J. Myanmar Acad. Arts Sci. 2023 **Vol. XXI. No.6**

PROCESS SKILLS IN LEARNING PHYSICS THROUGH THE USE OF CONTEXTUALIZED INSTRUCTION*

Su Mon Aung[1] and Thida Wai[2]

Abstract

The main purpose of this study is to investigate how utilizing contextualized instruction could enhance science process skills acquisition in learning physics. The research design adopted was one of the quasi-experimental designs, nonequivalent control group design. The research instruments were pretest, posttest, materials including unit plans, lesson plans and contextualized workbook, questionnaires. By using the simple random sampling method, four basic education high schools from Yangon Region were selected. Data were analyzed by using analysis of covariance, Pearson's product moment correlation and multiple regression analysis. The findings of physics achievement on science process skills showed that experimental groups who received the contextualized instruction were significantly higher than the control groups who did not. There was a strong relationship between students' physics achievement on science process skills and their attitudes towards contextualized instruction. The stronger the students' attitudes towards contextualized instruction were established, the higher the physics achievement on science process skills. The predicting factors for physics achievement on science process skills were basic process skills, interpersonal skills and integrated process skills. Therefore, the research findings proved that the use of contextualized instruction had a positive impact on the acquisition of science process skills in high school physics teaching and learning.

Keywords: Science Process Skills, Physics, Contextualized Instruction, Acquisition, Instructional Design

Introduction

In the 21st century, scientific literacy has become a major aim of science education. The goal of all science education is to develop scientifically literate and personally concerned citizens who are able to think and act rationally. Scientific literacy is the capacity to use scientific knowledge, to identify questions and to draw evidence-based calculations in order to understand and help make decisions about the natural world and the changes made to it through human activity (The Organization for Economic Co-operation and Development [OECD], 2003). If the students cannot interpret the physical, chemical or biological actions happened in their environment, it means science education could not reach one of the most important goals which is 'science for all'. To become scientifically literate, four dimensions of science, namely, conceptual knowledge of science, science process, application of science and nature of science, must be understood by the students. These dimensions are involved in understanding science. Gallaugher (2007) stated that understanding cannot be transmitted from the teacher to the students. Students must construct their own understanding from experience. Therefore, learning with understanding requires that students make sense of ideas and experiences and connect them with other, related ideas and experiences that form students' prior knowledge. To apply knowledge also requires that students see the connection between the knowledge and its application. Therefore, this study attempts to successfully implement contextualized instruction which aims to enhance the acquisition of students' science process skills in learning physics.

---

* Best Paper Award Winning Paper in Curriculum and Methodology (2022)

[1] Department of Curriculum and Methodology, Yangon University of Education
[2] Department of Curriculum and Methodology, Sagaing University of Education

Purposes of the Study

The main purpose of this study is to investigate how utilizing contextualized instruction could enhance science process skills acquisition in learning physics. The specific objectives are as follows.

1. To investigate the use of contextualized instruction that can enhance the acquisition of students' science process skills in learning high school physics.
2. To explore the attitudes of students concerned with contextualized instruction.
3. To make suggestions and recommendations based on the research results for the improvement of teaching and learning physics.

Research Questions

1. Are there any significant differences in acquisition of science process skills of the students who received contextualized instruction and those who did not?
2. Are there any significant relationships between students' physics achievement on science process skills and their attitudes towards contextualized instruction?
3. Do students' attitudes towards contextualized instruction predict physics achievement on science process skills?

Scope of the Research

1. This study is geographically restricted to Yangon Region.
2. Grade Ten physics students and teachers from the selected schools during the academic year 2019-2020 are participated in this study.
3. It is limited only four chapters from Grade Ten physics textbook prescribed by the Basic Education Curriculum, Syllabus and Textbook Committee, 2019.

Definitions of the Key Terms

The definitions of the key terms are presented as follows.

Science Process Skills: The term science process skills refer to a set of broadly transferable abilities appropriate to many science disciplines and reflective of the behaviour of scientists (Padilla, 1990).

Physics: Physics is defined as the scientific study of matter and energy and the relationships between them, including the study of forces, heat, light, sound, electricity and the structure of atoms (Hornby, 2015).

Contextualized Instruction: Contextualized instruction is a way to introduce content using a variety of active learning techniques designed to help students connect what they already know to what they are expected to learn, and to construct new knowledge from the analysis and synthesis of the learning process (Hudson & Whisler, 2007).

Acquisition: Acquisition is the learning or developing of a skill, habit or quality (Hornby, 2015).

Instructional Design: Instructional design is defined as the systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation (Smith & Ragan, 1990).

Statement of the Problem

It is rare that Myanmar students in schools or college comprehend the science content they have studied, and it is even rarer that they can apply the science they know effectively in contexts that are different from those in which it has been learned. Most have forgotten the facts that have been learned in schools, and they have not added to that knowledge in the interim. In other words, the knowledge of science that has been learned in school does not affect how students are able to interact with the world of daily experience. Although the students have a strong factual base in science, but they have not integrated that knowledge in a way that makes sense to them or enables them to use it effectively. According to Gallagher (2007), it is textbook knowledge but it lacks the synthesis required to achieve understanding and application.

