Pedagogical Guide for using technology in formative assessment

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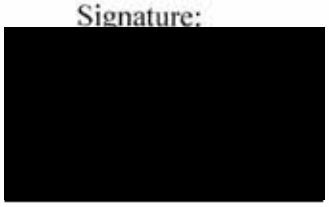
Signature: 

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Dedication

I dedicate this project

To my wife, Samar, who is the one I will always accept, appreciate, and love

To my daughter, Huda, who is the closest to my heart and soul

To my son, Omar, whom I see myself within

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Abstract

Contemporary educational theories are calling for assessment practices to be an integral part of learning. They are as well calling for a shift in our perceptions about assessment, attributing equal place to "assessment for learning" and "assessment of learning" (Earl, 2003). That is, assessment should not only measure learning but promote learning as well.

A Computer-Assisted Assessment (CAA) package is used as a platform to demonstrate that a data–driven decision–making utility regarding formative, summative and diagnostic evaluation is an essential ingredient for enhancing instruction, promoting learning and motivating students.

In addition, the project aims at the development of a teacher's pedagogical guide for using the above technology tool in formative assessment settings.

As part of its development phases, interviews with selected teachers were conducted in an attempt to identify their perceptions about formative assessment and their current practices, difficulties and needs.

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Introduction

Context of the Study

Educational researchers who study students learning tend to view achievement gaps as a matter of variations among students. Although teachers provide uniform instruction to all students, some students reach high levels of achievement while others achieve less. Many factors affect the achievement levels of students; however, teachers can make the achievement gap narrowed by differentiating instruction. Such a process should take into consideration the different learning styles, the obstacles that individual students are facing and appropriate instructional strategies. This requires teachers to collect a lot of data out of each assessment and take the necessary corrective measures in order to attempt to close the achievement gap.

Moreover, publications exist that highlight the importance of formative assessment in enhancing the learning / teaching process. However, it is observed that teachers are not usually able to engage in formative assessment practices due to the complexities they entail. The need arises for a tool that facilitates the major phases of formative assessment, including assessment analysis and communication of results.

In addition, any teaching act is the result of a decision. Teachers constantly make decisions regarding students' learning and instructional practices. In order for these decisions to be valid and reliable, they should be based on solid evidence. Doing so requires a data-driven decision-making utility that serves as an e-portfolio of students' performance and teacher's practices.

The aim of this project is to present and evaluate a technological tool that may help resolve the above issues and to provide a facilitating pedagogical guide for teachers to

use that tool. It is hoped that educators will start to engage in formative assessment practices more often if they are guided through the process of using dedicated software for that purpose. This project is then an attempt to transfer research results on formative assessment into professional practice assisted by computer technology.

Purpose of the Study

This study is based on the assumption that effective implementation of formative assessment practices needs a data-driven decision-making utility. The purpose of the project is two-fold:

- Evaluate a Computer-Assisted Assessment (CAA) package that includes a Data-driven Decision-making Utility (DDU) aiming at facilitating formative assessment.
- Develop a teachers' pedagogical guide for using the above technology tool in formative assessment.

Rationale

"Assessment must be seen as an instructional tool for use while learning is occurring and as an accountability tool to determine if learning has occurred" (National Education Association, 2003). For an assessment to function formatively, the results (of the assessment) have to be used to adjust teaching and learning. Clarke (2001) defines formative assessment with a gardening analogy:

> If we think of our children as plants… summative assessment of the plants is the process of simply measuring them. The measurements might be interesting to compare and analyze, but in themselves, they don't affect the growth of the plants.

> Formative assessment, on the other hand, is the gardening equivalent of feeding and watering the plants – directly affecting their growth. (p.21)

However, formative assessment requires the development of special skills in teachers. It is time consuming and entails special efforts on the part of teachers that would add to their job burden. Global observation leads us to say that very few teachers are willing to go through the process and possess the skills it requires. Thus the need emerges for a helping tool that would encourage teachers to embark into formative assessment of their students.

Operational Definitions

Technology. As an object, technology encompasses the meaning of a tool, device, instrument (such as computers, calculators, pen …). Technology as a process starts with a need and ends with a solution (software applications, programs, utilities…).

Formative Assessment. When assessment results are used to:

- Improve learning,
- Enhance instruction,
- Identify learning obstacles,

then the assessment is called formative assessment. For an assessment to function formatively, the results have to be used to adjust teaching and learning.

Data-driven Decision-making Utility (DDU). It is a system of purposeful data gathering that allows principals and teachers to understand if a school or classroom is meeting their purpose and vision. In this project, we will concentrate on a specific aspect of the DDU which relates to getting better information about students to help teachers make informed instructional decisions.

Computer-Assisted Assessment (CAA). It is a common term for the use of computers in the assessment of student learning. The term encompasses the use of computers or software to deliver, mark and analyze assessments. It also includes a reporting facility that serves as a communicator of assessment results.

For the purpose of this project, CAA and DDU will be used interchangeably although it is assumed that the proposed CAA should include the DDU.

Literature Review

Introduction

Raising the standards of learning in schools is an educational goal that most countries of the world are pursuing. However, most reform attempts have failed to achieve the above stated goal (Black & Wiliam, 1998).

Learning is driven by what teachers and learners do in classrooms. Teachers need to manage the complex situation of a classroom in action. Teachers have to channel personal, emotional and social pressures of a group of learners in order to help them learn. Standards can be raised only if teachers can tackle this task more effectively. Black and Wiliam (1998) stated that treating the classroom as a black box with input and output seems to be a futile policy. We need to know what is happening inside the box.
An effective way to do so is through formative assessment and the data it generates. If used effectively—as an integral part of teaching, formative assessment can provide teachers and their students with the information they need to foster learning.

Many publications are found that highlight the importance of formative assessment in guiding teaching. However, few are the scholarly works that attempt to put technological tools in the service of assessment. The following review of literature aims at setting a theoretical framework and practical ideas for formative assessment that would be applied in this project. It also aims at delineating the specifications for a Computer-assisted assessment package.

Assessment and Learning

A complementary relationship exists between learning and assessment. Being an integral part of learning and teaching, assessment can contribute to learning in many ways.

Assessment of learning (Summative Assessment). Its purpose is to sum up how well a student has performed over time and at a variety of tasks. It is usually done at the end of a unit or grading period. The results are expressed symbolically as marks or letter grades and summarized as averages of a number of marks across several content areas to report to parents. A strong emphasis is placed on comparing students, and feedback to students comes in the form of grades with little direction for improvement. Earl (2003) notes that summative assessment doesn't give much indication of mastery of particular concepts due to the fact that the content is usually too limited and the scoring is too simplistic to represent the wide range of knowledge and skills that has been covered.

Assessment for learning (Formative Assessment). Formative assessment shifts the emphasis from making judgments to creating descriptions that can be used in favor of the next stage of learning and teaching. It usually happens during the learning process rather than at the end. Teachers use observation, worksheets, quizzes, questioning in class and student-teacher dialogues to get information that will provide them, as well as students, with feedback on how teaching and learning is going on and how things could get better.

According to Earl (2003), "Record keeping in this approach may include a grade book, but the records on which teachers rely are things like checklists of student progress against expectations, rubrics, artifacts, portfolios of student work over time and worksheets to trace the progression of students along the learning continuum"(p.24).

