

DIAGNOSTIC ASSESSMENT ON SLOW LEARNERS IN GRADE TEN PHYSICS

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Abstract

The primary purpose of this study was to examine the effect of Diagnostic Assessment for Grade 10 slow learners in Physics. Both quantitative and qualitative approaches were used in this study. Data were collected through attitude scale, classroom observation, diagnostic test, remediation and semi-structured interviews. The number of respondents was 1085 students (491 males and 594 females). The slow learners were identified by using three screening methods: attitude scale, teacher's assessment and academic achievement test. After identification of the slow learners, the diagnostic test was used to explore their background knowledge and the nature and causes of difficult areas. And then, remediation was implemented and qualitative follow up study was conducted by semi-structured interview and continuous assessment. In this study, the diagnostic assessment was the most effective and advantageous approach for slow learners.

Key Words: Diagnostic Assessment, Remediation, Slow Learner

Introduction

Slow learners are children with below average cognitive abilities who are not disabled, struggle to cope with the traditional academic demands of the regular classroom. Their slower rate requires accommodation to ensure their success in school. They are limited in their capabilities, which impede their school progress and personal development. They are capable of achieving a moderate degree of academic success through the additional time and help. If the needs of such children are not met, they experience failure and drop out permanently from school. The identification of slow learners is a difficult task as children show potentialities in one or the other areas but may be poor in school performance. If the child is poor in academic subjects like mathematics, science and other compulsory subjects, it matters a lot for parents as well as teachers. They worry and bother very much as children cannot escape studying these subjects and moreover achievement in these academic subjects is considered as the yardstick for the higher education and career.

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In Myanmar, some of the slow learners in Physics think that Physics is the unfamiliar subject which is introduced in Grade-10. In fact, basic science and general science have been studied in the primary and middle school students. Some always believe that they cannot do Mathematics well and so Physics will be the same. They need to understand the concept of Physics. The student understanding of the concept is crucial to successful teaching and learning. Actually, Physics is a natural science that involves the study of matter and the world. Physics is all around us. Grade-10 is the basic of Higher Education in Myanmar. A student's educational career and the kind of employment he/she obtains depend upon how well he/she performs in the matriculation examination. Before entering the matriculation examination the students who are deficit in their Physics learning should be given the required remediation. Therefore the teachers must create the process of assessment to determine some of the students' underlying strengths and areas of need.

Diagnosing their background information determines the difficult areas of the lesson. It involves the nature of the difficulties, and the factors causing it (McNell & Wiles, 1990). The purpose of diagnostic assessment is to ascertain each student's strengths, weaknesses, knowledge and skills (Child, 1993). The information obtained by diagnostic assessment is valuable for the learners who are slow in hierarchical subject such as Physics where the learning of new skills is very much dependent on the achievement of previous skills.

To be effective instruction for slow learners, the use of diagnostic assessment is beneficial. Using a diagnostic assessment, the educator may find that the students already know a concept in the current course and can demonstrate good skills with that concept before receiving instruction. Thus, the present study was to investigate the effect of using diagnostic assessment on slow learners in Physics.

Purpose of the study

The purpose of the study is to find out the effect of diagnostic assessment on slow learners in Physics.

Review of Related Literature

Rowntree (1981) explained that assessment is the process whereby one person (usually a teacher or examiner) attempts to find out about the knowledge, attitude and skills possessed by a learner. According to Kellough and Kellough (1999, p.417), "Teaching and learning are reciprocal processes

that depend on and affect one another. Thus, the assessment component deals with how well the students are learning and how well the teacher is teaching".

