

DIAGNOSTIC MODEL OF STUDENT LEARNING DIFFICULTIES BASED ON NATIONAL EXAM

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Abstract

The objective of this study is to develop a diagnostic model of student learning difficulties based on a national exam. To see its performance, the introduced model was tested on data collected from six State Senior High Schools. For the implementation of the model in improving student achievement, 24 teachers were involved in the study. The student sample for the large-scale tryout consisted of 945 students from six State Senior High Schools and was selected using the purposive sampling. The research instruments consisted of a test, an evaluation sheet, and item analysis cards. Based on the assessment of experts and practitioners, the results showed that the model can be used to identify the student learning difficulties. Applied on Indonesian national exams 2014, the model indicated that students got difficulty in understanding the competencies and indicators of the national curriculum in all tested subjects. Moreover, the analysis of test item shows that students experienced difficulties mostly in the subjects; Indonesian, Sciences, English, and Mathematics. In future, this work can be extended to diagnose student learning difficulties based on any formal test in school.

Keywords: *Diagnostic Model; National Exam; Learning Difficulties*

Introduction

The national examination is a system of standardised evaluation, especially at the primary and secondary education level. In Indonesia, for example, a national instrument to judge the quality and equality of education between regions is done by the National Education Standards, based on the mandate of the Law of the Republic of Indonesia, Number 20, 2003. This law stated that a national examination is to be used to control the quality of national education evaluation as a form of accountability for education providers to the parties concerned. Further it stated that the evaluation be conducted by an independent agency, be periodic, thorough, transparent, and systematic to assess the achievement of national education standards and the monitoring process. So the evaluation should be done on an ongoing basis. Monitoring the evaluation process, if done continuously and sustainably, will eventually result in an improved education process (Anderson, 2003)

Efforts to reform the quality of education are done in various ways, one of which begins with the determination of a standard process (Berliner, 2005). The effort to raise standards is expected to encourage an improvement in the quality of education both

nationally and regionally. Determining education standards involves the determination of the limit grade (*cut-off score*) for graduation exam results. A person is said to have graduated/are competent when they have passed the limit score a limit value between students who have mastered certain competencies and students who have not mastered certain competencies. If it happens on the national exams or at the school level; then this serves to separate the value of the boundary between the students who pass and do not pass the so-called boundary benchmark, known as standard setting.

The benefits of setting and standard-setting a pass level in the exam is to get the boundary of each subject in accordance with the demands of its minimum competencies. With the same standard for each subject as the achievement of minimum standards of competence, the monitoring of the achievement of national quality education is easy to determine (Birbaum, 1997).

Various attempts have been made to improve the results of a national exam. These attempts range from the provision of facilities and infrastructure to the implementation of effective teaching and learning processes that motivate student to actively learn. An alternative approach is a diagnostic one, to detect and analyse what the barriers are to learning.

Diagnosis is a term adopted from medicine. According to Thorndike and Hagen (Muhibbin, 2002), diagnosis can be interpreted as: (a) efforts to find a weakness or identify the disease process (*weakness, disease*) that is experienced by a person through testing and a thorough study of the symptoms (*symtoms*), (b) a careful study of the facts of a case to find a characteristic or errors and so on is essential, and (c) the decision reached after a careful study of the above symptoms or facts about something.

Based on the above three terms of diagnosis, it can be concluded that the concept of diagnosis, implicitly covers the concept of prognosis. Thus, the process of diagnosis is not just to identify the type and characteristics as well as the background of a weakness or a specific disease, but also it implies an attempt to extrapolate and suggest actions to solve the problem. So, the diagnosis of activities directed at solving the problems that occur in learning, is referred to as a diagnosis of learning difficulties. It is possible to diagnose and identify learning difficulties symptoms, look for the factors that cause them and seek to solve the problem.

Diagnosis of learning difficulties is a procedure in solving learning difficulties. The procedure consists of systematically arranged steps. According to Satterly (2006), the stages of diagnosing students' learning difficulties are the answers to the following questions: (1) *Who are the pupils having trouble?;*(2) *Where are the errors located?;* (3) *Why are the errors occurring? (4) What remedies are suggested? and (5) How can errors be prevented?*

Satterly suggests the following phases of activity, namely: (1) Identifying students suspected of having learning difficulties, (2) Recognize students' learning difficulties through behavior analysis, (3) Recognize students' learning difficulties through the analysis of their learning achievement, (4) Identify the learning difficulties, and (5) Identify the factors that cause learning difficulties.

