Published online at: https://ejournal.mannawasalwa.ac.id/index.php/wangsa

Wangsa
Journal of Education and Learning

Vol. 01 No. 01 2024 e-ISSN Media Electronic:

Refining Professional Development For Science Teachers In Early Childhood Education

Eric Forkpah
Cebu Normal University, Cebu, Philliphine
ericforkpah2015@gmail.com

Abstract

This research aims to address the imperative need for refining professional development opportunities for Teacher in science in early childhood education (ECE)in Bong County, Liberia. Employing a grounded theory approach, the study seeks to unravel the complexities of the current professional development landscape and formulate context-specific strategies to refine the quality of education for young learners. Through qualitative data collection methods, including interviews, focus groups, and observations, the research aims to develop a grounded theory that can inform policy and practice in fostering the continuous growth and effectiveness of ECE educators in the region.

Keywords: Professional Development, Science Teachers, Early Childhood Education

ARTICLE INFO

Submit	07-05-2024	Review	12-05-2024
Accepted	15-05-2024	Published	17-05-2024

Introduction

Professional development for early childhood science teachers was crucial for ensuring that young children received high-quality science education (Barenthien et al., 2019). Early childhood teachers played a significant role in shaping children's attitudes towards science and fostering their curiosity and interest in the subject. Professional development programs for early childhood science teachers were essential in ensuring that educators had the necessary knowledge and skills to effectively teach science to young children (Van Driel et al., 2001). These programs typically focused on enhancing teachers' understanding of early childhood development, integrating science into the curriculum, and utilizing hands-on, inquiry-based teaching methods.

Research studies on professional development for early childhood science teachers showed that ongoing, job-embedded professional development was essential for improving teacher knowledge and practice in science education. One study conducted by Yoon (2017) found that teachers who participated in a year-long professional development program that included workshops, coaching, and collaborative planning significantly increased their science content knowledge and self-efficacy in teaching science. Another research study by Garet et al. (2001) suggested that professional development programs should be designed with a clear focus on content knowledge and pedagogy, as well as opportunities for teachers to engage in meaningful collaboration and reflection.

Professional development for science teachers in Bong County, Liberia was crucial to improving the quality of science education in the region (Nicol et al., 2022). With limited resources and infrastructure, it was essential for teachers to receive ongoing training and support to enhance their teaching practices and keep up to date with the latest advancements in science education. One key aspect of professional development for science teachers in Bong County was the need for specialized training in inquiry-based teaching methods (Wilson, 2013). Inquiry-based learning encouraged students to explore scientific concepts through hands-on experiments and investigations, fostering critical thinking and problem-solving skills.

Science teachers in Bong County faced several challenges in their professional development. One major challenge was the lack of resources and materials needed to effectively teach science subjects. Many schools in the county lacked proper laboratory equipment, textbooks, and other resources necessary for conducting hands-on experiments and engaging students in practical learning experiences (Nicol et al., 2022). This lack of resources hindered the ability of science teachers to provide a comprehensive and engaging education for their students. Additionally, science teachers in Bong County often faced challenges related to classroom management and student behavior. Many classrooms in the county were overcrowded, making it difficult for teachers to effectively manage and engage all students (Khan & Iqbal, 2012). In addition, some students lacked motivation or interest in science subjects, which made it challenging for teachers to create a positive learning environment. The grounded theory approach to study differed from typical methodologies in social science. It began not with a hypothesis, but with the collecting of data using various approaches. These conceptual groups were then refined

into categories or axioms, which served as the foundation for theoretical development (Moghaddam, 2006).

Scientific literacy had become a fundamental requirement for all people in a culture prevalent with scientific research findings. It was vital that everyone made everyday judgments based on scientific data. Furthermore, everyone had to participate thoughtfully in public debates and discussions about major scientific and technology concerns. Finally, everyone should have been able to enjoy the thrill and personal enrichment that came from knowing and enjoying the natural world's beauties (National Research Council, 1996, p.1).

