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Perceptions of Physics Teachers towards Creativity in Teaching and Learning Wave Motion at Secondary School Level

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Abstract: ***Teachers and learners should be equipped with relevant 21st century skills such as Creativity to thrive academically and professionally. This study examined perceptions of Physics teachers towards Creativity. The objectives were to find out Physics teachers' understanding of Creativity, identify factors perceived vital in developing Creativity, and discover Physics teachers' own beliefs about Creativity, how they plan and foster Creativity in their classes. The study population was 26 Physics teachers in 10 secondary schools of Mansa District in Zambia. Random sampling was used to select 20 teachers from the population. Four research instruments were used to collect data and these were the Creativity Perception Questionnaire for Physics Teachers (CPQPT), Creativity Rubric for Physics Lesson Plans (CRPLP) and Creativity Rubric for Physics Lesson Observation (CRPLO). Results show that access to Information Communication Technology (ICT) facilities and asking thought - provoking questions during Physics lessons were the most important factors in developing the Creativity of learners. The most commonly held beliefs were building the confidence of learners to become divergent thinkers and providing them an opportunity to exercise creative thinking. Although the majority of Physics teachers had no problems planning for Creativity during lessons on wave motion, they experienced challenges in the implementation of activities that foster Creativity. School - Based Continuing Professional Development (SBCPD) was strongly recommended as a significant tool for implementing and enhancing the Creativity of learners.***

Keywords: perception, Creativity, teaching and learning, Physics teachers, wave motion

1. Introduction

Creativity is one of the four 21st century learning and innovation skills which include critical thinking and problem solving, communication, collaboration, Creativity and innovation (Partnership for 21st Century Skills, 2009). Stehle and Peters - Burton (2019) revealed that 21st century skills are difficult to teach explicitly at high school level and recommended that future studies consider investigating why teachers are not frequently incorporating higher - level 21st century skills into their lessons.

A study by Arsad (2010) showed that the relationship of 21st century skills on students' attitude towards Physics was strong while the relationship of 21st century skills on students' perception on teaching and learning of Physics was moderate.

The study by Blom et al. (2017) revealed that 450, 000 secondary school graduates in Botswana, Lesotho, and Zambia were unemployed or economically inactive. A key reason articulated by employers in the study was that contemporary forms of secondary education did not sufficiently prepare graduates of secondary education with the needed 21st century skills (cognitive and socio - emotional) and vocational skills demanded in a 21st century economy. This demonstrates that the need to foster 21st century skills such as Creativity in the teaching and learning of Physics cannot be over emphasised. Creativity is not new to the Zambian curriculum despite being presented as a competence in the 2013 Zambia Education Curriculum Framework that learners should develop as they learn all the subjects.

2. Theoretical Framework

Bloom's (1956) taxonomy does not address learning outcomes such as learning how to learn, leadership and interpersonal skills, ethics, communication skills, character, tolerance, learning about oneself and others, and the ability to adapt to change. However, these are addressed by Dee Fink's Taxonomy of Significant Learning and they promote the Creativity of learners during and after the learning process.

According to Fink (2003), for learning to occur, there has to be some kind of change in the learner. Significant learning requires that there be some kind of lasting change that is important in terms of the learner's life. This change can only be evident if learners develop Creativity skills to address different issues. Fink developed a taxonomy based on six kinds of significant learning which include foundational knowledge, application, integration, human dimension, caring and learning how to learn.

Foundational knowledge provides learners with the basic understanding which is necessary for other kinds of learning. It is important for learners to have some valid basic knowledge. Foundational knowledge is the basis for creative thinking of the learners on any particular Physics concept or idea being learned during Physics lessons. For example, the

foundation knowledge that the learners will need to grasp the concept of wave motion is energy.

Application enables learners to not only pick up facts and ideas when learning Physics on any particular topic, but also often learn how to engage in some new kind of action, which may be intellectual, physical, or social. Learning how to engage in various kinds of thinking (critical, creative or practical) is an important form of application learning. This category of significant learning also includes developing certain skills such as communication or observation or learning how to manage complex projects. Managing of complex Physics projects by learners can enhance their Creativity skills. Application learning allows other kinds of learning to become more relevant and useful to the learners. Critical thinking and engaging in some new kind of action after the learning process is at the centre of Creativity.

