



Science Teachers Perceptions on Impacts of Virtual and On-Site Supervision and Mentoring on Effective Instructional Delivery

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ABSTRACT

The study investigated the impact of virtual and on-site supervision and mentoring on instructional delivery effectiveness of secondary school science teachers in Jalingo Metropolis, Taraba State; with a focus on promoting teacher professional growth, improving instructional practice, and enhancing student learning outcomes. The study type for the research was an investigative survey design. The target population for the study comprised of 321 science teachers in 80 secondary schools. A random sampling of 174 science teachers participated in the study. The instrument adapted for this study was a Virtual and On-site Supervision and Monitoring of Instructional Delivery Effectiveness Questionnaire (VOSMIDEQ) and used for data collection. The VOSMIDEQ contained 24-item questions relevant to the objectives of the study and was subjected to face and content validations. The reliability coefficient from Cronbach's alpha method was at 0.82 which justified the reliability of the instrument. The research questions were answered using the descriptive statistics to calculate frequency, summation, mean scores and standard deviations. The findings revealed that both virtual and on-site Supervision and Mentoring contributed to improvements in instructional delivery effectiveness of the science teachers. Substantial increase in mean rating scores was recorded from categories "poor" to "very good" for virtual supervision and mentoring intervention, while the on-site supervision and mentoring recorded the highest mean scores as "good" and least mean scores was recorded for "very good". Based on the findings, it was concluded that even though both virtual and on-site supervision and mentoring contributed to the positive improvements, virtual supervision and mentoring emerged with slightly greater observable impacts. Based on the findings, it was recommended amongst others that the Ministries of Education can develop a Multi-Modal Mentoring System which can implement a blended mentoring approach that integrates both virtual and on-site support for effective supervision.

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INTRODUCTION

Digital tools have played important role in enhancing the course of educational pursuits and advancement and one of the components of education is supervision and mentorship. Effective supervision and teacher mentorship are significant for every successful educational system in the world, as they play pivotal role in enhancing teacher performance, student achievement as well as the general school

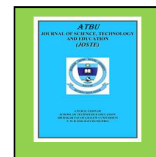
improvement (Ekong, 2024). In public secondary schools, supervision and mentorship are essential for promoting teacher professional development, improving instructional practices, and fostering a positive school culture (Ekpoh & Edet, 2019). However, traditional methods of supervision and mentorship, which rely heavily on face-to-face interactions and paper-based documentation, can be time-consuming,

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inefficient, and often ineffective in achieving these goals.

The emergence of digital tools has revolutionized the way supervision and mentorship are conducted in educational settings (Ekpenyong, 2024). Digital tools, such as learning management systems, online collaboration platforms, and mobile apps, offer a range of benefits, including increased flexibility, accessibility, and efficiency; and by leveraging these tools, supervisors and mentors can provide targeted support, feedback, and guidance to teachers, thereby enhancing their instructional delivery, practices and student outcomes. More so, mentoring and supervision plays a vital role in the professional growth of science teachers as it enables the exchange of knowledge and skills between science teachers in training and those already in service; providing valuable support, guidance, enhances job satisfaction, encourages professional networking and collaboration, and nurtures potential educational leaders (Jack et al., (2025). Hence, the impact of virtual and on-site supervision and mentoring on instructional delivery effectiveness for secondary school science teachers in Nigeria can be of great significance.

Virtual supervision may enhance accessibility to resources and expertise, while on-site mentoring provides immediate feedback and support in a real classroom setting. Both methods are essential in developing effective instructional strategies and improving teaching outcomes, as they can lead to professional growth and better student engagement. However, the effectiveness can vary based on factors like the teachers' adaptability to digital tools, the quality of mentorship provided, and the existing infrastructure for virtual learning. Ultimately, sustained professional development and mentorship tailored towards student-centered pedagogies are crucial for maximizing instructional effectiveness.