However, educational achievement cannot truly be attained through traditions and practices such as rote-learning, teacher-centered approaches, and so on (Hallinger, 1998). All schools in Myanmar use the same curriculum. The syllabus for Grade Ten Physics focuses on Mechanics, Heat, Wave and Sound, Optics, Electricity and Magnetism. Analysis of the study content of physics in high school shows that syllabi are quite dense and overloaded with many topics. At the end of the lessons, the teachers can only give problems to solve and homework assignments. Therefore, the teachers do not have enough time to provide the students with the contextualized practical activities. As a result, the quality of physics teaching, in particular, its practical, experimental component, dramatically decreased. Methodology Department (2017) investigated how physics is taught in basic education high schools in Myanmar. According to the results from this investigation, physics teachers in Myanmar mostly used teacher-centered approach in their physics teaching. This is also highlighted that the quality of physics teaching become purely theoretical with almost no practical work involved.

Collette and Chiappetta (1989) stated that science instruction becomes more relevant to students when it is taught within the context of the everyday life along with which takes place in the science laboratory. Therefore, to provide meaningful learning for students, physics course content must include practical as well as theoretical ideas. For physics instruction, it is needed to focus on students' interests, common events, inventions and social problems. As a result, students could see the usefulness of physics and become more interested in science and technology. Over the years, students' achievements of physics in Myanmar secondary schools have been decreased. This is due to the fact that these students fail to see the inter-dependent relationship that exists between the academic contents of physics subjects offered in school and their applicability in real life. Consequently, there is low transfer of what is learned in the school to the real-world. This is the gap that this study is construed to fill. Therefore, this research emphasizes the experiencing contextualized activities for the students. On the other hand, deviating from the traditional mode of instruction, contextualized instruction highlights a change in the instructional pattern (Stuart & Henry, 2002, as cited in Panek, 2012). Contextualized instruction is student-centered and encourages student learning through observation, connection and authentic instead of factual memorization.

Review of Related Literature

Fundamental Factors of Contextualized Instruction: To gain success in applying contextualized instruction in learning physics, there are seven components of contextualized instruction that are useful (Wijarwadi, 2008). They are constructivism, inquiry, questioning, learning community, modeling, reflection and authentic assessments.

Constructivism: Constructivist theory rests on the assumption that knowledge is constructed by students as they attempt to make sense of their experiences (Driscoll, 2005). Therefore, learners are not empty vessels waiting to be filled, but rather active organisms seeking meaning.

Inquiry: Inquiry is a cycling process of observing, questioning, investigating, analyzing and concluding. It is the core component in contextualized instruction. In contextualized instruction, inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world.

Questioning: In contextualized instruction, questioning is seen as teacher's activity to motivate, provide, and assess thinking ability of students. The process of questioning in contextualized instruction can be created between teacher to the students, students to teacher and students to students.

Learning Community: Learning community can be used as a successful teaching strategy in which small groups, each with students with different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of the group is responsible for learning, but also for helping others learn.

Modeling: In contextualized instruction, both teacher and students are required to be the models at the classroom activities. Modeling can take the form of something that can be imitated by the students.

Reflection: In contextualized instruction, students and teacher review and respond the events, activities and experiences. Thus, both teacher and students are required to record what they have learnt, felt and appeared new ideas.

Authentic Assessment: Contextualized instruction is intended to build knowledge or skill in meaningful ways by engaging students in real life, or authentic context. Therefore, in contextualized instruction, authentic assessment is used to describe the real competence of students to subject matter. Authentic assessment aims at evaluating students' ability in real world context. It is a kind of effective assessment since it is not only done at the period, but it also integrated together with teaching and learning activities. The main factor of learning physics is that students learn through inquiry process so that they can study in good spirit and comfortable conditions. Students will learn from what they have done and get experience from it. In this way, students' conceptual understanding and science process skills can be developed.

Science Process Skills in Physics: The curriculum project, Science – A Process Approach (SAPA), has classified the science process skills into two types – Basic and Integrated. The basic (simpler) process skills provide a foundation for learning the integrated (more complex) skills. Basic process skills apply specifically to foundational cognitive functioning especially in the elementary grades. In addition, these skills also form the backbone of the more advanced problem-solving skills (Brotherton & Preece, 1995). Integrated process skills are immediate skills that are used in problem-solving. Integrated skills include skills such as identifying variables, constructing tables of data and graphs, describing relationships between variables, acquiring and processing data, analyzing investigations, constructing hypotheses, operationally defining variables, designing investigations and experimenting. The integrated processes are more appropriate for students at students four and above. Science process skills are cognitive and psychomotor skills employed in problem solving. Science process skills can be acquired and developed through science practical activities. Thus, both basic and integrated science process skills which are relevant and appropriate for high school physics are applied in this study.

