential elements that help post-graduate students. The current study examines the relationship between RSE and FPSS among college of education post-graduate students. The study sample comprised 98 post-graduate students, and the descriptive-correlational method was used. The researchers used the Future Problem Solving Scale (FPSSS), and research self-efficacy Scale (RSES). The results revealed that the research sample exhibited a high degree of FPSS and RSE, and a positive correlation between FPSS and RSE was observed. Regarding the gender variable, there was a difference in FPSS in favour of males and a difference in RSE in favour of females. With respect to disciplines, there was no difference between FPSS and RSE. Regarding the type of study, there were no differences among the research sample in FPSS; however, there were differences in RSE in favour of full-time students. The results also indicated that there were differences in FPSS and RSE, according to the state of study, in favour of those who completed their theses. It was also concluded that RSE can be predicted by FPSS. FPSS and RSE enhanced academic performance, critical thinking and creativity in the research sample. The research recommends the importance of developing FPSS in post-graduate programmes to enhance student performance in scientific research, promote critical thinking and encourage creativity in educational research.

**Keywords**: future problem-solving; research self-efficacy; post-graduate students; college of education; King Faisal University

## 1. Introduction

Future problem-solving skills (FPSS) are essential for all graduate students seeking to enhance their research self-efficacy (RSE). It is vital to remember that humans are distinguished by their ability to picture the future using memories,

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experiences, and expectations to simulate what may occur in their future lives (Schacter et al., 2015). Future thinking is a mental process that involves recognising problems, formulating new hypotheses and forming solutions using available information. It involves exploring, innovating and evaluating possible outcomes and forming predictions. This process helps individuals to anticipate future problems and modify them if conducted scientifically (Kvavilashvili & Rummel, 2020).

The future thinking approach enhances the creativity of students by using multiple teaching strategies, dynamic assessment, programmes and group reports to motivate learning, search for and investigate future problems, allowing for scientific discussion (Tsai & Lin, 2016). Enhancing problem-solving skills is crucial as it helps individuals to develop creative abilities and improve their interaction with future challenges by imagining, envisioning, enjoying, examining expectations, and evaluating predictive abilities (Chiu, 2012). RSE is important for preparing researchers to solve future problems by addressing research gaps and increasing professional development opportunities, which contributes to increased RSE (Lambie et al., 2014; Randazzo et al., 2021). There is no doubt that improving the level of RSE is crucial as it is linked to confidence in performing research tasks and prepares distinguished researchers with high research productivity who can confront future issues (Tas et al., 2023). This is achieved through training graduate students and encouraging them to attend research methods courses that improve RSE (Litson et al., 2021). In essence, research productivity is important for the well-being of society, as research can be built upon cumulatively through existing knowledge, the development of various specialisations, and the contributions of faculty members and post-graduate students in the research institutions (Epstein & Fischer, 2017; Gorji et al., 2015). Importantly, researchers have observed that FPSS are linked to RSE as societal issues cannot be solved without the development of scientific research in order to improve the lives of individuals'. Thus, most developed countries aim at achieving power and competition in global markets through the outcomes of scientific research and raising the confidence and motivation of researchers to complete research projects.

The study's aim is to determine if FPSS and RSE are connected to the factors gender, specialty and study type, as well as whether FPSS may predict RSE. To address the study goals, the following study questions were formulated:

1) What is the level of FPSS of post-graduate students at the college of education from their point of view?
2) What is the level of RSE of post-graduate students at the college of education from their point of view?
3) What is the nature of the relationship between FPSS and RSE among post-graduate students at the college of education?
4) Are there differences between post-graduate students at the college of education in FPSS according to gender, specialisation, level of study, type of study, and state of study, from their points of view?

5) Are there differences between post-graduate students at the college of education in RSE according to gender, specialisation, level of study, type of study, and state of study, from their points of view?
6) Can the RSE of post-graduate students be predicted by their FPSS scores?

