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Analysis of the Achievement of Secondary School Students of Mizoram in Science Theory and Practical

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Abstract

The purpose of the study was to analyse Mizoram Class X students' performance in science. The HSLC results of Mizoram Board of School Education for the past five years in science subject were examined using a descriptive study. A detail record of marks of the previous five years were collected from MBSE. The sample of the study consists of 92386 students who appeared for the HSLC examination during the last five years (2019–2023). An analysis of the results from the previous five years revealed that theory and practical marks have a 0.54 correlation co-efficient, which is a moderately positive association. The fact that those who perform better on the practical also perform better on the scientific theory could be observed. Additionally, it was shown that there have been no appreciable changes in the average science theory grade during the past five years. The records from the previous five years, however, show a gradual increase in the practical marks.

Keywords: Achievement, Secondary school, Student, Theory, Practical.

INTRODUCTION:

Education has become essential for everyone's survival in today's society since it is the only weapon that allows people to learn and obtain information. Everyone wants to have a good education in today's world. It is something that must be instilled in the right way from the beginning. A good education offers us a better perspective on life and a better grasp of what is going on around us.

Science is a broad field of study that investigates the structure and behaviour of the physical and natural world via observation and experimentation. The following three fields of science education are the most common; Biology, chemistry, and physics. Science education refers to the teaching and learning of science to school children, college students, and general public adults. Science education encompasses research in science content, science process (the scientific method), social science, and instructional methodology. Students' understanding of science is expected to develop throughout their schooling and beyond, according to scientific education standards. Physical, life, earth, space, and human sciences are among the classical areas covered by the standards. While science education has a reputation for just teaching facts by rote, it has increasingly focused on teaching science concepts and resolving misconceptions that students may have about science concepts or other subject in recent years. Constructivist philosophy has had a considerable influence on science teaching since the 1980s. Constructivism in science education is based on a large body of study regarding student science thinking

and learning, with a special focus on how teachers may help students transition to canonical scientific thinking. Constructivism emphasises the learner's active role, the importance of present knowledge and understanding in mediating learning, and the value of instruction that gives learners with the best possible direction. Research on scientific teaching and learning has become increasingly influential in science education practise. Science education research employs a diverse set of approaches drawn from a variety of fields of science and engineering, including computer science, cognitive science, cognitive psychology, and anthropology. The goal of scientific education research is to describe or characterise what constitutes science learning and how it is accomplished.

India has a long and illustrious history in the fields of pure and applied sciences education. Science has always been a subject of study in India, dating back to the ancient times. Unfortunately, during the medieval period, most of the knowledge was lost. After independence, India's science education advanced dramatically. Following independence, the critical relevance of science for economic progress and social transformation became clear. The importance of science education cannot be overstated in the context of developing modern science and technology as a living and active force. In the realms of scientific research and technological innovation, science education is critical and vital.

Background of the study

Formal education in Mizoram started with the arrival of Christian missionaries. The Christian Missionaries introduced the Roman scripts in 1894 with a phonetic form of spelling. They started opening schools in few villages, such as Khawrihnim, Phulpui and Chhingchhip 1901. In 1903, three more schools were opened and seven more in the next year. In 1909, the first ever Middle Schools were opened in Aizawl and Serkawn respectively. In 1944, the first High School was started in Aizawl by public donations. The opening of High School marked a new epoch of event in the educational progress in the hilly area, now called Mizoram. (Directorate of School Education,n.d.)

The National Achievement Survey (2015) for Class X students in the subject of Science conducted by the National Council of Education Research and Training (NCERT) showed that average performance of students in the state of Mizoram was much lower than the national average. Again, a study report on 'Regional Plan and Status of Science Education in Schools in the North Eastern Region (NER)' by North Eastern Development Finance Corporation Ltd. (NEDFi) with Academic Inputs from Indian Institute of Technology Guwahati (IITG) and Support from Homi Bhabha Centre for Science Education, TIFR, Mumbai, October 2017 shows the state's level in comparison to neighbouring states. The average scores in Nagaland, Meghalaya, and Mizoram were lower than the regional norm.

The organisation of school education in Mizoram was reorganised in accordance with the expectations set forth in the National Policy on Education (NPE) 1986/1992 (Education Reforms Commission, 2010). The framework has been reorganised as follows - Primary (I-V), Upper Primary (VI-VIII), Secondary (IX-X) and Higher Secondary (XI-XII). Education Reforms Commission (2010) also recommended SCERT and MBSE to be re-examined in light of science advancements to guarantee that the process of science is prioritised over the outcome of science. Further, every school should be required to have a scientific laboratory and mathematics kits that are appropriate for the conceptual needs of different stages of schooling. This may necessitate reorienting the State's current courseware.