Background Teaching Models: There are four background teaching models that supposed the proposed instructional design of contextualized instruction. They are Glaser's basic teaching model, Khin Zaw's multimodal model, Landa's algorithmic model and Roth's conceptual change instructional model. In this study, contextualized instruction is provided through the use of proposed instructional design. The following table shows the conceptual framework for this study.

Table 1 Conceptual Framework

Science Process Skills	Contextualized Instruction	Learning Procedure
Observing	Contextualization	1. Orientating Exchange of Knowledge
Measuring		2. Contextualizing Prior Knowledge
Classifying		3. Exposing Cognitive Conflict
Identifying Variables		
Formulating Hypotheses	De-Contextualization	4. Performing Cognitive Apprenticeship
Designing Investigations		
Interpreting Data		5. Experiencing Contextualized Activities
Inferring		
Graphing Skills	Re-Contextualization	6. Reconciling Contextualized Knowledge
Predicting		7. Applying Contextualized Knowledge
Communicating		8. Reflecting on Contextualized Knowledge

Figure 1. shows the instructional design for contextualized instruction.

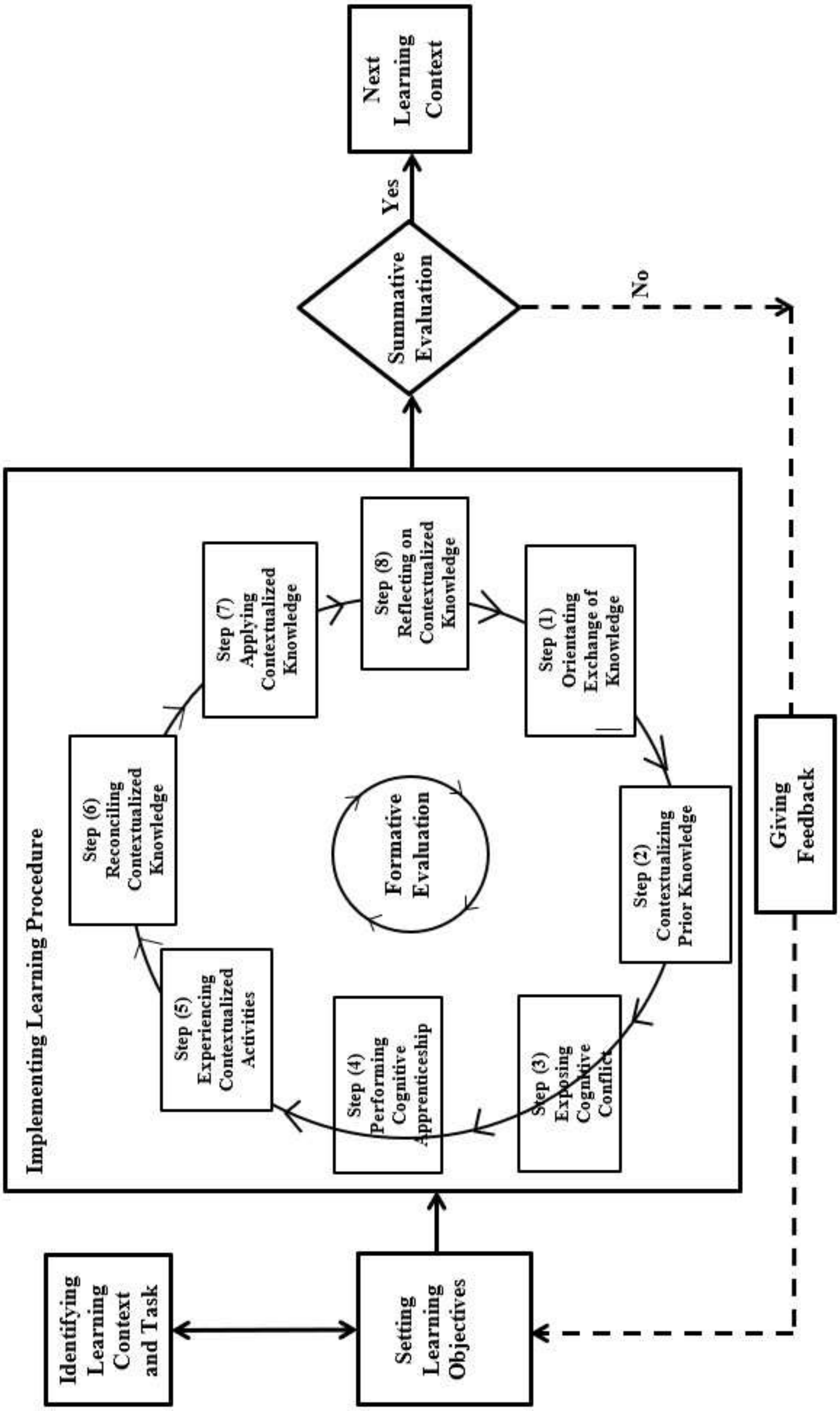

Figure 1 Instructional Design for Contextualized Instruction

Methods

Research Design. The research design used in this study was one of the quasi-experimental designs, nonequivalent control group design.