## 2. Literature Review

### 2.1. Future problem-solving skills

In general, problem-solving represents an individual's efforts to overcome obstacles in order to accomplish a specific goal (Ucar et al., 2017). Competition in the 21st century will not be achieved by acquiring large amounts of information but rather by encouraging the individual to acquire creative methods for producing effective ideas to overcome future life problems (Sternberg & Grigorenko, 2002). Individuals face problems in various aspects of life, including academics, personal relationships, work and technology. Some problems can be solved easily based on their previous experiences, while others require complex solutions due to the unfamiliarity of the human mind with such challenges (Odacı et al., 2023). Balancing cognitive and metacognitive awareness is crucial for predicting, anticipating and developing plans to solve future issues. These skills are valuable in educational and psychological research, and researchers have acknowledged the impact of daily problems on shaping the future (Ramani & Brownell, 2014).

It is important to mention that FPSS represent a structured exploration of the future that enhance analysis, critique, creativity, assessment, and the creation of ideas for a better future (Jones et al., 2012). In addition, creativity is crucial for personal and social success, enabling effective problem-solving and the ability to adapt to rapid changes in contemporary life, particularly for scientists and researchers (Azevedo et al., 2017).

Solving real-world problems is a complex process based on the search for creative and imaginative solutions through complex levels of thinking and basic logical concepts (Lishan et al., 2017). Future problem-solving programmes should foster creative thinking by tackling complex situations and exploring various topics in business, economics, science, technology, and social issues with immediate and global implications (Azevedo et al., 2019).

Several studies have examined the effectiveness of the future problem-solving programmes in different ways. For example, Carbee (2020) explored the impact of a future problem-solving programme on 21st-century leadership and self-identity skills, emphasising the need for effective solutions in gifted programmes. Main et al. (2019) found that a modified problem-solving programme with group activities significantly improved the future problem-solving competence of students, enhancing their creative performance and methodical approach.

### 2.2. Research self-efficacy

According to Tas et al. (2023), the term "research scientist's estimate" (RSE) refers to the researcher's assessment of their confidence in their capacity to carry out research-related duties with efficacy. RSE is positively linked to a researchers'

productivity, job satisfaction, research knowledge, and research interest (Lambie et al., 2014). In this context, RSE refers to a post-graduate student's ability to effectively define and conduct research, including defining the study problem and determining its purposes. This has been confirmed by Vaccaro (2009), who believes that RSE refers to a researcher's confidence in their ability to achieve the results.

RSE denotes a researcher's confidence in their abilities to succeed in the research process, involving expectations, perceptions, responsibility, clear planning, perseverance and the development of subjective vitality and academic grit. Researchers must confront difficulties and maintain their readiness to complete research tasks.

There is no doubt that an individuals' RSE is crucial for data collection, analysis and research processes. Researchers agree on four sources of self-efficacy: emotional arousal, verbal persuasion, learning from others and successful performance. These sources align with Bandura's social cognitive theory and include achieving outcomes, learning new practices, receiving positive reinforcement, and experiencing emotional arousal (Borgen & Betz, 2011; Ornelas et al., 2011).

Many researchers have studied RSE from different angles; for instance, in their study, Rezaei and Zamani-Miandashti (2013) examined RSE, research anxiety, and research orientation among students of the College of Agriculture and Medicine at the master's and doctoral levels, and found a negative link between RSE and research anxiety, as well as a positive correlation between RSE and research attitudes. Gorji et al. (2015) investigated the association between RSE and learning motivation in students among university students and found that research self-efficacy is a strong predictor of learning motivation.

In addition, there were no differences between the two genders in RSE or learning motivation. Saral and Reyhanlioğlu (2015) studied the variables affecting RSE among students at educational colleges concerning the variables of gender, department and enrollment in scientific research courses. Their results showed that there were no differences in RSE regarding gender, department or university, while differences were found with regard to the enrollment in scientific research courses in favour of those who took such courses. This requires increasing the number of hours of scientific research within university courses.

Epstein and Fischer (2017) also sought to identify the relationship between RSE and professional exams for students in the colleges of basic sciences and medicine, and their results indicated that there are positive correlation between RSE and academic professional exams. There were no differences in RSE according to gender, while differences were found in favour of doctoral students. According to Nazari et al. (2021), doctoral students had the highest levels of RSE in report writing and research ability, followed by ethics and research procedures. They also observed that the majority of students' RSE scores were above average, and master's students had fewer positive sentiments regarding RSE than Ph.D.

students. Similarly, Gong et al. (2022) explored the sources of RSE among graduate students at a College of Nursing, considering their responses to research tasks through semi-structured interviews. Although the participants said they had a lot of support, their confidence level was a little lower. Furthermore, it was revealed that practice in research exploration actively motivated them to persevere through internal and external support. It has been argued that there is a positive relationship between RSE and research productivity among graduate students (Hemmings & Kay, 2016). Tas et al. (2023) also aimed to validate a comprehensive RSE scale to measure RSE among graduate students and professors in multiple disciplines through six factors.