According to studies and statistics, children had significantly better learning potential than previously thought. As a result, early childhood programs were supposed to offer more interesting and enriching learning experiences. Children's early experiences, when overseen by competent teachers, could have a significant impact on their long-term learning objectives. Furthermore, science was critical in early childhood education because it not only laid the groundwork for future scientific comprehension, but it also fostered vital learning skills and attitudes (National Research Council, 1996). According to the National Science Education Standards, "Science inquiry encompassed the various methods through which scientists investigated the natural world and formulated explanations grounded in evidence derived from their research" (National Science Research Council, 1996, p. 23).

When children started school, they showed a strong understanding of the natural world, though much of it may have been implicit. This called into question conventional wisdom that newborns' cognitive capacities were essentially physical and rudimental. A recent study had revealed the intricate cognitive capacities present in youngsters, indicating their ability to apply various reasoning processes that formed the groundwork for scientific thought. These qualities were apparent despite differences in their experiences and the educational journey they had yet to embark on (Duschl, Schweingruber, & Shouse, 2007, pp. 2-3).

Recognizing the importance of instructors in developing children's scientific understanding was critical for science teachers' professional development (National Research Council, 1996). This was a demanding task that demanded a thorough understanding of children, educational philosophies, and scientific principles. Teachers guided students' scientific inquiries by emphasizing key scientific principles related to the chosen topic. Professional development was a crucial aspect of career growth and success in any field. It referred to the process of continuously improving one's skills, knowledge, and abilities in order to stay relevant and competitive in the ever-evolving job market (Bhaskar & Dayalan, 2021). Professional development was not limited to formal education or training programs but also included informal learning opportunities such as workshops, seminars, networking events, and self-study.

Moreover, professional development could also lead to personal growth and job satisfaction (Thahir et al., 2021). When individuals invested in their own learning and development, they were more likely to feel fulfilled in their careers and motivated to

achieve their goals. Continuous learning not only enhanced one's professional skills but also fostered a sense of accomplishment and confidence (Hord, 1997). Ultimately, professional development was an investment in oneself that could lead to greater job security, advancement opportunities, and overall career success. Professional development was crucial for educators in all fields, including those who specialized in teaching science to young children (Van Driel, Beijaard, & Verloop, 2001).

Professional development for science teachers in early childhood education provided numerous benefits that ultimately enhanced the quality of education provided to students. One of the key benefits was the opportunity for teachers to stay updated on the latest research and best practices in early childhood science education (National Research Council et al., 2015). By participating in workshops, conferences, and other forms of professional development, teachers could gain valuable insights into effective teaching strategies and new curriculum resources that could be integrated into their classrooms.

As a science teacher, there were several ways to engage in professional development and enhance teaching practice. One effective method was to attend science education conferences and workshops where educators could network with other educators, learn about the latest teaching techniques, and gain valuable insights from experts in the field (Lieberman, 1995). Additionally, participating in online courses and webinars provided convenient and flexible opportunities for professional growth. By staying connected to professional organizations and resources, science teachers could access a wealth of information and support to help them stay current in their field (Baker-Doyle, 2011). Another important way for science teachers to engage in professional development was through collaboration with colleagues (Ufnar & Shepherd, 2019).

By working together with other teachers, sharing ideas, and reflecting on teaching practices, educators could learn from each other and improve their teaching skills. Collaborative professional development activities, such as lesson study groups or peer observations, provided opportunities for teachers to receive feedback, try out new strategies, and reflect on teaching practices. By working collaboratively, science teachers could support each other in their professional growth and ultimately enhance the learning experience for their students.

Research Methodology

The deductive approach in a qualitative study was a fundamental concept of logic and critical thinking. It was a type of approach where a conclusion was drawn from a set of premises or statements that were assumed to be true. The process of deductive reasoning in research involved moving from general statements, known as premises, to a more specific statement, which was the conclusion (Evans, 2005). Bayne (2018) referred to this method as top-down thinking, which often began with numerous axioms. Delaram and Valilai (2018) described these axioms as primordial assumptions or statements.