Population and Sample Size. The population and sample size of the study are depicted in Table 2.

Table 2 Population and Sample Size

Region	District	Township	Name of School	No. of Population	No. of Sample
Yangon	East	South Okkalapa	No. (1) Basic Education High School, South Okkalapa	205	105
	West	Hlaing	No. (1) Basic Education High School, Hlaing	172	101
	South	Dala	No. (1) Basic Education High School, Dala	310	115
	North	Mingaladon	No. (12) Basic Education High School (Branch), Mingaladon	100	100
Total				**787**	**421**

Instruments. The research instruments were pretest, materials including sample unit plans, lesson plans based on the instructional design for contextualized instruction, posttest and questionnaires.

Analysis of Data. The Statistical Package for the Social Sciences (SPSS) Version 22 was used to analyze the data. The data were analyzed by using one-way analysis of covariance, Pearson’s product moment correlation and multiple regression analysis.

Findings

Research Findings of Physics Achievement on Science Process Skills

In an attempt to answer the first research question, one-way ANCOVA was used to determine the significance of contextualized instruction between the experimental and control groups on the acquisition of science process skills. Based on the results of the pretest, the comparison of pretest mean scores on the science process skills in the four selected schools is displayed in Table 3.

Table 3 Results of Pretest Scores on Science Process Skills in Four Schools

School	Group	N	M	SD	MD	*F*	*p*
S1	Experimental	53	20.21	3.57	1.82	6.61	.012*
	Control	52	18.29	4.07			
S2	Experimental	50	19.48	3.86	−.56	.615	.435 (ns)
	Control	51	20.04	3.27			
S3	Experimental	57	19.46	3.78	.16	.047	.828 (ns)
	Control	58	19.29	4.23			
S4	Experimental	50	19.50	3.44	.18	.058	.810 (ns)
	Control	**50**	**19.32**	**4.01**			

Note. S1 = No. (1) Basic Education High School, South Okkalapa; S2 = No. (1) Basic Education High School, Hlaing; S3 = No. (1) Basic Education High School, Dala; S4 = No. (12) Basic Education High School (Branch), Mingaladon., ns = not significant. *$p < .05$.

The ANCOVA results from the Table 3 showed that no significant difference was found between the pretest mean scores of the experimental and control groups except in S1. Therefore, the students from the experimental and control groups could be assumed to have had approximately the same science process skills prior to the intervention. Based on the ANCOVA results of pretest scores on science process skills in four schools, the graphical illustration for the comparison of pretest mean scores on science process skills is presented in Figure 2.

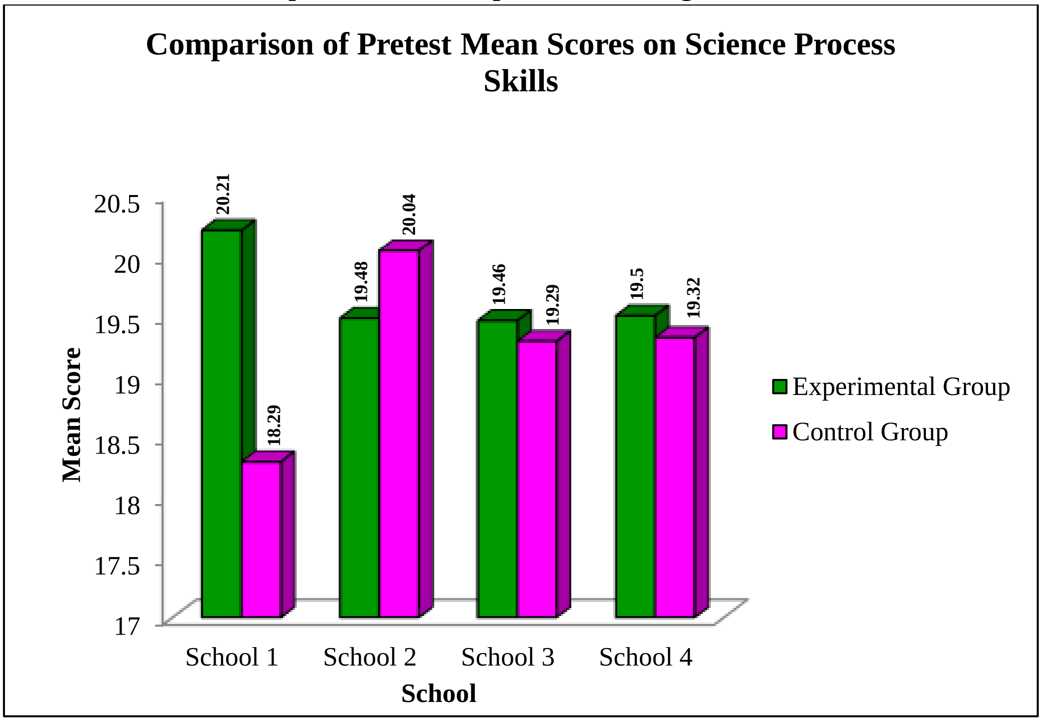

Figure 2 Comparison of Pretest Mean Scores on Science Process Skills in Four Schools

Quantitative Findings for the Posttest Scores on Science Process Skills

According to the quasi-experimental design, the two intact groups from each school were selected as the experimental group who received contextualized instruction and the control group who did not. Gay and Mill (2016) stated that for controlling variables, use of ANCOVA is basically equivalent to matching groups on the variable or variables to be controlled. Therefore, in this study, to analyze the data from posttest on science process skills, one-way ANCOVA was used.