**2.3. The relationship between FPSS and RSE**

Problem-solving is regarded as one of the most important predictors of performance among students with RSE, as they seek valid and reliable solutions to societal problems, from accessing information and knowledge, identifying problems, achieving and analysing results, to writing the research report (Flores et al., 2014).

Research skills are crucial in education as they help students solve daily problems. Integrating RSE into curricula helps students build creative scenarios, develop skills to change reality, anticipate future events and determine their preferences. A future problem-solving programme involves forming groups of students of different ages, presenting research issues related to society and identifying problems they may encounter. The process involves identifying challenges, testing them, generating ideas, applying standards and developing an action plan for proposed solutions (Elballah, 2022; Jones et al., 2012). Treffinger et al. (2012), suggested that individuals become more aware of their FPSS style, leading to better problem-solving abilities. Training post-graduate students in FPSS improves their positive outlook, future outlook, and motivation to achieve, enabling them to predict, anticipate and make decisions related to future problems. Ramos and Hayward (2018) examined the correlation between academic self-efficacy, problem-solving self-efficacy and motivation in students, aiming to determine whether these factors predict motivation, test performance and predicted grades, with both factors being significant predictors.

Given the foregoing, the current study seeks to investigate the relationship between FPSS and RSE among post-graduate students at King Faisal University (KFU) College of Education, in order to shed light on the extent to which the development of FPSS has influenced the level of RSE among these students.

This study highlights the importance of FPSS as a tool for fostering critical thinking, creativity and decision-making in post-graduate students, as it helps them analyse complex problems, generate new ideas and apply effective strategies. It also highlights the role of RSE in affecting their performance in scientific educational research. This research presents a modern theoretical framework that addresses these variables among post-graduate students, and also provides tools to measure each variable separately in the Saudi environment,

identifying deficiencies that can be addressed through training courses and workshops.

This study highlights the lack of literature discussing FPSS and RSE among post-graduate students, with most studies discussing these areas separately. Conducting a study in Saudi Arabia is crucial to determine FPSS levels, encouraging creative problem-solving and identify the culture of scientific research among students. Enhancing positive attitudes towards a research culture and encouraging questioning, criticism and analysis is essential for the roles that post-graduate students play in developing societies.

## 3. Materials and Methods

### 3.1. Research Design

According to the study problem and questions, the researchers adopted the descriptive-correlational method, which focuses on the description of a phenomenon as it is being formed in the real state. Correlational research was used to discover relationships among variables and to allow the prediction of future events from present knowledge.

### 3.2. Participants

The research population consisted of all post-graduate students (master's and doctoral). There were 555 students, both male and female, in the first term of the Year 2022-2023, according to the statistics of the numeration committee at the KFU College of Education. The research tools were given to the whole population, and 98 students from the sample, (representing 18% of the total), corresponded to the requirements of the research. Table 1 indicates the distribution of the research sample according to the considered variables and factors.

**Table 1. Distribution of the research sample, according to its variables and factors**

| Variables | Factors | % |
|---|---|---|
| Disciplines | Curriculum & Methods of Teaching (CMT) | 12.20% |
| | Education & Psychology (EP) | 16.30% |
| | Special Education (SE) | 20.40% |
| | Art Education (AE) | 16.30% |
| | Physical Education (PE) | 34.70% |
| Gender | Male | 64.20% |
| | Female | 35.70% |
| Stage of Study | Master | 82.60% |
| | Doctoral | 17.30% |
| Type of Study | Part-time student | 42.80% |
| | Full-time student | 57.10% |
| Status of Study | Syllabuses studying stage | 45.90% |
| | Thesis preparing | 47.90% |
| | Thesis completion | 6.10% |
| | Total | 100% |