Integration makes learners see and understand the connections between different things when an important kind of learning has taken place. Sometimes they make connections between specific ideas, between whole realms of ideas, between people, or between different realms of life (between school and work or between school and leisure life). The act of making new connections gives learners a new form of power, especially intellectual power which is what Creativity is all about. When learners learn about electromagnetic waves, for example, they should be in a position to make connections and understand how heat energy and light reaches us on earth from the sun.

Human dimension learning experience informs learners about the human significance of what they are learning. When learners learn something important about themselves or about others, it enables them to function and interact more effectively. They discover the personal and social implications of what they have learnt. What they learn or the way in which they learn sometimes gives learners a new understanding of themselves (self - image) or a new vision of what they want to become (self - ideal). At other times, they acquire a better understanding of others such as how and why others act the way they do or how they can interact more effectively with others. Interaction and collaboration among learners during the learning process promotes Creativity, as they will share knowledge, skills and ideas.

Caring - Sometimes a learning experience changes the degree to which learners care about what they have learnt. This may be reflected in the form of new feelings, interests, or values. Any of these changes means learners now care about something to a greater degree than they did before, or in a different way. When learners care about something, they then have the energy they need for learning more about it and making it a part of their lives. Creativity is also about the zeal of wanting to learn more. Without the energy for learning, nothing significant happens. For instance, when learners learn about energy conservation in Physics, they will care more about saving energy through the use of different forms of alternative energy sources such as solar and bio gas, among others.

Learning how to learn is evident in that as learners are learning Physics, they may learn something about the learning process itself. They will learn how to be better learners, how to engage in a particular kind of inquiry (such as the scientific method), or how to become self - directed learners. All these constitute important forms of learning how to learn. This kind of learning enables learners to learn effectively on their own without the presence of the teacher by researching further to understand what is being taught. This promotes lifelong learning, even after the learners have graduated from school and have forgotten the Physics content they were taught in school, they will continue learning on their own. Learning how to learn also makes learners learn, unlearn and re - learn as well. Learning, unlearning and re - learning are vital for fostering Creativity in the learners.

Dee Fink's Significant Learning Taxonomy is not hierarchical but rather relational and interactive. The interactive nature of this taxonomy means that the six kinds of learning in the taxonomy are synergistic. Each kind of learning is related to the other kinds of learning and that achieving any one kind of learning simultaneously enhances the possibility of achieving the other kinds of learning as well. The teacher should find a way to help learners achieve one kind of learning so as to achieve other kinds of learning, for example, when learners acquire foundational knowledge on alternative energy sources in Physics. This cannot only make them use alternative energy sources like solar at home but also begin to care for the environment as it is environment friendly. They can as well come up with creative and innovative ideas of how to conserve the form of energy in question.

Creativity enables learners to thrive, live, function and survive in the 21st century environment. This can only happen if learners have significant learning experiences. Fink's (2003) assertion that "What students learn has a high potential for being of value in their lives after the course is over, by enhancing their individual lives, preparing them to participate in multiple communities, or preparing them for the world of work" resonates well with the value of creativity for an individual.

3. Method

3.1 Data Collection

Data on Physics teachers' understanding of Creativity, factors perceived as important in developing Creativity and own beliefs about Creativity through self - assessment was collected using CPQPT. CRPLP was used to collect data of how Physics teachers planned for Creativity in their Physics classes. CRPLO was used to assess how Physics teachers fostered Creativity in their Physics lessons.

3.2 Data Analysis

The data collected from CPQPT, CRPLP and CRPLO was analysed using the Statistical Package for the Social Sciences (SPSS) version 27 to show the means, standard deviation

and percentages of data. Thematic analysis was used for open ended responses from the questionnaire.

4. Results

Table 1 shows Physics teachers' understanding of Creativity.

Table 1: Physics teachers' understanding of Creativity **(**n=20)

Understanding	Rating (%)				
	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
Discovering new ideas	35.0	65.0	0.0	0.0	0.0
Expressing ideas in a new way	50.0	15.0	25.0	10.0	0.0
Use of imagination or original ideas to create something new	30.0	35.0	25.0	5.0	5.0
Interpreting or viewing problems in a new way	30.0	65.0	5.0	0.0	0.0
Producing novel work	15.0	5.0	50.0	10.0	20.0
Exploring many answers or solutions to a question or problem	20.0	45.0	15.0	10.0	10.0
Thinking outside the box	45.0	45.0	5.0	5.0	0.0
Combining different ideas	10.0	50.0	25.0	5.0	10.0

Table 2 shows the themes that were developed on the open ended question; "state your own understanding of Creativity?"