Assessment of learning or summative assessment is still the predominant approach to assessment in schools and the modes of such assessment are tests, homework and projects. Even when teachers use informal assessments such as in-class questioning and students' observation, they typically do so to make or confirm judgments about individual students, and they rarely retain the information they get from these observations or find a way of keeping it for future consideration.

Crooks (as cited in Earl, 2003, p.43) stated that formative assessment can contribute to learning. In the short term, classroom assessment can

- focus attention on important aspects of the subject,
- give students opportunities to practice skills and consolidate learning,
- guide further instructional or learning activities.

In the medium and long term, assessment holds the possibility of

- influencing students' motivation as learners and their perceptions of their capabilities,
- communicating and reinforcing teaching goals, including performance criteria and desired standards of performance,
- influencing students' choice of and development of learning strategies, skills and study patterns,
- influencing students' subsequent choice of courses and careers.

Black and Wiliam (1998) conducted a meta analysis study concerning formative assessment. The study involved reviewing research that is published up to 1997. This process yielded about 681 articles or chapters to study. All of these studies show that strengthening the practice of formative assessment produces significant and substantial learning gains. According to Black and Wiliam, research indicates that improving learning through assessment depends on five factors:

- provision of effective feedback to students,
- active involvement of students in their own learning,
- adjusting teaching to take into account results of assessment,
- need for students to be able to assess themselves and find ways to improve,
- recognition of the profound influence that assessment has on the motivation and self esteem of students.

Assessment and Motivation

Students' motivation to learn implies that the student is willing to spend the necessary time and effort to complete a task. Increased motivation can result in improved learning and enhanced attitudes about learning.

Extrinsic motivation occurs when students do something to earn external reward such as grades, prizes or praises. Such students are not concerned with their performance level or the quality of their learning as much as they are with the final outcome. On the other hand, *intrinsic* motivation comes from within a person. To increase motivation, educators create the circumstances that may positively contribute to students' motivation. Students are motivated by both success and competence. They are as well influenced by their beliefs about what contributes to success (Earl, 2003). Students are motivated by a need for achievement, which is a desire to attain goals that require some degree of competence. Supported by a belief that all students can achieve, teachers can nurture, through assessment, a culture of success. In addition, students attribute success or failure to the following factors: ability, effort, task difficulty, or luck. Teachers can facilitate, through assessment, motivational circumstances by showing that ability is not a fixed capacity but rather an incremental one that can be improved; and by attributing success and failure to the effort factor.

One way to achieve this is by making learning progress visible and tangible and by stressing that hard work is an essential ingredient for learning growth.

Self – efficacy. Social cognitive theorists such as Albert Bandura (as cited in Snowman & Biehler, 2000) emphasize that people's sense of self –efficacy strongly affects motivation to learn. Greater efficacy leads to greater effort and persistence in task accomplishment. Past performance and experience affect students' self-efficacy. A student with a history of repeated failure may experience a weak sense of self –efficacy. Students who encounter repetitive successes in moderate challenging tasks experience a strong sense of self – efficacy.

Making students believe that their performance is not good in comparison to others (through summative assessment) undermines their self efficacy. Self-efficacy in any given domain arises out of successful performance in that domain. So tasks or assessments that motivate students' work for success, need to be part of classroom life. Another factor that contributes to self-efficacy development is providing feedback to students, both during their work and after assessment.

Feedback. According to Wiggins (1993), "feedback is information that provides the performer with direct, useable insights into current performance, based on tangible differences between current performance and hoped for performance" (p.182).
It should focus on helping pinpoint areas of strengths and weaknesses. Feedback should also provide a person with information on how to improve. Effective feedback is clear, accurate, precise, timely and iterative.

Feedback for learning can be evaluative or descriptive (Gipps 2000, as cited in Earl, 2003). Teachers provide evaluative feedback in the form of grades and short

comments. This kind of feedback offers little direction for moving their learning forward. Descriptive feedback, as described by Earl (2003), provides evidence for right or wrong answers. It gives recognition for achievement and progress. It tackles the specific learning needs of each student or group, telling students what they have achieved or have not achieved. It provides manageable directions for improvement.

Page (as cited in McMillan, 2007) conducted an investigation to study the effect of comments on students' achievement. Results showed that students who received descriptive comments with their grades achieved significantly higher scores than those who received only a letter grade or a numerical score.

When feedback allows students to see and manage the gap between their actual production and some reference point that makes sense to them, they are both motivated and able to work with their conceptions in order to make adjustments.

Self regulated learners. Learning is a constructive process that occurs best when the learner is actively engaged in creating his or her knowledge. Black and Wiliam (1998) noted that self-assessment is an essential component of formative assessment. "When anyone is trying to learn, feedback about the effort has three elements: recognition of the desired goal, evidence about present position, and some understanding of a way to close the gap between the two" (p.8). Self-assessment allows students to reflect on their own thinking, and to monitor their own knowledge. This ongoing and collaborative process leads to the development of self-regulation strategies that allow students to adapt their learning tactics to meet their learning needs. Besides, more control over their learning leads to an increased motivation to learn.

The instructional role of assessment

Assessment is the basis for decisions that teachers make about instructional matters such as what to teach and for how long, what to communicate to parents, and who get promoted to next grade levels.

Wilson (1996) notes that teachers are involved in various assessment roles: *Teacher as mentor* that provides feedback and support to each student, *teacher as guide* that gathers diagnostic information to lead the group through the work at hand, *teacher as accountant* that maintains records of student progress and achievement, *teacher as reporter* that reports to parents, students, and school administration about student progress and achievement, and *teacher as director* that makes adjustments and revisions to instructional practices.

Heritage (2007), describes what she calls the elements of formative assessment as: identifying the gap, feedback, student involvement, and learning progressions. Teachers, using formative assessment as a mean, need to identify the gap between a student's current level in learning and some desired instructional objective. To realize the instructional power of formative assessment, teachers of the same grade level should meet to have collaborative discussions about students' progress and to identify the patterns evolved from formative data. Once the gaps are identified, the teacher -- using the feedback provided by formative assessment -- takes steps to close the gap by deciding on appropriate instructional interventions such as modifying or differentiating instruction (Heritage, 2007).

Assessment Results: Grading and Reporting

When the classroom activities focus mainly on rewards or grades, students look for ways to get the best grades rather than to enhance their learning. The fact that tests and grades are bases for various kinds of social rewards—promotion, graduation, certification, better jobs, higher prestige, more money—gives tests and grades motivational power. That's why schools should keep using them. However, grading should be done in reference to specific learning criteria rather than to normative criteria. According to Guskey and Bailey (2001), grading "on the curve" does not communicate what students have learned or are able to do. It makes learning a competitive activity that is based on ill-defined criteria.

If a grade is supposed to provide a description of what students have achieved or learned, then averaging scores is considered inappropriate for the following two reasons: First, the mean is distorted with extremely high or low scores. Second, averaging scores of past performance with scores of current performance is considered unfair since "learning is a progressive and incremental process" (Guskey & Bailey, 2001, p.140). Since, any single measure of student learning is considered unreliable if used alone, teachers must use multiple sources of information when assigning grades to reflect students' achievement level. If the gathered evidence is consistent among the various indicators, and a student's scores are fairly uniform, then deciding what final grade a student should get is an easy task. However, if the evidence is not consistent, then other measures should be taken. Guskey and Bailey, (2001) recommend the following guidelines:

- the most recent evidence or score should be assigned greater weight,
- the most comprehensive form of evidence should be given the greater weight,

- the evidence gathered that relates to the most important objectives or standards for the course should be given priority.

