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Research Article

A Steam Model for Enhancing Teaching Methods and Professional Development for the Schools Teachers

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ABSTRACT

This researcher aimed to enhance the effective approaches for the teacher development as a meaningful form of professional development (PD). The study involved teachers from the schools collaborative learning initiative designed to support educators in improving classroom instruction and enhancing school performance. This study aims to examine the impact of teachers' learning as an approach to professional development and to summarize the best practices in teacher development approaches. The objectives are to explore the STEAM teachers teaching method in schools. To find out the relationship between professional development and STEAM teaching methods in schools. Alternative approaches to teacher learning and development have proven effective. This study elaborates on the outcomes of these approaches and provide insights into their current implementation. To develop a STEM teaching model for enhancing teachers' professional development for the schools' teachers. According to Creswell, the purpose of mixed method is used for this study for understanding the meanings that groups and individuals have regarding a human or social issue. The findings revealed the most effective approaches for professional development and enhancing teachers' learning include establishing the school as a professional development, implementing teacher-as-learner programs, providing coaching by master teachers, and fostering teacher networks.

Keywords: Teaching method, STEAM, Professional Development and Teachers.

Introduction:

Science, innovation, designing, and math (STEM) is at present perceived and generally utilized as a meta-discipline that joins applications in happy region teaches, for example, STEM to make information overall (Johnson, 2012). Financial, political, instructive, and world pioneers and associations support STEM-centered educating as a method for expanding scholarly meticulousness in schools and present understudies' abilities and information that are of developing significance to the upcoming labor force. Despite the endeavors of STEM training to increment variety in the related fields (Reyes, 2012; Tsui, 2007). STEM professions are still extraordinarily homogenous; ladies and minorities hold just 28 and 10%, individually, of STEM occupations (Public Science Board, 2014). To work on the STEM labor force to mirror numerous viewpoints and information, we want to change the way we ponder and educate STEM. This work "starts in grade school and stretches out through the professoriate and the remainder of the labor force". To resolve the issue of drawing in and holding a different STEM labor force, how we are showing our understudies should be re-conceptualized to draw in and hold elective viewpoints that will help with tackling the world's most major problems.

Review of Literature:

The researcher reviewed the literature about the STEAM teachings methods and the relationship between professional development and STEAM teachings methods.

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STEAM Teachings Methods:

STEAM education initiates critical thinkers, enhances science literacy, and facilitates innovators. Teachers have a crucial role to build up this innovation and science literacy but mostly they need help on how to operate STEAM education in their classrooms. According to the Best Practice Guide in The National STEM School Education Resources Toolkit (The Australian Government Department of Education, 2019), there are eight principles for teachers to apply in STEM education. Not every principle would be appropriate in every situation, but each would provide strong guidance.

1. Use inquiry-based learning: The approach fosters investigation and problem-solving. Thanks to this approach, students learn key STEM and life skills through inquiry-based learning: social interaction, exploration, argumentation, comfort with failure. For example, teachers build active learning into teaching practices through problem-based scenarios to encourage students to think critically.

2. Solve real-world problems: Students tackle real-world STEM problems from businesses and the community. Real-world problems demonstrate the relevance of STEM; it can enhance student motivation and interest. To illustrate, a teacher asks his/her local council or a local business for a challenging problem they're working on. Then, the teacher takes it to his/her students and sees what they come up with.

3. Teach integrated STEM learning: Integrated STEM learning combines the subject matter of two or more STEM subjects into a joint learning experience. It supports cross-disciplinary STEM skills; can enhance student interest. For instance, teachers can teach Science using an Engineering process (design-based learning) which is a series of steps that you repeat to develop or improve a product, process, or system.

4. Equip and empower teachers: Equipping and empowering teachers means providing them with the right resources (e.g. high-quality professional learning opportunities, up-to-date technology) and skills to teach best practice STEM education.

5. Use technology as an enabler: Selective use of technology to support high-quality teaching and learning accelerates student learning, increases confidence and ability in using technology. Teachers can get students to program a technology instead of showing them what something does.

6. Differentiate for different levels: Learning is tailored to the needs and abilities of individual students, and teachers support all students' needs regardless of starting point. As a suggestion, teachers can assess student capability formally and informally so lessons can be tailored.

7. Link education to 21st century learning: Teachers build in the development of 21st century skills such as critical thinking, creativity, communication, and collaboration in STEM education because 21st century skills are highly valuable for students' future careers. The skills encourage teamwork and healthy debate. Teachers can let students 'play' with the subject matter.