A study conducted by Heis (2020) described these axioms as basic assumptions or statements that were accepted as true without needing to be proven. These were claims in the theory under investigation that could be accepted without requiring confirmation from

additional statements derived from the theory (Lehrer, 2018). These axioms were processed and assimilated into propositions (Zhang et al., 2019), which were the outcomes or products of many axioms. These propositions were then carefully tested using suitable methodologies. Once accepted, these claims constituted the foundation for the theory's formulation (Zalaghi & Khazaei, 2016). These axioms were processed and incorporated into propositions (Zhang et al., 2019), which described the results produced by various axioms. These propositions were then submitted to appropriate testing techniques. When approved, they became the foundation for theory formulation (Zalaghi and Khazaei, 2016). In this study, the Holistic Teacher Empowerment Framework (HTEF) was a theory generated that aimed at refining professional development for early childhood science teachers. These theory development processes were based on Padua (2012).

The approach to theory development depicted follows a deductive axiomatic framework from Choosing the Phenomenon of Interest, Reading the Literature, Brainstorming Formulating the Axioms and Propositions and Theory Construction (Adapted from Padua, 2012)

Result and Discussion

Phenomenon

This study focused on boosting the professional development of science teachers in early childhood education (ECE). Professional development was a widely used idea in education, with many scholars and researchers investigating its efficacy in holistically equipping teachers, notably in scientific education. The goal was not just to expand teachers' expertise but also to promote holistic empowerment, which improved self-efficacy and knowledge retention among ECE students. Despite some promising discoveries, there was still a lack of concentration in the research area on professional development tailored to ECE science. As a result, the researcher hoped to create a theory that not only maintained the positive impact of refining professional development for science teachers in ECE but also delved into the critical components for refining science education and ensuring the effective implementation of professional development initiatives within the ECE education framework. Therefore, this study generated the EForkpah Holistic Teacher Empowerment Framework (EFHTEF), a theoretical model that aimed at refining professional development for early childhood science teachers.

AXIOMS

After conducting a thorough review of relevant literature and studies, the researcher identifies several universally accepted, established, and empirically supported statements. The following axioms capture these findings (1)The refinement of professional development is universal across topics within the science education community in early childhood education (ECE), (2) Professional development for science teachers in ECE stimulates critical thinking among learners and aids students in their academic growth, (3), Professional development sustains teachers' motivation and engagement in the ECE science classroom, (4), Participation in professional development activities positively influences the satisfaction and effectiveness of science teachers in their instructional roles.

AXIOMS 1

The refinement of professional development is universal across topics within the science education community in early childhood education (ECE).

Professional development in early childhood education science education plays a vital role in enhancing student learning outcomes and promoting effective teaching practices within the ECE (Sheridan et al., 2009). It serves as a common framework that is accessible and understandable to educators and learners, aiming to enhance student learning outcomes within the ECE science context (Buysse et al., 2009). This demand of professional development is evident in its relevance and adaptability across diverse ECE settings, encompassing various aspects of science education such as inquiry-based learning, hands-on activities, and STEM integration. By fostering a holistic approach to ECE science instruction, professional development initiatives enable educators to effectively engage young learners and facilitate their scientific exploration and understanding (Buysse et al., 2009).

AXIOMS 2

Professional development for science teachers in ECE stimulates critical thinking among learners and aids students in their academic growth.

Professional development tailored for ECE science educators serves as a catalyst for fostering critical thinking skills among young learners and nurturing their academic progress (Hong et al., 2013). This specialized training equips teachers with innovative instructional strategies and pedagogical approaches aimed at engaging students in scientific inquiry and exploration. By encouraging active participation and inquiry-based learning, professional development initiatives empower students to develop essential critical thinking skills, such as problem-solving, analysis, and evaluation (Buczyński & Hansen, 2010). Through hands-on experiments, collaborative projects, and meaningful discussions facilitated by well-trained teachers, students are provided with opportunities to apply scientific principles to real-world situations and develop a deeper understanding of scientific concepts. As a result, professional development for science teachers in ECE not only enhances the quality of science education but also contributes to students' overall academic growth and development (Sheridan et al., 2009).

