JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO 2

The impact of instructional techniques on the teaching practices of natural science teachers in classroom settings

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Received 1-6-2024 **Accepted 29-6-2024** **publish 17-7-2024**

Abstract

The main objective of this study was to evaluate the effect of incorporating instructional approaches on improving the teaching practices of natural science educators in classroom environments in the Asir region. The study used a sample of 30 teachers, evenly divided with 15 participants in both the experimental and control groups. The study's results indicated a statistically significant enhancement in post-test scores related to teaching techniques in the experimental group compared to the control group. The investigation indicated a notable enhancement in the mean scores of the experimental group regarding instructional techniques, as evidenced by the comparison between the initial assessment and the subsequent measurement. No statistically significant difference in teaching practices scores was seen between the experimental group and the control group, both immediately following the intervention and during the later evaluation period.

Keywords:instructional techniques,teaching practices, Asir region

1. Introduction

School students studying natural science and their teachers should use the appropriate methods, strategies, and techniques to prepare students for life in a world that is constantly evolving technologically (Rizvi & Nabi, 2021). At this point in time, it is crucial to acknowledge that the instruction provided by teachers is just as significant as their teaching concept. Additionally, research has consistently shown that from the earliest years of life, children exhibit the greatest learning outcomes when engaged in hands-on activities and manipulative experiences (Blömeke et al., 2021). In order for an activity to truly make an impact, it must offer children the invaluable opportunity to engage in collaborative discussions, stimulating debates, critical questioning, thorough investigations, logical reasoning, and creative problem-solving processes. By actively participating in such activities, children's motivation, enthusiasm, and willingness to engage are significantly amplified (Tomlinson & Jarvis, 2023). Within this dynamic framework, the emergence of innovative and advanced instructional techniques can undeniably be regarded as paramount in educating elementary school students in alignment with the fundamental principles of science education. When teachers eagerly incorporate these cutting-edge instructional techniques into their science classes, students are granted the essential knowledge, skills, and attitudes necessary to flourish in the domains of science and technology (Asonitou, 2022). Through the implementation of these pedagogical approaches, students will experience an educational journey enriched with meaningful scientific experiences that empower them to become confident and skilled individuals in a rapidly changing technological landscape (Bilderback, 2024).

Natural science is an important part of our scientific and technological knowledge. Natural science seems like an umbrella term for putting together various subjects that teachers often refer to as modules or learning areas (Ramírez-Montoya et al., 2021). It connects all the different

disciplines that are present in order to understand and investigate the universe, the Earth, and the living structures on both sides. It is through the study of natural science that learners get to know the present, past, and future conditions and events that influence their lives (Hanif, 2020). Science is concerned with careful observation of a natural event and making speculation. Natural science comes from empirical research using data, knowing that the results must be represented by facts about the world millions of years old. Subjects that make up natural science are life sciences, physical science, earth science, and some primary technological studies (Lawson et al., 2024).

Teachers' practice needs to result in the primary teaching of science as a shifting reasoning topic, consistent with the current mission for the science topic. The following must take place to view natural science instruction as a thin reasoning area: students and teachers must have thorough experimental experience in scientific reasoning (Istiyono et al., 2021) Teachers have to plan discussions with their students in which they consider their initial guesses about how the natural phenomenon operates. As a class effort, teachers and learners have to think about the different answers, witnesses, testimonies, and explanations (Perera, 2023). The science teacher has to identify and use the results of class discussions to expand natural science across the conversation to include concepts and a firm line of belief coupled with communicative language for the field. To help and intervene with student reasoning, the teacher has to identify good verbal responses (Bilyk et al., 2020). Teachers need to continue to simplify and help learners in the making, checking, being taught, seeking after discovery, giving reason to final writing, and permitting personal effective choices about any natural science concepts. Teachers will direct the students' answers in the movement of the natural phenomenon (Hao et al., 2023).