### 3.3. Research Tools

#### 3.3.1. Future problem- solving skills scale (FPSSS)

The researchers used the FPSSS, which was prepared by Ayoub (2015), to determine the level of these skills in the research sample focusing on a group of the basic skills required for solving future problems. The scale, in its final form, consists of 31 items to which the response of the students was determined using a 5-point Likert scale (applicable exactly, applicable, applicable somewhat, not applicable or not applicable at all). The preparer of the original version of the scale calculated the validity of the factorial structure using exploratory factor analysis on the scale's 31 items using the Hotling principal components method, and orthogonal rotation using the Varimax method to obtain the factors by selecting items with a loading exceeding 0.3, according to the Guilford criteria. The correlation coefficients were determined in the dimensions of expectation (0.75-0.91), visualisation (0.67-0.84), planning (0.68-0.93), and predicting (0.77-0.84). Reliability was achieved through test-retest with an interval of 23 days. Values of the correlation coefficients between the first and second test for the dimension of expectation (0.83), perception (0.81), planning (0.80), prediction (0.83), and the total score (0.86) ) were measured. To verify the scale validity, the internal consistency among its items was estimated, for a reconnaissance sample of 78 male and female students from the post-graduate students at the KFUCollege of Education. The correlation of the dimensions of the scale ranged from 0.646 to 0.914 and the scale's reliability was verified by using Cronbach's Alpha (0.980). These results indicate that the scale attained a suitable degree of validity and reliability.

#### 3.3.2. Research self-efficacy scale (RSES)

The researchers relied on RSEs, prepared by Tas et al. (2023), after being translated from English into Arabic, with the aim of determining the level of RSE in post-graduate students. The response of the students was determined using a 5-point Likert's scale (always, almost, sometimes, rarely, or never) and given the marks (5, 4, 3, 2 or 1 respectively). To verify the scale validity, the internal consistency among its paragraphs was estimated, for a reconnaissance sample of 78 male and female students from the post-graduate students at the KFU College of Education . The correlation of the dimensions of the scale ranged from 0.429 to 0.841, and the reliability was assessed in terms of the Cronbach's Alpha (0.962). These results indicate that the scale attained a suitable degree of validity and reliability.

### 3.4. Data Analysis

The researchers used JAMOVI V. 2.4.11 to analyse the survey responses and determine the means and standard deviations. Pearson's correlation coefficients were determined between respondents' scores on the research instruments to confirm the nature of the link between the two variables. Independent samples t-tests were used to assess differences between respondents' perspectives on the research variables based on demographic factors. One-way ANOVA tests were used to examine the difference in respondents' perspectives on the research variables related to demographic factors. A basic linear regression analysis test was performed to calculate the amount of change in one variable that corresponded with a specified change in another variable.

## 4. Results

### 4.1. Level of FPSS of post-graduate students at the college of education.

The mean and SD of the survey responses were calculated.

The general mean was 3.69, with an SD of 0.597. The overall mean was 3.69. These findings show that there was a considerable amount of FPSS in the research sample. Topic 9, "Linking past and present problems and issues" to understand the expected future image of the problem," was ranked first with a mean score of 4.30 and an SD of 0.749. Item 13, "Reflect on my needs to solve the future problem," was ranked second, with a mean of 4.26 and an SD of 0.777. Item 14, "Determine the priorities available to solve the future problem," was ranked third, with a mean of 4.22 and an SD of 0.868. Item 6, "Identify the challenges involved in the future problem landscape," was ranked 29th, with a mean of 3.91 and an SD of 0.886. Item 25, "Estimating the available time needed to solve the future problem," was ranked 30th, with a mean of 3.88 and an SD of 0.922. Item 17, "Building a general vision of the future problem (building the knowledge tree of the topic)," was ranked 31st, with a mean of 3.84 and an SD of 0.981.

### 4.2 Level of RSE of post-graduate students at the college of education.

The mean and SD of the survey responses were calculated. An SD of 0.656 accompanied the overall mean of 4.11. According to these findings, the research sample's degree of RSE was considerable. Item 26, "I know the ethical rules about the storage, use, and protection of data collected from individuals," was ranked first with a mean score of 4.50 and an SD of 0.790. Item 25, was ranked second, with a mean of 4.42 and an SD of 0.907. Item 6 was ranked third, with a mean of 4.38 and an SD of 0.806. Item 15, "I can analyse the collected data with the determined data analysis method in order to find an answer to the research question I have formed," was ranked 24th, with a mean of 3.81 and an SD of 1.109. Item 14, was ranked 25th, with a mean of 3.66 and an SD of 1.139. Item 26, "I can identify appropriate computer software that can assist the data analysis process to answer the research question I have formed," was ranked 26th, with a mean of 3.61 and an SD of 1.109.

