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# AN INVESTIGATION INTO THE IMPACT OF INSTRUCTIONAL DESIGN FOR CONTEXTUALIZED INSTRUCTION ON STUDENTS' CONCEPTUAL UNDERSTANDING IN LEARNING PHYSICS*

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## Abstract

The main purpose of this study is to investigate the impact of instructional design for contextualized instruction on students' conceptual understanding in learning physics. The research design adopted was one of the mixed methods designs, namely, the explanatory sequential mixed methods design (QUAN→qual design). For the quantitative study, nonequivalent control group design was used. To follow up on quantitative results, descriptive case study design was used. The research instruments were pretest, posttest, materials including unit plans, lesson plans and contextualized workbook, questionnaires, classroom observational guide and interview. By using the simple random sampling method, four basic education high schools from Yangon Region were selected for the quantitative study. Purposive sampling was used to select the students and the teachers in the experimental groups for the qualitative study. In quantitative research findings, the findings of physics achievement on conceptual understanding showed that experimental groups who received the instructional design for contextualized instruction were significantly higher than the control groups who did not. There was a strong relationship between students' physics achievement and their attitudes towards the instructional design. The stronger the students' attitudes towards the instructional design were established, the higher the physics achievement. The predicting factors for physics achievement were experience, preference and academic value. Concerning qualitative research findings, the results of questionnaires, observation and interview revealed that teachers and students preferred, well performed and are willing to apply this instructional design. The qualitative research findings also supported the quantitative research findings.Therefore, the research findings proved that the instructional design for contextualized instruction had a positive impact on high school physics teaching and learning.

**Keywords:** Instruction, Instructional Design, Contextualized Instruction, Conceptual Understanding, Physics

## Introduction

The ultimate aim of education or pedagogy is to grow not just physically, but in greater insight into and control over oneself and over one's environments (Khin Zaw, 2001). To achieve this aim and successfully cope with the novelty of future and its still-unknown problems, pedagogues must teach their wards to think. Therefore, it is necessary to develop an innovative instruction that can cultivate students' higher-order thinking skills and scientific processing capacity. Out of many innovative strategies in teaching physics, contextualized instruction is student-centered and encourages student learning through observation, connection and authentic instead of factual memorization. It allows students to develop a deeper understanding of the concepts and gives students practice in defining problems, gathering data to solve the problems, and helps develop higher-order thinking skills. Therefore, this study attempts to successfully implement the instructional design for contextualized instruction which aims to develop students' conceptual understanding, problem solving and inquiring mind and scientific attitudes towards physics.

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**Objectives of the Research**

1. To develop an instructional design for contextualized instruction that can enhance students' physics learning through their conceptual understanding.
2. To investigate the impact of instructional design for contextualized instruction on teaching and learning high school physics.
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 physics achievement of the students who received instructional design for contextualized instruction and those who did not?
2. Are there any significant relationships between students' physics achievement and their attitudes towards instructional design for contextualized instruction?
3. Do students' attitudes towards instructional design for contextualized instruction: experience, preference and academic value predict physics achievement?

**Scope of the Research**

1. This study is geographically restricted to Yangon Region.
2. Participants in this study are Grade Ten students who are studying physics and physics teachers from the selected schools during the academic year 2019-2020.
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.

**Instruction:** Instruction is the intentional facilitation of learning towards identified learning goals (Smith & Ragan, 1990).

**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).

**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).

**Conceptual Understanding:** Conceptual understanding is an understanding of a concept. When students have an understanding of concept, they can think with it, use it in area other than that in which they learned it, state it in their own words, find a metaphor or an analogy for it or build a mental or physical model of it (Moran & Page, 2015).

**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).

## Statement of the Problem

Problem in students' conceptual understanding of physics are common in Myanmar. Students' conceptual understanding in physics would be incomplete without having mathematical problem solving skills. However, if the students view understanding physics as applying formulae to solve problems, little will be gained in terms of conceptual understanding. Therefore, this study attempts to develop an instructional design to cultivate the students' problem solving attitude of mind and scientific inquiry skills instead of merely transmitting information to them. In addition, all the students have misconceptions about physics. They acquired many of the physics concepts early in life by inadequate observation and false assumptions that do not reflect reality. As pointed out by Victor (1989), a good physics program should take advantage of the fact that students have inquiry minds, and it will encourage them to look for the cause and effect of things that are happening to them. Therefore, in conducting this study, physics concepts, laws and facts are taught by using contextualized practical activities with the help of contextualized worksheets and workbook to overcome these misconceptions in physics.

The analysis of the study content of high school physics in Myanmar 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. As a result, the quality of physics teaching, in particular, its practical, experimental component, dramatically decreased and the 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. Finally, one of the objectives of learning physics in Myanmar is not only to solve a physics problem, but also to know and understand the application of the basic knowledge and skill of physics to daily-life phenomena and national production. In order to implement this objective, this study mainly emphasizes the experiencing contextualized activities for the students not only in the classroom but also in the laboratory. Therefore, this study would be beneficial to both high school physics teachers and students who are studying physics as this study would provide an instructional design for contextualized instruction by which students are prepared to develop the 21$^{st}$ century skills for learning.