Virtual Supervision and mentoring in education offer several benefits, including accessibility; which educators can use to connect with mentors and resources from anywhere in the world, breaking geographical barriers. Online supervision and mentoring equally promotes flexibility as it allow both mentors and mentees to schedule sessions at their convenience, accommodating different

time zones and personal commitments (Shah, et al., 2023). This implies that distance does not count or hinder the possibility of engaging in virtual Supervision and mentoring. Virtual platforms can facilitate connections with a broader range of experts and professionals, providing diverse perspectives and knowledge and often reduces the costs associated with travel and logistics, making professional development more affordable. Again, mentors can easily share digital resources, tools, and materials through online platforms, enhancing the learning experience and virtual supervisions and mentoring programs can reach more participants than traditional face-to-face programs, making it easier to implement large-scale mentoring initiatives. Pena et al., (2022), and Montgomery (2017) have also posited that the role of virtual and online platforms are vital and crucial in facilitating supervisions and mentorship relationships, knowledge sharing, and career advancement within professional networks. They have opined that the facility has brought a new horizon and paradigm shift to the academic and professional fields.

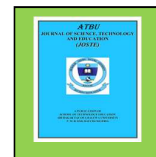
Instructional delivery encompasses the process by which teachers transmit knowledge, skills, and values to students within educational settings. It involves various elements such as lesson planning, content delivery, assessment, and classroom management, all aimed at facilitating effective learning experiences. Moreover, digital tools can facilitate data-driven decision enabling supervisors and mentors to identify areas of strength and weakness, and develop targeted interventions to address them. As described by Onji and Amadi, (2018), instructional delivery entails dynamic interactions among students, teachers, content, and instructional materials, fostering engagement and collaboration in the learning process. Effective instructional delivery relies on the competencies and skills of teachers, which encompass a range of areas including classroom management, teaching methods, assessment practices, among others. Teachers must possess the ability to create engaging learning environments, employ innovative teaching strategies, provide constructive feedback, and leverage technology tools effectively to enhance instructional delivery (Onji & Amadi, 2018). Mastery of these competencies enables teachers to adapt their

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instructional approaches to meet the diverse needs of students and maximize learning outcomes. Science teachers play a major role in implementing the secondary school science curriculum through instructional delivery, exerting considerable influence on the quality of educational outcomes in the subject.

Science teachers play a crucial role in shaping students' understanding of the natural world, and building their characteristics such as attitude, behaviour, and norms. Effective science instruction demands strong teacher skills, knowledge, and ongoing support. Supervision and mentoring are vital tools for developing and refining teaching practices, both for novice and experienced teachers. Science teachers' perceptions on virtual and on-site supervision and mentoring vary, with studies (Isma'il & Olatunbosun, 2024a&b)) revealing that both approaches offer unique benefits and challenges, impacting instructional delivery effectiveness. On-site supervision often allows for direct observation and immediate feedback, while virtual mentoring enables flexibility and access to a wider pool of expertise. Science teachers often perceive on-site mentorship as crucial for practical skill development and immediate feedback, while virtual supervision can offer flexibility and access to diverse expertise, leading to a more balanced approach for effective instructional delivery.

Understanding teachers' perceptions and the actual impacts of different supervision and mentoring strategies are crucial for improving teacher development and, ultimately, for positively impacting student learning. By examining these factors, educators can implement more effective strategies to support science teachers and improve the quality of science education. Science teachers' perceptions on virtual and on-site supervision and mentoring vary, with studies revealing that both approaches offer unique benefits and challenges, impacting instructional delivery effectiveness. On-site supervision often allows for direct observation and immediate feedback, while virtual mentoring enables flexibility and access to a wider pool of expertise. This study explores science teachers' perceptions of virtual and on-site supervision and mentoring and their impact on effective science instruction, ultimately aiming to understand how these

approaches can best support teacher development and student learning.

Statement of the Problem

In defiance of the growing interest in supervision and mentoring for professional development, limited research compares the effectiveness of virtual and on-site supervision and mentoring, particularly for science teachers. Most new science teachers often struggle with effective instructional delivery, especially in complex topics like ecology, due to limited resources and access to support. The effectiveness of science instruction in many schools is hindered by inconsistent mentoring and supervision, leaving teachers, especially new science teachers, unsupported, leading to challenges in classroom management, content delivery, and overall teaching quality. This study investigates how different mentoring approaches (virtual vs. on-site) impact the instructional delivery of science teachers. Also, there is a gap in understanding how science teachers in Jalingo perceive virtual and onsite supervision and mentoring, particularly concerning their impact on the effectiveness of science instruction.