The types of learning criteria that should be used for grading fall into three categories: *product*, *process* and *progress*. Product criteria refer to what students know and are able to do at a particular point in time (Summative evaluation of achievement). Process criteria reflect not just the final grade but also how students got there (effort). Progress criteria refer to how much students have gained from their learning activities (educational growth or improvement). Teachers should describe the criteria that they will use to evaluate students' achievement, effort and progress. They should also communicate these criteria to all concerned stakeholders (Guskey & Bailey, 2001).

As to assessment reporting, Guskey and Bailey (2001) stated that the most traditional means by which assessment results are communicated to students and parents is by means of report cards. However, report cards suffer from being bad conductors of what is important to students and parents in regard to achievement and improvement. Not only are grades imprecise, they are vague in their meaning. They don't provide parents or students with a thorough understanding of what has been learned or accomplished. Guskey and Bailey contend, moreover, that most school administrators want to do a better job of communicating student learning, especially to parents. They recognize that such communication is essential to involving parents in students' learning efforts and to gaining parents' support for school programs."What is needed is a data-driven decision-making utility with a multifaceted reporting system that communicates multiple types of information to multiple audiences in multiple formats" (Guskey & Bailey, 2001, p.173).

Teacher, assessment and data-based instruction

Teachers need to have clear understanding of the theory and practice of all phases of assessment. The focus should be on supporting teachers to use assessment as an integral part of teaching and learning in a way that will improve student achievement and give students ownership of their learning through clear instructional objectives and the skills to achieve them.

In 1990, a joint committee of the American Federation of Teachers, National Council on Measurement in Education, the American Association of Colleges of Teacher Education and the National Education Association published a set of seven standards pertaining to what teachers should know about classroom assessment. The seven competencies needed by teachers as stated in Payne (2003, p.46) are the following:

Teachers should be skilled in:

1. choosing assessment methods that are appropriate for instructional decisions.
2. developing assessment methods appropriate for instructional decisions.
3. administering, scoring and interpreting both standardized tests and classroom assessments.
4. using assessment results to make decisions about individual students, instruction, curriculum and school improvement.
5. developing valid pupil grading procedures that use pupil assessments.
6. communicating assessment results to students, parents, other lay audiences and other educators.
7. recognizing unethical, illegal and otherwise inappropriate assessment methods and uses of assessment information.

The above Standards were developed by synthesizing collective research and thus the need arises for practical solutions to the problems associated with educational assessment of students.

McLeod (2005) defined data-driven decision-making as "a system of teaching and management practices that gets better information about students into the hands of classroom teachers" (p.1). Data-driven decision-making requires a shift in our perception of instruction; a shift that emphasizes a pedagogy that is dedicated to the achievement of results rather than that of a process and delivery.

The four major elements of data-driven instruction as specified by McLeod (2005) are:

- good baseline data (from previous years),
- measurable instructional goals (from curriculum guides),
- frequent formative assessment,
- focused instructional interventions.

Data-driven schools know the academic standing of their students at the beginning of the year and have measurable objectives as to where they want their students to be at the end of the year. Formative assessments are used to benchmark the progress of students during the academic year toward the specified end goals. According to McLeod (2005), data-driven teachers use their expertise to identify formative indicators that can be used to enhance students' learning during the academic year. In doing so, they use appropriate technologies to collect, analyze and communicate data to students, parents and administrators.

The role of statistics in educational assessment

According to Hinkle, Wiersma and Jurs (2003), tests are devices used to translate observations into numbers or scores. Statistics serve as a vehicle for scientific understanding of scores. They provide the basic rationale behind planning and decision making by educators.

Here are two reasons why an understanding of basic statistical concepts is essential:

1. statistics can be used to efficiently summarize and describe a large number of scores,
2. statistics are used in describing validity, reliability, item analysis and other characteristics of tests and surveys.

Statistical data generated can offer both students and teachers a detailed picture of the performance of an individual student. This type of feedback can be very positive in terms of motivating and enhancing student learning. It can inform students of specific strengths and weaknesses and evaluate their progress in relation to the course objectives and in comparison to their peers. At the level of a course, statistics can be usefully employed to help determine future curriculum design and development.

Frequency distribution of scores, the mean of scores, Z scores, correlation coefficients and other statistical measures can or must be used to inform instruction. Such measures are used to identify strengths and weaknesses of students and also to pinpoint which topics or objectives need remedial instruction. However, teachers, even if they have plenty of spare time, are not willing to go into the tedious computations required by statistical procedures. Technology, CAA packages in particular, automate such processes and include a reporting facility that generates a range of statistical analysis on the performance of both the test – takers and the questions.

The school system needs integrated software that automatically does the following:

- compute the required statistical formulas,
- plot the necessary graphs and charts,
- provide teachers with solid evidence(s) that supports the accuracy of interpretations and the validity of inferences,
- calculate the various reliability correlation coefficients,
- perform the various item Analysis tasks.

Assessment and Technology

People live in a technology-rich environment where almost every aspect of their lives is being affected by technology. Classroom assessment is no exception, provided that proper technology is chosen based on needs and nature of difficulties that teachers are experiencing. An important role that technology can play in assessment, which exemplifies its importance, is as a decision-making tool that helps the teacher or the administrator in the process of formative assessment.

Many of the mechanical tasks involved in test development, scoring, interpreting and reporting can be handled by technology in an efficient manner (Payne, 2003).

Advocating the role of technology in assisting teachers while assessing students, Axelson, McGraw and McEntee, (2003) stated that assessment in the future must use analytical tools, applied in a variety of media and formats, that capture multidimensional data on student achievement. These data can serve both formative and summative needs. Such assessments require computational assistance to be manageable.

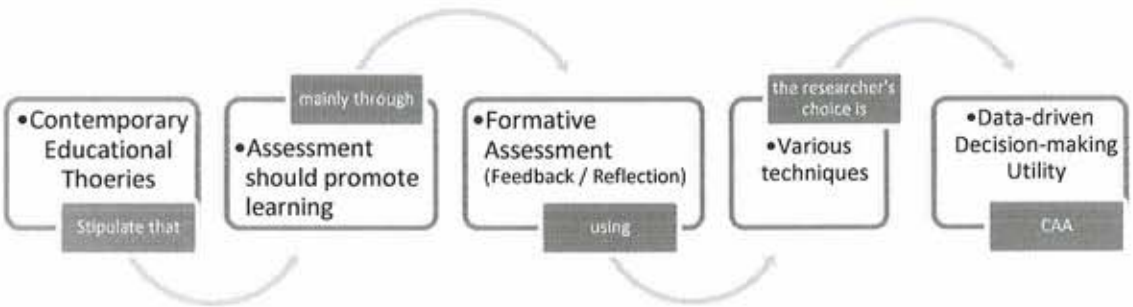
In addition, several education associations emphasized the emerging role of technology by publishing teachers' standards that pertain to assessment and technology. See Appendix A for standards issued by the International Society for Technology in

Education (2000). As one can notice, educational theories are calling for assessment to be considered as an integral part of the instructional process that promotes learning. Thus, the formative dimension of an assessment should be emphasized. However, doing so requires educators to handle many challenges that I will discuss throughout this project.