REVIEW OF RELATED LITERATURE

The following literature and past studies were reviewed:

The study conducted by Bradley (2005) explored the issues involved in the theoretical bases, rationale

and implementation of practical work in junior secondary science programs. The researcher has carried out a multi-stage field study using both qualitative and quantitative methods to achieve the objectives of the study. Science practicals are defined for the purposes of this study and a new Theoretical Model for Science Practicals is proposed. The model enables the description and statement of purpose of eight types of science practicals. The target population of the study is Australian science teachers and students. The model provides a theoretical basis for the development of the survey instrument, Science Practicals Inventory (SPI), to investigate students' perceptions of the use of practicals in science learning. The results of this study include implications for science curricula and recommendations for further research and are generalizable to science teachers and students in Australia.

Zohmingliani (2011) studied 'Status of science education in Mizoram: A critical study' and concluded that despite the government's efforts, science education continues to advance steadily. It is clear that the state has a long way to go in terms of science education growth and development. The state has no defined policy for science education until the last academic session included by the study. No effective monitoring system to check the practical work on science was laid down and a very low enrolment in science education from HSSLC was experienced. At the high school level, the student-to-teacher ratio was incredibly high. The nearly equal number of teachers and students at the college level, on the other hand, demonstrates how costly science education was for the state at the time the survey was done. The uneven distribution of theory and practical work from high school till college level was highly undesirable.

Banu (2011) studied the role of practical work in teaching and learning physics at secondary level in Bangladesh. The major findings of the study include that teachers used mostly transmissive pedagogy to assist students to understand physics concepts and theories. Teachers and students in non-government schools faced comparatively more difficulties than those in government schools. Low teacher/student ratios and no positions for laboratory assistants were reasons given for teachers‟ intense workloads. This study implies a need to provide government and non-government schools with necessary equipment for doing practical work; to appoint sufficient teachers with higher studies and training that includes practical work in physics; to create positions for laboratory assistants; to set up classrooms with a smaller number of students; and to develop awareness of the value of practical work among school administration and among physics teachers..

Abrahams I et. al. (2013) wrote a paper on 'The assessment of practical work in school science'. The article reviews how practical work, including practical skills, is currently assessed summatively in school science. Whilst practical skills in school science are clearly valued as being of importance, there is a lack of clarity as to what these skills actually are and how they might, most effectively, be validly assessed. Countries vary greatly in the extent to which they employ what we term 'Direct Assessment of Practical Skills' (DAPS) or 'Indirect Assessment of Practical Skills' (IAPS). Each of these approaches has advantages and disadvantages but it can be concluded that too great a reliance on IAPS reduces the likelihood that practical work will be taught and learnt as well as it might be.

NAS, 2015 was conducted by NCERT for Class X students (same batch of the present study) reported that average performance of students in the state i.e. Mizoram was significantly lower than the national average in Science subject. Average performance of students from rural areas in the state does not differ significantly from those in urban areas in Science subjects. Average performance of girls in the state does not differ significantly from that of boys in Science subjects. Thus, there is need for improvement of 64.8 % in Science subject. There are no students who score 75 % and more in Science subject.

The study on the influence of practical work in the laboratory on the academic performance of secondary school students in physics in idemili south Local Govt. area was conducted by Okafor in 2016. A descriptive survey design was utilized and questionnaire consisting of 13 items was employed based on the structured research questions, using simple percentage analysis technique. Finding from the study revealed that physics laboratories in Idemili South Local Government Area (IDSLGA) in Anambra Secondary Schools are inadequate and ill - equipped. Based on the findings, it was recommended that the government should make provision for science laboratories and ensure regular training of physics teachers. Also physics teachers should expose physics students to constant practical work to enhance their understanding and performance.

Shana and Enas (2019) investigated the impact of science practical work on students' science achievement. The purpose of this quasi-experimental study is to evaluate the overall effect of practical work on students' academic attainment in science. Participants were selected from tenth grade students (chemistry and biology) and eleventh grade students (chemistry), then divided into groups. The control groups were taught using traditional methods of teaching science, while the same content was given to the experimental groups using intensive practical work. Pre and post-tests were given to all groups. The mean score comparison revealed a significant difference in the attainment scores of the experimental over the control groups. It is thus recommended that students be given ample opportunity to be engaged in practical lessons in secondary schools. This entails that the administration of schools supplies their labs with all equipment needed for practical work to be effectively implemented