Professional Development and STEAM teaching Methods:

In a functional environment, content from multiple STEAM areas (e.g., math and science) is contextualized and applied through the robot to solve an authentic problem and engage students in computational thinking. It is the integrative nature of the approach that has the potential to improve STEAM education. The course in question included the complete teaching material of a school year in particle physics, named "Playing with Protons" (PwP). By working through the modules, the teacher learned both the subject matter and the creative way of STEAM teaching (Alexopoulos, Pavlidou, & Cherouvis, 2019). In this way, the new STEAM concepts did not compete with old teaching concepts, and this ensured that the teachers followed the creative guide, using only the prepared teaching material. While working through the modules, teachers accustomed to creative STEAM teaching as they

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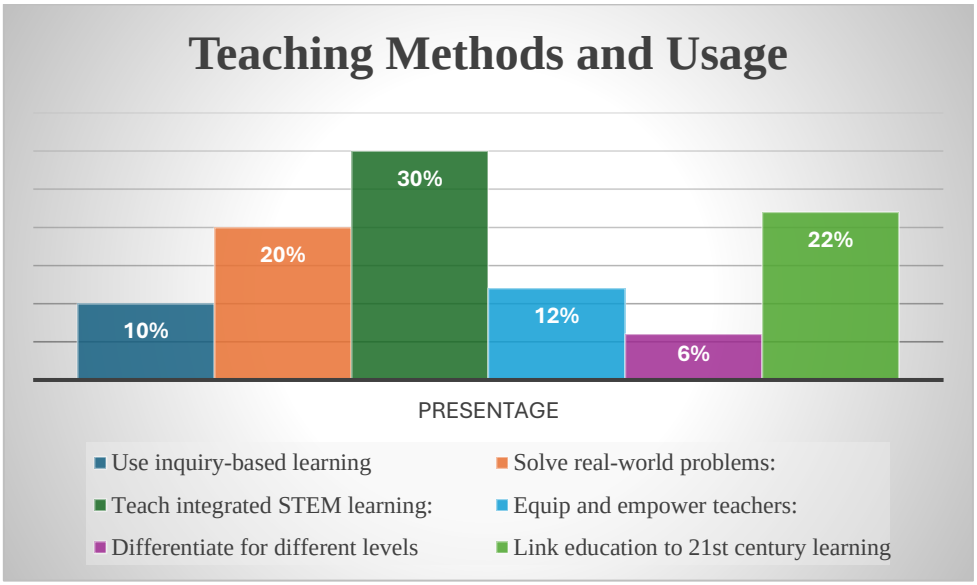
were to imitate it in their lessons (Chamaeleon Effect, (Hattie & Yates, 2014). The lesson design followed the 5E Instructional Model incorporating five phases: engagement, exploration, explanation, elaboration, and evaluation (Sotirou, Bybee, & Bogner, 2017) concretized in the creativity-based pedagogical framework established within the Creations project (Chappell et al., 2019). A strong emphasis was placed on inquiry-based learning with the features of dialogue, risk, immersion and play, and inter-disciplinary framework, the application of which can help make science teaching and the learning process inspiring and engaging for both teachers and students (Alexopoulos et al., 2019).

Methodology:

The methodology of the study is used mixed method as a qualitative and quantitative. The objective one is to explore STEAM teachers teaching methods. Systematics review of literature is used for the analysis of objective one. The second objective is to find out the relationship between professional development and STEAM teaching methods in schools. MANOVA as a statistics tool is used for the analysis of objective two. The random sampling method is used for collecting data. Three hundred teachers are used as a sampling.

Findings and Recommendations:

The researcher has explored the review of literature to finding the teaching method for adopting STEAM educations. The following sections of the paper detailed the findings of the systematics review literature for the leadership styles for the teachers teaching and learning.



The pictures showed that the STEAM teaching methods were found from the systematics review of literature and the usage of percentage level also given. The highest level of teaching integrated STEAM learning is used 30 % of teachers. The differentiate for different levels are used very lowest percentage.

To find out the relationship between professional development and STEAM teaching methods in schools.

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Table: 1 Multivariate Test Results (Shows overall significance for the relationship between PD and STEAM teaching methods).

Test	Value	F	df1	df2	Sig.
Wilks' Lambda	0.85	4.23	3	295	0.006
Pillai's Trace	0.92	5.32	3	295	0.002
Hotelling's Trace	0.91	4.88	3	295	0.004
Roy's Largest Root	0.87	4.52	3	295	0.005
Wilks' Lambda	0.85	4.23	3	295	0.006
Pillai's Trace	0.92	5.32	3	295	0.002

Since the significance values (Sig.) for all tests are less than 0.05, we can reject the null hypothesis and conclude that professional development has a significant effect on the STEAM teaching methods.