Method

Theory into practice approach

If teachers or principals are to effectively implement formative assessment practices, they must have tools that allow them to collect, analyze and communicate formative data. A technology-based data-driven decision-making utility is this report author's choice. This project attempts to put theory into practice according to the following diagram:



The development approach of the CAA package along with its guide are governed by the following procedures:

1. What the research says regarding formative assessment: Theoretical underpinnings for developing teachers' guide.
2. Interviews conducted by the researcher with three teachers in an attempt to identify their perception about formative assessment and their current practices. The interviews had for aim to identify the difficulties teachers face in formative assessment. Their needs in this area helped in setting the

framework for evaluating the proposed DDU and in guiding the development of the proposed pedagogical guide. (See Appendix B).

3. Review of similar products and adoption of one as a model for comparison. The selected package is Pearson Education: *Prosper Assessment System* was examined and contrasted to the DDU used in this project. This revision enabled the researcher to extract more evaluation criteria for the DDU.
4. Review of the various phases of formative assessment in order to evaluate the package against these phases, and to build the guide accordingly.
5. based on the above, the researcher developed what he called *Teachers' Technical section* that serves as a guide for using DDU in formative assessment.

Results

This study is based on the assumption that effective implementation of formative assessment practices needs a data-driven decision-making utility. In this section, the researcher will elaborate on what is mentioned in the previous section in an attempt to verify the purpose of the study.

1. *Theoretical underpinnings for developing teachers' guide*

An innovative project like the one presented in this study requires a change in the current beliefs and practices of teachers. According to Priestly (as cited in Priestly & Sime, 2007), the form and extent of innovation depend on the attitudes and values of teachers. However, external innovation tends to disregard the power of teachers as change mediators. Cuban (as cited in Priestly & Sime, 2007), suggested that change is unlikely to be successful unless it actively engages the "practitioners who are the foot-soldiers of every reform aimed at improving student outcomes" (p. 2).

The proposed change requires pedagogical transformation regarding many issues of assessment such as the following:

View on Assessment. According to Priestly and Sime (2007), assessment is viewed by many teachers as an accountability tool that is used to rank students. Viewing an assessment as an instructional tool is almost an absent perception in most schools.

Teaching to the test. Priestly and Sime (2007), stated that teachers seeking improvement in students' achievement, tend to focus on certain activities such as memorization and excessive test practice. Such a practice has a detrimental effect on learning.

The motivational aspect of assessment. According to Black, William, Harrison, Lee and Marshall (2004), learning is not just a cognitive activity, it involves the whole person. Most teachers wrongfully assume that providing extrinsic rewards such as stars or grades is the best way to motivate students. On the contrary, there is considerable evidence that students will invest effort in a task only if they believe they can achieve something. In tackling this issue, the type of feedback that is communicated to students seems to have a substantial effect on students' motivation.

The impact of feedback. Black, William, Harrison, Lee and Marshall (2004), stated that students who are given feedback as grades tend to compare themselves with others (ego involvement); whereas students who are given feedback in terms of comments perceive feedback as an improvement tool (task involvement). In a competitive system, low achievers attribute their performance to lack of ability. In a task-oriented system, all students attribute performance to their effort.

Torrance and Pryor (as cited in Priestley and Sime, 2007) state that feedback, as a Vygotskian notion of social learning, is in tension with predominant modes of teaching within a schooling system dominated by convergent rather than divergent modes of assessment and a pervasive environment of accountability.

According to Black et al. (2004), there is a need to reconsider teachers' core aim to be that of enhancing student learning. Achieving this goal calls for a change in the roles of teachers and students. In addition, the learning environment must be engineered to focus on student learning and to actively involve students in the learning process. Doyle and Ponder (as cited in Priestley & Sime, 2007) propose the following system that guides and evaluates school reforms:

Congruence. Are the proposed reforms congruent with teachers' prior practice,

skills and values?

Instrumentality. How easily do the changes fit with existing structures, procedures and expectations in the school? In other words how workable are they?

Cost/benefit. For example will there be costs or benefits in terms of workload, pupil behaviour and inspections? (p. 4).

Thus, the proposed model of formative assessment should take into consideration the above concerns so that teachers may acquire the disposition to change.

As for any innovation, teachers need support in overcoming the initial uncertainties emerging from the risky business of changing the assessment culture in the classroom. As such, a pedagogical guide for teachers, a continuous professional development program and ongoing support are essential ingredients of the desirable change. In addition, the interviews that were held with selected teachers revealed the need for a pedagogical guide of formative assessment using technology as a supporting tool.

2. *Teachers' Interview*

The researcher conducted semi structured interviews with three teachers in an attempt to identify their perceptions about formative assessment and their current practices. The teachers belong to three different schools and teach various subject matters at different grade levels. Their answers are transcribed in Appendix C.

The results of the interviews showed that teachers' perception about formative assessment is not clear. This may be partially due to the fact that they don't actually conduct formal formative assessment practices. In addition, teachers don't use technology as a supportive tool in assessment. Purposeful data collection and analysis is not

apparent. No one mentioned anything about conducting analysis procedures or printing feedback reports for formative purposes.

3. *Examining Similar Product*

A formative assessment software package that is called *Prosper assessment system* from Pearson NCS (www.pearsonncs.com) puts powerful tools in the hands of teachers to help them create, score and analyze classroom tests. With assessment data at their fingertips, instructors can spot weaknesses and provide tailored instruction.

As stated in the article ("Now Entering the Era of Assessment"), the above software was developed in an attempt to meet the demands of the No Child Left Behind (NCLB) Act of 2001 released by the Department of Education in the United States of America. The NCLB requires every state to measure progress by student, school, demographic subgroup and school district. By requiring every school to analyze and use data to strengthen instruction and boost student performance, the NCLB created a daunting data-management challenge. "John Bailey, a former technology director for the U.S. Department of Education, told American School Board Journal that it would be nearly impossible for schools to meet federal requirements without using technology"(p. 2). As stated in the Pearson web site (www.pearsonncs.com), Prosper allows schools and teachers to:

1. match test content to learning objectives,
2. manage testing to optimize the process of creating, correcting and scoring tests and ensure that teachers will have more time to teach,
3. analyze data to report student and group performance,

9. when the class summary shows mastery by all students, the teacher knows the current approach is worth repeating,
10. to aid in meeting individual student needs, Prosper allows users to tie prescription or remedial information to each test item,
11. results can also be used to make decisions about the curriculum and teacher training,
12. the Prosper assessment system produces detailed, accurate reports, including:
    - *Class Standards*, which measures student proficiency against each objective
    - *Learner Standards Proficiency*, which measures student progress against overall objectives
    - *Class Performance Statistics with Learning Objectives*, which evaluates class performance based on each student's ability to answer each question.
    - *Class Proficiency*, which measures the group's (classroom, school) mastery of each objective.
    - *Learner Test Report*, which displays specific test scores for individual students.
    - *Detailed Item Analysis*, which displays group performance on each item, including powerful test statistics.
    - *Cumulative Class Proficiency*, which displays the class performance on learning standards for an individual test or across a series of assessments.
    - *Comparative Class and Learner Summaries*, which displays student and class results across multiple assessments.