Table 2: Distribution of themes on Physics teachers' understanding of Creativity (n = 20)

Theme	Frequency	Percentage
Coming up with new ideas	9	45.0
Thinking in a new way	7	35.0
Those who did not answer	4	20.0
Total	20	100.0

Table 3 shows factors perceived as important in developing Creativity in the learners by Physics teachers.

Table 3: Factors perceived as important in developing Creativity by Physics teachers (n=20)

Factor	Rating (%)				
	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
Use of teaching methods that support Creativity	30.0	40.0	25.0	5.0	0.0
Teaching and learning not heavily reliant on testing and assessment but Creativity	10.0	10.0	35.0	40.0	5.0
Independent search for answers and solutions to problems or questions by learners	45.0	25.0	15.0	10.0	5.0
Access to ICT facilities such as computers and internet that facilitate Creativity	15.0	80.0	5.0	0.0	0.0
Asking learners thought provoking questions during Physics lessons	15.0	80.0	0.0	0.0	5.0
Engaging learners in Physics debate on different topics during Physics classes	25.0	20.0	45.0	10.0	0.0
Physics projects being given to learners to foster Creativity	70.0	20.0	10.0	0.0	0.0
Access to Physics journals/materials showing past and latest discoveries and inventions	20.0	75.0	5.0	0.0	0.0
Having involved and supportive families that support creative work of their children	10.0	55.0	5.0	15.0	15.0

Table 4 shows Physics teachers' own beliefs about Creativity.

Table 4: Physics teachers' own beliefs about Creativity (n=20)

Belief	Rating (%)				
	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Builds confidence in the learners to become divergent thinkers	25.0	60.0	15.0	0.0	0.0
Provide learners an opportunity to exercise creative thinking	40.0	60.0	0.0	0.0	0.0
Makes Physics teachers to be more creative and resourceful	20.0	20.0	35.0	25.0	0.0
Promote positive competition among learners	15.0	45.0	15.0	20.0	5.0
Make learners develop interest in Physics and not view it as a difficult subject	50.0	20.0	25.0	0.0	5.0
Prepare learners to be innovators	20.0	60.0	10.0	10.0	0.0
Prepare learners to be functional at personal and societal level	20.0	50.0	25.0	0.0	5.0

Table 5 shows results on how Physics teachers planned for Creativity in their classes through lesson planning on wave motion.

Table 5: Physics teachers planning for Creativity through lesson planning (n=20)

Criteria	Score (%)				
	Excellent	Very good	Good	Fair	Poor
Learning outcomes	10.0	60.0	25.0	5.0	0.0
Teaching methods	0.0	0.0	70.0	30.0	0.0
Questions	0.0	0.0	45.0	55.0	0.0
Hands on activities	0.0	0.0	10.0	75.0	15.0
Technology	0.0	0.0	20.0	25.0	55.0
Assessment	0.0	0.0	15.0	85.0	0.0

Table 6 shows results from lesson observations on how Physics teachers were fostering Creativity in their classes on wave motion.

Table 6: Physics teachers fostering of Creativity in their classes (n=20)

Criteria	Score (%)				
	Excellent	Very good	Good	Fair	Poor
Teaching methods	0.0	0.0	45.0	30.0	25.0
Questions	0.0	0.0	25.0	30.0	45.0
Hands on activities	0.0	0.0	0.0	50.0	50.0
Collaboration of learners	25.0	15.0	45.0	25.0	15.0
Content	25.0	55.0	20.0	0.0	0.0
Technology	0.0	0.0	0.0	20.0	80.0
Assessment	0.0	0.0	25.0	0.0	75.0

5. Discussion

5.1 Physics teachers understanding of Creativity

Section 2 of CPQPT was used to collect data of Physics teachers' understanding of Creativity. This section comprised eight statements of understanding of Creativity as shown in **table 1**. Teachers indicated whether they strongly agreed, agreed, were undecided, disagreed or strongly disagreed with the statements.