The problem statement focuses on understanding how the perceived effectiveness of virtual versus on-site supervision and mentoring impacts the quality of science teachers' instructional delivery. Specifically, it examines whether different approaches to mentorship, and supervision impact how science teachers perform in the classroom, and if so, what the factors influencing the effectiveness are. Some bothering questions where existed serious gaps in literatures include: How does the quality of instruction (e.g., lesson planning, classroom management, student engagement) vary depending on the mentoring and supervision methods? How do teachers feel about being supervised and mentored virtually versus in person? Are there specific benefits or drawbacks to either approach? What factors (e.g., time commitment, resources available, mentor/supervisor expertise) are most influential on the perceived effectiveness of the different mentoring and supervision methods? Therefore the statement of the problem is: To what extent do virtual and on-site supervision and mentoring strategies influence the

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effectiveness of science teachers' instructional delivery, and how do science teachers perceive these different approaches?

Purpose of the Study:

The purpose of this study is to investigate science teachers' perceptions of virtual and on-site supervision and mentoring, and their influence on the effectiveness of science instruction within the context of Jalingo, aiming to inform the development of more effective professional development programs.

Specifically, the research aims to:

- i. Identify the perceived strengths and weaknesses of both virtual and on-site mentoring and supervision for science teachers.
- ii. Determine the impact of these mentoring approaches on teachers' instructional practices and student learning outcomes.
- iii. Investigate how teachers' experiences with different mentoring models affect their instructional confidence and job satisfaction.

Research Questions:

The following research questions were raised to guide the study:

- i. What are science teachers' perceptions of the effectiveness of virtual mentoring and supervision?
- ii. What are science teachers' perceptions of the effectiveness of on-site mentoring and supervision?
- iii. How do science teachers' perceptions of virtual and on-site mentoring and supervision impact their instructional delivery effectiveness?

METHODOLOGY

A suitable methodology for this study on science teachers' perceptions of virtual and on-site supervision/mentoring involves a mixed-methods approach, combining quantitative data (e.g., surveys) with qualitative data (e.g., interviews) to gain a comprehensive understanding. Hence, the study type was a survey design to explore the impacts of virtual and on-site supervision and mentoring on instructional delivery effectiveness of secondary school science teachers in Jalingo Metropolis, Taraba State, Nigeria. The target population for

the study consist of 321 Science teachers in 80 secondary schools according to the planning and statistics unit, 2023/2024 academic session. A random sampling of 174 science teachers (Biology, Chemistry & Physics) participated in the study.

The instrument adapted a Virtual and On-site Supervision and Monitoring of Instructional Delivery Effectiveness Questionnaire (VOSMIDEQ) and was used as data collection tool. The instrument was adapted from Wieman and Gilbert's (2014) Teaching Practices Inventory (TPI) and observation protocols by Danielson (2013) developed based on established frameworks for assessing teaching effectiveness. VOSMIDEQ contains 24-item questions relevant to the objectives of the study and the was subjected to face and content validations by two experts in Science Education and Measurement and Evaluation unit of Department of Educational Foundations, Faculty of Education. Corrections and modifications were made on the instrument based on the comments and suggestions of the experts before it was used for data collections. VOSMIDEQ encompassed the following areas; instructional planning, teacher-student interactions, questioning techniques, instructional strategies, accommodation of diverse student needs, utilization of teaching aids, clarity of instructions, objective achievement, teacher content knowledge, classroom management, time management, and lesson presentation sequence. The instrument as designed and assigned a score indicating the level of effectiveness of each aspect or area, ranging from Poor, Fair, Good to Very Good, based on the observations of participants. These scores were then tabulated to provide an overall assessment of the teacher's instructional delivery effectiveness. After pilot test of the instrument, the reliability coefficient from Cronbach alpha method was at 0.82 which justifies the reliability of VOSMIDEQ.

In analyzing the data, the research questions were answered using the using descriptive statistics to calculate frequency, summation, mean scores and standard deviations for each dimension of instructional delivery effectiveness.

RESULTS

The data collected and analyzed are presented with tables and interpreted as follows:

effectiveness of virtual mentoring and supervision?

Table 1 was used to answer research question one.