- *Demographic Filters*, which compiles results for different demographic groups.

Except for the features numbered 9, 10 and 12 above, the Prosper software is very similar in functionality to the CAA package proposed in this project.

4. Phases of formative assessment

The literature review conducted in the previous section shed the light on important aspects of formative assessment. To further extract the criteria of what a CAA should be capable of, one needs to examine the phases of formative assessment. Such examination, along with the relevant literature review, serves as the basis of the pedagogical guide for teachers on using formative assessment.

1. Phase I: Constructing the task—to gather evidence about students' achievement
2. Phase II: Correcting the task
3. Phase III: Analyzing and interpreting the tasks' results.
4. Phase IV: Communicating the results to the concerned stakeholders
5. Phase V: Acting accordingly
6. Phase VI: Keeping records

Phase I: Constructing the test. Gathering evidence about students' achievement in relation to instructional objectives can be done *formally* using written tests or performance-based tasks or *informally* using questioning, discussions or dialogues. The CAA package proposed in this project covers the formal type of data collection methods. These are the types that are usually used in schools. Nevertheless, technology solutions that tackle informal types of data gathering are starting to emerge. Irons (2008) mentioned that Personal Response Systems (PRS) can be used in the classroom for instant feedback. Students are given handsets and asked to respond to questions prompted

by the teacher or embedded in a PowerPoint presentation. The teacher can then examine the students' responses—stored in the handset—to assess student comprehension. Several analysis tasks can be performed with the data collected using such technology.

As far as instructional objectives are concerned, teachers greatly value a piece of software that allows them to classify and store their objectives along with the corresponding questions or test items according to:

- domains and competencies,
- their hierarchy in Bloom's Taxonomy levels.

Such facility should permit teachers to import test items from the test banks included in popular textbooks.

Phase II: Correcting the task. Tests consisting of selected response or short-answer tasks are referred to as *objective tests.* The correct or best response to each task is determined and placed on a scoring key. Everyone using the scoring key should arrive at the same score for each task, for each objective, and for the entire assessment for each student.

In constructed response tasks, one has to read the answer given or observe the actual performance. Based on this reading or observation, this person must assign one or more scores to what is written or performed to indicate whether or how well the student achieved the objectives being assessed. However, because there is no scoring key per se, we may not be confident that this person's assigned score represents the student's actual achievement.

According to Arter and McTighe (2001), the likelihood of subjectivity entering into the scoring of constructed response tasks is much greater when those doing the

scoring have no guidelines to inform their scoring. Without guidelines, each scorer is left to his or her devices to determine what to consider (and what to leave out) and how well a student must do to get a certain number of points. To minimize subjectivity, guidelines are absolutely essential. Three types of guidelines are used most frequently: checklists, rating scales and rubrics.

Arter and McTighe (2001) state that *performance criteria* are properties, rules or components by which student responses, products, or performances are judged. They describe what to look for in student performances or products to judge quality. What are our criteria for quality science lab report, oral presentation, critical thinking, life – long learning, motivation to learn, science progress skills, or math problem solving? However, rubrics are not widely being used in classrooms due to the following reasons:

- Developing rubrics is time – consuming.
- Scoring performance tasks using rubrics is a difficult job.
- Analyzing performance criteria for a large number of students is almost impossible.

The first inhibitor stated above can be partially overcome by using ready – made rubrics. However, the other two obstacles need a technology tool like the one proposed in this project.

As far as the process of obtaining information is concerned (via the selection of assessment method), teachers would, according to the researcher, appreciate a piece of software that:

- classifies and stores their questions, problems or test items according to their type,

- allows them to use various types of assessments or quizzes (written or performance tests),
- automatically generates and prints quizzes,
- facilitates the use of scoring rubrics.
- acts like a digital portfolio documenting student performance over an extended period of time and skill areas.

Phase III: Analyzing and interpreting the tests' results. A teacher hands back a test. All that is written on is a number. A student got 62. Probably, the student thought of the following questions when he/she were wondering how to interpret the score of 62.

- If I got 62, how did others do?
- What does a grade of 62 mean I can and can't do?
- Does 62 mean I have improved?

Each question is asking for a frame of reference to interpret that score. That is, what will be your frame of reference for making sense out of the numbers, scores and percentages that your tests or observations produce? (Borich & Tombari, 2004).

Norm–referenced interpretation. Interpretation is provided by comparing the student's performance with the performance of others. This is accomplished by comparing a student's performance to a norm or the average performance of other students on the same assessment.

Criterion–referenced interpretations. They require that a teacher specify various criteria of mastery for a particular area. After the students take the assessment, their performance is described in terms of how well they met the criteria specified.

Criterion–referenced grading occurs when various categories of grades (A, B+, C, etc.) are associated with different degrees of student mastery. For example, a grade of A can be given to a student who can add 2-digit numbers with no more than one error, a B is given to students who can add 2-digit numbers with no more than two errors and so forth.

Growth–referenced interpretations. Performance is compared with the student's prior performance. That is, students' progress and improvement.

Using Multiple Interpretations. According to Borich and Tombari (2004), different interpretations or comparisons are likely to be needed to make different decisions. Different approaches to interpretation should be viewed as complementary, not competitive.

Both criterion–referenced and norm–referenced interpretation can be applied to a performance. For instance, one might observe that the student who can add 2-digit numbers with a grade of 80, for example, scored higher than 70% of the other students in the class. Both perspectives provide useful information.

Teachers would, according to the researcher, value a piece of software that:

- automatically computes students' scores on a certain quiz,
- automatically computes the class average score on a certain assessment or quiz,
- automatically computes students' averages in a certain semester,
- supports norm–referenced interpretations of performance measures by comparing student's performance to that of others,
- supports criterion-referenced interpretations of performance measures by comparing student's to preset criteria,

- supports growth–referenced interpretations of performance measures by comparing student's current performance with previous one.

Phase IV: Communicating the results to the concerned stakeholders. As mentioned earlier, assessment results are communicated to students and parents by means of report cards. However, report cards don't provide parents or students with an understanding of what has been learned or accomplished. On the other hand, formative assessment requires the incorporation of a big number of feedback reports to various stakeholders; instructional objectives and quality criteria of performance should be made explicit and thus communicated. Progress reports, feedback reports, letters to parents, reports to administrators etc... all need to be communicated in a professional manner. Schools need a reporting system that facilitates formative assessment and responds to the requirements of reporting to all school stakeholders."Teachers would highly appreciate a piece of software that include a comprehensive, multifaceted reporting system that communicate multiple types of information to multiple audiences in multiple formats" (Guskey & Bailey, 2001, p.173).

*Phase V: Acting accordingly.*By definition, an assessment is said to be formative only if the results of the assessment are taken into consideration and acted upon. With the wealth of information provided from formative assessment practices, all stakeholders, especially teachers, should take the necessary measures towards mastery learning. Mastery learning, as specified by Bloom (as cited in McMillan, 2007), includes two essential elements:

- feedback, corrective, and enrichment process,
- instructional alignment.