## Review of Related Literature

**Philosophical Considerations:** Pragmatism, progressivism, contextualism and constructivism are deeply taken into philosophical consideration for developing an instructional design for contextualized instruction. From the pragmatic perspective, education ought to be dominated by real-life tasks, challenges, theory and facts were to be learned through activity (Ozman & Craver, 1986). And, from the progressive perspective, the students would have to exercise their brain by problem solving and thinking critically, resulting in learning (Armstrong, Henson & Savage, 1989). Then, from the contextualistic perspective, ideas are verified by human experiences with an idea's meaning essentially defined by its practical consequences and its truth by the degree to which those consequences reflect successful action. Additionally, from the constructivist perspective, students need to be actively investigating and experimenting to develop meaningful understanding.

Therefore, in implementing contextualized instruction, students are provided with the learning experiences that build on understanding of content in context and this context mediates their understanding of content.

**Learning Theories:** In developing the instructional design for contextualized instruction, Kohler' learning theory, Piaget's cognitive learning theory, Vygotsky's socio-cultural learning theory, Bruner's concept formation and Ausubel's learning theory are also taken into considerations. Kohler theorized that insight is the mental ability which helps an individual to perceive all of a sudden, the relationship of the elements in the environment that would provide a way to solve the problem. Piaget (1950) indicated that learning involves reconciling newly encountered ideas and reasoning such as those in a new experience or lesson with the learner's existing ideas and reasoning (Sang, 2003). Vygotsky's socio-cultural learning theory emphasizes the social contexts of learning and that knowledge is mutually built and constructed. According to Bruner, cognitive structures that provide understanding to experiences allow the individual to explore new discoveries. Accordingly, Ausubel believed that knowledge is hierarchically organized, that new information is meaningfully to the extent that it can be related to what is already known.

Therefore, in this contextualized instruction, the new physics concepts and propositions to be learned is designed to incorporate into a hierarchically arrangement framework in cognitive structure so as to use the insight to solve learning problems.

**Background Teaching Models.** There are four background teaching models that support the proposed instructional design for contextualized instruction. They are Glaser's basic teaching model, Dr. Khin Zaw's multimodal model, Landa's algorithmic model and Roth's conceptual change instructional model. The conceptual framework for this study is derived in part from Hung's 3C3R (3C – content, context, connection and 3R – researching, reasoning, reflecting) Problem Design Model. The instructional design for contextualized instruction and the learning materials are devised if the heart, the hand as well as the head are to be influenced.