Diagnostic Assessment is an evaluation of a learner's skills, strengths and weaknesses (ERIC, 2002). Although some authors delineate Diagnostic Assessment as a component of formative assessment, most consider it a distinct form of measurement (Kellough et al., 1999). To William Wiersma and Stephen G.Jurs (1990), all testing is subsumed under assessment, and assessment and measurement are synonymous. If a test is used for data collection, then the assessment or measurement is conducted through testing. Diagnostic Assessment should be used to determine each learner's starting level of achievement. A Diagnostic Assessment of knowledge and skills done early in a course will provide evidence of each learner's present status and needs. Diagnostic Assessments should also measure student abilities on any pre-requisite skills. Additionally, if recorded, these diagnostic measurements provide proof that the students have learned because the scores should be much lower than the ones achieved on equivalent assessment instruments at the end of the course or unit. Using a Diagnostic Assessment, the educator may find that the students already know a concept in the current course and can demonstrate good skills with that concept before receiving instruction.

The most important single factor influencing learning is what the learner already knows. It should be ascertained this and teach him accordingly (Ausubel, Novak, and Hanesian, 1978). Assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning. Diagnostic Assessment becomes formative assessment when the information is used by the teacher to improve teaching and learning. Formative assessment is also used to provide feedback to students, engaging them in the assessment of their own and their peers' thinking and learning. An assessment activity can help learning if it provides information to be used as feedback by teachers, and by their students in assessing themselves and each other, to modify the teaching and learning activities in which they are engaged. Such assessment becomes formative assessment when the evidence is used to adapt the teaching work to meet learning needs.

A teacher's interpretation of a student response, question, and action will be related to the teacher's understanding of the concept or skill that is at issue. Thus a solid understanding of the subject matter being taught is

essential (National Research Council, 2001, p.87). The ongoing identification, collection, and use of information in the classroom are a complex business.

According to McNell and Wiles (1990), analyzing a student's errors can be a way to discover how the student learns. The error may not be due to carelessness but instead involve a complex and logical thought process. Individuals often devise their own systems for resolving problems. Different types of problem examples must be given to be sure that the student understands. Inspection of the student's responses may disclose patterns among the errors that suggest the student is consistently applying an incorrect rule. By looking carefully at a student's errors, it is sometimes possible to discover a pattern. According to Wiersma and Jurs (1990) focusing on the kind of error the student is making leads more efficient remediation than a general review of the content.

Diagnostic assessments fall into two categories: formal or standardized and informal. A formal assessment is given a numerical score or grade based on student performance, whereas an informal assessment does not contribute to a student's final grade such as this copy and pasted discussion question. In the formal or standardized assessments, a student is given a battery of tests which have several sub-tests that measure a variety of skills and abilities. These tests must only be given by qualified staff and will reflect scores that are based on norms researched to be specific to the test given. Once stored, these tests provide a profile of abilities and skills. This type of assessment generally takes a significant amount of time to give. Interpretation of the profile must be delegated to specific staff members who are highly skilled in deriving conclusions from testing data (Fletcher, Coulter, Reschly & Vaughn, 2004).

Informal types of assessment can also review a student's sub-skills. They are very inexpensive, easy to give, and can be administered by a certified teacher with very little training. The results of these assessments will break down a student's skill deficit area into its component parts on a hierarchy in order to plan instruction. Educational decisions using this type of assessment places students into appropriate instructional groups to remediate skill area deficits that will affect progress in state required curricula. Diagnosis should, according to L.R. Gay (1985), be an on-going process. In addition to administering a number of informal diagnostic instruments, the teacher should constantly be the alert for signs of physical problems, psychological problems or learning difficulties. Teacher-made achievement

tests are more valid indicators of achievement of what was actually taught. Accordingly teacher-made diagnostic instruments may be more effective in identifying deficiencies following instruction. Once a particular academic deficiency is observed, a plan or prescription must be made to correct the problem. It is only important that goals are established, periodic assessments are made and plans are devised to correct weaknesses. This is the crux of optimal teaching and learning.

PosamentierStepelman (1986) defined the term remediation as that of being offered to correct that which is in need of repair. After the teacher administers and analyzes a diagnostic test, he/she will fill in the pages and examples of the particular items needing remediation. Each student then follows the remediation plan on a daily basis. The teacher checks on the pupil's progress as frequently as possible, and provides personal assistance when it is needed.