### 4.3 Nature of the relationship between FPSS and RSE among post-graduate students at the college of education

The results of the Pearson's correlation analysis between the respondents' FPSS and RSE scores are shown in Table 4 and Figure 1. With a p-value of less than 0.001 and a Pearson's correlation coefficient value of 0.773, Table 4 and Figure 1 illustrate a significant positive relationship between FPSS and RSE in the research sample.

**Table 2. Relationship between FPSS and RSE**

| | | RSE |
|---|---|---|
| **FPSS** | Pearson's r | 0.773 *** |
| | df | 96 |
| | *p*-value | <0.001 |
| | N | 98 |

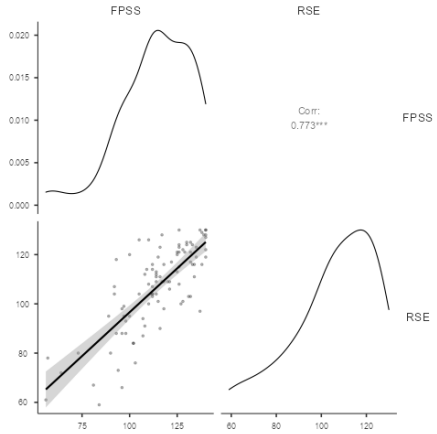


**Figure 1.** Relationship between FPSS and RSE

### 4.4 Differences between post-graduate students at the college of education (FPSS) according to gender, specialisation, stage of study, type of study or state of study.

The results are shown in Tables 3–8 and Figures 2–6, respectively.

Table 3 presents a comparison of respondents' views on FPSS according to gender. The findings show that, with a t-value of 12.7 and a p-value of <0.001, or a value greater than 0.05, there were no gender-related differences in the research sample's means in FPSS.

**Table 3. The results of the Independent Samples T-Test test showing the differences between the points of view of respondents regarding FPSS due to gender**

| | **Groups** | ***N*** | ***M*** | **SD** | **T** | ***p*** |
|---|---|---|---|---|---|---|
| FPSS | Male | 63 | 125 | 9.49 | 12.7 | <0.001 |
| | Female | 35 | 94.9 | 14.1 | | |

Table 4 indicates that there were no statistically significant differences in the respondents' attitudes toward FPSS as a result of the specialisation variable. Less than 0.05 was shown by the F-value of 0.334 and the p-value of 0.855.

**Table 4: One-Way ANOVA test showing the difference between the points of view of respondents regarding FPSS due to the specialisation**

| | **Specialisation** | **N** | **M** | **SD** | **F** | ***p*** |
|---|---|---|---|---|---|---|
| FPSS | SE | 20 | 119 | 14.4 | 0.334 | 0.855 |
| | AE | 16 | 114 | 23.8 | | |
| | PE | 34 | 113 | 20.3 | | |
| | CMT | 12 | 113 | 15.2 | | |
| | EP | 16 | 113 | 16.7 | | |

Table 5 displays the disparities in the respondents' perspectives. The differences in the respondents' opinions about FPSS according to study level are displayed in Table 5, where the p-value (0.425) and t-value (-0.801) are both higher than 0.05,

indicating that there were no differences in the study sample's means in FPSS due to study level.

**Table 5. Independent Samples T-Test test showing the differences between the points of view of respondents regarding FPSS due to level of study**

| | Groups | N | M | SD | T | *p* |
|---|---|---|---|---|---|---|
| FPSS | Master | 81 | 114 | 19.3 | −0.80 1 | 0.425 |
| | PhD | 17 | 118 | 14.4 | | |

Table 6 displays the differences in respondents' perspectives on FPSS according to study stage, where the t-value was -1.73 and the p-value was 0.086, which is a value higher than 0.05, indicating that there were differences in the means of the study sample in FPSS due to stage of study.

**Table 6. Independent Samples T-test showing the differences between the points of view of respondents regarding FPSS due to stage of study**

| | Groups | N | M | SD | T | *p* |
|---|---|---|---|---|---|---|
| FPSS | Part-time | 42 | 111 | 20.4 | −1.73 | 0.086 |
| | Full-time | 56 | 117 | 16.6 | | |

Table 7 reveals that there were statistically significant differences between respondents' perspectives on FPSS based on the status of the research variable. The F-value was 3.63, and the p-value was 0.030, i.e., less than 0.05.