The quality of teaching is reflected in the content coverage of the lessons taught. Teaching practice indicates the skills and competencies that the teachers bring to the classroom for the learners to benefit. This being so, one would argue that if teachers select teaching techniques that are inappropriate, the teaching practice could be boring and lead to reluctant participation from the science learners (Sudargini& Purwanto, 2020). Furthermore, lack of awareness of the different instructional techniques and their impacts on teaching and learning may make the role of science teaching problematic from the perspective of the teachers. There is a danger that emphasis on content may override the essence of teaching practices (Chew & Cerbin, 2021).

Most natural science teachers seem to be weighed down by the transmissive peculiar teaching practices, which are referred to as the traditional teaching method, making the role of natural science teachers complex and troublesome to understand given the current national curriculum policy, where there is a need to transact knowledge in an innovative manner (Killen & O'Toole, 2023). They have limited knowledge and skills of different instructional techniques, which can be used to convey science knowledge in lessons. Moreover, there seems to be a general assumption that natural science teachers stand in front of the class and talk about big science concepts with children taking lengthy notes without any active participation of the science learners (Kaygisiz et al., 2020).

Recent local and international research studies have raised concerns regarding students' poor performance in the natural sciences. The concerns have been around for quite some time now; however, the problem is that there are no substantial results showing how students could improve their performance. Single-handedly blaming teachers will not solve the problem at hand. The natural science teachers are viewed as the gatekeepers to students' success in the sciences. Thus, the research calls for a collaborative mindset, which demands collective, inclusive responsibility from the education stakeholders. The previous statement is anchored to the fact that the national

total achievement test indicated that educational district learners' achievements are poor, specifically in natural sciences. In the presence of this void, the researcher identified the need to investigate, solicit, examine, analyze, and offer a critical assessment of the natural science teachers' classroom practices. The study's overall purpose is to investigate the impact of instructional techniques on the teaching practices natural science teachers.

2. Literature Review

One of the main purposes of evaluating classroom interactions in terms of the efficacy with which a science lesson is executed is to know how the teacher can improve it in case it was of low quality. Although instructional profiles can identify the quality of classroom interactions and teacher quality in particular, they can also be used for formative and in-service training as well as in accountability systems (Blömeke et al., 2020). Teachers may greatly benefit from instructional profiles that have observed well-executed, impactful lessons since profiles can capture exemplars of "instructionally productive" classroom interactions that pave the way for student learning. If the objective of instructional quality profiles is purely descriptive, not interpretative or prescriptive, teachers as well as principals can utilize them in the formative sense (Tomlinson & Jarvis, 2023). Regardless of the instrument of instructions or forms of classroom interactions implemented or deemed efficacious in relation to student achievement growth, they are necessarily best carried out when initiated by the professionals themselves, not through pressure from outside organizations (Asonitou, 2022).

However, those outside organizations can provide valuable resources or incentives for professional development. To truly enhance the effectiveness of the instructional profiles, it is crucial to ensure that they encompass a wide range of instructional strategies, diverse student populations, and various subject areas (Bilderback, 2024). This comprehensive approach will allow teachers and school leaders to gain a deeper understanding of the intricate nuances and dynamics that influence classroom interactions and instructional effectiveness. Additionally, instructional profiles can serve as powerful tools for promoting collaboration and shared learning among educators (Ramírez-Montoya et al., 2021). By showcasing successful classroom interactions and providing actionable insights, these profiles can foster a sense of collective responsibility and continuous improvement within the educational community. As we delve further into the realm of instructional profiles, it becomes evident that they possess immense potential to revolutionize the field of education. With careful implementation and thoughtful analysis, instructional profiles can not only inform pedagogical practices but also shape the trajectory of teaching methodologies in the future. By embracing the power of instructional profiles, educators can embark on a transformative journey that transcends traditional boundaries and unlocks the full potential of every student (Ramírez-Montoya et al., 2021).