Pecaut (1991), the term slow learner should be restricted to the child who does not have the capacity or potentiality to learn intellectual things at the same rate as average children. Madison (1991) defined slow learner as "a child cannot keep up scholastically with his age mates, cannot learn things as fast in school and cannot retain information as well as long. According to Singh (2004), slow learners are the students who find difficult to keep pace with their classmates. Slow learners are not mentally retarded, but are capable of achieving academic success at a slower rate compared to normal or regular class students only.

Methodology

Descriptive research method was applied with both quantitative and qualitative approaches. Data were collected through attitude scale, diagnostic tests, observation checklist and interview. As the intervention, remediation was conducted. And pretest before remediation and posttest after remediation were compared to display the effect.

Sample

The number of respondents was 1085 students (491 males and 594 females). For remedial class, 36 grade ten students (21 males and 15 females) were identified. Ten students participated in observations and interviews. Five teachers involved in interview.

Instrumentation

In this study, attitude scale for Physics, diagnostic test for prior stage, observation checklist in formal class, diagnostic test for previous lesson, remediation planning, interview for teachers and interview for slow learners were used.

Attitude Scale for Physics. Attitude scale was modified based on The Colorado Learning Attitude about Science Survey (CLASS) by Department of Physics, University of Colorado (2006). It contains 16 items (46 points) which were constructed on the basis of the following factors: name, gender, age, subject combination, present living arrangements, physical health, vocational interest, academic interest, learning problems in Physics and attitudes towards Physics (eg. I have self-confidence in learning Physics). The students were asked to tick the numbers on the questionnaire. They indicated the extent to which they agreed or disagreed with the statement using a five-point Likert-type scale ranging from 1= "strongly agree" to 5= strongly disagree". The three factors representing attitude scale were self-confidence, personal interest and real world connection. The factor self-confidence consisted of nine items to know the students' confidence in Physics about how they feel and do in it. The reliability coefficient using Cronbach's alpha coefficient for self-confidence was 0.78. Items included in the factor personal interest were measures of how the students solve and feel when they met the difficulty in Physics. The reliability coefficient using Cronbach's alpha coefficient for personal interest was 0.73. Real world connection was created using 11 items regarding students' understanding and application of Physics in daily life. The reliability coefficient using Cronbach's alpha coefficient for real world connection was 0.74.

Diagnostic Test for Prior Stage. In Myanmar, the curricula were formed like a spiral shape from primary to tertiary level. Grade ten Physics course, chapter-10, Reflection of Light, was based on the science courses of grade seven and grade eight, chapter-4, Energy. It was the reason why the researcher constructed the Diagnostic Test for Prior Stage. It took for 45 minutes and consists of 25 items which the students have already known. These items were used to analyze the students' conceptual understanding and calculation.

Observation in Formal Class. The purpose of the observation aimed to inquiry the students' behavior in formal class. The researcher involved as a non-participant observer. The researcher wore the school uniform to be familiar with the students. It contained 13 items which were prepared on the

following factors: fail to submit homework, lose or forget work or materials, easily distracted, volunteer in class, make disturbed behavior, obedience teacher's instruction, taking exercise regularly and actively participation.

Diagnostic Test for Previous Lesson. In this study, this diagnostic test was used to diagnose learning difficulties in chapter-10 from Grade Ten Physics, Reflection of Light including completion items, true-false items, rays diagram and problem solving. It was also intent that learning difficulties which the students faced can be pinpointed and remedied. It was divided into three parts such as concept, diagram and calculation. The researcher constructed a table of specification for them. There were 21 items for knowledge, 77 items for comprehension and 8 items for application.

Remediation Planning. The remediation planning was conducted systematically based on Instructional Objectives, Entering Behavior, Selection of Concept, Teaching Aids, Corrective Actions Stage and Feedback Phase.

Interview Questions. Semi-structured interview was used in this study. There were two parts, one for teachers and the rest for the students. Interview for teachers was built by 5 items to explore the teachers' opinion, attitude and comment for diagnostic assessment.