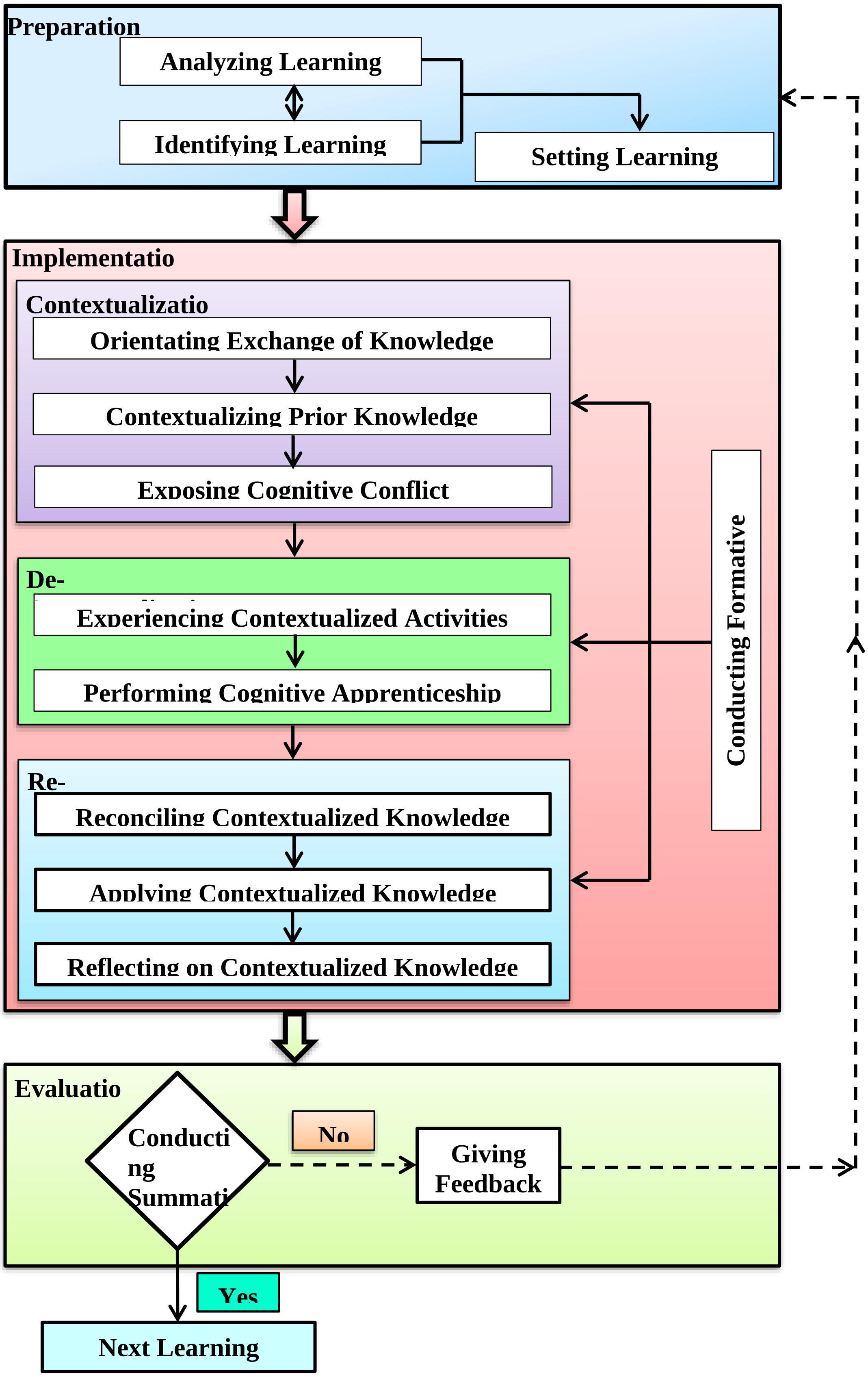


**Figure 1** Proposed Instructional Design for Contextualized Instruction

## Methods

**Research Design.** One of the mixed methods design, the explanatory sequential mixed methods design (QUAN→qual) was employed for this study. The framework for the design is depicted in the following Figure 2.

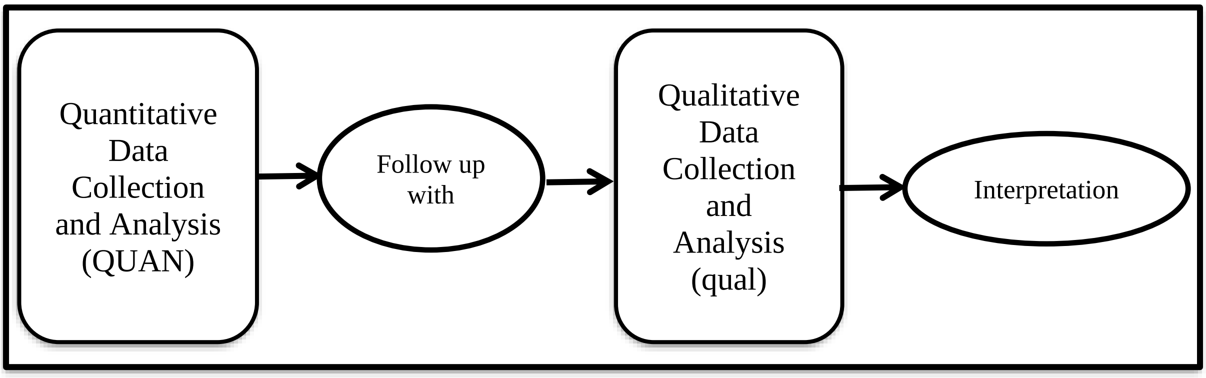


**Figure 2** Explanatory Sequential Mixed Methods Framework

Source: From Creswell, (2014), p.541.

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

**Population and Sample Size.** Simple random sampling method was used in the quantitative study. The population and sample size is depicted in Table 1.

**Table 1** Population and Sample Size for Quantitative Research

| 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 |

**Qualitative Research Design.** The adopted qualitative research design for this study was one of the case study designs, descriptive case study design.

**Population and Sample Size.** The population and sample size of the qualitative study was four physics teachers and 210 physics students from experimental groups.

**Instruments.** Quantitative research instruments were pretest, materials including sample unit plans, lesson plans which are based on the instructional design for contextualized instruction and posttest. As qualitative research instruments, questionnaires, observation and interview guides were used.

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

## Findings

## Quantitative Research Findings

In an attempt to answer the first research question, one-way analysis of covariance (ANCOVA) was used to analyze the data from posttest. According to the selected quasi-experimental design, the two intact groups from each school were selected as the experimental group who received instructional design for contextualized instruction and the control group who did not. Using ANCOVA allowed the researchers to adjust for any pretreatment differences that existed between the experimental groups and the control groups (McMillan & Schumacher, 2006). The following Table 2 shows the results of pretest scores in the four selected schools.

**Table 2** Results of Pretest Scores on Conceptual Understanding in Four Schools

| School | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| S1 | Experimental | 53 | 13.0 | 3.11 | 1.75 | 9.743 | .002** |
| | Control | 52 | 11.25 | 2.61 | | | |
| S2 | Experimental | 50 | 17.10 | 3.82 | −.21 | .092 | .762 (ns) |
| | Control | 51 | 17.31 | 3.22 | | | |
| S3 | Experimental | 57 | 11.49 | 2.97 | .20 | .120 | .729 (ns) |
| | Control | 58 | 11.29 | 3.14 | | | |
| S4 | Experimental | 50 | 14.90 | 3.62 | −.06 | .007 | .934 (ns) |
| | Control | 50 | 14.96 | 3.57 | | | |

*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* < .01.

**Analysis of the Posttest Scores on Conceptual Understanding in S1.** The following Table 3 shows the analysis of covariance results for posttest scores in S1.