To identify students who have difficulty learning: first, analyze their academic achievement. In terms of student achievement, students show they are experiencing difficulty when: (1) the value of learning outcomes (formative test, summative test, report cards, national exam) is lower than the corresponding average value of the class, (2) the performance achieved is now lower than before; and (3) the achievement is under their actual ability. Secondly, analyze the behavior associated with the learning process. Analysis of the behavior of the students suspected of having learning difficulties is done by: First, compare the behavior concerned with the behavior of other students from the same grade level or; Second, compare the behavior concerned with the behavior expected by the institution. Thirdly, analyze the social relationship. The intensity of social interaction with a group of students can be identified by sociometry. With sociometry, we can recognize those who have been isolated from their groups. This symptom is one of the learning difficulty indicators.

In order to provide an effective supervision to students who have the difficulties, a teacher should recognize the causes of the problem. Learning difficulties can be discovered through the behavioral analysis; for example, the time to complete their assignment, their presence and persistence in following their lessons, their participation in a group task, and their ability to work in a group and their social adjustment.

The deadline of assignments or the time limit of tests can assist teachers in identifying learning difficulties. By recording time needed for each student to complete his/her assignment, teacher will know which students can complete before the time limit, on time, or longer than that. Then, the time extension is compared with the extension frequency in the group.

In relating to the presence and persistence to follow the lesson in class, those students who are not hard-working, anxious, or absent can be considered as having learning difficulties. For some subjects, students are required to be able to communicate and interact with others, such as giving opinions, presenting argument. Through their participation in their group, we can identify students who have difficulties in learning process. Those who are not able to work collectively, do not trust, and do not believe in others in their group can be also assumed having learning difficulties.

Syamsuddin (2003) recorded and analyzed his notes during learning process and then interpreted the results in terms of learning difficulties. One can use the reference criterion to interpret such notes, which is often called the standard or norm reference. The steps to use criterion reference are as follows: (1) determine the minimum passing grade, (2) compare his/her score with the passing grade for each student, (3) identify students who get grades below the passing grade as those with learning difficulties, and (4) determine the priority for assistance based on the gap of their scores from the passing grade. Those with large difference must get more assistance.

If the reference norm is used, the average score of group serves a benchmark for the score of each student. The steps are as follows. (1) calculate the average of class score, (2) identify students with the grades below the class average, and (3) determine the assistance priority.

Once learning difficulties have been identified, next step is to review or to find out the difficulties, namely, (1) which subjects they have experienced the difficulties, (2) which aspects of the learning objectives they get the difficulties, (3) which part or section in the subjects the difficulties occur, and (4) which aspects of learning process they get problem.

Next stage is to identify the causes of learning difficulties. All factors considered to contribute in the learning difficulties should be revealed. Most experts have considered this as the most difficult stage since the causes of learning difficulties are very complex. Therefore, it is not possible to understood completely but it can be only expected to look more dominant factors of learning difficulties that others (Hellen 2002).

The techniques to determine factors of learning difficulties can be done in various ways, including 1) observation, 2) interview, 3) questionnaire, 4) attitude scaling, 5) test, and

6) a medical examination if the difficulty is related to a disease or a physical and psychological disorder.

Thus, there are several signs from students as the symptoms of learning difficulties. Therefore, teachers should understand and are able to identify students with learning difficulties (Hettie and Timperley, 2007). There are a number of steps that teacher can apply to detect learning difficulties experienced by students. These steps include (1) observe unexpected behavior of students during classes, (2) examine students' audio-visual, in particular those with learning difficulties, (3) interview parents to find out the possibility that family may cause learning difficulties.

In this preliminary research, we develop a diagnostic model which can be used to identify student learning difficulties based on national exams. The results can be useful to improve the learning process in classes so that students can have a better achievement in next year national exam. The developed diagnostic model can detect student's difficulties in answering national exam, including which subjects the students get difficulties and which subjects they have understood. With the application of this model, teachers can use the results of national exam to have some remedial of learning process in schools. At the end, it is expected to improve student's achievement in the following national exam.

The main objective of this study is to develop a diagnostic model of student learning difficulties based on a national exam. To see its performance, the introduced model was tested on data obtained from six State Senior High Schools. For the implementation of the model in improving student achievement, 24 teachers were involved in the study.

Method

The procedure used in this study basically refers to those developed by Brog and Gall (1989) and Plomp (1997). However, several stages are modified to adjust the purposes and the objectives of this research. The stages of the model development can be described as follows; (1) collecting preliminary information and examining some requirements, (2) developing the model, (3) testing the model, (4) evaluating the results, (5) implementing the model in classroom, and (6) disseminating the result.

On the development stage of model, two trials were carried out in limited and expanded base. Samples were obtained from the results of national test, in this case national

test packets conducted in Mei 2014 for junior high school. There were four types of test packets; Mathematics, Science, Indonesian, and English.