The following table shows the analysis of covariance results for posttest scores on science process skills in four schools.

Table 4 Analysis of Covariance (ANCOVA) Results for Posttest Scores on Science Process Skills in Four Schools

School	Group	N	M	SD	MD	*F*	*p*
S1	Experimental	53	30.38	6.24	11.55	105.02	.000***
	Control	52	18.83	5.10			
S2	Experimental	50	35.50	6.27	7.17	31.05	.000***
	Control	51	28.33	6.47			
S3	Experimental	57	35.14	6.16	15.30	211.57	.000***
	Control	58	19.84	5.03			
S4	Experimental	50	30.16	3.85	7.12	52.11	.000***
	Control	50	23.04	5.77			

Note. S1 = No. (1) Basic Education High School, South Okkalapa; S2 = No. (1) Basic Education High School, Hlaing; S3 = No. (1) Basic Education High School, Dala; S4 = No. (12) Basic Education High School (Branch), Mingaladon, ****p* < .001.

When pretest scores on science process skills was considered as a covariate, it was found that there were significant differences between the experimental and control groups for the posttest scores on science process skills at (p = .001) level. Therefore, it can be interpreted that the use of contextualized instruction significantly enhanced the students' ability to conducting the physics experiment, handling of data, computation of results and reporting the physics experiment. Based on the one-way ANCOVA results of posttest scores on science process skills in the four schools, the graphical illustration for the comparison of posttest mean scores on science process skills in four schools is presented in Figure 3.

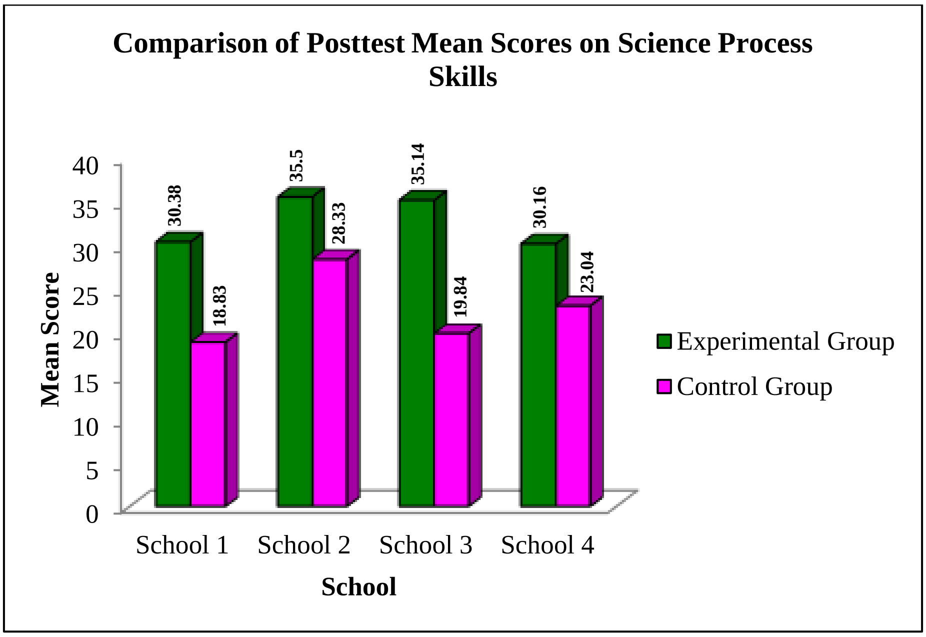

Figure 3 Comparison of Posttest Mean Scores on Science Process Skills in Four Schools

Relationship between Students' Physics Achievement on Science Process Skills and Students' Attitudes towards Contextualized Instruction: In an attempt to answer the second research question, Pearson product-moment correlation was used. The correlation between physics achievement on science process skills and three variables from students' attitudes towards contextualized instuction are shown in Table 5.

Table 5 Correlation between Physics Achievement on Science Process Skills and Students' Attitudes towards Contextualized Instruction

Variables	Physics Achievement on Science Process Skills	Basic Process Skills	Interpersonal Skills	Integrated Process Skills
Physics Achievement on Science Process Skills	1	.770**	.757**	.747**
Basic Process Skills		1	.754**	.754**
Interpersonal Skills			1	.750**
Integrated Process Skills				1

Note. ** Correlation is significant at the 0.01 level (2 – tailed).