Ferreira and Morais (2020) conducted a study on Practical Work in Science Education: Study of Different Contexts of Pedagogic Practice. The study investigates differentiated teaching practices of practical work in distinct social contexts and with different experienced teachers, at the level of the Portuguese high school science education. Four teaching practices were analysed in terms of the level of complexity of both scientific knowledge and cognitive skills and in terms of their structural and interactional characteristics. The results showed that the social context of the school together with teachers' academic qualification and professional development seem to influence science teachers' practices in practical work contexts. Schools placed in the lower levels of national external assessment and also whose students came from social sectors with fewer resources, showed to have teachers' practices characterised by lower levels of complexity of both scientific knowledge and cognitive skills, a valuing of the horizontal discourse and implicit evaluation criteria.

RATIONALE OF THE STUDY

The importance of science practical in learning science cannot be overstated. It is believed that science practical engages students in the development of their abilities, capabilities, creating awareness to the scientific knowledge and may provide understanding of scientific topics. Hands-on learning may facilitate and enhance the aptitude and understanding level of students in science subject. It is generally accepted that practical is at the heart of science education. Without actual practice, learning science is akin to learning literature without reading books. The education system today is more inclined towards examination-oriented and even practical examination is conducted not in line with the objectives set forth in the practical syllabus and sometimes may not serve the main purpose or objectives. As per the objectives of science practical laid down by Mizoram Board of School Education (MBSE) at secondary level, the practical activities try to engage the students in exploratory and hands-on activities that lead to the development of basic cognitive and psychomotor skills through language, observation, recording,

differentiation, classification, inference, drawing, illustrations, design and fabrication, estimation and measurement (High School Curriculum, 2009). Practical examination as conducted by MBSE may or may not be in compliance with the prescribed syllabus and this makes the present study extremely relevant to be taken up as a research topic.

Practical work is fundamental in science teaching and learning. Despite the fact that a good number of research have looked into the definitions, typologies, and aims of practical work, only few have an in-depth study about the theoretical and practical aspects of science subject at secondary level in Mizoram. Therefore, the study concerning towards the correlation between the achievement of secondary school students in theory and practical of science subject is extremely necessary.

OBJECTIVES OF THE STUDY

Keeping in view the concerns and issues related to the linkages of Theory and Practical in secondary school science, the following are the objectives of the study

1. To find out the correlation between achievement of secondary school students in science theory and science practical.
2. To compare the last five year result of HSLC under Mizoram Board of School Education

OPERATIONAL DEFINITION OF THE TERMS USED:

Linkage: For the present study, linkage means connectedness and or interconnectedness of theory and practicum of science subject under Mizoram Board of School Education

Science theory: The content of the science textbook mandated by the MBSE for secondary level school science is referred to as science theory in this study.

Science practical: The activities in school which concerns with practical experience and observation rather than theory in science subject.

Secondary school: In the present study, secondary school means the schools which runs standard 9^{th} and 10^{th} level under Mizoram Board of School Education.

METHODOLOGY AND PROCEDURES

Method of study

The study is descriptive in nature and survey method is employed as the method of study.

Sample of the study

The sample of the study includes all the HSLC candidates during the last five years (2019-2023) comprising of 92386 students.

Mode of data collection

Secondary data were collected where the investigator personally visited Mizoram Board of School Education and took permission from the concerned authorities. For analysis of HSLC result, records of five years mark in science subject from statistical cell of MBSE were collected.

Data analysis

Data collected were analysed using Pearson product moment method to find out the correlation between Theory and Practical marks

ANALYSIS AND RESULTS OF THE STUDY

Objective No. 1 : Correlation between achievement of secondary school students in science theory and science practical.

The correlation between achievement of secondary school students in science theory and science practical is analysed by using Pearson product moment correlation.

Table 1. Correlation between Theory and Practical achievement in science subjects

Parameters	N	Mean	Co-efficient of Correlation
Theory	92386	28.17	0.543
Practical		7.87	

The correlation coefficient between theory and practical marks was found to be 0.543, indicating a moderately positive correlation, according to Table No. 1. The result suggests that there is a connection between scientific theory and application. Students who did better in the practical also perform better in the theory.

Objective No. 2 : Comparison of last five year result of HSLC under Mizoram Board of School Education

The year wise analysis of theory and practical mark in science were done by calculating the average marks for each academic year with the pass percentage in science subject. The correlation between theory and practical marks for each year was also calculated using Pearson Product Moment Correlation.

