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The mentoring experience of Jordanian pre-service science teachers

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ABSTRACT

The purpose of this study is to examine Jordanian pre-service science teachers' perceptions of their mentoring experience using the five-factor model of mentoring (personal attributes, system requirements, pedagogical knowledge, modeling, and feedback). This study uses a descriptive survey research design, and the Arabic version of the validated Mentoring for Effective Primary Science Teaching (MEPST) survey was administered electronically to collect responses from 49 participants. The data was summarized using descriptive statistics, and t-tests were conducted to test for significant differences in the perceived mentoring experiences between male and female Jordanian pre-service science teachers. The study supports efforts to validate the Arabic version of the MEPST survey. The means of the participants' perceptions of mentoring were relatively high, greater than four on a five-point Likert scale, indicating that the pre-service teachers perceived their mentoring experience as positive based on the five factors. No statistically significant differences were found in the perceived effectiveness of the mentoring experiences between the male and female pre-service science teachers. The study findings have several practical implications and suggested directions for future research. Researchers are encouraged to investigate mentors' perceptions and practices related to effective mentoring, and research on identifying and understanding school factors that may influence the effectiveness of mentoring in schools is also needed.

Contribution/Originality: The current study contributes to existing literature through examining pre-service science teachers' perceptions of their mentoring experience in a Middle Eastern context. Moreover, it provides evidence that supports the validity of the Arabic version of the MEPST survey.

1. INTRODUCTION

There has been global interest in preparing effective teachers through pre-service programs that improve teachers' skills and classroom practices. This interest echoes the increase in the requirements and qualifications of the teaching profession (Cleaver, Detrich, & States, 2020). Jordan is among the countries striving to improve their pre-service teachers' programs.

The USAID Preservice Teacher Education program in Jordan supports the efforts of the Ministry of Education and the Ministry of Higher Education in preparing qualified teachers for Grades 4–10 (International Research & Exchanges Board, 2023). The program was launched at four public universities in Jordan, including Hashemite

University (International Research & Exchanges Board, 2023). Other partners, such as the Queen Rania Teacher Academy and the Higher Education Accreditation Council, have also been involved in and supported this project.

A strong practicum or school experience is an important element in the design of effective pre-service teachers' education programs (Muzaffar, Rahim, & Jessee, 2011). Through school experience, pre-service teachers (mentees) are guided by experienced teachers (mentors) in schools. Mentoring activities are an important component in teacher preparation programs (Ndebele & Legg-Jack, 2022) and have a positive impact on mentees' pedagogical practices (Gomez Johnson, Schaffer Dr, Nix, & Hayden, 2020). Having skilled, trained mentors improves pre-service teachers' skills and competencies (Cleaver et al., 2020; Hennissen, Crasborn, Brouwer, Korthagen, & Bergen, 2011; Simsar & Dogan, 2020).

Nikoçeviq-Kurti (2023) found a positive correlation between a positive mentoring experience and higher levels of mentees' self-efficacy. Mentoring is a dynamic process in which mentors and mentees need to understand their roles and adapt to contextual situations (Leshem, 2012). Mentors should be carefully selected and trained in specific mentoring skills (Muyengwa & Jita, 2020). Based on the five-factor model of mentoring, mentors need training in pedagogical knowledge, system requirements, personal attributes, modeling, and feedback (Hudson & Skamp, 2002). Mentors also need to be trained to share knowledge with and guide mentees and should acquire coaching skills (Albakri et al., 2021).

A mentoring manual is required to help mentors provide high-quality mentoring (Suryati, Kuswandi, & Astuti, 2023). As the relationships between mentors and mentees are not always positive, extra attention should be paid to negative and positive mentoring relationships (Sokhulu, 2022). Some school factors, such as a high teaching load and large classes, may affect the quality of the mentoring process and its outcomes (Matorevhu, 2022) and should be considered carefully.

1.1. The Purpose of the Research

The purpose of this study is to examine the mentoring experience of pre-service science teachers in Jordan using the five-factor model of mentoring in teaching (Hudson & Skamp, 2002). It examines their perceptions regarding the extent to which they received the necessary mentoring. The study addresses two research questions:

1. What are the perceived mentoring experiences of Jordanian pre-service science teachers?
2. Are there statistically significant differences in the perceived mentoring experiences between male and female Jordanian pre-service science teachers?