From the Table 5, it can be seen that physics achievement on science process skills was significantly correlated with the students' attitudes towards contextualized instruction: basic process skills (r = .770**, $p < .01$), interpersonal skills (r = .757**, $p < .01$) and integrated process skills (r = .747**, $p < .01$). According to the strength of correlation stated by Gay, Mills and Airasian (2012), a strong statistically significant correlation was found between physics achievement on science process skills and the students' attitudes towards contextualized instruction. Therefore, it can be interpreted that students who possessed the interpersonal skills, basic process skills and integrated process skills through contextualized instruction tended to have the best physics achievement on science process skills.

Regression Analysis of Predictions of Students' Attitudes towards Contextualized Instruction for Physics Achievement on Science Process Skills: In an attempt to answer the third research question, multiple regression analysis was used to see what impact multiple variables have on an outcome. For the predictions, continuos predictor variables are basic process skills, interpersonal skills and integrated process skills towards contextualized instruction and a continuous criterion variable is physics achievement on science process skills. Table 6 shows the results of the regression findings for predictions of students' attitudes towards contextualized instruction for physics achievement on science process skills.

Table 6 Regression Analysis Summary for the Variables from Students' Attitudes towards Contextualized Instruction Predicting Physics Achievement on Science Process Skills

Variables	*B*	*β*	*t*	*R*	R^2	*Adj* R^2	*F*
Physics Achievement on Science Process Skills	8.371		2.650***	.830	.689	.684	152.128***
Predictor Variables							
Basic Process Skills	1.418	.348	5.299***				
Interpersonal Skills	1.274	.299	4.592***				
Integrated Process Skills	.808	.261	3.998***				

Note. Constant = Dependent variable: Physics Achievement on Science Process Skills, ***$p < .001$.

The summary table shows that the multiple correlation coefficient (*R*), using all the predictors simultaneously is .830 (R^2= .689) and the adjusted R^2 is .684. It means that 68.4% of the variance in physics achievement on science process skills can be predicted from basic process skills, interpersonal skills and integrated process skills towards contextualized instruction. In regression analysis summary, beta column (β) indicated that the best predictor was basic process skills (β = .348***, $p < .001$). Then, the second predictor was interpersonal skills (β = .299***, $p < .001$) and the last predictor was integrated process skills (β = .261***, $p < .05$).

Based on these regression findings, the regression equation can be defined as follows:

PA = 8.371+ .1.418 X1 + 1.274 X2 + .808 X3

Where: PA = Physics Achievement on Science Process Skills

X1 = Basic Process Skills

X2 = Interpersonal Skills

X3 = Integrated Process Skills

The multiple regression model for predicting students' attitudes towards contextualized instruction for physics achievement on science process skills obtained from applying regression analysis was shown in Figure 4.

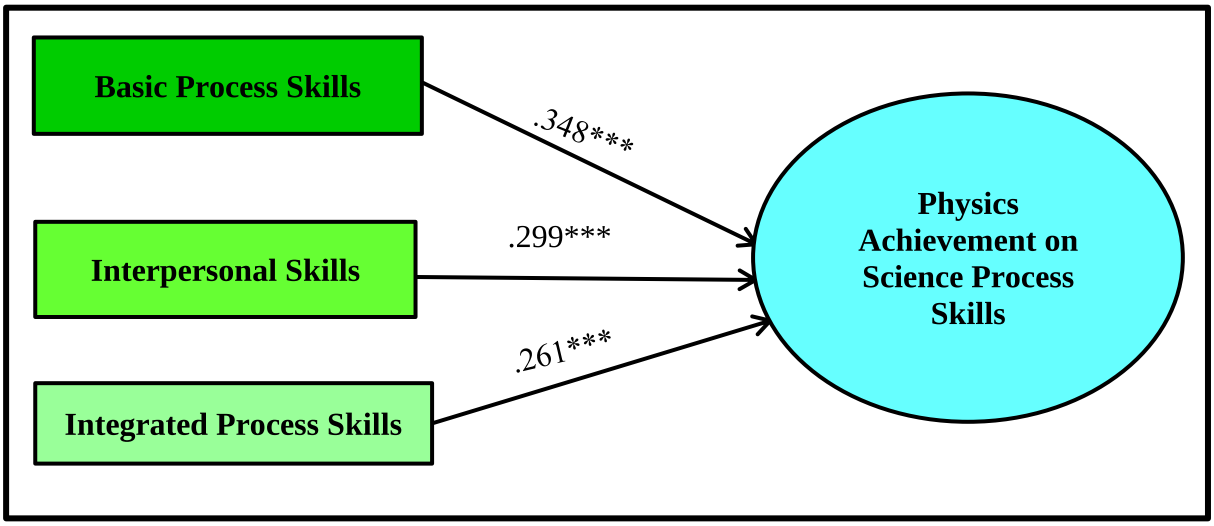

Figure 4 Multiple Regression Model of Predicting Students' Attitudes towards Contextualized Instruction for Physics Achievement on Science Process Skills