Table 2: Analysis of five years HSLC result of MBSE in science subject

Year		Theory marks	Practical marks	Co- efficient of correlation between Theory & Practical
2019	Average mark	28.06	7.61	0.544
	Pass %	75.35%		
2020	Average mark	25.21	7.77	0.53
	Pass %	71.11%		
2021	Average mark	31.06	7.96	0.58
	Pass %	85.56%		
2022	Average mark	29.54	7.87	0.56
	Pass %	75.93%		
2023	Average mark	26.99	8.12	0.517
	Pass %	73%		

From table No 2, it was shown that the average marks of science theory in 2019 is 28.06, 25.21 in 2020, 31.06 in 2021, 29.54 in 2022 and 26.99 in 2023. The highest average marks of 31.06 was seen in 2021 and lowest marks of 25.21 in 2020. It can be concluded that there have been no appreciable changes in the average science theory marks during the past five years. The records of marks in practical from the previous five years, however, showed a gradual increase with the lowest of 7.61 in 2019 and highest of

8.12 in 2023. Additionally it was found that pass percentage was highest in the year 2021 (85.56%) where the highest average mark was seen and the lowest pass percentage (71.11) was seen in the year 2020.

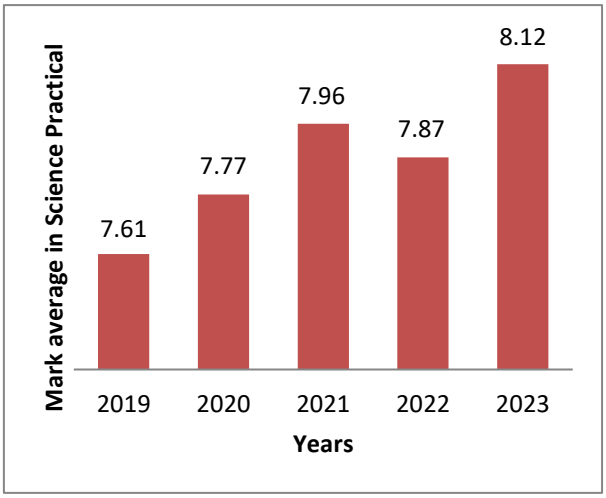

Fig: Five years average marks of theory

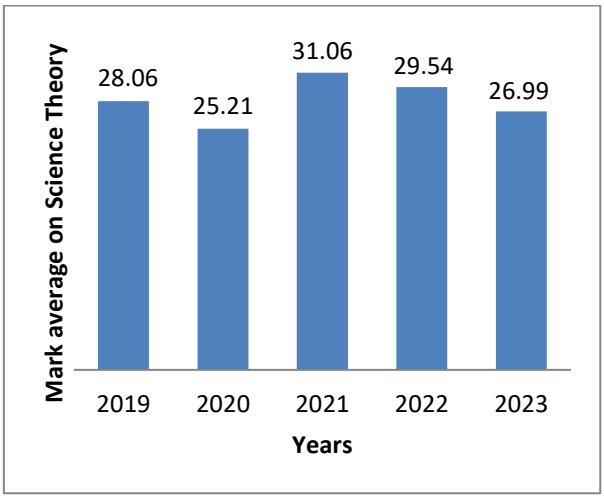

Fig: Five years average marks of practical

Discussion:

The present study has great importance in the context of education and academic assessment. It implies that there exists a visible and favorable relationship between the comprehension of scientific theory and its practical application among students. This insight has several implications. Firstly, educators and educational institutions can use this information to refine their teaching methods and curricula, emphasizing the integration of theory and practical application. Additionally, it highlights the importance of a well-rounded education that not only imparts theoretical knowledge but also encourages hands-on experience and practical skills. Moreover, this correlation underscores the need for assessments that take both theory and practice into account, ensuring a comprehensive evaluation of a student's grasp of a subject.

The overall observation with regards to comparison of five years result indicates that there have been no significant changes in the average science theory marks over these five years. This stability in average scores might suggest that the educational system has maintained a relatively

consistent standard in teaching and assessing theoretical knowledge in science. Conversely, the practical marks have displayed a gradual and consistent increase over the same time frame. This progressive improvement in practical marks could be attributed to various factors, such as enhanced teaching methods, updated laboratory equipment, or greater emphasis on hands-on learning experiences.

Notably, the pass percentage is closely related to the average marks, with 2021 displaying the highest pass rate of 85.56% coinciding with the year of the highest average marks. Conversely, 2020 saw the lowest pass rate of 71.11%, corresponding with the lowest average marks in science theory. This correlation underscores the importance of maintaining a balanced and effective educational approach that ensures not only higher average marks but also a greater number of students successfully passing their assessments. Overall, these findings provide a comprehensive view of the academic performance in science theory and practical components over the past five years.

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