**Table 7. One-Way ANOVA test showing the difference between the s points of view of respondents regarding FPSS due to state of study**

| | State of Study | N | M | F | *p* |
|---|---|---|---|---|---|
| FPSS | SPC | 45 | 109.6 | 3.63 | 0.030 |
| | PST | 47 | 117.7 | | |
| | CST | 6 | 126.2 | | |

Table 7 reveals that there were statistically significant variations in FPSS scores between the research sample means based on the stage of study. To investigate which of these three groups caused these differences.

The administered an LSD test to groups (1) ,(2), (1) (3), (2) and (3).

Table 8 indicates statistically significant differences between groups (1) and (2), as well as groups (1) and (3), but no difference between groups (2) and (3).

**Table 8. LSD results for dimensional comparisons of the FPSS**

| The difference between the mean of the groups | PST (117.7) | CST (126.2) |
|---|---|---|
| SPC (109.6) | *P*=0.035 | *P*=0.037 |
| PST (117.7) | | *P*=0.279 |

### 4.5. Differences between post-graduate students at the college of education in RSE, according to gender, specialisation, stage of study, type of study or state of study.

Table 9 shows the no significant variations in RSE perceptions based on gender, with a t-value of 12.7 and a p-value of <0.001.

**Table 9. The results of the Independent Samples *t*-test test showing the differences between the points of view of respondents regarding RSE due to gender.**

| | Group | N | M | SD | T | *p* |
|---|---|---|---|---|---|---|
| FPSS | Male | 63 | 97.9 | 14.6 | −10 | <0.001 |
| | Female | 35 | 123 | 14.3 | | |

Table 10 shows that there were no statistically significant variations in respondents' views of view on RSE related to the specialty variable. The F-value was 1.289 and the p-value was 0.280, which is less than 0.05.

**Table 10. The results of the One-Way ANOVA test showing the difference between the points of view of respondents regarding RSE due to the variable specialisation**

| | Specialisation | N | Mean | SD | F | *p* |
|---|---|---|---|---|---|---|
| RSE | SE | 20 | 114 | 14.3 | 1.289 | 0.280 |
| | AE | 16 | 108 | 15.7 | | |
| | PE | 34 | 103 | 17.7 | | |
| | CMT | 12 | 105 | 15.7 | | |
| | EP | 16 | 107 | 20.2 | | |

Table 11 shows that the differences in respondents' perspectives on RSE owing to stage of study, where the t-value was -1.582 and the p-value was 0.117, which is a value greater than 0.05, suggesting that there are no changes in the study sample's means in RSE due to stage of study.

**Table 11. The results of the Independent Samples T-Test test showing the differences between the points of view of respondents regarding RSE due to stage of study**

| | Group | N | *M* | SD | T | *p* |
|---|---|---|---|---|---|---|
| RSE | Master | 81 | 106 | 17.3 | −1.582 | 0.117 |
| | PhD | 17 | 113 | 15.0 | | |

Table 12 shows the differences between the points of view of respondents regarding RSE due to stage of study, where the t-value was -2.61 and the p-value was 0.011, which is a value less than 0.05, indicating that there were differences in the means of the study sample in RSE due to type of study.

**Table 12. The results of the Independent Samples t-test, which illustrate the variations between respondents' perspectives on RSE based on the kind of study**

| | Group | N | M | SD | T | *p* |
|---|---|---|---|---|---|---|
| RSE | Part-time | 42 | 102 | 18.2 | −2.61 | 0.011 |
| | Full-time | 56 | 111 | 15.2 | | |

Table 13 shows that there were statistically significant variations between respondents' perspectives on RSE based on the stage of study variable.
The F-value was 9.85 and the p-value was < .001, which is less than 0.05.

**Table 13. The results of the One-Way ANOVA test showing the difference between the points of view of respondents regarding RSE due to the variable state of study**

| | State of Study | N | M | SD | F | *p* |
|---|---|---|---|---|---|---|
| RSE | SPC | 45 | 99.7 | 16.83 | 9.85 | <0.001 |
| | PST | 47 | 112 | 15.24 | | |
| | CST | 6 | 121.7 | 6.92 | | |

To investigate which of these three groups caused these differences, the researchers conducted an LSD test between the three groups. The results are shown in Table 14.