AXIOMS 3

Professional development sustains teachers' motivation and engagement in the ECE science classroom.

Professional development initiatives in ECE science education play a crucial role in sustaining teachers' motivation and engagement within the classroom environment. These tailored training programs provided educators with ongoing support, resources, and opportunities for growth, which are essential for maintaining enthusiasm and dedication to their teaching profession (Hong et al., 2013). By participating in professional development activities focused on ECE science education, teachers gain access to new teaching strategies, instructional techniques, and curriculum resources that enhance their effectiveness in the classroom (Sheridan, Edwards, Marvin, & Knoche, 2009). Additionally, professional development fosters a sense of community among educators, providing

opportunities for collaboration, networking, and sharing best practices. Through continuous professional development, teachers remain inspired and motivated to deliver high-quality instruction, create dynamic learning experiences, and support the academic success of their students in the ECE science classroom (Huang, Siraj, & Melhuish, 2024).

AXIOMS 4

Participation in professional development activities positively influences the satisfaction and effectiveness of science teachers in their instructional roles

Engagement in professional development activities tailored to ECE science education has a notable impact on the satisfaction and effectiveness of science teachers in their instructional roles. By actively participating in ongoing training and development opportunities, educators gain valuable knowledge, skills, and resources that enhance their teaching practices and pedagogical approaches (Desimone et al.,2002). This professional growth leads to increased confidence, competence, and job satisfaction among science teachers, as they are better equipped to meet the diverse needs of their students and facilitate meaningful learning experiences (Alquhtani, 2020). Moreover, professional development fosters a supportive and collaborative learning environment, where educators can exchange ideas, share experiences, and receive feedback from peers and mentors. As a result, teachers feel more empowered, fulfilled, and effective in their instructional roles, leading to improved outcomes for both themselves and their students in the ECE science classroom (Desimone et al.,2002).

The establishment of the four axioms prompted the researcher to formulate five propositions, outlined as follows: (1) Professional development should integrate inquiry-based learning in science education. (2) Professional development for science teachers should foster collaboration and stimulates critical thinking in ECE among learners. (3) Professional development should sustain teachers through growth promotion and mindsets in ECE classroom. (4) Participation in professional development should provide personalized support, emphasizing cultural responsiveness which will positively influences the satisfaction of science teachers.

PROPOSITION 1 Professional development should integrate inquiry-based learning in science education.

(Axiom 1) Professional development should have incorporated inquiry-based learning into science education, ensuring that instructional strategies and activities aligned with inquiry-based principles and promoted active exploration, investigation, and discovery among educators and students. ECE Teachers in science had to shift their professional teaching method from the traditional teacher-centered approach to a more student-centered approach. Instead of simply providing students with information to memorize, teachers acted as guides and facilitators, encouraging students to think critically and discover knowledge for themselves (Axiom 2). This approach fostered a sense of curiosity and encouraged students to develop a lifelong love of learning in science. Professional development should integrate inquiry-based learning in science education.

PROPOSITION 2 Professional development for science teachers should foster collaboration

(Axiom 2) Professional development for science teachers should have cultivated collaboration and encouraged critical thinking in early childhood education (ECE), promoting collaborative learning environments that fostered inquiry, problem-solving, and the exchange of ideas among students, facilitated by teachers who modeled and scaffolded critical thinking skills. (Axiom 3) Professional development opportunities for science teachers were essential for staying updated on the latest research, teaching techniques, and technologies in the field of science education. (Axiom 5) These opportunities provided teachers with the necessary skills and knowledge to effectively engage and inspire their students in the classroom. Professional development helped teachers to continuously improve their teaching practices and to adapt to the ever-changing landscape of education and stimulates critical thinking in ECE among learners. Professional development for science teachers should foster collaboration and stimulates critical thinking in ECE among learners.