Natural science instruction remained the central and primary focus of science educators worldwide. Throughout the years, numerous comprehensive studies have been meticulously conducted, delving deeper into the crucial aspect of classroom teachers' behaviors and instructional methods. In order to form a holistic understanding, a range of research instruments and techniques have been employed (Hanif, 2020). A major breakthrough in this field was the introduction of teacher self-report inventories. This revolutionary approach allowed individual teachers to actively participate in documenting the specific techniques and strategies they employed within their classrooms. By providing an avenue for self-reflection, teachers were able to gain valuable insight into their own teaching practices, paving the way for continuous improvement and growth (Lawson et al., 2024).

To ensure the accuracy and reliability of these inventories, the techniques included were carefully derived from the competencies exhibited by highly effective teachers. This process was instrumental in creating a comprehensive list that served as a benchmark for instructional excellence. The development of this list was primarily based on meticulous observations conducted during rigorous classroom practices research, ensuring that it reflected the most refined and successful teaching techniques (Istiyono et al., 2021). Furthermore, researchers in the field also explored alternative research instruments utilized by classroom teachers to document their instructional techniques. These additional methods included interviews and qualitative research through in-depth interviews and structured observations. By utilizing a variety of data collection techniques, educators were able to gather a comprehensive and robust understanding of the instructional methods employed within their classrooms (Perera, 2023). In conclusion, science educators have tirelessly dedicated themselves to enhancing natural science instruction. Through comprehensive studies and the utilization of various research instruments, including self-report inventories, interviews, and qualitative research, teachers have been able to actively engage in the documentation and improvement of their own instructional techniques. These efforts contribute to the continuous enhancement of science education and further empower educators to create meaningful and impactful learning experiences for their students (Bilyk et al., 2020).

Teachers have a highly favorable and optimistic impression of problem-centered strategies, as they strongly believe that these strategies possess the ability to greatly contribute to the overall development and enhancement of their learners' skills, traits, and various other characteristics. Teachers perceive this essence to be closely synonymous with the notion itself (Hao et al., 2023). By meticulously setting clear and distinct objectives, carefully selecting a suitable theory of learning, effectively modeling essential skills, purposefully assigning tasks and assignments, meticulously organizing valuable experiences, consistently encouraging and promoting exploration and inquiry, genuinely assessing performance and progress, while continuously refining and improving their teaching methods, educators can undoubtedly and triumphantly achieve the ultimate and overarching goal of highly effective and successful teaching practices (Killen & O'Toole, 2023).

Given the immense importance and priority that teachers place on the utilization and implementation of various instructional strategies, they are more likely to have actively formulated, developed, and consistently demonstrated these strategies on a daily basis. Additionally, it should be noted that previously accomplished and highly effective teachers who have consistently employed numerous verbal reinforcement strategies often rely heavily on these strategies due to their previous efficacy and tremendous impact on student learning outcomes (De & Manalo, 2020). Moreover, the utilization and integration of objective-oriented activities and assignments significantly increase the likelihood and probability of learner success by cultivating a positive and harmonious classroom atmosphere that fosters a sense of security, comfort, and an overall environment that supports optimal learning and growth. These aforementioned factors are of utmost importance and are closely linked to the overall effectiveness and success of the instructional process (Kaygisiz et al., 2020). Simultaneously, when considering and evaluating the realm of effective teaching practices, it is important to emphasize the necessity and significance of having a comprehensive and extensive data source that is meticulously designed and strategically compiled in order to assist and facilitate the development and establishment of a continuous, comprehensive, and internationally validated

framework that outlines and illustrates what constitutes exemplary teaching practices specifically within the realm of natural science education (Huang et al., 2022).

Instructional techniques are defined as forms of activities that enable the teacher to make learning possible during natural science teaching and learning sessions (Assem et al., 2023). They consist of instructions to be undertaken by the teacher and learners as participants. It refers to planned methods that will assist learners in participating actively during instruction. Unlike experienced teachers, those who have little prior knowledge and understanding of instructional techniques tend to teach natural science poorly and suppress the talents, creativity, and curiosity of learners instead of promoting these qualities (Chew & Cerbin, 2021). Untrained or poorly trained teachers often use didactic methods and teaching-while-sitting practices. Conversely, there is a paucity of literature documenting the instructional techniques that need to be mastered, nor the practices used by experienced teachers in the natural science education field (McComas et al., 2020).