Procedure

As an initial phase of this study, the pilot testing was conducted with the sample of 45 Grade 10 students from selected basic education high school in Yangon in the last week of November, 2012. Then the researcher improved the weaknesses of wording, statements and instructions according to the result of the pilot study. After that, the questionnaires were sent to selected school in the first week of December, 2012.

Diagnostic test for prior stage was administered in the third week of December and observations were also carried out in formal class to investigate the behavior of the slow learners who always have low achievement in Physics. Ten grade ten students were observed for one week and the researcher recorded information of each sample, according to the observation checklist. To examine the areas that the slow learners met the difficulties, the researcher used the pre diagnostic test. Then remediation was started in January, 2013. During the remediation, the researcher assessed and recorded the improvement of the students continuously. After one month, the follow-up interviews with teachers and slow learners were conducted. After that, a post diagnostic test was administered to the slow learners to reveal the effect of

remediation. Finally, the qualitative data obtained by observation and interview were analyzed by inductive logic to produce results.

Data Analysis and Results

The following table showed the students' opinion which pointed the reason why they were low grade in Physics.

Table 1 Analysis of the Students' Opinion

No	Students' Opinion	Frequency	Percentage
1	Subject complexity	411	37.9
2	Not understand	208	19.2
3	Illness	73	6.7
4	Time is not enough for learning	154	14.2
5	Not interested	92	8.5
6	Excitement	369	34
7	Time is not enough for exam	32	2.9
8	Weakness in English	471	43.4

Question 15 required the responses of students concerning with their suggestions how to help to improve their Physics learning. Acquired qualitative data from open-ended question are categorized as follows.

Table 2 Students' Suggestions how to Help Them to Improve Their Physics Learning

No	Responses	Respondents
1	Teachers should make explanation in detail and interesting presentation.	445
2	Students need the relationship between the theory and the experiments.	375
3	Students should use more time to make drill.	64
4	Students should be taught to be skilful in English.	33

It could be stated from the tabulated data in Table 2 that students wanted teachers' patient explanation and interesting presentation. They also have the desire to do experiments and required more time to be skilful in Physics. Moreover they wanted to be taught English effectively because they have difficulty in it.

Table 3 Analysis of Diagnostic Test for Prior Stage

No	Error Patterns	Respondents
1	Formation of Images	6
2	Application of Mirrors (concave mirror and convex mirror)	16
3	Concepts of Pole, Focus, Axis and Centre of Curvature	28
4	Nature of Light	9
5	Concept of Reflection	36
6	Incorrect Computational Procedures	34

Table 4 showed the frequency that the student do the observed behavior within the observation period.

Table 4 The Frequency of the Observed Behavior in Slow Learners

No	Observed Behavior	Frequency
1	Absence for class	6
2	Lose or forget work or materials	7
3	Fail to submit homework	12
4	Ask for leave while teaching	3
5	Easily distracted	29
6	Make disturbed behavior while teaching	10

No	Observed Behavior	Frequency
7	Ask question if something is not understood	1
8	Volunteers in class	2
9	Obedience teachers' instruction	16
10	Taking notes and exercises regularly	10
11	Appear happy when engaged in Physics activities	3
12	Work independently	4
13	Actively participation in teaching	20

Table 4 indicated that the frequency of the distraction was the most prominent and it was one of the causes of slowness in learning. Although the students actively participated and follow their teacher's instruction, they rarely asked questions about what they didn't understand. Sometimes they failed to finish their homework and forgot their textbooks and other materials as well. Then, they were punished by their subject teacher. Even though they were noisy and talkative in the class, they rarely take part in voluntary tasks. In addition to those observed behaviors, they avoided discussion in the class and were never reluctant to choose the punishment. In this way, they tried to cover their academic weaknesses. Even after punishment, they were unruly and never changed to the teacher's expected behavior. Accordingly, all these misbehaviors indispensably lead them to slow learners.