PROPOSITION 3 Professional development should sustain teachers through growth promotion and mindsets in ECE classroom

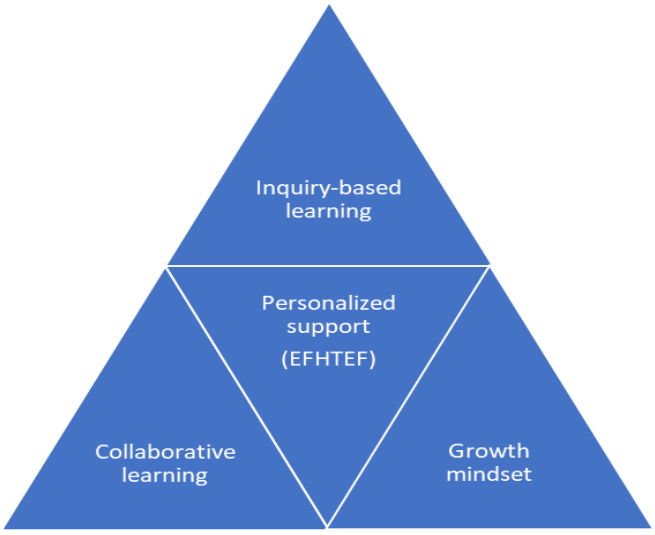
(Axiom 3) Professional development should have supported teachers in cultivating growth mindsets in early childhood education (ECE) classrooms, fostering a culture of continuous improvement and resilience among educators and students. Promoting a growth mindset in early childhood education was crucial for setting a strong foundation for lifelong learning and success. (Axiom 4) A growth mindset was the belief that abilities and intelligence could be developed through effort, practice, and perseverance. This contrasted with a fixed mindset, which believed that abilities were innate and unchangeable. By instilling a growth mindset in young children, educators could have helped them embrace challenges, learn from failures, and continuously strive for improvement. Professional development should sustain teachers through growth promotion and mindsets in ECE classroom.

PROPOSITION 4 Participation in professional development should provide personalized support, emphasizing cultural responsiveness which will positively influences the satisfaction of science teachers.

(Axiom 4) Participation in professional development should have offered personalized support and prioritized cultural responsiveness, fostering an inclusive and supportive environment that positively impacted the satisfaction and effectiveness of science teachers in their practice. (Axiom 5) Cultural responsiveness in professional development was a crucial aspect of ensuring that educators were able to effectively support and engage with students from diverse backgrounds. This approach recognized the importance of understanding and valuing the cultural identities, beliefs, and experiences of all individuals involved in the educational setting. By incorporating cultural responsiveness into professional development programs, educators could have enhanced their ability to create inclusive learning environments that addressed the unique needs of all students.

Conclusion

Refining professional development in ECE education is powered by 1. Holistic, 2. Teacher, and 3 Empowerment. A holistic approach in education acknowledges the interconnected aspects of learners' lives, encompassing their academic, physical, emotional, social, and spiritual well-being. Teachers play a central role in implementing this approach by fostering a positive and inclusive classroom environment. Empowering teachers involves providing resources and autonomy to meet diverse student needs and create meaningful learning experiences. By embracing holistic perspectives and empowering teachers, education can nurture the whole child and prepare students for success in all aspects of life. EForkpah Holistic Teacher Empowerment Framework (EFHTEF) implementation theory in Refining Teachers professional development in ECE science.



References

Alqahtani, T.H. (2020). Work-Life Balance Of Women Employees. Granite Journal: A Postgraduate Interdisciplinary Journal, 4(1), 37-42.

Baker-Doyle, K. J. (2011). The Networked Teacher: How New Teachers Build Social Networks For Professional Support. Teachers College Press.

Barenthien, J., Oppermann, E., Steffensky, M., & Anders, Y. (2019). Early Science Education In Preschools–The Contribution Of Professional Development And Professional Exchange In Team Meetings. European Early Childhood Education Research Journal, 27(5), 587-600.