The largest percentage of Physics teachers (65%) **agreed** that Creativity means discovering new ideas and interpreting or viewing problems in a new way. This implies that the majority of the Physics teachers understood Creativity as discovering new ideas as well as interpreting or viewing problems in a new way.

Expressing ideas in a new way emerged as another understanding of Creativity by the Physics teachers as 50% **strongly agreed.** Physics teachers can promote this by allowing learners to express themselves freely during lessons.

The Physics teachers also **agreed** that thinking outside the box (45%), use of imagination or original ideas to create something new (35%), exploring many answers or solutions to a question or problem (45%) and combining different ideas (50%) as their understanding of Creativity.

Despite producing novel work being important in Physics education, 50% of the Physics teachers were **undecided** on this as their understanding of Creativity. This simply means that it is very difficult for them to give learners work that promote novelty as themselves do not subscribe to that.

Table 2, section 2 of the CPQPT, shows the themes that were developed on the open ended question; "state your own understanding of Creativity?" Coming up with new ideas had a frequency of 9 which represents 45%, thinking in a new way had 7 scores which represents 35% while 4, which represents 20%, did not answer this question. Discovering and coming up with new ideas were understood by many teachers as Creativity.

Results from **tables 1 and 2** indicate that Physics teachers had a clear understanding of Creativity. However, despite this understanding, Physics teachers did not adequately incorporate Creativity in their lessons. Stehle and Peters - Burton (2019) share the same concern in their work.

5.2 Factors perceived important in developing Creativity in the learners by Physics teachers

Section 3 of the CPQPT was used to collect data on factors perceived as important in developing Creativity. This section comprised nine factors perceived as important in developing creativity as shown in **table 3**. Teachers indicated whether they strongly agreed, agreed, were undecided, disagreed or strongly disagreed with the statements.

Forty percent of Physics teachers **agreed** to the use of teaching methods that support Creativity as an important factor in developing the Creativity of learners during Physics lessons. Twenty - five percent were **undecided.** The largest percentage of teachers felt that teaching methods that support Creativity were vital in developing creative thinking in the learners. Methods such as discovery learning, problem based learning, project based learning among others were identified. The findings agree with Fryer (1991) who examined British teachers' perceptions of Creativity, with regard to factors believed to help and hinder the Creativity of children. Teaching methods came out prominently as one of the major factors regarded as important in developing Creativity in the learners during lessons.

Eighty percent of the Physics teachers **agreed** that access to ICT facilities such as computers and internet and asking learners thought - provoking questions during Physics lessons were important factors in developing Creativity. Despite being aware of these factors, this did not come out during the planned and observed lessons on wave motion as shown in **table 5** and **6** respectively.

Physics projects given to learners to foster Creativity was also considered crucial in developing the Creativity of learners as 70% of Physics teachers **strongly agreed**. Although this sounds good, there is no evidence of practical engagement with project based learning happening and this trend was observed and existed even before COVID - 19 triggered school closures and reduced contact between teachers and learners.

Seventy - five percent of Physics teachers **agreed** that access to Physics journals and materials showing past and latest discoveries and inventions was another factor important in developing the Creativity of learners. The need to have access to such learning materials as revealed in the study cannot be over looked because learners are exposed to latest discoveries and inventions in Physics. Exposing learners to materials of this nature can equally motivate learners to be creative and have new perspectives of Physics that are not only about facts and content but also Creativity.

Independent search for answers and solutions to problems or questions by learners was another factor where 45% of Physics teachers **strongly agreed** that it can promote the creative thinking of learners. What should be encouraged is to allow learners to work independently with minimal supervision and interference from Physics teachers during the learning process.

Regarding engaging learners in debate on different topics during Physics classes**,** 45% of the Physics teachers were **undecided** whether this was an important factor in developing Creativity or not. This was the highest percentage rating on this factor. This suggests uncertainty and possible unpreparedness for Physics teachers to fully engage learners in debate on wave motion during the lessons. Debate does not only improve communication skills of the learners, which are one of the vital 21st century skills, but also collaboration. Debate compels learners to do research which in turn enables them to discover new information with regards to the topic under study. Although the teachers were undecided on this factor, its importance in developing Creativity cannot be ignored.