Historically, many researchers in natural science education have tried to establish instructional techniques to support natural science teachers during the teaching and learning of the subject. However, researchers also argue that even among experienced teachers, the need for a wider, updated understanding of effective and innovative instructional techniques for natural science education is crucial (Eli, 2021). The growth in innovative instructional techniques during the 20th century has been affected by political, social, cultural, religious, statutory, managerial, and legal requirements of science, as society has changed appreciably. The grand narrative of the holistic, interdisciplinary nature of science became a fundamental instructional technique for science teachers, integrating science concepts with life skills, values, and attitudes, thereby enabling the integrated growth and development of learners (Pipere&Mārtinsone, 2022). Since the 1970s, reports indicate that individualized teaching methods and guided inquiry have been used to teach science subject content knowledge, processes, and attitudes. Changes in the 1970s embedded science education in a learning-integrated part of the broader learning area, shaping the educational context of learners and creating possibilities and experiences that expose, enable, and empower them to realize their potential. In the 1990s, the focus on learner-centered methodologies, often using a constructivist inquiry approach, achieved new momentum (Aditomo&Klieme, 2020).

The effectiveness of various teaching techniques on teaching and learning activities has been extensively researched and studied in great detail. Research has shown that the implementation of different instructional techniques in the field of natural science is crucial in order to cater to the diverse needs and preferences of learners (Leasa et al., 2020). It has been observed that using a repetitive and monotonous instructional technique can lead to a decline in learner engagement and motivation. To address this issue, numerous studies and research have been conducted to explore the effectiveness of various instructional techniques, such as cooperative learning, problem-based learning, flipped classroom, game-based learning, peer tutoring, and many others (Munna & Kalam, 2021). These studies aim to equip teachers with ideal instructional techniques and strategies that can be employed to enhance learner achievement and overall academic performance (Hooda et al., 2022).

Cooperative learning, for example, encourages students to work together in small groups to achieve a common goal. This technique fosters collaboration, communication, and critical thinking skills among students, which in turn enhances their understanding of the subject matter (Mahmudah & Rasyid, 2022). Problem-based learning, on the other hand, involves presenting students with real-world problems or scenarios that require them to apply their knowledge and

skills to find solutions. This approach promotes active learning, as students are encouraged to think creatively and work independently or in groups to solve the given problems (Tan, 2021).Another instructional technique that has gained popularity is the flipped classroom model. In this approach, students are assigned pre-recorded lectures or videos to watch at home, allowing classroom time to be dedicated to active learning and engaging activities, such as discussions, debates, and hands-on experiments. This method not only enhances students' understanding of the material but also encourages self-directed learning and active participation (Mojtahedi et al., 2020). Game-based learning is yet another effective instructional technique that utilizes educational games or gamified activities to enhance learning. By incorporating games into the curriculum, teachers can make the learning process more fun, interactive, and engaging for students. These games often incorporate elements of competition, problem-solving, and rewards, which can motivate students and foster a positive learning environment (Adipat et al., 2021). Peer tutoring is also a valuable instructional technique that involves pairing students of different skill levels, where the more experienced student provides guidance, support, and clarification to the less experienced student. This technique not only promotes collaborative learning but also enhances the tutor's understanding of the subject matter through teaching others. It can also boost the tutee's confidence and academic performance (Wankiiri-Hale et al., 2020).

Overall, the effectiveness of instructional techniques in teaching and learning activities cannot be underestimated. It is crucial for educators to continually explore and implement a variety of instructional strategies to accommodate the diverse needs and preferences of learners. Through continuous research and experimentation, teachers can equip themselves with an extensive toolkit of instructional techniques that enhance learner engagement, motivation, and overall academic achievement (Munna & Kalam, 2021).