Bayne, T. (2018). On The Axiomatic Foundations Of The Integrated Information Theory Of Consciousness. Neuroscience Of Consciousness, 2018(1), Niy007.

Bhaskar, P., & Dayalan, P. (2021). Career Growth And Development: Srole Of Continuing Education Among Teachers. Business Excellence & Management, 11(3).

Booth, A., Sutton, A., Clowes, M., & Martyn-St James, M. (2021). Systematic Approaches To A Successful Literature Review.

Buczynski, S., & Hansen, C. B. (2010). Impact Of Professional Development On Teacher Practice: Uncovering Connections. Teaching And Teacher Education, 26(3), 599-607.

Buysse, V., & Hollingsworth, H. L. (2009). Program Quality And Early Childhood Inclusion: Recommendations For Professional Development. Topics In Early Childhood Special Education, 29(2), 119-128.

Delaram, J., & Valilai, O. F. (2018). An Architectural View To Computer Integrated Manufacturing Systems Based On Axiomatic Design Theory. Computers In Industry, 100, 96-114.

Desimone, L., Porter, A., Garet, M., Yoon, K., & Birman, B. (2002). Effects Of Professional Development On Teachers' Instruction: Results From A Three-Year Longitudinal Study. Educational Evaluation And Policy Analysis, 24, 81–112.

Duschl, Richard A.; Schweingruber, Heidi A.; & Shouse, Andrew W. (Eds.). (2007). Taking Science To School: Learning And Teaching Science In Grades K-8. Washington, Dc: National Academies Press.

Evans, J. S. B. T. (2005). Deductive Reasoning. The Cambridge Handbook Of Thinking And Reasoning, 169-184.

Florio, A. (2012). Science In Axiomatic Perspective.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What Makes Professional Development Effective? Results From A National Sample Of Teachers. American Educational Research Journal, 38(4), 915-945.

Heis, J. (2020). Kant On Parallel Lines: Definitions, Postulates, And Axioms. Kant's Philosophy Of Mathematics, 1, 157-80.

Hong, S. Y., Torquati, J., & Molfese, V. J. (2013). Theory Guided Professional Development In Early Childhood Science Education. In Learning Across The Early Childhood Curriculum (Pp. 1-32). Emerald Group Publishing Limited.

Hord, S. M. (1997). Professional Learning Communities: Communities Of Continuous Inquiry And Improvement.

Hu, M., Shealy, T., Milovanovic, J., & Gero, J. (2022). Neurocognitive Feedback: A Prospective Approach To Sustain Idea Generation During Design Brainstorming. International Journal Of Design Creativity And Innovation, 10(1), 31-50.

Huang, R., Siraj, I., & Melhuish, E. (2024). Promoting Effective Teaching And Learning Through A Professional Development Program: A Randomized Controlled Trial. Journal Of Educational Psychology.

Khan, P., & Iqbal, M. (2012). Overcrowded Classroom: A Serious Problem For Teachers. University Of Science And Information Technology, 49, 10162-10165.

Lehrer, K. (2018). Theory Of Knowledge. Routledge.

Levy, Y., & Ellis, T. J. (2006). A Systems Approach To Conduct An Effective Literature Review In Support Of Information Systems Research. Informing Science, 9.

Lieberman, A. (1995). Practices That Support Teacher Development: Transforming Conceptions Of Professional Learning. Innovating And Evaluating Science Education, 95(64), 67-78.

Maddy, P. (2011). Defending The Axioms: On The Philosophical Foundations Of Set Theory. Oxford University Press.

Moghaddam, A. (2006). Coding Issues In Grounded Theory. Issues In Educational Research, 16(1), 52-66.

Moran, K., & Burson, R. (2017). The Phenomenon Of Interest. The Doctor Of Nursing Practice Scholarly Project: A Framework For Success, 89-115.