Fifty - five percent of the Physics teachers **agreed** that having involved and supportive families that support creative work of their children can develop creative thinking in the learners. This is supported by Fryer (1991) who says that the factor of family can help and hinder Creativity of the children.

5.3 Physics teachers own beliefs about Creativity

Section 4 of CPQPT was used to collect data on Physics teachers' own beliefs about Creativity. This section comprised seven beliefs as shown in **table 4**. Teachers indicated whether they strongly agreed, agreed, were undecided, disagreed or strongly disagreed with the statements.

Sixty percent of the Physics teachers **agreed** that Creativity builds the confidence of learners to become divergent thinkers. According to Bisschoff (2013), Creativity requires divergent thinking as well because it enables learners to generate many unique ideas.

Sixty percent of the Physics teachers **agreed** and 40% **strongly agreed** to the belief that Creativity provides learners an opportunity to exercise creative thinking. This implies that the majority of the teachers believed creative thinking can be promoted in the learners if they were given an opportunity to do so.

Fifty percent of the teachers **strongly agreed** that Creativity makes learners develop interest in Physics and not view it as a difficult subject. Fink (2003) argued that if the learners develop interest in what they are learning, they care and inquire more about it. Inquiry based learning promotes Creativity and when learners develop interest in Physics, they inquire more about concepts taught.

Furthermore, 50% of the Physics teachers **agreed** that Creativity prepares learners to be functional at personal and societal level. According to Sternberg and Lubart (1999), at personal level, Creativity is part of a problem - solving process used to address challenges of daily life. At a more global level, it benefits humanity by catalysing many scientific breakthroughs. Additionally, Guray and Kubat (2018) emphasise creative thinking as one of the most important skills that students need to acquire to ensure future career successes.

5.4 Physics teachers planning for Creativity through lesson planning.

The rubric CRPLP based on six criteria as shown in **table 5** was used to collect data on how Physics teachers planned for Creativity in their classes through lesson planning on wave motion. The lesson plans were analysed and scored to indicate whether they were excellent, very good, good, fair or poor.

Regarding planning for learning outcomes, 60% of the teachers planned for **very good** learning outcomes while 20% planned for **good** learning outcomes. These findings clearly indicate that teachers had no problems in planning for learning outcomes that promoted Creativity during Physics lessons on wave motion. There was evidence of creative learning outcomes that were observable and measurable. However, the problem was with implementation as shown in **table 6**. For example, one of the analysed lesson plans on wave motion on the lesson topic *laws of reflection* had the following learning outcomes (i) define reflection (ii) state the types of reflection (iii) verify the laws of reflection. According to the lesson plan, learners in groups of five members were supposed to conduct a practical activity to verify the laws of reflection but that did not happen during the lesson as learners were just engaged in a discussion.

Seventy percent of the Physics teachers had planned for **good** teaching methods that could foster Creativity in the learners during the lessons on wave motion. The most common methods planned for were group work, discussion, question and answer and in some cases those that needed hands on activities. It was discovered that 75% of the hands - on activities planned were **fair**. This means that there was evidence of little creative activities despite limitations and lack of connection between the lesson and real world Physics on wave motion.

Questions planned for in the lesson plans were **fair** (75%). This implies that Physics teachers did not plan for either **very good** or **good** questions that promoted Creativity during the Physics lessons on wave motion. The questions in this case were lower level questions demanding for

explanations only. **Excellent** and **Very good** questions as highlighted in the rubric were supposed to be thought - provoking demanding for imagination, curiosity, why and how explanations. This, however, did not come out clearly in the lesson plans that were analysed by the researchers.

Technology had a **poor** percentage score of 55%. What this means is that there was little or no evidence of technology planned for by the Physics teachers in 55% of the lesson plans analysed on wave motion. Only 10% of the lesson plans had evidence of some technology such as videos and were rated **good.** Most forms of assessment planned by the Physics teachers on wave motion lessons only connected to learning outcomes to a limited degree and showed only one way to demonstrate creative thinking by the learners.

5.5 Physics teachers fostering of Creativity in their classes

An adjusted rubric CRPLO based on seven criteria as shown in **table 6** was used to observe lessons on how Physics teachers fostered Creativity in their classes on wave motion. The lessons were scored to indicate whether they were excellent, very good, good, fair or poor.