Answering Research Question one: What are science teachers' perceptions of the

Table 1: Descriptive Statistics comparison Science teachers' instructional delivery effectiveness using virtual mentoring

S/N	Instructional Delivery Effectiveness	Impact of Virtual Supervision and Mentoring				
		Rating (f)				Mean (μ)
		Poor	Fair	Good	Very Good	
1	How would you rate the support provided by your supervisor/mentor in teaching	3	10	6	9	7.0
2	How satisfied are you with the feedback you receive from your supervisor/mentor during virtual mentoring sessions?	0	5	3	7	3.8
3	To what extent do you feel that virtual supervision/mentoring has improved your instructional delivery in teaching science?	1	4	6	5	4.0
4	How effective do you find the virtual supervision/mentoring in addressing your specific needs in teaching science?	2	4	5	6	4.3
5	How would you rate the support provided by your supervisor/mentor during on-site visits in teaching science?	1	2	4	5	3.3
6	How satisfied are you with the feedback you receive from your supervisor and mentor during on-site mentoring sessions?	2	7	4	4	4.3
7	How effective do you find the on-site supervision and mentoring in addressing your specific needs in teaching science?	1	3	2	3	2.3
8	To what extent do you feel that online supervision and mentoring has improved your instructional delivery in teaching science?	0	4	8	4	4.0
9	How would you rate the impact of virtual supervision and mentoring on your instructional delivery effectiveness in teaching science?	2	2	2	2	1.5
10	To what extent do you think virtual supervision/mentoring has encouraged collaboration among science teachers?	1	5	2	3	2.8
11	How do you rate the overall impact of virtual mentoring on your instructional delivery effectiveness in teaching science compared to on-site mentoring?	1	7	3	2	3.3
12	How would you rate the accessibility of resources provided by your supervisor and mentor during virtual mentoring sessions?	2	2	1	5	2.5
Summation (Σ)		16	55	46	57	43.5
Mean (μ)		1.33	4.58	3.83	4.75	3.6

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SD (α)	1.45	2.13	2.83	3.49	2.5
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Table 1 shows mean score responses on Science teachers' instructional delivery effectiveness in teaching science using virtual supervision and mentoring. Notably, the table shows that item 1 had the highest mean scores (7.0), followed by items 4 and 6 (4.3). Item 9 had the least mean score (1.5). The table shows a total mean score of 3.6 with a standard deviation (2.5). From the findings and mean score values, it shows clearly that Virtual Supervision and Mentoring had great impact on

Science teachers' instructional delivery effectiveness.

Answering Research Question Two: What are science teachers' perceptions of the effectiveness of on-site mentoring and supervision?

Table 2 was used to answer research question two.

Table 2: Descriptive Statistics comparison of Science teachers' instructional delivery effectiveness using On-site Supervision and Mentoring

S/N	Instructional Delivery Effectiveness	On-site Supervision and Mentoring Rating (f)				Mean (μ)
		Poor	Fair	Good	Very Good	
1	How would you rate your overall satisfaction with on-site supervision and mentoring in teaching science?	5	4	8	2	4.8
2	To what extent do you think On-site supervision and mentoring has helped you develop innovative teaching strategies in science?	3	5	5	1	1.8
3	How would you rate the communication with your supervisor/mentor during on-site mentoring sessions?	3	6	4	3	4.0
4	How clear are the expectations set by your supervisor/mentor during on-site mentoring sessions?	5	4	5	4	4.5
5	How would you rate the level of trust in your relationship with your supervisor and mentor during on-site mentoring sessions?	3	5	3	2	3.3
6	To what extent do you think on-site supervision and mentoring has encouraged collaboration among science teachers?	4	3	4	4	3.8
7	How would you rate the accessibility of resources provided by your supervisor and mentor during on-site mentoring sessions?	2	4	5	1	3.0
8	How would you rate the effectiveness of the feedback provided by your supervisor and mentor during on-site mentoring sessions?	3	3	2	2	2.5
9	How would you rate the overall support provided by your supervisor and mentor in teaching science through on-site visits?	2	4	3	5	3.5
10	How likely are you to recommend on-site supervision and mentoring for other science teachers teaching science?	4	2	4	4	3.5