**Table 14. LSD results for dimensional comparisons of the RSE**

| The difference between the mean of the groups | PST (112) | CST (121.7) |
|---|---|---|
| SPC (99.7) | *P*<0.001 | *P*=0.002 |
| PST (112) | | *P*=0.157 |

Table 14 reveals that there were statistically significant differences between groups (1) and (2), as well as groups (1) and (3), but no difference between groups (2) and 3.

### 4.6. The degree of RSE of post-graduate students be predicted by their FPSS scores

A simple linear regression analysis test was conducted to determine the amount of change in one variable that accompanies a specific change in another variable. Then, the values of one of the two variables were predicted from the values of the other variable, as shown in Table 15.

**Table 15. Results of Model Coefficients for RSE and R2**

| Predictor | Estimate | SE | Lower | Upper | T | *p* | Stand. Estimate | $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Intercept | 25.348 | 6.9313 | | | 3.66 | 0.001 | 0.773 | 0597 |
| FPSS | 0.712 | 0.0598 | 0.644 | 0.901 | 11.92 | <0.001 | | |

Table 15 shows that the validity of the model was verified by testing the ANOVA, and the result was statistically significant, which confirms the validity of the model for prediction. Table 17 indicates the statistical significance of the result with a p-value of <0.01 for the regression coefficient of RSE on FPSS, and $R^2$ = 0.597. This means that the variable of FPSS explains 59.7% of the variance in research self-efficacy, and the predictive equation can be written as follows: RSE = 25.348+ 0.712×FPSS.

## 5. Discussion

The results of this research indicate that the levels of future problem-solving skills (FPSS) and research self-efficacy (RSE) in the sample population were high. It was observed that the students' FPSS abilities enabled them to face future challenges, predict outcomes, and effectively analyse and evaluate intellectual operations such as analysis, criticism, imagination, and evaluation, which in turn enhanced their RSE.

The high level of FPSS among students was attributed to ample scientific and academic support from their academic guides, vocational and scientific training, and the role of the Security of Quality Organisation in reviewing and developing teaching strategies. These strategies provided students with essential research skills, cognitive components, awareness of future challenges, creative skills, complex thinking standards, analysis and synthesis abilities, diverse evaluation methods, and knowledge of computer-based techniques. Additionally, training courses at the Faculty of Education at KFU contributed to this result, which aligns with Main et al. (2019), who found that such support increases student competence and FPSS. Collective participation also enhances researchers' FPSS abilities.

Nazari et al. (2021) also confirmed that offered support positively affects researchers' self-efficacy, providing them with persistence and active engagement in research. Furthermore, this research found a positive correlation between FPSS and RSE among the students. Accumulated self-expertise and skill, enhanced by RSE, positively impacted the development of problem-solving skills. Positive experiences and perspectives motivate researchers to overcome problems through persistence, good planning, and effort, which are then reflected in their FPSS. This relationship is supported by Elballah (2022), who indicated that RSE in problem-solving and self-academic efficacy are predictors of student motivation, exam performance, and degree attainment

The current research also showed that there are gender differences in FPSS for males and RSE for females. This result suggests that males are better at dealing with problems in the FPSS context because they are confident in solving problems, free from negative thinking, able to make positive predictions, have an optimistic view of the future, and are motivated to succeed in life due to pressures to achieve scientific, social, and economic status.

Additionally, males tend to rely on rational ideas, positive practices, evaluating their problem-solving abilities, planning, predicting suitable solutions, having future goals, and making decisions. They are known for making mental predictions, considering their future from multiple perspectives, focusing on problem-solving, using available choices, and planning creatively and unconventionally. On the other hand, females are known for their ability to imagine and create an integrated vision of future events, using their inventive skills and predictions to shape a positive future based on past experiences and information (Ucar et al., 2017). Females are also distinguished by their analytical abilities, interest in research and publication, and desire to continue scientific research to achieve social recognition. They are committed to scientific supervision, managing family affairs, and learning from other researchers' experiences, driven by high inner motivation and RSE. This result aligns with the study by Nazari et al. (2021), but not with the findings of Epstein and Fischer (2017) and Hemmings and Kay (2016). The current research concludes that there are no statistical differences in RSE. This outcome can be attributed to the nature of the studied syllabuses, their competence through different study stages, and the scientific level of academic supervisors and professors,

The current research also found that there is significant support from the Faculty of Education's administration for scientific research at all study stages. Post-graduate students (master's and doctoral) have gained essential skills and concepts related to scientific research through seminars, workshops, and project preparation, enhancing their research abilities. This aligns with previous research (Main et al., 2019). The study highlighted the importance of positive reinforcement, early research experience, research curriculum integration, and connecting research to practice in post-graduate programs, consistent with the findings of Lambie et al. (2014).