Teaching methods and collaboration were rated 45% (**good)** which means that 45% of the lessons observed on wave motion showed group members working together and the workload evenly divided among the members. Further, this entails that at least one person in the group was viewed as not doing his/her fair share of the work. In terms of teaching methods, most of the teachers did not foster the Creativity of learners as planned. Very few teaching methods of student inquiry, group work and question and answer were implemented during lesson observations. Lecture method, demonstration and discussion methods were common in the lessons observed and did not show Creativity.

Fifty percent of the hands on activities observed during the lessons were **poor** as there was no evidence of creative activities in many instances. The questions asked during the lessons were equally 45% (**poor).** This was the highest percentage rating on this item. There was no evidence of thought - provoking questions demanding imagination and curiosity of learners during the lessons.

On the other hand, 55% of the Physics teachers observed during the lessons exhibited **very good** content knowledge of wave motion. There were minimal and very few factual errors as well as misconceptions from the teachers on this topic.

Eighty percent of the lessons observed in terms of technology were rated **poor.** This was the case because there was no evidence of the use of technology planned during the lessons.

Assessment was not connected to learning outcomes and did not show how to demonstrate creative thinking by learners in the lessons that were observed on wave motion in many instances. A score of 75% (**fair)** was recorded. This implies that most assessment forms that were given to the learners did not demonstrate at least one way of creative thinking by learners. For example, creating concept maps or coming up with role plays, debate, projects, and theorising among others were not demonstrated.

The findings revealed that most of what Physics teachers planned for in terms of teaching methods, questions, hands on activities, technology, and assessment were not implemented accordingly as highlighted in the lesson plans that were analysed.

6. Conclusion and Implications

6.1 Conclusion

The purpose of this study was to examine perceptions of Physics teachers towards Creativity in teaching and learning of wave motion at secondary school level. Generally, Physics teachers appear to have a comprehensive understanding or meaning of Creativity. This study established that teachers understood Creativity as discovering new ideas, thinking outside the box, interpreting or viewing problems in a new way, expressing ideas in a new way and use of imagination or original ideas to create something new and combining different ideas.

The Physics teachers in the study identified a number of factors perceived as important in developing the Creativity of learners during Physics lessons. Access to Information Communication Technology (ICT) facilities such as computers and internet and asking learners thought - provoking questions during Physics lessons emerged as the most important factors in developing the Creativity of learners. Physics projects being given to learners to foster Creativity, use of teaching methods that support Creativity and engaging learners in Physics debate on different topics during Physics classes were established as other main factors important in developing Creativity in the learners.

The Physics teachers agreed that there is need for confidence building and opportunity for creative work. Other factors considered important in developing and enhancing Creativity by teachers were access to Physics journals/materials showing past and latest discoveries and inventions and having involved and supportive families that support creative work of the learners. Most teachers were undecided whether engaging learners in Physics debate on different topics during Physics classes were an important factor in developing Creativity or not. This puts in jeopardy the Physics curriculum outcome of developing creative abilities and achieving the goal of industrialisation in line with vision 2030.

Physics teachers' own beliefs about Creativity show that building the confidence of learners to become divergent thinkers and providing learners an opportunity to exercise creative thinking were the most prominent beliefs held by the teachers. Preparing learners to be innovators and functional at personal and societal level was the second most scored belief.

The study also revealed that Physics teachers had no problems in planning for Creativity on wave motion lessons, but the major setback was implementation which made the fostering aspect almost impossible.

6.2 Implications

The results of this study have important implications for enhancing Creativity in Physics. Creativity in learners is a learning outcome at risk and needs urgent attention by Physics teachers in Mansa district. Physics teachers need to be sensitised on the major competencies of education as outlined in the 2013 Zambia Education Curriculum Framework, specifically the Creativity competence, which is one of the non - examined curriculum values. Efforts to promote Creativity should focus more on essential strategies and skills for enhancing creative thinking. Stakeholders at district and school level such as head teachers should give their overwhelming support for Creativity in education. This can be implemented through components of in - service training programmes such as SBCPD geared towards upgrading of professional skills in the teaching and assessment of Creativity in Physics.

Lack of commitment by Physics teachers to foster Creativity in practice as shown in the lesson plans deserves adequate attention. This calls for close supervision and monitoring by heads of natural science departments, school head teachers and standard officers from District Education Board Secretary (DEBS) office.