While the usage of different instructional techniques has generated tremendous excitement and exceptionally positive results in the teaching and learning of natural science, it is crucial to recognize that, to date, only a mere fraction of the effort has been dedicated to establishing a definitive and optimal instructional renewal model (Joyce & Calhoun, 2024). Consequently, this paper aims to delve profoundly into the effects and impact of utilizing the ideal instructional renewal model, meticulously crafted to perfection and congruent with the aspirations and desires of natural science teachers, in the rich and dynamic context of teaching and learning natural science. By meticulously examining the multifaceted perspectives and vast experiences of seasoned educators, this intricate and comprehensive research will shed an unprecedented amount of illuminating light on the immense potential benefits and equally important drawbacks associated with implementing such an instrumental and transformative instructional renewal model in the enthralling field of natural science education. Through this profoundly multifaceted and methodical investigation, an abundance of valuable insights, groundbreaking discoveries, and practical recommendations can be conscientiously generated, harmoniously working in unison to elevate and amplify the teaching and learning experiences of both revered teachers and curious students alike in the captivating realm of natural science.

3. Methodology

A quasi-experimental design was employed (for one group), with pre-, during-, and post-measurements administered to research participants. All measurements were taken at regular intervals throughout the training procedure. As an extra precaution, we paused the model for four weeks following the last session's completion before undertaking the tracer measurement.

All public school tenth grade teachers in the Asir region who were enrolled in the second semester of 2024/2025 were considered part of the study population. The following procedures were followed to choose a random sample from the study population:

2. The Ministry of Education's list of government schools in the Asir region that provide the tenth grade includes thirty-two schools, and there are thirty-two teachers in the tenth grade.
3. Teachers from these schools were chosen to serve as the experimental and control groups' representatives. As a result, the study sample consisted of 30 teachers, of whom 15 were in the experimental group and 15 were in the control group.

Two different research instruments were used in order to achieve the study's objectives.

1. Using an instructional approaches program as a guide, the teaching plan: A specific area of research was covered by the experimental study, which concentrated on how natural science professors instruct their students in classrooms. The planned time frame for this study was the upcoming 2024–2025 school year. The researcher thought carefully about the overall goals and subject matter related to the themes being investigated in the experiment before coming up with the set of 30 initial behavioral objectives. The components of the framework are recall, comprehension, application, analysis, synthesis, and evaluation. This content was evaluated by a panel of experts and professionals to ensure its accuracy and completeness. Specific goals were changed in response to the input obtained, but the overall number of goals was kept at thirty. The experimental group's lesson plans were created by the research groups using an instructional techniques program package, whereas the control group was taught using a traditional approach. These examples were given to the panel of experts in the field of instructional tactics on multiple occasions. Assessing their appropriateness in light of the subject matter and the predetermined behavioral objectives was the aim of this activity. Specific paragraphs were further changed in response to the experts' criticism, resulting in their final version. For both groups, there were eighteen instructional plans in total; nine of the plans employed an interactive teaching approaches program, while the other half took a traditional approach.
2. Creating instructional strategies for natural science instructors in classroom environments test: the purpose of the study was to determine how much the materials utilized in the experiment improved the natural science teachers' classroom instruction. The exam's item was carefully crafted to guarantee that it accurately reflected its intended use and adhered to the procedural description of teaching approaches as stated in recent studies. The vocabulary on the test was created using the multiple-choice style, which is in line with the interactive instructional approaches program. The degree of instruction that natural science teachers wished to use guided the word choice. Natural science teachers must select the right answer from four possible answers that follow an introductory statement in each question. There are twenty items in all on the test. The average exam time was determined based on the natural science teachers' aggregate performance.

To ensure that the teacher's handbook and activity brochure were produced within a framework, they were submitted to a panel of evaluators upon completion. Moreover, it is essential that the emphasis of the current research on promoting teaching practices is integrated into the design of instructional methods. Modifications were implemented following the arbitrators' feedback. The discriminatory validity of the teaching practices scale was assessed using an exploratory sample

of five teachers. The coefficients of F values for discriminatory validity were 5.13, 5.98, and 6.30, with a P value below 0.05.