Discussion

In assessing science process skills, the pretest scores revealed that there was no significant difference between the experimental and control groups in all selected schools. When pretest scores on science process skills were considered as a covariate, the results of the one-way analysis of covariance (ANCOVA) for posttest scores showed that the experimental groups performed significantly higher than the control groups in the acquisition of science process skills. Therefore, it can be interpreted that the use of contextualized instruction had a significant effect on students' achievement in science process skills. This finding is in agreement with the study conducted by Kurnianingsih (2017) that science process skills in science learning through contextual approach with model of learning cycle gained an average of good category. This is also supported by the study conducted by Pesman (2012) that the contextual approach in physics education can provide the students with problem solving skills, scientific process skills or scientific literacy. Therefore, these research results were consistent with the results of current research on assessing science process skills.

Regarding the results from the Pearson-product moment correlation, a statistically significant relationship was found between the dimensions of students' attitudes towards the contextualized instruction and physics achievement on science process skills. In examining the predicting factors of students' attitudes towards contextualized instruction, the best predictor was basic process skills, the second predictor was interpersonal skills and the last predictor was integrated process skills. As students are interested and preferred in basic process skills, their interpersonal skills and integrated process skills will be gradually improved. Therefore, it can be concluded that the application of contextualized instruction had a positive impact on the acquisition of students' science process skills in teaching and learning physics.

Suggestions

In physics teaching, the teachers have to teach to be able to draw illustration diagrams, labeling the diagrams precisely. It is mainly concerned psychomotor domain or skills of learners. So, this competency has to be practiced frequently. The teachers have to teach the meaning of physics concepts, definitions, laws, theory and principles including discoverers. It is essential to practice in solving problems themselves by thinking the learned material critically. In addition, the physics subject is a learning which explains the natural phenomenon in a simple way and it tries to connect between facts found in that phenomenon. Therefore, it is suggested that the physics teacher should make the students realize that the process in physics is not only learning about the academic process but also to comprehend the environment.

Generally, the high school students are between the ages of 11 to 15 years. Students at this level of development are at the formal operations stage as according to Piaget (1966). Students at this level are capable to perform logical operations wisely through firmly based on a limited learning experience. Besides, they are connected with hypothetical problems and are able to think logically. With respect to the development of high school students, therefore, it is suggested that teachers should apply a variety of learning strategies to ensure that the students' science process skills are developed effectively.

As pointed out by Ministry of Education (MOE, 2016), the practical component of the high school physics curriculum complements the theoretical component. As such it is an essential and integral part of the whole curriculum and is equally important. Therefore, it is suggested that students' learning physics should be promoted through a variety of activities such as experiments not only in physics laboratory but also in the classrooms. As teachers, it is needed to give students the specific instructions for laboratory session, guidelines to report the physics experiments. In addition, students' laboratory report should be graded. Tekbiyik (2010) pointed out in his study that contextualized materials increased students' learning and affected students' attitudes positively. Most of the students perceived that conducting assessment and instruction using contextualized workbooks and worksheets for each lessons promotes their thinking skills and science process skills. Therefore, it is suggested that students should be provided with contextualized materials to learn abstract concepts and eliminate misconceptions in physics.

In addition, according to the results from the quantitative study, there were significant differences in science process skills in physics between high school students who receive contextualized instruction and those who do not. Therefore, it is suggested that a physics teacher should use contextualized instruction to overcome the problems related physics in the classrooms and to develop higher-order thinking skills and science process skills.

Recommendations

In this study, contextualizing the learnt content and the context introduced earlier in the lesson enabled the students to evaluate their prior conceptions regarding a given physics phenomenon. The self-reflections enhanced students' reasoning skills, including science process skills and problem solving. To this end, it is recommended that the physics teachers encourage their students to make self-reflections through evaluation of previously learnt physics ideas, theory, laws and principles and at the end of the instruction.

The results of the study revealed that students will be achieving more if they are taught with contextualized instruction rather than formal instruction. The limitation of the study is that the research administered to Grade Ten students on the content areas of describing motion, forces, work and energy from Mechanics module and heat, temperature, measurement of heat from Heat module. Therefore, it is recommended that further research should be carried out by using wide content area of physics such as, light, waves and optics, electricity, and modern physics.

Since sample schools in this study were randomly selected from Yangon Region, it is recommended that further replication of this study with larger class sizes, classes operating during the same academic year and classes at other basic education high schools would yield results more generalizable to the typical high school course. This study showed the enhancement of acquisition of students' science process skills through the use of contextualized instruction. However, there are also some other methodologies which show the effectiveness on students' achievement in conceptual understanding, problem solving and science process skills. Therefore, it is recommended that contextualized instruction should be investigated and compared with other methodologies for further studies and researches.

To sum up, in building a modern developed nation, science education is also essential for Myanmar. Physics lies at the heart of science education. Therefore, physics teaching methodology should be given as a major task of science education. It is highly recommended to conduct further research in physics teaching methodology for the improvement of science education in Myanmar.