Phase VI: Record Keeping. Designing good assessment instruments is hard work; it involves trial, error and revision. Consequently, it makes little sense to administer an instrument and then throw it away along with the data obtained from its administration. Teachers must save and build on their work. They must also be able to follow up on students' progress rather than disposing their assessment tools and starting from scratch each year, they may place the instrument, the summary of student's responses to the instrument and notes they have made about how the instrument can be improved in a file folder (preferably a computer–based folder). Thus, the materials in the folder can be used as the basis for developing a more technically sound assessment instrument the next time the unit is taught (with some alterations).

An important aspect of quality instruction is record keeping. Although this concept can be as simple as the maintenance of a grade book, it can be as complex as the tracking of large numbers of students who are working on a diversity of objectives. For instance, how can a teacher keep track of one hundred students studying fifteen different modules and taking around ten tests each (One thousand tests, cumulatively)? The answer lies in the use of a computer–managed record keeping system that:

- allows teachers to save their assessment instruments,
- acts like a record keeper of students' assessment results and analysis.

In addition, identifying the strengths and weaknesses of students is an essential requirement of quality teaching. Students' records from previous years can be consulted

to identify learning obstacles or lack of prerequisite skills. One can't imagine doing this without using a computer-based record keeping utility.

5. *Teachers' Technical Section*

This guide is organized in four modules according to the logic of the assessment cycle (creating, correcting, scoring and reporting). The CAA proposed in this project is divided into the following four modules:

- *Program Settings*: how do you like the program to function? This module is used to set the values of the program's parameters.
- *Test Items*: define and classify problems.
- *Assessment Management*: create and grade assessments.
- *Reporting*: print statistical and analytical reports.

The above modules are examined in terms of the pedagogical aspects of each feature or step.

Program Settings. This module is used to define the instructional environment in terms of students, evaluation criteria, grade levels, support units, subject matters and their corresponding competencies.

Test Items. Before assessing students, teachers need to establish and classify the objectives or learning outcomes. According to Payne (2003), Bloom's Taxonomy provides an appropriate framework for classifying objectives in such a way that makes them belong to the various thinking levels (Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation).

Categorizing learning objectives allows educators to benefit from the following:

- Provide a range of objectives: prevent overemphasis on one dimension of learning such as memorization of facts.
- Ensure validity and reliability of inferences.
- Reinforce Learning: because each lower category of the taxonomy is subsumed by the next higher category, reinforcement of learning occurs.
- Ensure Instructional Congruency: If a teacher writes an objective at the application level, the teacher must provide learning experiences at the application level and should test students at that level.
- Diagnose Learning Problems: Should a student fail to perform at one level, the teacher can check to see if prerequisite knowledge or skills at the lower levels is a possible cause of the problem.
- Promote high-order thinking.

Different learning outcomes lend themselves to different learning tasks and ultimately to different types of assessment. Which type of assessment you choose will depend on the objectives you have stated. Objectives can be classified in terms of two broad categories:

1. knowing *about* something,
2. knowing *how* to do something.

Assessments that attempt to measure the range and accuracy of students' knowledge are called *written tests*, while assessments that attempt to measure how well students can do something are called *performance tests.*

Assessment Management. The correction and grading process of objective tests can be fully automated using an optical scanner along with its corresponding utility. The

scoring key can be entered into an optical scan machine and the scoring can be done by a completely automated process. The scoring key minimizes scoring errors and yields objective scoring. However, all constructed-response tasks and performance assessments require performance or scoring criteria.

The CAA under study allows educators to incorporate scoring rubrics to grade constructed-response or performance-based tasks. A rubric is a list of performance criteria along with a rating scale. The real strength of scoring rubrics lies in their ability to:

- provide consistency in evaluating student work,
- help students understand what is expected from them,
- help students see that learning is about gaining specific skills,
- give the opportunity to do self assessment and to reflect on the learning process,
- diagnose the cause of a problem,
- identify strengths and weaknesses.

Using the optical scanning feature, rubrics can be entered, graded and converted to regular grade marks. In addition, an interpretation engine is used to analyze the performance criteria and performance tasks and generate the corresponding formative reports.

Reporting Module. Once the assessment data is collected, the user can disaggregate as well as aggregate data to allow for multiple levels of analysis and for reporting to different audiences with the appropriate information. To examine sample reports that are generated by the CAA, see Appendix D.

Conclusion

Summary of findings—DDU Specifications

The researcher's perception of a CAA that may be used for formative assessment is that of a software that can assess students' understanding of key concepts or principles during the course of school year, allowing teachers to adjust their instruction accordingly and prescribe extra help for students who need it, before the end of the school year when it's too late. Success in this domain is achieved by accumulating, summarizing, analyzing and reporting assessment results with maximum efficiency. The more data-based the instructional decisions, the more effective will be instruction.

Based on the criteria that are set in the literature review and the analyzed results, the following optimal specifications of the proposed DDU were developed.

- Store teachers' problems or test items in a database and organize them by:
  - Domain / Competency
  - Topic
  - Type
  - Cognitive level (according to Bloom's Taxonomy)
- Student data can be scanned in, imported or entered manually, depending on what work best for the school or instructor.
- Automatic correction—using scanned answer sheets— of objective tests and rubric-based type of constructed response tests.
- Support tabular and chart-format reports.
- Compute and print students' scores and averages along with descriptive comments.
- Provide students and teachers with feedback regarding learning and teaching.
- Allow multiple interpretations of scores

  - Norm-referenced interpretation
  - Criterion-referenced interpretation
  - Growth-referenced interpretation
- Support performance based assessment by using rubrics.
- Provide support units for students who need it.
- Enforce curriculum alignment between objectives and test items.
- The capability to import test results gathered with handheld, wireless response devices. This capability allows reports to address all assessment delivery methods in the classroom.
- Incorporate test questions created by publishers of most widely used textbooks. This allows teachers to create tests that match the learning objectives and topics outlined in a particular textbook.
- Utilize proven and accurate scanning utilities permitting the number of correct answers, letter grade and the percent correct to be printed on each answer sheet as it passes through the scanner.
- Support the calculation of Standard scores or Z scores in order to allow educators compare students' performance among multiple subject matters.
- Include multifaceted reporting system that communicates multiple types of information to multiple audiences (students, teachers, administrators & parents) in multiple formats.
- Provide teachers with solid evidence that supports the accuracy of interpretations and the validity of inferences
- Act like a record keeper of students' assessment results and analysis.

Stiggins (as cited in Black & Wiliam, 1998, p.193) stated that "If we seek excellence in education, then the time has come to invest whatever it takes to ensure that every teacher is gathering dependable information about student learning day to day and week to week and knows how to use it to benefit students". According to Black & Wiliam (1998), formative assessment helps low achievers more than other students and so it serves in closing the achievement gap whilst raising overall achievement.

The microcomputer's real power lies well beyond its use for simple production of tests or storage of scores. It can be a revolutionary tool in the whole area of assessment if given a chance.

A certain procedure is usually considered appropriate depending on the purpose and the context of its use. A computer, for example, can be used as a typewriter, a presentation tool, or a learning tool, … Each usage is appropriate for a certain task or purpose. For instance, the Plagiarism Advisory Service like *Turnitin* software has been developed primarily to help students in the mechanics of accurate referencing and citation. Its purpose is to allow students to appreciate the originality of their work and identify situations where there maybe problems of inadequate referencing before submitting it for summative assessment (Irons, 2008). Some universities are using it for summative assessment instead.