**Table 3** Analysis of Covariance (ANCOVA) Results for Posttest Scores in S1

| Level | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| Knowledge | Experimental | 53 | 2.66 | .99 | 0.33 | 3.38 | .069 (ns) |
| | Control | 52 | 2.33 | 1.04 | | | |
| Comprehension | Experimental | 53 | 10.02 | 3.07 | 1.64 | 7.39 | .008** |
| | Control | 52 | 8.38 | 3.08 | | | |
| Application | Experimental | 53 | 10.85 | 1.09 | 1.77 | 38.59 | .000*** |
| | Control | 52 | 9.08 | 1.77 | | | |
| Analysis | Experimental | 53 | 3.85 | .79 | 1.96 | 176.63 | .000*** |
| | Control | 52 | 1.88 | .68 | | | |
| Synthesis | Experimental | 53 | 3.68 | .85 | 1.93 | 151.51 | .000*** |

| Level | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| | Control | 52 | 1.75 | .74 | | | |
| Evaluation | Experimental | 53 | 3.45 | .97 | 1.57 | 70.41 | .000*** |
| | Control | 52 | 1.88 | .86 | | | |
| Total | Experimental | 53 | 35.60 | 3.29 | 10.29 | 195.23 | .000*** |
| | Control | 52 | 25.31 | 4.24 | | | |

*Note.* ns = not significant.***p* < .01. ****p* < .001.

As described in Table 3, there was no significant difference in the posttest mean scores between the experimental group and the control group at the knowledge level questions in S1. Therefore, it can be interpreted that the formal instruction could improve the knowledge level posttest scores like the instructional design for contextualized instruction in S1. But at the comprehension, application, analysis, synthesis and evaluation level questions, there was a significant difference between the experimental group and the control group. Therefore, it can be interpreted that the use of instructional design for contextualized instruction significantly enhanced students' higher-order thinking skills in S1.

**Analysis of the Posttest Scores on Conceptual Understanding in S2.** The following Table 4 describes the analysis of covariance results for posttest scores in S2.

**Table 4** Analysis of Covariance (ANCOVA) Results for Posttest Scores in S2

| Level | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| Knowledge | Experimental | 50 | 3.22 | .86 | .32 | 4.29 | .061 (ns) |
| | Control | 51 | 2.90 | .64 | | | |
| Comprehension | Experimental | 50 | 11.10 | 1.27 | .65 | 8.07 | .005** |
| | Control | 51 | 10.45 | .923 | | | |
| Application | Experimental | 50 | 11.72 | 1.18 | 3.21 | 137.36 | .000*** |
| | Control | 51 | 8.51 | 1.52 | | | |
| Analysis | Experimental | 50 | 3.94 | .84 | 2.31 | 222.28 | .000*** |
| | Control | 51 | 1.63 | .66 | | | |
| Synthesis | Experimental | 50 | 3.66 | .82 | 1.69 | 79.10 | .000*** |
| | Control | 51 | 1.97 | 1.06 | | | |
| Evaluation | Experimental | 50 | 3.90 | .84 | 1.98 | 104.65 | .000*** |
| | Control | 51 | 1.92 | .94 | | | |
| Total | Experimental | 50 | 37.59 | 2.73 | 10.17 | 375.26 | .000*** |
| | Control | 51 | 27.37 | 2.54 | | | |

*Note.* ns = not significant. ***p* < .01. ****p* < .001.

According to the results from Table 4, it can be interpreted that the formal instruction could improve the knowledge level posttest scores like the instructional design for contextualized instruction in S2. Because, there was no significant difference in the posttest mean scores between the experimental group and the control group at the knowledge level questions. For the comprehension, application, analysis, synthesis and evaluation level questions, there was a significant difference between the experimental group and the control group. Therefore, it can be interpreted that the use of instructional design for contextualized instruction significantly enhanced students' higher-order thinking skills in S2.

**Analysis of the Posttest Scores on Conceptual Understanding in S3.** The following Table 5 shows the analysis of covariance results for posttest scores in S3.

**Table 5** Analysis of Covariance (ANCOVA) Results for Posttest Scores in S3

| Level | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| Knowledge | Experimental | 57 | 3.02 | .95 | .42 | 5.97 | .016* |
| | Control | 58 | 2.60 | .88 | | | |
| Comprehension | Experimental | 57 | 10.00 | 1.46 | .91 | 8.60 | .004** |
| | Control | 58 | 9.09 | 1.86 | | | |
| Application | Experimental | 57 | 10.16 | 2.86 | 4.07 | 61.77 | .000*** |
| | Control | 58 | 6.09 | 2.67 | | | |
| Analysis | Experimental | 57 | 3.44 | .14 | 1.41 | 64.43 | .000*** |
| | Control | 58 | 2.03 | .12 | | | |
| Synthesis | Experimental | 57 | 3.82 | .93 | 1.77 | 93.24 | .000*** |
| | Control | 58 | 2.05 | 1.03 | | | |
| Evaluation | Experimental | 57 | 4.02 | .77 | 2.00 | 167.89 | .000*** |
| | Control | 58 | 2.02 | .88 | | | |
| Total | Experimental | 57 | 34.46 | 3.54 | 10.65 | 185.16 | .000*** |
| | Control | 58 | 23.81 | 4.70 | | | |

*Note*. **p* < .05. ***p* < .01. ****p* < .001.

Comparison of the posttest mean scores of the experimental and control groups using one-way ANCOVA showed that there was a significant difference between the performances of the two groups at the knowledge, comprehension, application, analysis, synthesis and evaluation level questions. Therefore, it can be interpreted that the use of instructional design for contextualized instruction significantly enhanced students' lower-order and higher-order thinking skills in S3.

**Analysis of the Posttest Scores on Conceptual Understanding in S4.** The following Table 6 shows the analysis of covariance results for posttest scores in S4.