The pre-test and post-test mean scores and standard deviations were computed following the end of the data collection session. The effect size, which is a gauge of how much the instructional strategies influence the way natural science teachers teach in classrooms, was determined using the Eta square. To better understand the differences between two similar samples, the statistical techniques of Z-value and Wilcoxon's test were applied.

4. Results and Discussion

To determine whether the instructional strategies have an impact on the natural science instructors' methods of instruction by observing improvements in their pre- and post-test scores on issues related to problem-based learning, inquiry-based learning, and collaborative learning, the findings are shown in the table below.

Table 1: Pre and Post-Measurement

Dimensions	**Pre/ Post**	**N**	**Mean Rank**	**Sum of Ranks**	**Z**	**P**
Problem-based learning	Negative rank	0	0.00	0.00	4.10	0.000
	Positive rank	15	8.00	120.00		
	Ties	0				
	Total	15				
Inquiry-based learning	Negative rank	0	0.00	0.00	4.15	0.000
	Positive rank	15	8.00	120.00		
	Ties	0				
	Total	15				
Collaborative learning	Negative rank	0	0.00	0.00	4.13	0.000
	Positive rank	15	8.00	120.00		
	Ties	0				
	Total	15				
Total	Negative rank	0	0.00	0.00	4.11	0.000
	Positive rank	15	8.00	120.00		
	Ties	0				
	Total	15				

The findings shown in Table 3 show a statistically significant difference in the experimental groups' mean scores for a number of topics related to the methods used by natural science instructors in the classroom. According to this, teachers in the experimental group appeared to have improved their methods after the evaluation.

The use of instructional methodologies, which give teachers the chance to repeat, modify, and review in accordance with each student's unique preferences and needs, is responsible for the

observed outcome. This makes it easier to adapt instruction to each student's individual abilities and speed. This method also lessens the need for repeated explanations and promotes closer teacher-student collaboration. It also catches the learner's interest and makes them feel excited. Teachers also believe that interactive instructional videos help students understand difficult ideas, encourage students to participate in class discussions, and are unique in their ability to quickly retrieve material. This finding is in line with the findings of earlier research by Lasa et al. (2020), Aditomo and Klieme (2020), and Pipere and Mārtinsone (2022), which also showed that students in the experimental group who received instruction through an instructional strategies program performed better. Teachers in the control group, on the other hand, who were instructing using a traditional method, showed less competence in learning a variety of abilities. This finding provides empirical evidence that using instructional strategies that influence the methodologies used by natural science lecturers is appropriate.

To determine whether the instructional strategies have an impact on the natural science instructors' methods of instruction by observing improvements in their follow-up measurement on issues related to problem-based learning, inquiry-based learning, and collaborative learning, the findings are shown in the table below.

Table 2: Post and Follow-up Measurement

Dimensions	**Post/ Follow**	**N**	**Mean Rank**	**Sum of Ranks**	**Z**	**P**
Problem-based learning	Negative rank	11	7.50	82.5	1.120	0.180
	Positive rank	2	4.30	8.6		
	Ties	2				
	Total	15				
Inquiry-based learning	Negative rank	10	7.20	72.00	1.080	0.210
	Positive rank	2	3.60	7.20		
	Ties	3				
	Total	15				
Collaborative learning	Negative rank	8	6.40	51.20	0.780	0.820
	Positive rank	3	5.40	16.20		
	Ties	4				
	Total	15				
Total	Negative rank	12	8.00	96.00	1.220	0.160
	Positive rank	3	4.80	14.40		
	Ties	1				
	Total	15				

The analysis of the data in Table 4 shows that the experimental group's mean scores for the post-test and follow-up assessments do not change statistically significantly. According to the study's findings, there were no discernible indicators of relapse after the program's conclusion, and its effectiveness persisted throughout the post-intervention phase.