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11	How effective do you think on-site mentoring is in addressing your specific challenges in teaching science?	2	3	2	3	2.5
12	How will you recommend the on-site mentoring to other science teachers based on your experiences in teaching science?	3	3	3	5	4.0
Summation (Σ)		39	48	51	36	43.5
Mean (μ)		3.25	3.21	4.25	3.00	3.4
SD (α)		2.33	2.45	3.10	1.62	2.4

Table 2 shows responses on science teachers' instructional delivery effectiveness in teaching science using virtual supervision and mentoring. Markedly, the table shows item 1 had the highest mean scores (4.8), followed by items 4 (4.5), 3(4.0) and 12 (4.0). Item 2 had the least mean score (1.8). The table shows a total mean score of 3.4 with a standard deviation of 2.4. The findings show the impact of on-site supervision and mentoring on science teachers'

instructional delivery effectiveness with an overall mean ($M=3.4$) as good.

Answering Research Question Three: How do science teachers' perceptions of virtual and on-site mentoring and supervision impact their instructional delivery effectiveness?

Table 3 was used to answer research question three.

Table 3: Mean Rating Comparison of Virtual and On-Site Supervision and Mentoring Groups

Groups		Rating scale				
		Poor	Fair	Good	Very Good	Mean (μ)
Virtual Supervision and Mentoring	Mean (μ)	1.33	4.58	3.83	4.75	3.6
	SD (α)	1.45	2.13	2.83	3.49	2.5
On-site Supervision and Mentoring	Mean (μ)	3.25	3.21	4.25	3.00	3.4
	SD (α)	2.33	2.45	3.10	1.62	2.4

Table 3 compares the mean scores in instructional delivery effectiveness between virtual and on-site mentoring for science teachers teaching science. The rating scale of Virtual Supervision and Mentoring has a total mean score of 3.6 with a standard deviation of 2.5 while the rating scale of On-site Supervision and Mentoring shows a total mean score of 3.4 with a standard deviation of 2.4 This shows the difference in mean scores between the two intervention approaches are negligible. Even though both virtual and on-site Supervision and mentoring contributed to these improvements, virtual supervision and mentoring emerged with slightly greater observable impacts.

DISCUSSION

The study investigated into the impacts of virtual and on-site Supervision and

mentoring on the instructional delivery effectiveness of secondary school Science teachers. The results of the study revealed improvement in the instructional delivery effectiveness of fresh science teachers.

The research question one explored the impact of virtual mentoring on the instructional delivery effectiveness of science teachers. The findings, as evidenced in Table 1, revealed major progressions in mean scores as one move across each category showing the impact and acceptability of virtual supervision and mentoring. The reasons for the observed improvements could be attributed to the individualized support offered through virtual platforms, enabling teachers to receive targeted feedback to their specific needs as pointed out Osborne *et al.*, (2019). The finding supports the researches, Jack *et al.*, (2025), who reported

that digital mentoring is effective for science teacher continuous professional development. It also supports Isma'il and Olatunbosun, (2024a&b) in Nigeria who indicated that both virtual and on-site supervision and mentoring can positively impact science teachers' instructional delivery, though on-site approaches sometimes show a more impactful change in instructional effectiveness. More so, the interactive nature of virtual mentoring promotes reflective practice and encourages teachers to experiment with innovative instructional strategies as reported by Tobin (2018). More so, it could be due to the fact that the virtual modality allows for personalized feedback and guidance, overcoming geographical constraints and fostering continuous professional development. The study by Ejekwu and Worlu (2021) supports the potential of online training to facilitate professional development opportunities for teachers. Their findings emphasize the importance of digital devices and internet access in enhancing instructional delivery effectiveness. The findings also resonate with the study of Smith *et al.*, (2019), which reported the efficacy of virtual mentoring in providing accessible and flexible support to teachers. The findings of the present study are also in line with Wang and Hartley's (2020) report on the positive impact of virtual mentoring on teacher self-efficacy and instructional practices.