**Table 6** Analysis of Covariance (ANCOVA) Results for Posttest Scores in S4

| Level | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| Knowledge | Experimental | 50 | 2.02 | .89 | .38 | 5.96 | .063 (ns) |
| | Control | 50 | 1.64 | .63 | | | |
| Comprehensi | Experimental | 50 | 9.96 | 1.41 | 1.06 | 10.26 | .002** |
| | Control | 50 | 8.90 | 1.85 | | | |
| Application | Experimental | 50 | 10.32 | 2.51 | 5.32 | 109.64 | .000*** |
| | Control | 50 | 5.00 | 2.60 | | | |
| Analysis | Experimental | 50 | 3.18 | .98 | 1.42 | 69.45 | .000*** |
| | Control | 50 | 1.76 | .69 | | | |
| Synthesis | Experimental | 50 | 3.12 | .92 | 1.30 | 49.60 | .000*** |

| Level | Group | N | M | SD | MD | *F* | *p* |
|---|---|---|---|---|---|---|---|
| | Control | 50 | 1.82 | .92 | | | |
| Evaluation | Experimental | 50 | 3.52 | 1.05 | 1.82 | 110.20 | .000*** |
| | Control | 50 | 1.70 | .61 | | | |
| Total | Experimental | 50 | 32.12 | 3.69 | 11.30 | 211.85 | .000*** |
| | Control | 50 | 20.82 | 4.11 | | | |

*Note.* ns = not significant. $^{**}p < .01$. $^{***}p < .001$.

The results in Table 6 showed that there were no significant differences in the posttest mean scores between the experimental group and the control group at the knowledge level questions. But for the comprehension, application, analysis, synthesis and evaluation level questions, there was a significant difference between the experimental group and the control group. Therefore, it can be interpreted that the use of instructional design for contextualized instruction significantly enhanced students' higher-order thinking skills in S4. The following Figure 3 shows the comparison of posttests scores on conceptual understanding in the selected schools.

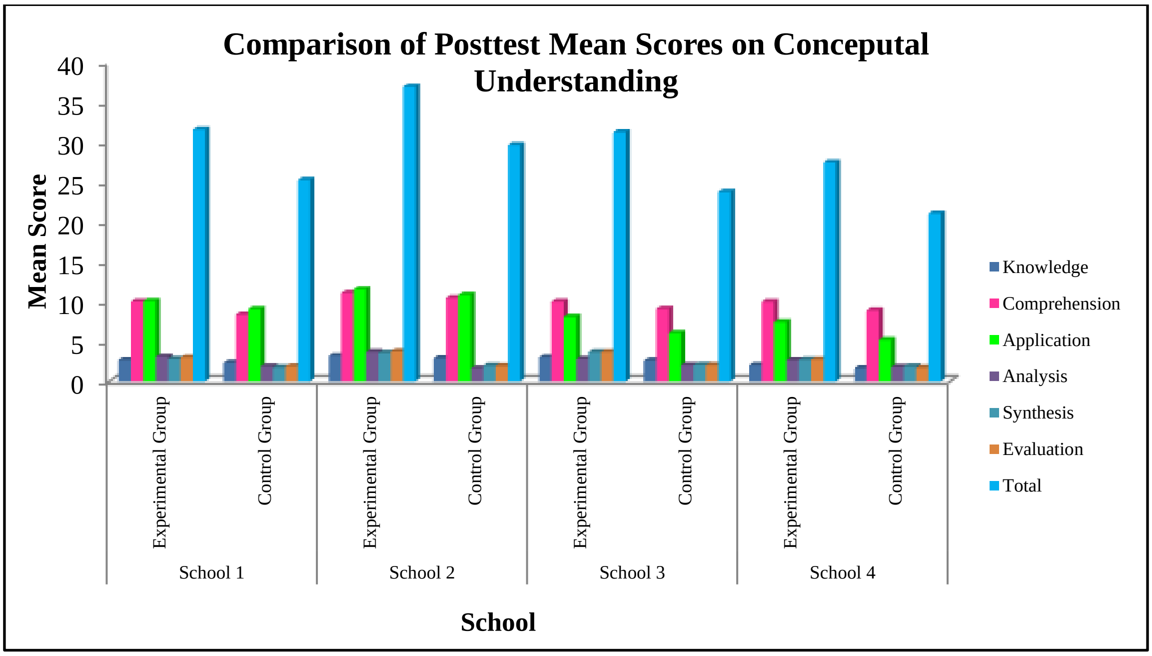


**Figure 3** Comparison of Posttest Mean Scores on Conceptual Understanding

**Relationship between Students' Physics Achievement and their Attitudes towards Instuctional Design for Contextualized Instruction:** In an attempt to answer the second research question, Pearson product-moment correlation was used. The corelation between physics achievement and three variables are shown in Table 7.

**Table 7** Correlation between Students' Physics Achievement and their Attitudes towards Instructional Design for Contextualized Instruction

| Variable | Physics Achievement | Experience | Preference | Academic Value |
|---|---|---|---|---|
| **Physics Achievement** | 1 | .643** | .693** | .558** |
| **Experience** | | 1 | .683** | .507** |
| **Preference** | | | 1 | . 622** |
| **Academic Value** | | | | 1 |

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

According to the results presented in Table 7, students' physics achievement was significantly correlated with their attitudes towards the instructional design for contextualized instruction: experience (r = .643, $p < .01$), preference (r = .693, $p < .01$) and academic value (r = .558, $p < .01$). Therefore, it could be generally interpreted that the stronger the experience, preference and academic value towards the instructional design for contextualized instruction were received, the higher the physics achievement.