Conclusion

Based on the results of the research that has been done, it can be concluded that the application of the contextualized instruction can improve students' science process skills. Students become more active in thinking and communicating in learning activities because students directly observe, plan experiments, conduct experiments to produce products that support the process of solving a problem. Students become aware of the whole material learned because students form their own knowledge, certainly not separated from the teacher's guidance as a facilitator of learning activities.

Regarding the data obtained through statistical computation, it is obvious that the application of contextualized instruction is useful to help the students to get better physics achievement on science process skills. Therefore, the research findings highlighted that the contextualized instruction is an effective instruction for teachers and students to develop physics achievement particularly science process skills in teaching and learning physics in Myanmar.

Acknowledgements

Firstly, I would like to express my sincere appreciation to Dr. Kay Thwe Hlaing (Rector, Yangon University of Education), Dr. Pyone Pyone Aung (Pro-Rector, Yangon University of Education), Dr. May Myat Thu (Pro-Rector, Yangon University of Education), Dr. Khin Khin Oo (Pro-Rector, Yangon University of Education) and Dr. Nyo Nyo Lwin (Pro-Rector, Yangon University of Education) for the administrative support and permission. Secondly, I am profoundly grateful to Dr. Khin Mar Khine (Professor and Head of Department of Curriculum and Methodology, Yangon University of Education) for her valuable suggestions, and support throughout this study. Thirdly, I would like to render my heartfelt gratitude to my supervisor, Dr. Thida Wai (Professor, Department of Curriculum and Methodology, Sagaing University of Education) and my co-supervisor, Dr. Swe Swe Nyunt (Professor, Department of Curriculum and Methodology, Yangon University of Education) for their precious suggestions, guidance and support during this study.

References

Brotherton, P. N., & Preece, P. F. W. (2006). Science process skills: Their nature and interrelationships. *Research in Science & Technological Education, 13* (1), 5-11.

Collette, A. T., & Chiappetta, E. L. (1989). *Science instruction in the middle and secondary schools* (2nd ed.). New York: Macmillan Publishing Company.

Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Boston: Pearson Education, Inc.

Gallagher, J. J. (2007). *Teaching science for understanding: A practical guide for middle and high school teachers.* New Jersey: Pearson Education Inc.

Gay, L. R., & Mills, G. E. (2016). *Educational research: Competencies for analysis and applications* (11th ed.). New Jersey: Pearson Education, Inc.

Hallinger, P. (1998). Education change in southeast asia: The challenge of creating learning systems. *Journal of Education Administration, Vol. 36.*

Hornby, A. S. (2015). *Oxford advanced learner's dictionary of current English* (9th ed.). Oxford: Oxford University Press.

Hudson, C. C., & Whisler, V. R. (2007). Contextual teaching and learning for practitioners. *Systemics, Cybernetics and Informatics, 6* (4), 54-58.

Kurnianingsih, C. T. (2017). *Analysis on science process skills of students through contextual approach on science-chemistry learning in Taiwan.* Semarang State University: Faculty of Mathematics and Natural Sciences.

Ministry of Education (MOE), (2016). *Physics Teacher's Manual: Grade Ten.* Basic Education Curriculum, Syllabus and Textbook Committee. The Government of Union of Myanmar.

OECD (2003). *The PISA 2003 assessment framework- mathematics, reading, science and problem solving knowledge*

Padilla, M. J. (1990). *The science process skills. Research matters-To the science teacher*. Reston, VA: National Association for Research in Science Teaching (NARST).

Panek, H. S. (2012). *Context-based science instruction.* Retrieved August 8, 2017 from http://www.digitalcommons. brockport.edu>cgi>vi

Pesman, H., & Ozdemir, O. F. (2012). Approach-method interaction: The role of teaching method on the effect of context-based approach in physics instruction. *International Journal of Science Education, 34* (14), 2127-2145.

Smith, P. L., & Ragon, T. J. (1999). *Instructional design* (2nd ed.). New York: John Wiley & Sons, Inc.

Tekbiyik, A., & Akdeniz, A. R. (2010). An investigation on the comparison of context based and traditional physics problems. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 4* (1), 123-140.

Wijawadi, W. (2008). *The effectiveness of contextual teaching and learning in teaching speaking.* Retrieved August 23, 2017 from db4.wikispaces.com/file/view/rc18-THE EFFECTIVENESSOFCONTEXTUAL TEACHING ANDLEARNINGINTEACHINGSPEAKING.pdf.

သင်ပြနည်း၌ာန၊ (၂၀၁၇)။ အခြေခံပညာ ဆရာ၊ ဆရာမများ၏ ဘာသာရပ်အသီးသီးအား လက်ရှိသင်ကြားပို့ချပေးနေမှု အခြေအနေကို လေ့လာဆန်းစစ်ခြင်း။ ရန်ကုန်မြို့၊ ရန်ကုန်ပညာရေးတက္ကသိုလ်။