Research question two investigated the impact of on-site mentoring on the instructional delivery effectiveness of science teachers. The results, as presented in Table 2, revealed the impact of on-site supervision and mentoring on the instructional delivery effectiveness, although there is a clear difference in mean scores when compared to the mean scores in Table 1. This implies that on-site supervision and mentoring has impact on instructional delivery effectiveness of science teachers. The findings are consistent with of the study by Anyanwu and Abe (2023) which supported the effectiveness of one-on-one physical meeting mentorship programme in enhancing teachers' service delivery, particularly for beginning teachers. The findings are also in line with Johnson *et al.*, (2018) emphasis on the crucial role of on-site mentors in providing hands-on support and personalized guidance to teachers. The physical presence of

mentors enables immediate feedback and modeling of effective teaching practices, thereby facilitating professional development among teachers. The observed improvements in instructional delivery effectiveness can be attributed to the contextualized support offered by on-site mentors, who have the opportunity to firsthand observe classroom instructions of the mentees and provide immediate needed feedback as stated by Davis *et al.*, (2017). The findings resonate with John's *et al.*, (2023) report that the collaborative nature of on-site mentoring fosters trust and rapport between mentors and teachers, creating an environment conducive to professional growth.

Table 3 presented a comparison of mean ratings for both virtual and on-site Supervision and mentoring groups. The findings of research question three revealed the comparative changes and differences in instructional delivery effectiveness between virtual and on-site Supervision and mentoring for science teachers on science. The results revealed substantial impact of virtual and on-site supervision and mentoring, yet with a significant difference in mean scores. These findings agreed with previous research by Wang and Hartley (2020), which showed the efficacy of both virtual and on-site mentoring in enhancing teacher self-efficacy and instructional practices. Possible reasons that could account improvements in the two groups include the personalized support and guidance provided by supervisors and mentors in both virtual and on-site settings. The finding equally resonates with that of Osborne's *et al.*, (2019) which affirmed that virtual supervisions and mentoring offers flexibility and accessibility, allowing teachers to engage in professional development activities remotely. On the other hand, as asserted by Tobin (2018), on-site mentoring provides direct observation and immediate feedback, promoting reflective practice and skill development. This implies that both virtual and on-site supervisions and mentoring offers science teachers incredible proficiency skills in instructional delivery.

Overall, the most effective approach likely involves a blended approach, combining the strengths of virtual and on-site methods. This could include online resources and guidance for pre- and in-service teachers, coupled with periodic, targeted on-site visits for

classroom observations, feedback, and collaborative planning. By recognizing the strengths and limitations of both approaches, science teachers can be adequately supported in developing and implementing effective instructional strategies.

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the study concluded that the impact of virtual supervision and mentoring interventions on the instructional delivery effectiveness of secondary school science teacher at both virtual and on-site mentoring interventions led to significant improvements across various aspects of the categories. Even though both virtual and on-site Supervision and mentoring contributed to these improvements, virtual supervision and mentoring emerged with slightly greater observable impacts.

The study also concluded that in Jalingo, perceptions of science teachers on virtual and on-site supervision/mentoring for effective instructional delivery suggest a need for blended approaches, integrating the strengths of both methods for optimal teacher support and professional development. Science teachers in Jalingo perceive both virtual and on-site mentoring as valuable, with on-site supervision potentially providing stronger, immediate support, while virtual mentoring offers flexibility and accessibility. Virtual mentorship can facilitate continuous professional development with convenient access to resources and expert guidance, particularly for rural or isolated teachers, while on-site mentorship provides direct observation, coaching, and feedback in real-time, enhancing the teacher's instructional delivery.

Based on the conclusion drawn, the following recommendations were made:

1. The Ministries of Education can develop a Multi-Modal Mentoring System which can implement a blended mentoring approach that integrates both virtual and on-site support for effective supervision.
2. School heads and Ministries of Education can leverage technology for virtual mentoring platforms to ensure convenient access to resources and guidance, while facilitating online discussions and

feedback. For new science teachers in Jalingo, on-site mentorship, including classroom observation, and direct guidance for initial development should be prioritized.

3. School administrators should identify and address any challenges or concerns regarding both virtual and on-site mentorship, such as technology access issues or concerns about timely feedback, through user surveys and ongoing conversations.
4. Ministries of Education and school administrators should provide regular professional development sessions on using mentoring effectively, particularly for virtual methods, as well as for adapting to the specific needs and contexts of the Jalingo region.
5. School supervisors should implement a system for ongoing monitoring and evaluation of both mentoring approaches, to ensure their effectiveness and relevance to the local context, with user feedback and ongoing feedback loops.

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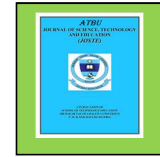
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