1.2. The Context of the Research

The study was conducted at a public university in Jordan. The teachers teach most school subjects, including science, to Grades 1–3. The majority of science teachers for Grades 4–12 are graduates of a school of science, not a school of education. The Ministry of Education used to support these teachers with intensive courses and workshops in teaching science for Grades 4–10. Preparing qualified science teachers has gained great attention from several partners in Jordan.

A diploma in teacher preparation was launched, which pre-service teachers are required to complete before teaching science in schools. Unlike traditional diploma programs, this program was carefully designed to ensure that its content was aligned with the national and international teaching standards. Moreover, non-traditional teaching methods and alternative assessment strategies were implemented in this diploma program. Supervised school experience is a main component of the diploma program and requires students to successfully complete work experience in three schools under the supervision of experienced mentors and university instructors. The participants took part in this study at the end of their diploma program after they had completed their work experience.

2. THEORETICAL FRAMEWORK

Significant efforts have been made to introduce a comprehensive framework to effectively mentor pre-service teachers (e.g., (Hudson & Skamp, 2002; Mafugu, 2022)). Researchers have focused on developing a specific mentoring framework rather than a generic one (Hudson, 2004). A review of the large body of related literature identified important mentoring factors, and a five-factor model for mentoring was proposed (Hudson, 2004; Hudson & Skamp, 2002). The five factors of this constructivist model are pedagogical knowledge, modeling, personal attributes, feedback, and system requirements (Hudson, 2006; Hudson & Skamp, 2002). These five factors and the associated practices have been justified and fully described (Hudson, 2004, 2007; Hudson & Skamp, 2002). The five-factor model assumes that the mentor and mentee cooperate and interact socially to enhance the mentee's attitude, confidence, and skills to teach science.

This model can serve as a guide for mentors and help them consider the five factors and their associated practices (Hudson, 2007; Hudson & Skamp, 2002). Some practices of the pedagogical knowledge factor involve strategies for teaching science and assisting mentees in timetabling, managing classrooms, implementing teaching strategies, and assessing students' learning of science. Modeling effective teaching and describing well designed activities are among the practices of the modeling factor. Providing oral and written feedback on lesson plans and mentees' teaching practices is associated with the feedback factor (Hudson, 2007). Other practices associated with the personal attributes and system requirements are presented by Hudson (2007).

Orland-Barak and Wang (2021) identified four categories of teacher mentoring approaches, including the personal growth approach. The same researchers introduced an integrated teacher mentoring approach. This approach requires the mentors to be knowledgeable in instruction, understand the paths of pre-service teachers who are learning to teach, be aware of different mentoring approaches, and know how to examine their mentoring practices collaboratively with the mentees and their colleagues. Recently, Mafugu (2022) introduced the IDEAL mentoring framework based on sociocultural theoretical perspectives, which assumes that pedagogical content knowledge learning is an iterative process involving modeling, feedback, and scaffolding in positive social interactions.

Based on a review and comparison of the available mentoring frameworks, a constructivist five-factor model was adopted as the analytical framework for this study. Collecting and analyzing the data and the interpretation of the results were guided by the five-factor model. The factors and their associated practices were fully justified and clearly presented.

The list of associated practices (Hudson, 2007) is useful for investigating the perceptions of pre-service science teachers.

3. LITERATURE REVIEW

3.1. Pre-service Teachers' Perceptions of Their Mentoring Experience

Several studies have investigated pre-service teachers' perceptions and views of their mentoring experience using the five-factor model of mentoring (e.g., (Abed & Abd-El-Khalick, 2015; Simsar & Dogan, 2020)). Most of these studies have targeted primary pre-service teachers' perceptions of their mentoring experience (e.g., (Abed & Abd-El-Khalick, 2015; Albakri et al., 2021)).

Notably, neither general primary teachers nor their mentors usually specialize in science, with primary teachers in many countries often teaching several subjects. The averages of the responses to the five factors were moderate, ranging from 2.29 to 3.14 out of 5 (Hudson, 2007). Personal attributes and feedback received the highest rating (3.14) from Australian pre-service primary science teachers. In another study using the same framework and instrument, Nikoçeviq-Kurti (2023) found that mentors focused more on the modeling and personal attributes factors and less on the feedback and system requirements factors. Using the MEPST survey, Abed and Abd-El-Khalick (2015) examined Jordanian pre-service primary teachers' perceptions of their mentoring experience related

to teaching and learning science. The pre-service teachers had already completed a number of courses, as they were required to teach several subjects to Grades 1–3. The means for four factors were less than 3 out of 5, indicating that most of the participating pre-service teachers did not experience effective mentoring (Abed & Abd-El-Khalick, 2015). However, the mean and standard deviation for the modeling factor (M = 3.23, SD = 0.64) suggest a relatively positive experience.