According to Black & Wiliam (1998), teachers will not embrace attractive ideas no matter how extensive the research base is, if educators are going to leave the task of translating ideas into everyday practice entirely up to the teachers. Teachers' classroom lives are too busy and fragile. What teachers need is a variety of living examples of implementation, as practiced by teachers with whom they can identify. They need to see

examples of what doing better means in practice. In addition, there is a need to invest in teachers with ongoing professional development.

Limitations of the study

Teachers' Beliefs: Learning, Assessment and Technology. Teachers are the corner stone of any renovation plan that calls for change. Without their effective contribution, even the most advanced plan will not reach the desired end. A plan like the one suggested in this project—emphasizing formative assessment practices—requires a change on behalf of teachers. According to McLeod (2005), one of the most challenges for teachers and principals is making the mental paradigm shift from existing practice that is based on process and delivery to a mindset that operates in a data-driven culture.

The claim is not that teachers don't want to contribute in such a desirable change; the claim is that they need to be convinced and motivated towards the need for such a change so that they may decide accordingly. Doing so is not an easy task. We have to broadcast the kind of awareness that positively reacts with their mentality and the conditions of their profession, which elicits changes and motivates decisions.

Change is never easy. It's especially difficult in education because much of the current practices are based on tradition rather than compelling evidence of effectiveness. Teachers continue to use certain practices not necessarily because they have thought about them deliberately or evaluated them thoroughly but, rather, because it's easier for them to continue doing what they have always been doing. Change is particularly difficult when it demands a fundamental change in pedagogy, which is the case that formative assessment requires.

One cannot expect change to happen without addressing the following teachers' beliefs:

Beliefs about learning. Teachers who assume that knowledge is a commodity that is transmitted from the teacher or textbook to the students will perceive formative assessment as unnecessary.

However, when learning is considered as an active process where students construct their knowledge and take role in self-assessment and regulation then formative assessment will be seen as an integral step in the teaching process.

Beliefs about learners. Many teachers feel helpless regarding their ability to significantly impact student learning. Teachers feel that the academic success of their students is dependent upon certain attributes of the students such as intelligence. The learners are thus perceived as a commodity. Believing that they have a limited role in closing the achievement gap, leads teachers to think of formative assessment as a meaningless activity. In addition, teachers who believe that students' abilities are fixed rather than incremental, will find formative assessment a waste of time.

Beliefs about Assessment. Educators are living in a culture that is dominated by assessment of learning (summative assessment). This is an important issue because the way we view assessment affects the way we use it and the benefits that we may get out of it. Many teachers seek judgment or evaluation of students out of an assessment rather than perceive assessment as a "source of information" (Bloom, as cited in McMillan, 2007, p.65) that provides descriptive feedback to enhance the teaching and learning processes.

Beliefs about technology. Teachers' beliefs about technology play an important role in whether they are going to use education technology or not. Their beliefs are mainly constructed from their prior experience with technology, their perception of what technology is capable of, and what they hear about it from their colleagues.

Since technology is not widely used in classrooms, one might conclude that teachers hold negative beliefs about the use of technology.

In order for educators to use technology in various aspects of schooling, they must first believe in its importance and capabilities. This can be done by spreading awareness and conducting professional development programs for teachers.

Curriculum coverage versus learning mastery

The management of time and the workloads are significant challenges in the provision of feedback. According to McMillan (2007), teachers fear that the introduction of feedback and corrective procedures will reduce the amount of content that they will be able to cover. This may be true at the beginning of the academic year. As the year proceeds, remedial teaching will be reduced in terms of time since students are better prepared from early units and they are becoming more competent through the implementation of mastery learning. Moreover, educators must balance between curriculum coverage and students' learning.

Recommendations

Professional Development. Despite the widespread use of computers, schools have not incorporated computer-based technologies into instructional practices. According to Cuban (as cited in Russell, Bebell, O'Dwyer, & O'Connor, (2003)), the problem is two-fold. First, teachers lack understanding of how technology can be used as

an integral part of classroom practices. Second, school systems are not yet structured to support the integration of technology.

Teachers' attitudes and beliefs about technology affect their decision to use technology. Pre-service and in-service teachers should be provided with opportunities to see and experience the positive effects of technology on teaching and learning. Teacher training programs should focus their efforts on teaching with technology rather than teaching about technology. It's the combined effects of effective teaching and pedagogically sound technologies that lead to improvements in learning. In addition, teachers need on-site and on-demand technical assistance with both the technology and the integration of technology into teaching and learning.

Moreover, it is a waste of time and energy to provide technology training when teachers don't have the resources, opportunity and support to apply their new knowledge and skills. So, school systems should be structured in a way that supports technology integration. According to McLeod (2005), teachers and principals should collaborate to ensure that professional development opportunities are aligned to student, teacher and school needs.

For instance, consider the implementation case of the computer-assisted assessment package that is under study in this project. To ensure effective use, Education departments in universities should create opportunities for pre-service and in-service teachers to use such software. CAA may be part of the assessment or measurement courses that the Education programs usually provide. In this way, Education departments will take their role in spreading the awareness about the importance of using education technology. In addition, the pedagogical aspects of computer-assisted assessment

exemplify the theory into practice approach of educational assessment. Teachers may then use CAA on an individual level, in a learning community or even better, they may convince the school's administration to use computer-assisted assessment on a school-wide level.

Curricula modifications. Using technology as an integral part of classroom practices requires modifications in the school curricula. Committees responsible for the development of curricula should take into consideration the demands or the requirements of technology integration. Technology integration should not be an additional or optional activity that teachers have to do. The design of such curricula and its embracing environment should make technology integration a transparent and a smooth classroom activity.

Future Research

The scope of this project is to study the use of a data-driven decision-making utility that facilitates formative assessment for enhancing student learning. A related or may be a complementary research could be an experimental study of the actual impact of a data-driven decision-making utility on student learning.

In addition, a research that studies the impact of using a school-wide data-driven decision-making utility on school improvement is worth the effort. It is suggested that the success of school improvement efforts rely on the existence of a data-driven school system with an embracing culture.

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Appendix A

National Educational Technology Standards for Teachers

All classroom teachers should be prepared to meet the following standards and performance indicators:

I. TECHNOLOGY OPERATIONS AND CONCEPTS

Teachers demonstrate a sound understanding of technology operations and concepts. Teachers:

A. Demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Educational Technology Standards for Students)

B. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.

II. PLANNING AND DESIGNING LEARNING ENVIRONMENTS AND EXPERIENCES

Teachers plan and design effective learning environments and experiences supported by technology. Teachers:

A. Design developmentally appropriate learning opportunities that apply technology – enhanced instructional strategies to support the diverse needs of learners.

B. Apply current research on teaching with technology when planning learning environments and experiences.

C. Identify and locate technology resources and evaluate them accuracy and suitability.

D. Plan for the management of technology resources within the context of learning activities.

E. Plan strategies to manage student learning in a technology – enhanced environment.

III. TEACHING, LEARNING, AND THE CURRICULUM

Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning. Teachers:

A. Facilitate technology-enhanced experiences that address content standards and student technology standards.

B. Use technology to support learner – centered strategies that address the diverse needs of students.

C. Apply technology to develop students' higher –order skills and creativity.

D. Manage student learning activities in a technology – enhanced environment.

IV. ASSESSMENT AND EVALUATION

Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies. Teachers:

A1. Apply technology in assessing student learning of subject matter using a variety of assessment techniques.