National Research Council, Division Of Behavioral, Board On Science Education, & Committee On Guidance On Implementing The Next Generation Science Standards. (2015). Guide To Implementing The Next Generation Science Standards.

National Research Council, Division On Earth, Life Studies, Commission On Life Sciences, & Committee On Biology Teacher Inservice Programs. (1996). The Role Of Scientists In The Professional Development Of Science Teachers. National Academies Press.

National Research Council. (1996). National Science Education Standards. Washington, Dc: National Academy Press.
Nicol, C. B., Gakuba, E., & Habinshuti, G. (2022). Effects Of Inquiry-Based Experimentation On Learning Outcomes In Bong County, Liberia. Book Of Proceedings–Long Papers, 273.
Padua, R. (2012). Teaching Theory Development. Training Presentation From Cebu Normal University, Cebu City, Philippines
Piasta, S. B., Logan, J. A., Pelatti, C. Y., Capps, J. L., & Petrill, S. A. (2015). Professional Development For Early Childhood Educators: Efforts To Improve Math And Science Learning Opportunities In Early Childhood Classrooms. Journal Of Educational Psychology, 107(2), 407.
Rahmanian, P. B. (2023). Brainstorming: Personnel Education And Planning Stage Of The Service. In Ecmo Retrieval Program Foundation (Pp. 121-129). Cham: Springer International Publishing.
Roeckelein, J. E. (Ed.). (2006). Elsevier's Dictionary Of Psychological Theories. Elsevier.
Sheridan, S. M., Edwards, C. P., Marvin, C. A., & Knoche, L. L. (2009). Professional Development In Early Childhood Programs: Process Issues And Research Needs. Early Education And Development, 20, 377–401. Doi:10.1080/10409280802582795
Snyder, H. (2019). Literature Review As A Research Methodology: An Overview And Guidelines. Journal Of Business Research, 104, 333-339.
Thahir, M., Komariah, A., Kurniady, D. A., Suharto, N., Kurniatun, T. C., Widiawati, W., & Nurlatifah, S. (2021). Professional Development And Job Satisfaction On Teaching Performance. Linguistics And Culture Review, 5(S4), 2507-2522.
Ufnar, J. A., & Shepherd, V. L. (2019). The Scientist In The Classroom Partnership Program: An Innovative Teacher Professional Development Model. Professional Development In Education, 45(4), 642-658.
Van Driel, J. H., Beijaard, D., & Verloop, N. (2001). Professional Development And Reform In Science Education: The Role Of Teachers' Practical Knowledge. Journal Of Research In Science Teaching: The Official Journal Of The National Association For Research In Science Teaching, 38(2), 137-158.
Van Driel, J. H., Beijaard, D., & Verloop, N. (2001). Professional Development And Reform In Science Education: The Role Of Teachers' Practical Knowledge. Journal Of Research In Science Teaching: The Official Journal Of The National Association For Research In Science Teaching, 38(2), 137-158.
Weichbroth, P. (2016). Facing The Brainstorming Theory. A Case Of Requirements Elicitation (No. 12/2016 (42)). Gut Fme Working Paper Series A.
Wilson, S. M. (2013). Professional Development For Science Teachers. Science, 340(6130), 310-313.
Wood, D. W. (2012). Axioms, Intuition And Construction. In " Mathesis Of The Mind" (Pp. 121-197). Brill.
Yoon, K. (2017). Professional Development And Its Impact On Teacher And Pupil Learning: A Community Of Practice Case Study In South Korea (Doctoral Dissertation, University Of Birmingham).
Zalaghi, H. And Khazaei, M. (2016). The Role Of Deductive And Inductive Reasoning In Accounting Research And Standard Setting. Asian J Finance Account, 8(1), 23-37
Zhang, Y., Peng, L., Shen, J., Zhinan, Z., & Tao, F. (2019). Development Of A Process For Perceptual Index Establishment Based On Axiomatic Design. In Matec Web Of Conferences (Vol. 301, P. 00020). Edp Sciences