**Regression Analysis of Predictions for Physics Achievement from Students' Attitudes towards Instuctional Design for Contextualized Instruction:** In an attempt to answer the third research question, multiple regression analysis was used to see what impact multiple variables have on an outcome.

**Table 8** Regression Analysis Summary for the Variables Predicting Physics Achievement

| Variable | *B* | *β* | *t* | *R* | $R^2$ | Adj $R^2$ | *F* |
|---|---|---|---|---|---|---|---|
| Physics Achievement | 32.364 | | 13.166*** | .742 | .551 | .545 | 84.333*** |
| Predictor Variables | | | | | | | |
| Experience | .852 | .291 | 4.510*** | | | | |
| Preference | .758 | .390 | 5.478*** | | | | |
| Academic Value | .504 | .168 | 2.792*** | | | | |

*Note.* Constant = Dependent variable: Physics Achievement, $***p < .001$.

The above summary Table 8 shows that the multiple correlation coefficient (*R*), using all the predictors simultaneously is .742 ($R^2$= .551) and the adjusted $R^2$ is .545. It means that 54.5 % of the variance in physics achievement can be predicted from experience, preference and academic value towards the instructional design for contextualized instruction. According to the results from Table 8, among the variables from students' attitudes towards the instructional design for contextualized instruction, the best predictor was preference (β = .390***, $p < .001$). Then, the second predictor was experience (β = .291***, $p < .001$) and the last predictor was academic value (β = .168***, *p* < .05). Based on these regression findings, the regression equation can be defined as follows:

PA = 32.364 + .852 X1 + .758 X2 + .504 X3

Where: PA = Physics Achievement

X1 = Experience

X2 = Preference

X3 = Academic Value

The multiple regression model for predicting physics achievement from students' attitudes towards the instructional design for contextualized instruction obtained from applying regression analysis was shown in the following Figure 4.

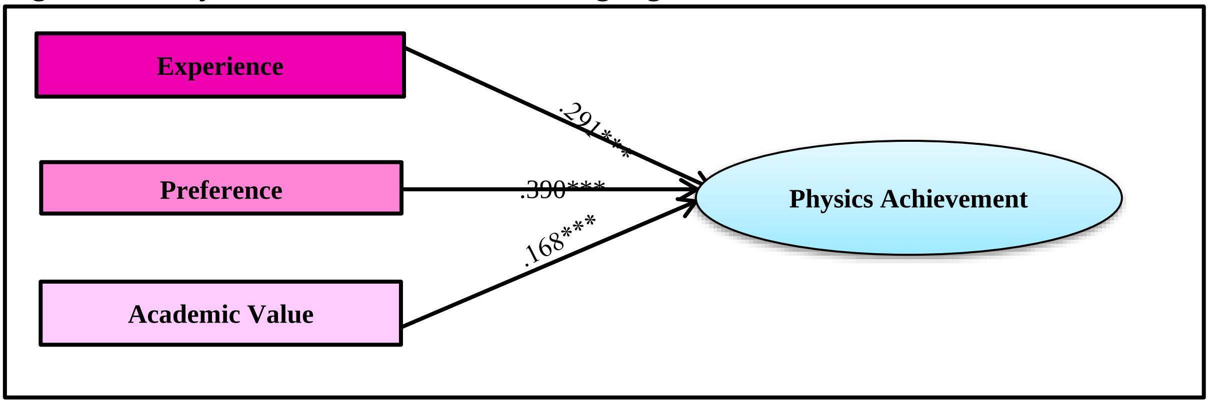


**Figure 4** Multiple Regression Model for Predicting Physics Achievement from Students' Attitudes towards Instructional Design for Contextualized Instruction

Pallant (2013) stated that multicollinearity exists when the independent variables are highly correlated (r = .9 and above). In this study, multicollinearity was avoided because none of the correlation coefficients of the indepentdent variables are highly correlated, the tolerance value for each independent variable is not less than .10 and the value of variance inflation factor (VIF) is well below the cut-off of 10. In the Normal P-P Plot, points lied in a reasonably straight diagonal line from bottom left to top right. This would suggest that no major deviations from normality is seen in this research. Since there is no multicollinearity problem and normality, it is reasonable to conclude that the multiple regression model to explain physics achievement is stable, good and quite respectable.Therefore, it can also be interpreted that the students who had high experience, preference and academic value towards the instructional design for contextualized instruction had high conceptual understanding in learning physics.

## Qualitative Research Findings

**Findings of Observational Guide:** The graphical illustration of results from classroom observational guide for physics teachers and students is presented in Figure 5.