Using the five-factor mentoring model, Ndebele and Legg-Jack (2022) showed that mentoring has a strong impact on South African mentees' pedagogical knowledge but relatively weaker impacts on modeling and feedback. These results suggest that in previous studies using the same model, no common pattern has emerged concerning which factors received more attention from mentors.

Several studies have produced recommendations for improving the quality of mentoring. For example, Albakri et al. (2021) found that modeling and pedagogical knowledge require more attention in order to improve the quality of mentoring. Simsar and Dogan (2020) considered knowledge and understanding of the skills and associated practices of the five factors as very useful in improving the effectiveness of mentoring. Albakri et al. (2021) advised that mentors need clear guidance and professional training on how to guide mentees effectively. Hudson and Skamp (2002) and Hudson (2006) recommended that more attention be paid to subject-specific mentoring practices to improve the effectiveness of mentoring.

Other researchers focused on investigating how mentors contributed when they mentored teachers and how they perceived their roles in mentoring (Li, Sani, & Azmin, 2021). Additionally, mentoring may have positive impact on mentors' leadership skills (Andrea, 2010).

A review of the literature from the last two decades showed that science education researchers focused on investigating primary teachers' perceptions of mentoring (e.g., (Abed & Abd-El-Khalick, 2015; Hudson, 2007)). It is noticeable that many primary teacher preparation programs offer limited science courses, which may affect the preparation of primary teachers and shape their mentoring experiences. In contrast, the participants of the current study had completed a bachelor's degree in science before obtaining an educational diploma and were prepared to teach science to Grades 4–12. As both the mentors and mentees of the current study specialize in science, the mentees' mentoring experiences may have been better than those of primary teachers who lack specialized knowledge of science content.

3.2. Assessing Pre-service Teachers' Perceptions of Their Mentoring Experience

Researchers have used various methods to investigate pre-service teachers' perceptions of mentoring. Several studies have used quantitative methods and administered the MEPST survey tool (Hudson, 2007). The five-factor model has been used as an analytical framework to analyze quantitative data collected via the MEPST in many related studies (e.g., (Abed & Abd-El-Khalick, 2015; Albakri et al., 2021; Hudson, 2007; Simsar & Dogan, 2020)). Other studies have employed qualitative methods to examine the relationships between mentors and mentees (e.g., (Izadinia, 2016; Sokhulu, 2022)) and the factors that influence the effectiveness of the mentoring experience (e.g., (Jita & Munje, 2022; Muyengwa & Jita, 2020; Ndebele & Legg-Jack, 2022)).

Other studies (e.g., Nikoçeviq-Kurti (2023)) have used a mixed methods approach. As recommended by other researchers (e.g., Hudson (2007)), the MEPST survey and the five-factor mentoring model were used in this study to collect and analyze data on teachers' perceptions of their mentoring experience and interpret the results.

4. METHODOLOGY

A descriptive survey research design was adapted for this study. The electronic version of the validated Arabic MEPST survey was administered to 49 pre-service science teachers who agreed to participate in this study. The collected data was analyzed using SPSS.

4.1. Survey Instrument

An Arabic version of the validated MEPST survey (Hudson, 2007) was used to collect data from pre-service science teachers. Hudson and Skamp (2002) developed this survey instrument based on an extensive literature review and the five-factor mentoring model. The survey addresses five factors, namely personal attributes, system requirements, pedagogical knowledge, modeling, and feedback, and contains 34 items. The validity of the survey is supported by the results of exploratory factor analysis (Hudson & Skamp, 2002) and confirmatory factor analysis (Hudson, 2007).

A five-point Likert scale was used to collect responses from the participants. Translation and back-translation processes were used to confirm the validity of the survey.

4.2. Participants (Mentees)

The survey was sent in electronic form to 70 pre-service science teachers (31 males and 39 females) who had recently completed educational diplomas in teaching science at a public university in Jordan. About 77 % of the pre-service science teachers were sponsored by the Ministry of Education. They had the opportunity to have experiences at public and private schools in several governorates in Jordan. Forty-nine students completed the electronic survey, constituting a return rate of 70%. These comprised 29 female and 20 male pre-service teachers who had just completed the diploma program. All the participants had completed a Bachelor of Science before joining the diploma program. The purpose of the diploma program is to support pre-service teachers by training them in essential skills for effective teaching.