Table: 2 Tests of Between-Subjects Effects (Shows individual effect of each independent variable on the dependent variables).

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
P. D	Frequency of STEAM Integration	25.4	1	25.4	4.7	0.03
P. D	Use of STEAM Strategies	34.2	1	34.2	5.1	0.02
P. D	Student. E. in STEAM	28.1	1	28.1	6.3	0.01

Each dependent variable (STEAM integration, use of STEAM strategies, and student engagement) shows a significant effect based on the professional development provided (p-value < 0.05).

Table: 3 Post Hoc Tests (If applicable, to determine which levels of independent variables have a significant difference).

Group Comparison	Mean Difference	Std. Error	Sig.
20 hours PD vs. 30 hours PD	0.45	0.15	0.02
Workshop vs. Online Course	0.65	0.12	0.03

The post hoc analysis can show which specific PD hours or types of PD programs are contributing to significant differences in the STEAM teaching methods. There is a significant relationship between professional development (both hours and type) and the use of STEAM teaching methods. Teachers who received more PD or specific types of PD (such as workshops or conferences) integrated STEAM methods more frequently in their teaching, used more STEAM-based strategies, and had higher student engagement in STEAM activities. The magnitude of the effect (e.g., partial eta squared or R^2) would indicate how strong the relationship is between professional development and STEAM teaching methods.

Conclusion:

In conclusion, the integration of a STEAM (Science, Technology, Engineering, Arts, and Mathematics) model in enhancing teaching methods and professional development for teachers proves to be an effective approach in fostering an innovative and engaging learning environment. By incorporating the

interdisciplinary nature of STEAM, teachers are better equipped to create dynamic and relevant lessons that cater to diverse learning styles and needs. This model encourages a hands-on, inquiry-based approach that promotes critical thinking, creativity, and problem-solving among students. Furthermore, professional development opportunities centered around STEAM enable educators to expand their skill sets, keep up with technological advancements, and adopt modern pedagogical strategies. Teachers who engage in STEAM-focused training are more likely to feel confident in utilizing new tools and resources, leading to more effective classroom management and student engagement. Collaboration among educators, both within and across disciplines, is another key benefit, as it fosters a sense of community and shared growth. Ultimately, the implementation of a STEAM model not only enhances teaching practices but also empowers teachers to continuously grow and adapt in an ever-evolving educational landscape, ensuring that they are well-prepared to guide students toward success in the 21st century.

Reference:

[1] Johnson, B. B. (2012). Climate Change Communication: A Provocative Inquiry into Motives, Meanings, and Means. Risk Analysis, 32, 973-991.
[2] Tsui, A. (2007) Complexities of Identity Formation: A Narrative Inquiry of an EFL Teacher. TESOL Quarterly, 41, 657-680.
[3] Reyes, M. R., & Salovey, P. (2012). Enhancing Academic Performance and Social and Emotional Competence with the RULER Feeling Words Curriculum. Learning and Individual Differences, 22, 218-224.
[4] National Science Board (NSF) (2014). Science and Engineering Indicators 2014. https://www.nsf.gov/statistics/seind14/content/etc/nsb1401.pdf.
[5] Australian Bureau of Statistics. (2019). Schools, Australia methodology. ABS. https://www.abs.gov.au/methodologies/schools-methodology/2019.
[6] Alexopoulos, A., Pavlidou, M., & Cherouvis, S. (2019). 'Playing with protons': a training course for primary school teachers at CERN. Physics Education, 54(1), 15013.
[7] Hattie, J. A. C., & Yates, G. C. R. (2014). Using feedback to promote learning. In V. A. Benassi, C. E. Overson, & C. M. Hakala (Eds.), Applying science of learning in education: Infusing psychological science into the curriculum (pp. 45–58).
[8] Sotiriou, Sofoklis & Bybee, Rodger W. & Franz X. Bogner, 2017. " A Case of Large-Scale Implementation of Evidence-Based Practice in Scientific Inquiry-Based Science Education," International Journal of Higher Education, Sciedu Press, vol. 6(2), pages 1-8.
[9] Hetherington, L., Chappell, K., Ruck Keene, H., Wren, H., Cukurova, M., Hathaway, C. et al. (2019). International Educators' Perspectives on the Purpose of Science Education and the Relationship between School Science and Creativity. Research in Science & Technological Education, 38, 19-41.