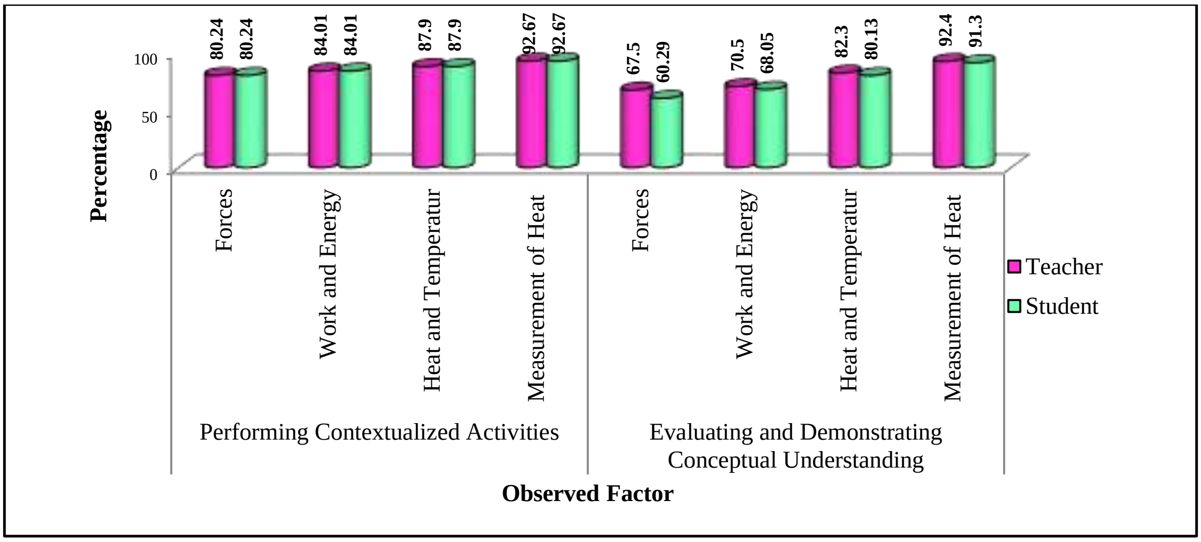


**Figure 5** Results from Classroom Observational Guide

According to the results from observation guide, at the very first lesson, the students experienced difficulty in communication within group works and demonstrating their conceptual understanding with the developed contextualized workbook. However, they eventually performed well in performing contextualized activities and demonstrating their conceptual understanding with the help of the proposed instructional design for contextualized instruction. And also, the experimental teachers are gradually able to prepare, implement and evaluate the contextualized lessons.

**Findings of Questionnaires**: The following Table 9 shows the results from the questionnaires.

**Table 9** Attitudes of Teachers and Students towards Instructional Design for Contextualized Instruction

| No | Item | Participant | Number | Percentaew (%) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree |
| 1. | Contextualized instruction is an active learning technique designed to help students connect what they already know to what they are expected to learn. | Teacher | 4 | 0 | 0 | 0 | 0 | 100 |
| | | Student | 210 | 0 | 0.3 | 11.4 | 16.3 | 72 |
| 2. | Students' contextualized practical activities are guided by means of modeling, coaching and fading in this instruction. | Teacher | 4 | 0 | 0 | 0 | 0 | 100 |
| | | Student | 210 | 0.3 | 0.1 | 2.5 | 19.1 | 78 |
| 3. | Contextualized practical activities are guided through reports, worksheests and posters in this instruction. | Teacher | 4 | 0 | 0 | 0 | 25 | 75 |
| | | Student | 210 | 1 | 1.1 | 8.4 | 20.5 | 69 |
| 4. | Contextualized learning activities are conducted in learning environment which allows to use physics dictionary, work book, practical apparatus and samples. | Teacher | 4 | 0 | 0 | 0 | 25 | 75 |
| | | Student | 210 | 1 | 0.2 | 4.5 | 19.3 | 75 |
| 5. | I prefer this instruction to formal instruction because it can develop the quality of assessment and evaluation of instructional activities. | Teacher | 4 | 0 | 0 | 0 | 0 | 100 |
| | | Student | 210 | 0 | 0.5 | 10.3 | 21.2 | 68 |

| No | Item | Participant | Number | Percentaew (%) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Strongly Disagree | Disagree | Uncertain | Agree | Strongly Agree |
| 6. | I prefer this instruction to formal instruction because students' thinking skills can be developed under the teacher's guidance by means of the proposed instructional design. | Teacher | 4 | 0 | 0 | 0 | 25 | 75 |
| | | Student | 210 | 0 | 1 | 9.5 | 24.5 | 65 |
| 7. | I prefer this instruction to formal instruction since it allows the students to reflect the acquired physics concepts and process skills. | Teacher | 4 | 0 | 0 | 0 | 50 | 50 |
| | | Student | 210 | 0 | 0.1 | 11.5 | 16.4 | 72 |
| 8. | I prefer this instruction to formal instruction since it allows the students to learn within small group and to share the learning experiences from group work. | Teacher | 4 | 0 | 0 | 0 | 50 | 50 |
| | | Student | 210 | 0 | 1.3 | 10.2 | 27.5 | 61 |
| 9. | Students' admiration towards the physicists were developed since the biography of physicists, observations and generalizations of physicists were learned through the charts, video and contextualized workbook by means of the proposed instructional design. | Teacher | 4 | 0 | 0 | 0 | 25 | 75 |
| | | Student | 210 | 0.2 | 1 | 8.5 | 25.3 | 65 |
| 10. | Students' memorization and retention were increased in contextualized learning environment which allows the students to derive the relationships between physical concepts and generalizations by themselves. | Teacher | 4 | 0 | 0 | 0 | 25 | 75 |
| | | Student | 210 | 1 | 0.5 | 6.3 | 20.2 | 72 |
| 11. | Students' thinking skills were developed in this instruction since the students learned the physical concepts and problems through contextualized practical activities. | Teacher | 4 | 0 | 0 | 0 | 0 | 100 |
| | | Student | 210 | 1 | 1.1 | 10.5 | 18.4 | 69 |
| 12. | This instruction creates meaningful physics learning since it connects the students' daily life phenomena and physical concepts. | Teacher | 4 | 0 | 0 | 0 | 0 | 100 |
| | | Student | 210 | 0.5 | 0.1 | 2.5 | 18.9 | 78 |

According to the results from the descriptive statistics on questionnaires, it can be interpreted that the participated teachers and students had positive attitudes towards the proposed instructional design for contextualized instruction.