4.3. Mentors

The mentors were carefully selected based on their qualifications, experience, and performance in schools. They received five days of well-planned training, including self-reading and mentors' active participation in the program's workshops.

These workshops covered numerous topics, such as teaching standards, the differences between coaching and mentoring, the roles and duties of mentors, methods for observing and supporting mentees, the use of technology in mentoring, listening and communication skills, and constructive feedback.

4.4. Data Collection and Analysis

The participants provided responses on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The mean, standard deviation, and Cronbach's alpha were calculated for each factor. Descriptive statistics for each item and factor were calculated for males and females to show the differences in the perceptions of mentoring between the male and female pre-service science teachers (see Table 2). An independent sample t-test was then used to test for a significant difference in teachers' perceptions of mentoring for each factor based on gender.

5. RESULTS

Basic descriptive statistics and Cronbach's alpha were calculated for each factor and are presented in Table 1. The means are greater than 4, which is relatively high, indicating that the pre-service teachers reported a positive mentoring experience for the five factors. The personal attributes factor had the highest mean (M = 4.16; SD = 0.81), while pedagogical knowledge and system requirements had the lowest (M = 4.03).

The Cronbach's alpha values ranged from 0.86 to 0.97, indicating that the survey was reliable at the factor level.

Table 1. Cronbach's alpha values for the five dimensions of the survey.

Factor	Mean	SD	Cronbach's alpha
Personal attributes	4.16	0.81	0.93
Feedback	4.12	0.79	0.93
Modeling	4.08	0.86	0.95
Pedagogical knowledge	4.03	0.92	0.97
System requirements	4.03	0.85	0.86

5.1. Personal Attributes

The mentoring experience had a positive impact on the personal attributes of the pre-service science teachers. The female science teachers reported that the mentors supported them in teaching science (M = 4.3). The male pre-service teachers believed that the mentors were comfortable talking with them about science teaching (M = 4.30), and they made them more confident as science teachers (M = 4.30). The grand mean of the personal attributes factor for the males (M = 4.18, SD = 0.92) was close to that for the females (M = 4.14, SD = 0.75).

5.2. System Requirements

The respondents reported that their mentors were supportive regarding the system requirements, such as discussing the aims and the policies of science teaching in schools. The grand means of system requirements were 4.02 for males and 4.05 for females.

5.3. Pedagogical Knowledge

This factor was addressed by 11 items that are directly related to the practices of teaching science. The observed grand mean of pedagogical knowledge for the male mentees (M = 4.10, SD = 1.06) was higher than that for the female mentees (M = 3.98, SD = 0.83). The means of the male mentees' responses ranged from 3.85 (Item 14: My mentor developed my strategies for teaching science) to 4.65 (Item 6: My mentor assisted me with timetabling my science lessons). The means of the female mentees' responses ranged from 3.86 (Item 18: My mentor discussed questioning skills with me) to 4.07 (Item 8: My mentor assisted me with implementing science teaching strategies and Item 6: My mentor assisted me with classroom management strategies for science teaching).

5.4. Modeling

The means of the mentees' responses to the eight items in this factor reflect their perceptions of the modeling support they received from school mentors. The mean for modeling for the male mentees (M = 4.12, SD = 1.04) was higher than that for female mentees (M = 4.06, SD = 0.73). The means of the responses of the male mentees ranged from 3.95 (Item 19: My mentor used hands-on materials for teaching science) to 4.30 (Item 15: My mentor was effective in teaching science). The means of the responses of female mentees ranged from 3.9 (Item 29: My mentor had well-designed science activities for the students) to 4.21 (Item 2: My mentor used science language from the current science syllabus).

5.5. Feedback

The means of the mentees' responses to the six items for feedback reflect their perceptions regarding the feedback support they received during their mentoring experience. The mean for feedback for the male mentees (M = 4.20, SD = 0.93) was higher than that for the female mentees (M = 4.06, SD = 0.69). The means of the male mentees' responses ranged from 3.50 (Item 28: Reviewed my science lesson plans) to 4.45 (Item 16: Provided oral feedback). The means of the female mentees' responses ranged from 3.6 (Item 28) to 4.21 (Item 20: Provided me with written feedback, and Item 34: Observed me teaching science). The lowest means for both the male and female mentees are associated with their mentors' reviews of their lesson plans.