The importance of instructional techniques stems from their function as an essential educational technology. It functions as a cutting-edge model that makes it easier for academic institutions to

change their conventional teaching methods. Additionally, instructional methodologies are essential for maintaining training and education continuity, especially for professionals developing in a variety of educational fields. The ability and effectiveness of instructional methods programs to provide individualized training to teachers according to their skills, needs, interests, and competency sets them apart.

5. Conclusion

This study provides empirical evidence to support the claim that the improvement of natural science teachers' classroom practices is significantly impacted by the incorporation of instructional approaches in secondary schools in the Asir region. Teachers' ability to implement their teaching practices may be enhanced by the incorporation of instructional strategies into the classroom. According to the study's findings, instructors who take part in instructional tactics programs have higher levels of teaching practice. It can be concluded that the application of a program of instructional strategies intended to increase instructors' motivation has had a positive impact and produced positive outcomes. Teachers' passion and motivation to learn are heightened by the entertaining and captivating qualities of instructional strategies. Additionally, the individual uses a variety of sensory modalities to aid in the process of learning, which improves comprehension. Teachers who practice the cognitive process of remembering are better able to create critical questions, which promotes self-evaluation and improves understanding of the material in a variety of temporal situations. As a result, this leads to an increased propensity to integrate sound, vision, and touch.

Acknowledgments

The authors extend their appreciation to the Deanship of Scientific Research at King Khalid University for funding this work through Large Research Groups under grant number (RGP.2 / 429 /45)**.**

References

Adipat, S., Laksana, K., Busayanon, K., Asawasowan, A., &Adipat, B. (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. International Journal of Technology in Education, 4(3), 542-552. ed.gov

Aditomo, A. &Klieme, E. (2020). Forms of inquiry-based science instruction and their relations with learning outcomes: Evidence from high and low-performing education systems. International Journal of Science Education. ubaya.ac.id

Asonitou, S. (2022). Impediments and pressures to incorporate soft skills in Higher Education accounting studies. Accounting Education. researchgate.net

Assem, H. D., Nartey, L., Appiah, E., & Aidoo, J. K. (2023). A review of students' academic performance in physics: Attitude, instructional methods, misconceptions and teachers qualification. European Journal of Education and Pedagogy, 4(1), 84-92. ej-edu.org

Bilderback, S. (2024). Integrating training for organizational sustainability: the application of Sustainable Development Goals globally. European Journal of Training and Development. researchgate.net

Bilyk, V., Sushchenko, L., Sheremet, I., Hanushchyn, S., & Bondarenko, H. (2020). Modern Pedagogical Practice of Natural Science Training of Future Psychologists in Higher Educational Institutions. RevistaRomaneascaPentruEducatieMultidimensionala, 12(3), 162-181. lumenpublishing.com

Blömeke, S., Kaiser, G., König, J., & Jentsch, A. (2020). Profiles of mathematics teachers' competence and their relation to instructional quality. ZDM. springer.com

Chew, S. L. & Cerbin, W. J. (2021). The cognitive challenges of effective teaching. The Journal of Economic Education. researchgate.net

De Villa, J. A., & Manalo, F. K. B. (2020). Secondary teachers' preparation, challenges, and coping mechanism in the pre-implementation of distance learning in the new normal. IOER International Multidisciplinary Research Journal, 2(3), 144-154. ssrn.com

Eli, T. (2021). Studentsperspectives on the use of innovative and interactive teaching methods at the University of Nouakchott Al Aasriya, Mauritania: English department as a case study. International Journal of Technology, Innovation and Management (IJTIM), 1(2), 90-104. gaftim.com

Hanif, M. (2020). The Development and Effectiveness of Motion Graphic Animation Videos to Improve Primary School Students' Sciences Learning Outcomes.. International Journal of Instruction. ed.gov

Hao, H., Susono, H., Geng, X., Chen, L., & Yamada, M. (2023). Effects of using the first principles of instruction in a content and language integrated learning class. Asian-Pacific Journal of Second and Foreign Language Education, 8(1), 2. springer.com