For the remedial purpose which was based on the results of the diagnostic of learning difficulties, students in grade nine from six junior high schools; SMP Negeri 1 Kendari, SMP Negeri 2 Kendari, SMP Negeri 4 Kendari, SMP Negeri 5 Kendari, SMP Negeri 9 Kendari, and SMP Negeri 10 Kendari, were selected. For the implementation of the model in improving student achievement, 24 teachers were involved in the study. The instruments of this study were the documentation, answer sheets, and questionnaires. Quantitative data in the form of recorded student's answers were analyzed using the software BIGSTEP (Edwards, 2009).

Result and Discussions

1. Model Validation

Based on the assessment carried out by the experts and practitioners, 87% of them stated that the procedures and the steps were valid or reliable to be used to detect the student difficulty in answering the questions in national examination.

The procedures and steps to diagnose student learning difficulties including the remedial are as follows.

1. Analyze questions of national exam by determining the basic competency as well as which indicators (items) chosen to be in the national exam.
2. Perform analysis to determine which parameters affecting on the difficulty level of the national exam.
3. Identify which items in the national exam considered difficult by step 2 and the map the items based on the basic competency of the curriculum.
4. Formulate remedial according to the basic competency and indicators based on the items considered difficult in the national exam.
5. Perform testing on the items considered difficult in the national exam based on step 3 to students.
6. Discuss the materials considered difficult.
7. Formulate questions which are the same difficult level, indicators, and basic competency as those in the national exam and, then they are tested to the students.
8. Formulate a test which is similar to the test of national exam with the same basic competency, but the different indicators and it is tested to students.

9. Form students in group based on levels, ranging from the lowest level (Level 1) to high level (Level 4).

With the procedure, we found that the difficulties occurred on which competency and indicators most students failed to give correct answers.

2. Competencies and Indicators are Not Yet Mastered by Students

Based on the analysis of national exam, the results indicated that students have not comprehended a number of basic competencies and indicators. These competencies were found in all tested subjects in the national exam; Mathematics, Science, Indonesian, and English. The details of the competencies and indicators are outlined as follows.

Mathematics

A number of competencies and indicators in mathematics have not comprehended by students as shown in Table 1. From two competencies tested in national exam, there were four indicators that have not been comprehended by students. These questions with those indicators were categorized difficult. Such questions generally measure the level of student understanding and ability to apply the indicators.

Table 1.
Competencies and Indicators that students did not comprehend
in Mathematics

No.	Competence	Indicator
1	Applying the concept of arithmetic operations and number properties such as comparison, exponential number, root number, social arithmetic, and sequences, into problem solving.	<ul style="list-style-type: none"> Solving problems which relate to comparison. Solving problems which relate to sequences and series.
2	Understanding the concept of algebraic operations, linear equations, inequality, line, set, relation, function, systems of linear equations, and their application in problem solving .	<ul style="list-style-type: none"> Solving problems relating to linear equations. Determining gradient, line.

Sciences

In sciences, Table 2 showed that there were a number of not-comprehended competencies and indicators. Three indicators from two competencies tested were still not

comprehended by students. These questions with those indicators were categorized difficult. Such questions generally measure the level of student understanding and their ability to apply the indicators.

Table 2.
Competencies and Indicators that students did not comprehend
in Science

No.	Competence	Indicator
1	Applying the concept of substance and heat as well as its usefulness in everyday life	<ul style="list-style-type: none"> Determine the amount of calories in the process of change in temperature or states of matter, changes in the implementation of daily life.
2	Understanding the concept of electricity and magnetism as well as its application in everyday life	<ul style="list-style-type: none"> Determine the dynamic electrical quantities in a series (series/parallel, or Ohm's Law Kirchoff's Law) as well as its application in everyday life
		<ul style="list-style-type: none"> Explaining electromagnetic induction events as well as its application on transformer

Indonesian

The result indicated that a number of competencies and indicators for Indonesian subjects were not mastered by students, see Table 3. From two groups of competence tested, there were seven indicators that have not been mastered by students. The questions tested on that indicators were categorized difficult and they generally measured the level of understanding and the capability to apply.