Table 2. Descriptive statistics for each item and factor for males and females.

Mentoring pre-service science teachers (MEPST)*				
* The MEPST survey, including all the items listed below, was adapted from Hudson (2007) and translated from English to Arabic.				
During my final professional school experience, my mentor:				
The items of dimension 1: Personal attributes	**Males**		**Females**	
	M	**SD**	**M**	**SD**
1. Was supportive of me teaching science	4.10	1.21	4.28	0.92
17. Seemed comfortable talking with me about science teaching	4.3	0.98	4.10	0.724
22. Instilled a positive attitude in me toward teaching science	4.25	1.07	4.07	0.84
23. Assisted me in reflecting on improving my science teaching practices	3.95	1.19	4.10	0.86
26. Made me feel more confident as a science teacher	4.30	0.98	4.17	0.89
31. Listened to me attentively on science teaching matters	4.20	1.01	4.10	0.86
Personal attributes dimension	4.18	0.92	4.14	0.75
The items of dimension 2: System requirements	Males		Females	
	M	SD	M	SD
4. Discussed with me the school policies used for science teaching	4	1.26	4.21	0.62
11. Outlined state science curriculum documents with me	4.05	1.15	3.97	0.87
25. Discussed the aims of science teaching with me	4	1.08	3.97	0.94
System requirement dimension	4.02	1.01	4.05	0.74
The items of dimension 3: Pedagogical knowledge	Males		Females	
	M	SD	M	SD
3. Guided me with science lesson preparation	4.05	1.23	4	1
6. Assisted me with classroom management strategies for science teaching	4.20	1.2	4.07	0.84
8. Assisted me with implementing science teaching strategies	4.05	1.23	4.07	0.80
10. Assisted me with timetabling my science lessons	4.65	0.93	4.00	0.89
14. Developed my strategies for teaching science	3.85	1.31	3.90	0.98
18. Discussed questioning skills with me for effective science teaching	4.10	1.21	3.86	0.99
21. Discussed with me the knowledge I need for teaching science	3.9	1.45	4.03	0.78
24. Gave me clear guidance for planning to teach science	4.1	1.17	3.93	0.96
27. Provided strategies for me to solve my science teaching problems	4.2	1.1	4	1
30. Gave me new viewpoints on teaching primary science	3.9	1.25	3.97	0.91
32. Showed me how to assess the students' learning of science	4.1	1.33	4	0.96
Pedagogical knowledge dimension	4.10	1.06	3.98	0.83
The items of dimension 4 : Modeling	Males		Females	
	M	SD	M	SD
2. Used science language from the current primary science syllabus	4.15	0.99	4.21	0.86
5. Modeled science teaching	4.05	1.23	3.93	0.88
7. Had a good rapport with the primary students doing science	4.2	1.32	4.17	0.66
9. Displayed enthusiasm when teaching science	4.10	1.37	4.07	0.75
12. Modeled effective classroom management when teaching science	4.15	1.23	4	0.89
15. Was effective in teaching science	4.3	1.03	4.03	0.78
19. Used hands-on materials for teaching science	3.95	1.47	4.14	0
29. Had well designed science activities for the students	4.05	1.01	3.9	0.9
Modeling dimension	4.12	1.04	4.06	0.73
The items of dimension 5: Feedback	Males		Females	
	M	SD	M	SD
13. Evaluated my science teaching	4.15	1.09	4.10	0.77
16. Provided oral feedback on my science teaching	4.45	1	4.14	0.64
20. Provided me with written feedback on my science teaching	4.5	0.95	4.21	0.68
28. Reviewed my science lesson plans before teaching science	3.5	1.4	3.66	1.05
33. Clearly articulated what I needed to do to improve my science teaching	4.20	0.95	4.07	0.88
34. Observed me teaching science before providing feedback	4.4	0.94	4.21	0.77
Feedback dimension	4.2	0.93	4.06	0.69

Note: * The MEPST survey was adopted from Hudson (2007) and translated from English into Arabic.