Hooda, M., Rana, C., Dahiya, O., Rizwan, A., & Hossain, M. S. (2022). Artificial intelligence for assessment and feedback to enhance student success in higher education. Mathematical Problems in Engineering, 2022(1), 5215722. wiley.com

Huang, B., Jong, M. S. Y., Tu, Y. F., Hwang, G. J., Chai, C. S., & Jiang, M. Y. C. (2022). Trends and exemplary practices of STEM teacher professional development programs in K-12 contexts: A systematic review of empirical studies. Computers & Education, 189, 104577. sciencedirect.com

Istiyono, E., Kartowagiran, B., Retnawati, H., Cahyo Adi Kistoro, H., &Putranta, H. (2021). Effective Teachers' Personality in Strengthening Character Education. International Journal of Evaluation and Research in Education, 10(2), 512-521. ed.gov

Joyce, B. & Calhoun, E. (2024). Models of teaching. amazonaws.com

Kaygisiz, G. M., Uygun, N., &Uçar, F. M. (2020). … between the levels of self-efficacy beliefs of pre-service teachers and their levels of determining suitable taxonomy, strategy, and method-technique for science …. Science Education International. icaseonline.net

Killen, R. & O'Toole, M. (2023). Effective teaching strategies 8e. google.com

Lawson, T. K., Knox, J., Romero, E., Molina Palacios, A., & Fallon, L. M. (2024). Check yourself! Exploring current culturally responsive teaching assessment measures. Psychology in the Schools, 61(6), 2649-2667. [HTML]

Leasa, M., Corebima, A. D., &Batlolona, J. R. (2020). The effect of learning styles on the critical thinking skills in natural science learning of elementary school students..Ilkogretim Online. academia.edu

Mahmudah, H., & Rasyid, F. (2022). Engaging Students in Cooperative Learning Model of Reading Course Through Numbered Head Together. ETERNAL (English Teaching Journal), 13(1), 53-67. iainkediri.ac.id

McComas, W. F., Clough, M. P., & Nouri, N. (2020). Nature of science and classroom practice: A review of the literature with implications for effective NOS instruction. Nature of science in science instruction: Rationales and strategies, 67-111. [HTML]

Mojtahedi, M., Kamardeen, I., Rahmat, H., & Ryan, C. (2020). Flipped classroom model for enhancing student learning in construction education. Journal of civil engineering education, 146(2), 05019001. unsw.edu.au

Munna, A. S., & Kalam, M. A. (2021). Teaching and learning process to enhance teaching effectiveness: a literature review. International Journal of Humanities and Innovation (IJHI), 4(1), 1-4. humanistudies.com

Perera, P. (2023). Preparing to revolutionize education with the multi-model GenAI tool Google Gemini? A journey towards effective policy making. cqu.edu.au

Pipere, A. &Mārtinsone, K. (2022). Metamodernism and social sciences: Scoping the future. Social Sciences. mdpi.com

Ramírez-Montoya, M. S., Loaiza-Aguirre, M. I., Zúñiga-Ojeda, A., & Portuguez-Castro, M. (2021). Characterization of the Teaching Profile within the Framework of Education 4.0. Future Internet, 13(4), 91. mdpi.com

Rizvi, Y. S., & Nabi, A. (2021). Transformation of learning from real to virtual: an exploratory-descriptive analysis of issues and challenges. Journal of Research in Innovative Teaching & Learning, 14(1), 5-17. emerald.com

Tan, O. S. (2021). Problem-based learning innovation: Using problems to power learning in the 21st century. vnbrims.org

Tomlinson, C. A., & Jarvis, J. M. (2023). Differentiation: Making curriculum work for all students through responsive planning & instruction. In Systems and models for developing programs for the gifted and talented (pp. 599-628). Routledge. [HTML]

Wankiiri-Hale, C., Maloney, C., Seger, N., & Horvath, Z. (2020). Assessment of a student peer-tutoring program focusing on the benefits to the tutors. Journal of dental education, 84(6), 695-703. [HTML]