Devising suitable methods of providing essential materials needed for creative work, in a cost effective way, should be discussed during School Based Continuing Professional Development (SBCPD) meetings at departmental and school levels. It is worth noting there are four stages of Creativity according to Wallas (1926) which are preparation, incubation, illumination and verification. Preliminary investigations may involve small - scale experiments during SBCPD meetings with predominantly local and improvised materials to gauge the potential for success when implemented in Physics classes.

References

[1] Adobe, (2013). *How Educators are Handling the Creativity Challenge*, Adobe, retrieved from http: //www.adobe. com/sea/special/creativity - report

[2] Arsad, *et al. (*2010). *The Relationship of 21st Century Skills on Students' Attitude and Perception towards Physics:* International Conference on Learner Diversity. Procedia Social and Behavioural Sciences *7* (C) 546–554

[3] Babbie, E. (1990). *Survey Research Methods (2nd - Ed).* Belmont, CA: Wadsworth.

[4] Bisschoff, *et al.* (2013). Theoretical Model to Measure Creativity at a University, *Journal of Social Sciences, No.34*, 47 - 59.

[5] Blom, A. *et al. (*2017). *Job - Ready Graduates of Secondary Education in Botswana, Lesotho and Zambia*: Reforming Instruction, Curriculum, Assessment, and Structure to Teach Vocational and 21st - Century Skills.

[6] Fink, L. D. (2003). *Creating Significant Learning Experiences*, Jossey – Bass, A wiley Imprint, USA. De Bono, E. (1970). *Lateral Thinking: Creativity Step by Step*. New York: Harper & Row. Delors, J., Learning: *The Treasure within Report to UNESCO of the International Commission on Education for the Twenty - first Century*, UNESCO, Paris 1996.

[7] Fryer, D. (1991). Qualitative Methods in Occupational Psychology: Reflections upon why they are so useful but so little used. *The Occupational Psychologist*, *14*, 3 - 6.

[8] Gale, J. (2001). *Encyclopedia of Childhood and Adolescence*, April, 06, 2001, /1998, Gale Research.

[9] Goff, K. and Torrance, P. E. (1990). Fostering Academic Creativity in Gifted Students, in *ERIC EC Digest* No 484 (ED 321489). Retrieved from http://ericec.org/digests/e484.htm

[10] Gorny, E. (2007). Creative Person. In *Dictionary of Creativity: Terms, Concepts, Theories & Findings in Creativity Research*. Netslova. ru. http://creativity.netslova.ru/Creative_person.html

[11] Guilford, J. P. (1950). Creativity. *American Psychologist*, 5, 444–454.

[12] Guray, E. & Kubat, U. (2018). To STEM or not to STEM? That is not the Question. *Cypriot Journal of Educational Science*, *13*, (3), 388 - 399.

[13] Hussain, T. (2011). *Research Methodology*. Pinnacle Technology. pp.25 - 29.

[14] Indoshi *et al* (2011). Perceptions of Physics Students and Teachers towards Creativity. *International Journal of Current Research*, *33*, (6), 234 - 240.

[15] Kumar, R. (2010). *Research Methodology: A Step - by - Step Guide for Beginners*. SAGE. pp.148 - 159.

[16] Partnership for 21st Century Skills. (2009). P21 framework definitions. Retrieved from http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf.

[17] Starko, A. J. (2013). *Creativity in the Classroom Schools of Curious Delight*. New York: Routledge.

[18] Stehle, M. S. and Peters - Burton, E. E, (2019). Developing Student 21st Century Skills in Selected Exemplary Inclusive STEM High Schools. *International Journal of STEM Education* 6: 39

[19] Sternberg, R. J., & Lubart, T. I. (1999). The concept of creativity: Prospects and Paradigms. In R. J. Sternberg (Ed.), *Handbook of Creativity (*pp.3 - 15). Cambridge: Cambridge University Press.

[20] Torrance, E. P. (1979). *The Search for Satori and Creativity*. New York: Creative Education Foundation.

[21] Wallas, G. (1926). *The Art of Thought*. New York. Harcourt, Brace & Company.

[22] Zambia Education Curriculum Framework (2013). *Guidance to enable Teachers to make best use of the Zambia Education Curriculum Framework.*

Author Profile

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