To answer the second research question, an independent sample t-test was used to examine whether there were statistically significant differences between the means of the mentees' perceptions of the five factors that could be attributed to their gender. The t-test results showed that the differences between the means were not significant for personal attributes ($t = 0.19$, $df = 47$, $p = 0.85$), system requirements ($t = -0.12$, $df = 47$, $p = 0.91$), pedagogical knowledge ($t = 0.43$, $df = 47$, $p = 0.67$), modeling ($t = 0.25$, $df = 47$, $p = 0.81$), or feedback ($t = 0.59$, $df = 47$, $p = 0.58$).

6. DISCUSSION

This study supports the efforts to validate the Arabic version of the MEPST survey. Although the validity of the instrument, including its factors, has been supported by many previous studies (e.g., (Abed & Abd-El-Khalick, 2015; Hudson, 2007; Hudson & Skamp, 2002)) the current study used the translated version of the MEPST and found that this instrument was reliable at the factor level. As the MEPST is strongly grounded in the five-factor model, it can be adapted for other subjects and stages. Other researchers have already used the instrument to investigate the mentoring practices and experiences of pre-service English teachers (Albakri et al., 2021) and the instrument and the five-factor model have been recommended for investigating the mentoring experience in other subjects, such as math, Arabic, social studies, and others. The current study found the MEPST to be valid for use among pre-service teachers of Grades 4–12, even though it has mainly been used for primary stage teacher assessments (e.g., (Abed & Abd-El-Khalick, 2015; Hudson, 2007)). Therefore, the MEPST survey can also be used for the secondary stage. In addition to utilizing the quantitative survey research design, other researchers have used the qualitative or mixed methodology to understand the mentoring of pre-service teachers (e.g., (Ambrosetti, 2014; Sokhulu, 2022)).

Pre-service science teachers were found to have experienced positive mentoring in schools, as indicated by the mean for each factor being greater than 4 out of 5. The mentoring of the pre-service science teachers surveyed in this study appears to have been more effective than that in other studies (e.g., (Abed & Abd-El-Khalick, 2015; Hudson, 2007)). This might be attributable to the characteristics of the participating mentors and mentees. The participants in the current study had sufficient science content knowledge to begin teaching, having already completed a bachelor's degree in science before obtaining a higher diploma in education. The participating mentors had also received extensive training in mentoring and guiding the pre-service science teachers in their schools. The relatively low effectiveness of mentoring observed in other studies (e.g., (Abed & Abd-El-Khalick, 2015; Hudson, 2007)) could be attributable to the fact that primary teachers typically take few science courses. Future research could investigate how content knowledge impacts mentoring.

Some factors and their associated practices received more attention from mentors. Therefore, organized training for mentors that is focused on the five factors and their associated practices is recommended. For example, to implement the feedback factor effectively, mentors need training on implementing the associated practices of feedback, such as reviewing science plans, observing mentees' teaching of science, and providing oral and written feedback. The mentors need continuous support to help them play their mentoring roles effectively (Schneider, 2008).

No significant differences in the perceived effectiveness of the mentoring experience were detected between male and female pre-service science teachers in this study. It is worth mentioning that the female pre-service teachers had completed their work experience in all-female schools, while male pre-service teachers had completed their work experience in all-male schools. The approximately equal perceived effectiveness of mentoring from both the male and female mentees could be attributed to the fact that both genders received the same training and completed the same diploma courses in mixed classes at university. In summary, the gender of pre-service science teachers in Jordan was not an issue with regard to the effectiveness of their mentoring.

7. CONCLUSION

The current study found that the pre-service science teachers had positive mentoring experiences in schools. This positive experience could be attributed to the careful selection and training of mentors and the effective supervision from the university instructors.

7.1. Implications and Recommendations for Future Research

Diploma program providers in Jordan are encouraged to continue focusing on the selection and training of mentors to maintain high levels of effectiveness. It may be necessary to design training programs for mentors to include the knowledge they need, how teachers learn, and the roles of mentors in enhancing mentees' skills in teaching science (Schneider, 2008).

The current study also provides recommendations for researchers of teacher education. They are encouraged to investigate mentors' perceptions and practices related to effective mentoring. Also, research on identifying and understanding school factors that may affect the effectiveness of mentoring in schools is needed.

7.2. Limitations

As the sample of the current study was drawn from one public university in Jordan, teacher educators should carefully generalize its findings. Collecting and analyzing quantitative data might limit the depth of the discussion; therefore, using a mixed design research methodology may provide a more in-depth understanding of the effectiveness of mentoring.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The authors declare that they have no competing interests.
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