Table 5. The Result of One-Sample Statistics from Pretest and Posttest

	t	df	P	Mean Difference
Pretest	17.00	35	.000	67.61
Posttest	44.72	35	.000	170.08

Table 5 indicated that there was a significant difference between pretest and posttest at 0.01 level. It can be said that, the effect of remediation used in this study was remarkable.

Remediation was implemented as the intervention procedure. It was conducted from 7.1.2013 to 31.1.2013. After assessing the pre-test (Diagnostic Test), the students showed difficulties in all areas. It was caused by the lack of concept because the attention span of the slow learners was relatively short and they were able to grasp concrete ideas rather than abstract ones. These factors forced the researcher to move forward to the third step. The researcher selected the main concept in the previous lesson because the level of achievement expected of the slow learners must be realistic. Since they cannot understand the abstract concepts easily, the researcher did not lay much stress on abstract and theoretical study. Instead, the researcher prepared the short notes involving main points, diagram and tables and delivered them to the students.

The role of teaching aids in remediation was also emphasized for it can arouse the interest of the slow learners who were unable to pay attention for abstract concept. Appropriate figures and pictures that are related to the learning materials were also used to help them grasp the learning concepts.

The teachers (interviewees) said that Physics teaching needed to emphasize the concept formation. The slow learners were unable to grasp the new concept easily. So to find out their prior knowledge and link it with the new concept was the most effective and suitable approach for the slow learners. The teachers exclaimed that using concept maps was also essential for the slow learners because they made them improve their understanding. The teachers assumed that experiments facilitated the slow learners' learning because of their attention span. An experienced teacher said that although the teachers gave the remediation to the slow learners based on their exam results, they needed more time for individual development. One of the teachers who teaches Physics approved that diagnostic assessment was the effective way for the slow learners because it provided the definite instruction that supported the needs of the slow learners. Moreover, the teachers (interviewees) pointed out the important role of the parents. Students' progress depended on not only the teachers but also the parents. Parents' cooperation with the teachers concerning how they could help and support their students' learning Physics at home. Besides, the teachers suggested that the diagnostic assessment was the perfect process for the slow learners if they have enough time and facilities.

According to students' interview results, Physics is an interesting and useful subject in daily life. The students confirmed that experiments improved

their understanding and memorizing. They said that peer group teaching is effective for them. Sometime they hesitated to ask for explaining the lesson again to their teachers although they did not understand it. Peer group teaching made them progress and be familiar with their classmates. They also wanted the individualized remediation in their remedial class. The students said that they felt upset and disappointed when they met the difficult area which they could not grasp in their regular class. But they did not dare to complain because of shyness. When the teacher gave them special attention and remediation they developed in learning. They had self-confidence and interest in the subject more when they had studied clearly and actively. They believed that they were the same students like others and they could learn and succeed in academic areas. They described that their improvement in learning could increase their belief of life and goals.

Conclusion, Suggestion and Recommendation

In the present research study, evaluation was essential for determining effectiveness of the remediation. All the selected teachers and learners approved that diagnostic assessment was simply a systematic approach because it has a precise focus on particular important attainment targets which were required for the slow learners.

The teachers must learn to know the development of physical, mental and academic factors that may inhibit learning of the content. The learning and training should be started when a learner reaches an appropriate level of maturation. If the teaching is not suitable to his slower rate of progress, the students meet learning difficulties. Diagnostic assessment approach may also prove useful for designing instructional programs to remediate students' misconceptions. Moreover diagnostic assessment can be created to provide insights into persistent errors that interfere with students learning in the targeted domain. Not all children can learn at the same speed so it is impossible to plan in advance a set of remediation which will be effective under all conditions. A good diagnostic test in physics should enable the teacher to identify the special weaknesses which the student may possess. Diagnostic test results are increasingly used to guide the design of remedial instruction and placement in supplemental intervention programs. Diagnostic tests may promote valid diagnostic inferences about students' persistent misunderstandings and cognitive errors. Remedial instruction in Physics should be suited not only to the weaknesses in the fundamentals which the

tests and other measures reveal, but should also take into account each learner's interests and goals.