**Findings of Interview:** According to the results from interview data, the participated teachers and students agreed that the instructional design for contextualized instruction made the physics content more meaningful because it is directly related to an authentic context. Generally, the participants were positive about the sequencing of the phases in the proposed instructional design. They expressed that learning physics by means of this instructional design will help them to see how concepts are related to each other, and to relate the new concepts to their prior knowledge. Therefore, it can be said that these qualitative findings were also in agreement with the quantitative findings.

## Discussion

Regarding the results from the one-way ANCOVA for posttest scores in all schools, it can be interpreted that the use of the instructional design for contextualized instruction had a significant positive effect not only on lower-level thinking skills but also on higher-order thinking skills of students in all schools. This result is in line with the study of Johnson (2002) that in order to help students develop their intellectual potential, contextual learning teaches the cognitive processes that can be used in critical and creative thinking and provide opportunities to use high level thinking skills in real-life situations. Understanding of concepts as a result of this instructional design leads to the generation of problem solving skills. According to Doctor et al. (2015), integrating conceptual knowledge with problem solving is a desirable goal in physics instruction. Therefore, this result pointed out that the instructional design for contextualized instruction can achieve the desirable goal of physics instruction.

Regarding the results from the Pearson-product moment correlation, a statistically significant relationship was found between the dimensions of students' attitudes towards the instructional design for contextualized instruction and physics achievement. In examining the predicting factors of students' attitudes towards the instructional design for contextualized instruction, the best predictor was preference, the second predictor was experience and the last predictor was academic value. As students are interested and preferred in what they are learning, their conceptual understanding will be gradually improved. The follow-up results of the qualitative study also supported the findings of the quantitative study. Therefore, it can be concluded that the application of the instructional design for contextualized instruction had a positive impact on students' conceptual understanding in teaching and learning physics.

## Suggestions

Actually, physics is not only learning about the facts, the concepts, principles and postulate but also to learn how to gain information, to use scientific method, science and technology application. Depending on the interviews and questionnaires findings, most of the students stated that they enjoy physics more when they can learn through contextualized practical activities with a lot of variety. As pointed out by Ministry of Education, MOE (2016), the practical component of the high school physics curriculum complement 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. According to the results of the regression findings for students' attitudes towards instructional design for contextualized instruction predicting physics achievement, the best predictor was experience in contextualized instruction and the last predictor was academic value. These results revealed that physics is one of the courses which are disliked by the students. This result is in agreement with the interview results. This possibly stems from the current emphasis on rote memorization of factual information during teaching and learning in schools. Therefore, it is suggested that students should be provided with contextualized instructional activities which is one of the student-centered learning.

All the interviewed students claimed that they were more actively involved in contextualized learning environment. In general, they are very positive about contextualized learning materials such as contextualized workbook, worksheets, practical guidelines, printed materials, video and real teaching aids. Tekbiyik and Akdeniz (2010) pointed out in their 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 lesson promotes their thinking skills and conceptual understanding. Therefore, it is suggested that students should be provided with contextualized materials to learn abstract concepts and eliminate misconceptions in physics.

## Recommendations

It is hoped that this study will make a number of contributions to the improvement of physics teaching methodology at the high school level in Myanmar. However, this study is not perfect in all situations. This study could accommodate only four schools in 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.

The generalizability of the research is limited 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. It is recommended that further research should be carried out by using wide content areas of physics such as, light, waves and optics, electricity, and modern physics. There are also some other methodologies which show the effectiveness on students' achievement in conceptual understanding, problem solving and physics process skills. Therefore, it is recommended that the instructional design for contextualized instruction should be investigated and compared with other methodologies for further studies for the improvement of physics education in Myanmar.

## Conclusion

By providing the instructional design for contextualized instruction in learning physics, it was found that it helps the students in looking for the meaning of what they are learning through synchronizing the physics and the context of their daily life. In other words, it motivates the students to direct their own learning and to connect between the knowledge and its application with every context found in their life. Besides, the students are expected to learn through experiencing not by memorizing the learning materials. Therefore, it can be concluded that the instructional design for contextualized instruction is an instructional system which is based on the philosophy that the students learn when they get the meaning in academic materials and then they connect the new information with their prior knowledge and the environment.

Regarding the data obtained through statistical computation, observation and interview, it is obvious that the instructional design for contextualized instruction is useful to help the students to get better physics achievement. By applying the instructional design for contextualized instruction, the teacher can relate the materials with the real-world situation outside the classroom, and motivate the students to link the knowledge they learn to its application in their lives. Therefore, the research findings highlighted that the instructional design for contextualized instruction is an effective instructional design for teachers and students to develop physics achievement especially conceptual understanding in teaching and learning physics in Myanmar.

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