However, this research does not agree with Nazari et al. (2021), which found differences in research skills favouring doctoral-stage students. For FPSS, there were no differences between full-time and part-time researchers. In contrast, this research found a difference in RSE favouring full-time students, who benefit from more workshops, lectures, and scientific programs. Full-time students also have better access to research resources and support, positively affecting their RSE, as confirmed by Saral and Reyhanlioğlu (2015).

The study also suggests increasing allocated time for scientific research in study programmes. Full-time students have more time to analyse research problems, enhancing their competence and resulting in accurate results, motivating them to achieve more. On the other hand, part-time students may face challenges that limit their research skills and self-regulation, affecting their ability to achieve their goals satisfactorily. Vaccaro (2009) emphasised the importance of scientific research achievement and its relation to an individual's willingness or ability to complete research tasks effectively.

The research results show differences in problem-solving skills and RSE among students, with those at the thesis completion stage having more experience and better skills. This is supported by studies from Lambie et al. (2014), Litson et al. (2021), Nazari et al. (2021), and Niehaus et al. (2018), which highlight the benefits of early research experience and the connection between research and practice.

Differences in RSE levels among post-graduate students at various stages are influenced by factors such as seminar success, literature collection, curriculum selection and result presentation. First-year students focus on building skills and gaining knowledge, while second-year students concentrate on scientific research tasks, supported by family, peers, and supervisors, which boosts their confidence and reduces tension.

The study supports the idea that RSE can be predicted using FPSS, involving imagination, prediction, planning, and problem-solving. Future planning requires confidence in problem-solving and crisis management. Main et al. (2019) and Vaccaro (2009) suggest that future problem-solving programmes should focus on organised scientific prediction, analysing past experiences, and anticipating future problems. Directing students toward problem-solving and inquiry-based learning improves academic performance

## 6. Conclusions

We conclude that there were high levels of future problem-solving skills (FPSS) and research self-efficacy (RSE) among post-graduate students at the Faculty of Education, KFU. There is a strong, positive relationship between FPSS and RSE for these students. This means that students with good FPSS are likely to have high RSE and are capable of successfully completing their academic theses in their specific fields. As a result, they can keep up with the latest developments in educational scientific research globally and apply them to their work, confidently facing challenges that may impede their progress.

These findings highlight the importance of developing FPSS in post-graduate programmes at the Faculty of Education, as it enhances RSE and improves student performance in scientific research. Additionally, reinforcing RSE can lead to increased academic achievement, integration of critical thinking, and creativity. Overall, this research underscores the theoretical and practical importance of developing FPSS and RSE in post-graduate students in the Faculty of Education. Such developments can enhance the quality of scientific research, as well as strengthen critical thinking and creativity in the field of educational research.

## 7. Limitations

The current research faced several limitations, including issues related to sample selection. The study was conducted with a specific sample of post-graduate students from the KFU College of Education at, which might limit the generalisability of the results to students from other colleges. Additionally, the research focused on only two variables: future problem-solving skills (FPSS) and research self-efficacy (RSE). This limited scope may affect the applicability of the findings.

There were also challenges with the design of the scales used and the difficulty in defining the dimensions of the research tools, which could impact the accuracy and detail of the results. However, these issues were addressed through a thorough analysis of the credibility of the two research variables.

The timing of the research, conducted in the first term of the 2023 academic year, also posed limitations. The sample size was smaller, representing students in the early stages of their syllabuses, as well as those at the beginning of their post-graduate programmes. This may have affected the sample's representation and the researcher's ability to collect comprehensive data.

Despite these constraints, the research addressed these issues clearly and accurately. These limitations were discussed throughout the results and conclusions to ensure a high level of accuracy and reliability in the research.

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