Table 3.
Competencies and Indicators that students did not comprehend
on Indonesian

No.	Competence	Indicator
1	Reading and understanding a variety of texts not literary (biography, articles, news, advertising, table/diagrams, charts, graphic, maps, floor plans), various literature (poetry, an anthology of poems, short stories, a book of short stories, children's story, children's story books, teen novels, novels force's 20-30, and drama)	<ul style="list-style-type: none"> • Equation determines the content of the story • Conclude paragraph • Identifying intrinsic elements of poetry
2	Writing and editing text non literary using a various and effective vocabularies in the form of diaries, personal letters, official letters, narratives and short messages, reports, announcements, instructions, summaries, news text, slogans/posters, advertisement, reviews, and essays, letters to editor, text to speech, and scientific works; writing literary texts in the form of poetry, rhymes, fairy tales, short stories, and drama.	<ul style="list-style-type: none"> • Writing report/ announcements/reviews • Writing slogan in context • Writing editing sentences, spelling/punctuation, word choice • Completing poetry

English

Table 4 describes the competencies and indicators that were tested but they were not mastered by students for English. From the two groups of competence tested, there were three indicators that were not been dominated by students. The questions with these indicators were categorized difficult and they generally measured the level of understanding and the capabilities for application.

Table 4.
Competencies and Indicators that students did not comprehend
in English

No.	Competence	Indicator
1	Reading. Understanding the meaning in short written discourse either functional text or simple form of descriptive essays (descriptive, procedures, and reports) and narrative and recount- in the context of everyday life.	<ul style="list-style-type: none"> Determine a general overview / main thoughts paragraph or specific information/details / information or referral implied meaning of a word or word / phrase or communicative goals in a short functional text in the form caution/notice/warning, greeting cards, letter/e-mail, short message, advertisement, announcement, invitation, schedule.
2	Writing . Reveal the meaning written short functional text and simple form of descriptive essays (descriptive, procedure, and report and narrative (narrative and recount) in the context of everyday life.	<ul style="list-style-type: none"> Determining the correct word to complete the form of descriptive text hiatus/simple procedures Determine the proper sentence structure to create a coherent and meaningful paragraph

3. The Implementation of Remedial Approach

Based on the analysis of a number of questions, it was found that the questions with a high degree of difficulty were considered as difficult questions for students. Those difficult questions spread in all tested subjects. The results suggested that problems with easy, moderate, and hard category were found in all tested subjects.

Table 5.
Results of Problem Identification by Category Level Difficulties Index; Easy, Moderate, and Hard for all Tested Subjects

No.	Subject	Category Level of difficulty Index			Number
		Easy	Moderate	Hard	
1	Indonesian Language	11	23	16	50
2	English	22	19	9	50
3	Mathematics	15	20	5	40
4	Science	10	19	11	40

Table 5 shows that the difficult problems were mostly found in all tested subjects; namely, Indonesian (32%), Sciences (28%), English (18%), and Mathematics (13%). Based on the degree of question difficulty; easy, moderate, and hard, the proportions were found as follows. For Indonesian the proportions were 0.2: 0.5: 0.3; for Sciences the proportion were

0.2: 0.5: 0.3; for English the proportions were 0.4: 0.4: 0.2; and for Mathematics the proportions were 0.4: 0.5: 0.1, respectively. So, the highest proportion of difficult questions occurred in the subject of Indonesia and Sciences; i.e., 30% out of questions were hard.

Based on the results of remedial for all tested subjects, students were grouped into three categories according to student mastery levels; Level 1, Level 2, Level 3, and Level 4. These levels indicate the percentage of students ability to understand the given test material; Level 1 (0% – 65%); Level 2 (66% – 75%), Level 3 (76% – 85%), and Level 4 (86% – 100%). After the implementation of remedial, the results showed that mathematics and sciences were at Level 3, Indonesian and English were at Level 2. This suggested that students still needed to learn more intensive in order to be able to master all material tested in the national exam (UN 2014), for the same competence and indicators as those tested in the national exam, for the same competence but different indicators, or for different competencies and indicators.

In addition, due to many variants of the problem tested, students still got unequal treatment in terms of the material in the questions even though it the questions were considered having fulfill the principle of equal level of difficulty. The efforts of the improvement of the achievement were not optimal, as indicated by the achievement of the students which reached up to Level 3 for all four subjects tested in the national exam. These findings suggested that teacher should implement learning remedial at school in more intensive and sustainable. The learning activities to be carried out were not only on the problem-solving exercise but also the understanding of concepts for all subjects.

Conclusions

We have introduced a diagnostic model based on national exam that can be used to identify student learning difficulties. The developed model has been tested in a large-scale sample and it worked well. In the case study of national exam in Mei 2014, it was found that students experienced learning difficulties in the subjects of Indonesia (32%), Sciences (28%), English (18%), and Mathematics (13%). With the implementation of remedial measures to student, Mathematics and Sciences were reached at Level 3, Indonesian and English were reached at Level 2.

Suggestions

For increased student achievement at national exam next year, the teachers are expected in applying the model of learning in school activities.

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