Slow learners or educationally backward children need special attention and care for being duly helped in getting rid of rate of learning and educational achievement. Neglecting or overlooking them may pose a serious problem for their progress and welfare besides proving a nuisance to the society. Using diagnostic assessment, the classroom teachers would come to know what conditions affect the learning process, what topics are causing the most difficulty for the student and which materials seem to help and which inhibit. Therefore, diagnostic assessment is fruitful process not only for slow learners but also classroom teachers in their teaching-learning situation.

This study was investigated for only Physics and the participants were grade-ten students and teachers who teach Physics. If the subject area and the sample size were big enough, this study would be more advantageous. Moreover, diagnostic assessment is a simple process but needs to go step by step systematically. It requires the time for specific diagnosis and remediation which is tailored with the students' needs. In this study, remediation planning is used only about one month because of the time limit. The type of remediation to be given each student should depend upon the character of the diagnosis which is made. If the identified students are assigned to different classes based on learning abilities or speed, the overall cost of the remediation will be higher because additional staff and facilities are required to conduct the different classes. Lastly, this study was implemented only in Yangon Region so it should be continued for the whole country.

Acknowledgements

We would like to express respectful gratitude to Dr. Aung Min (Rector, Yangon University of Education), Dr. Aye Aye Myint (Pro-Rector, Yangon University of Education) and Dr. Yi Yi Maw (Pro-Rector, Yangon University of Education) for their valuable administrative support and effective guidance. We appreciate the helpful services of the librarians and the staff members of the library of Yangon University of Education and University of Distance Education. We are deeply grateful to participated teachers and students from the selected school for data collection of this study.

References

- Adams, W. K., Perkins, K. K., Podolefsky, N. S., Dubson, M., Finkelstein, N. D., & Wieman, C. E. (2006). *The Colorado learning attitudes about science survey*. Department of Physics, University of Colorado, USA.
- Ausubel, D.P. (1978). *Educational psychology: A cognitive view*. New York: Holt, Rinehart & Winston.

- Child, D. (1993). *Advanced Educational Psychology* (6thed.). New Delhi: Vikas Publishing House PBT LTD.
- ERIC. (2002). *Diagnostic Assessment*. Retrived November 3, 2003, from <http://www.defs.gov.uk/readwriteplus/learningInfrastructure>
- Fletcher, J.M., Coulter, W.A., Reschly, D.J. & Vaughn, S. (2004). *Texas Council for Developmental Disabilities*. <http://www.projectidealonline.org/rti-definition-assessment.php>
- Gay, L.R. (1985). *Educational Evaluation and Measurement: Competencies for Analysis and Application*. Columbus: Merrill.
- Kellough, R.D. and Kellough, N.G. (1999). *A Primer: Diagnostic, Formative, & Summative Assessment*. Retrived November 10, 2003 from <http://www.mmrwsjr.com/assessment.htm>.
- Madison, J. P., (1991), The slow learner: A winner at last? *Elementary English*, 48(7): 896-901
- McNell, J.D. & Wiles, J. (1990). *The Essential of Teaching: Decisions, Plans, and Methods*. NY: Macmillan.
- National Research Council. (2001). *National science education standards*. Washington, DC: National Academy Press.
- Pecaut, L.S. (1991). *Why can't Johnny learn?* *Principal*, 70(4): 29-30
- Rowntree, D. (1981). *A Dictionary of Education*. New Jersey: Barnes & Noble Books.
- Singh, V.P. (2004). *Problems of educational backwardness*. Sarup and Sons, New Delhi, pp.227-250
- Stepelman, P. (1986). *Teaching secondary school mathematics: Techniques and enrichment units*, (2nded.). Columbus: Merrill.
- Wiersma, W. & Jurs, S.G. (1990). *Educational Measurement and Testing* (2nded.). Boston: Allyn and Bacon.