A2. Evidence of using technology to collect and analyze student performance data may include electronic grade books, Web-based testing, spreadsheets, databases, student electronic portfolios, and other performance task end products.

B1. Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional Patrice and maximize student learning.

B2. Evidence of using technology to interpret student assessment information, report results, analyze trends, recognize patterns, and draw conclusions about classroom performance to improve instructional practice, including:

- Technology – supported individual learning reports for parents and students.
- Assessment data across years for individual teaching, across schools, and across students to show long – term gains or effects of changes in teaching pedagogy.
- Reflections including specific references.

C. Manage student learning activities in a technology – enhanced environment.

V. PRODUCTIVITY AND PROFESSIONAL PRACTICE

Teachers use technology to enhance their productivity and professional practice. Teachers:

A. use technology resources to engage in ongoing professional development and lifelong learning.
B. Continually evaluate and reflect on professional practice to make informed decisions regarding the use of technology in support of student learning.
C. Apply technology to increase productivity.
D. Use technology to communicate and collaborate with peers, parents, and the larger community in order to nurture student learning.

VI. SOCIAL, ETHICAL, LEGAL, AND HUMAN ISSUES

Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in K-12 schools and apply that understanding in practice, Teachers:

A. Model and teach legal and ethical practice related to technology use.
B. Apply technology resources to enable and empower learners with diverse backgrounds, characteristics, and abilities.
C. Identify and use technology resources that affirm diversity.
D. Promote safe and healthy use of technology resources.
E. Facilitate equitable access to technology resources for all students.

Appendix B

Semi-structured interview form

- What type of formative assessment techniques do you use? How often do you use such techniques?

- What type of reflection do you conduct based on the results of formative assessment?

- On what basis do you plan for remedial instruction in your classroom?

- What techniques do you use to identify learning obstacles?

- How do you know if students have achieved the preset competencies or not?

- What type of feedback, other than grades, do students/parents get?

- What data, other than grades, do you use in parents meetings?

- Let us assume that you conducted a written test that consists of three questions. Each of these questions belongs to a different domain or competency. And you have, let's say, fifty students. So you have to analyze 150 problems. How do you manage to analyze such large amount of data?

  Is this an easy task to do with hundreds of students and hundreds of problems?

- You use computers to:

  a) Present your lessons
  b) Type your quizzes
  c) Save your grades
  d) All of the above

- Do you use any technological tool to help you in your assessment tasks?

  a) Yes, specify _____
  b) No, why _____

- What is the most burdensome part of the assessment process? Do you wish for a certain utility that might help you in the assessment / evaluation process?

Appendix C

Interviews with teachers (contrasted)

Science Teacher (Int.)	English Teacher (Elem.)	Science Teacher (Elem.)
What type of formative assessment techniques do you use? How often do you use such techniques?		
Oral questioning in class Journal Entries (monthly) Lab activities (weekly)	Question / Answer Short tests and quizzes Homework Observation	Question / Answer Short tests Homework On monthly basis

What type of reflection do you conduct based on the results of formative assessment?		
How well students grasped new concepts	If a student acquired or didn't acquire the objective	Formative assessment helps me: Assess students' learning Identify students' strengths and weaknesses Assess the effectiveness of an instructional strategy. Involve parents in their child's work in class.

On what basis do you plan for remedial instruction in your classroom?		
If the majority of students didn't perform well on a test or quiz.	On the basis of objectives that are not acquired or On the basis of the learning style.	No remedial instruction during my classes.

What techniques do you use to identify learning obstacles?		
Assessment	Formative assessment techniques	None.

How do you know if students have achieved the preset competencies or not?		
Through a test or quiz that covers a variety of skills.	Through all of the above mentioned formative assessment techniques and how much the student is able to apply and use this objective.	Through their answers and results.

What type of feedback, other than grades, do students/parents get?		
Parent / Teacher conference	Parent / Teacher meetings provide parents with a clear idea about their child's achievement and study habits.	Motivation & Initiative Classroom participation Homework comments.

What data, other than grades, do you use in parents meetings?		
Students' profile based on the interaction and the behavior of students in class.	Tests and guides (test analysis sheets) that allow parents to know the objectives that were not met.	Participation in class Homework Class Activities

Let us assume that you conducted a written test that consists of three questions. Each of these questions belongs to a different domain or competency. And you have, let's say, fifty students. So

you have to analyze 150 problems. How do you manage to analyze such large amount of data?		
Based on observation as I correct each problem at a time	I will not correct all the papers at the same time. I will put the criteria on which I want to base my grading. I can correct like ten tests at a time or I may correct the first question of all or selected number of students.	Time and perseverance
Is this an easy task to do with hundreds of students and hundreds of problems?		
No	It is not easy because it is time consuming and the teacher might get bored and she won't be attentive when correcting.	Absolutely Not.

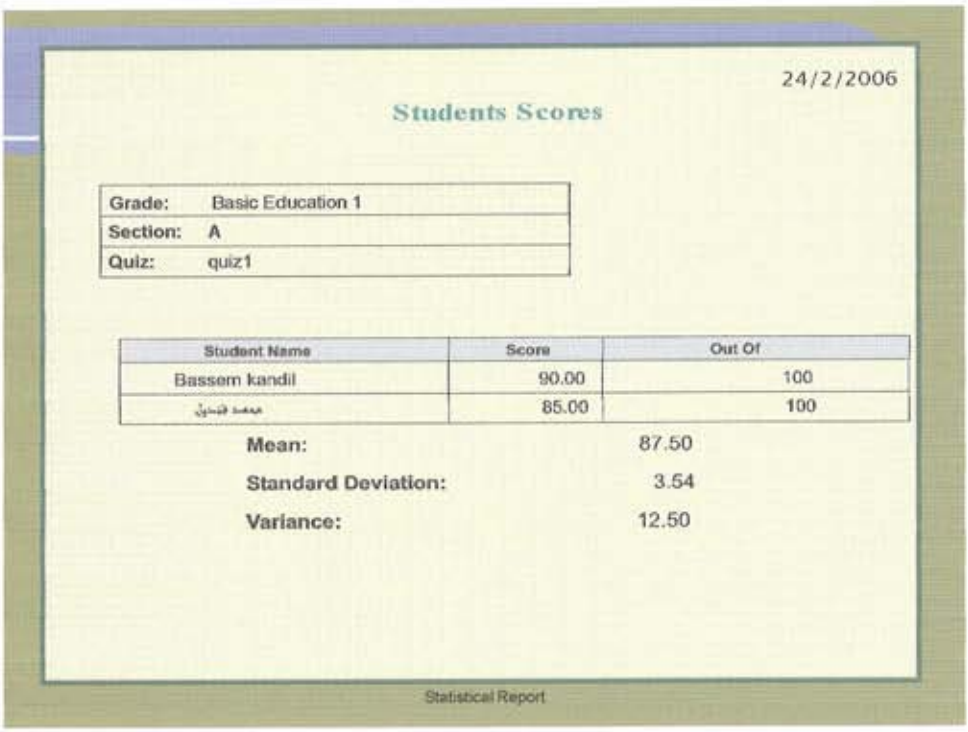
You use computers to: a) Present your lessons b) Type your quizzes c) Save your grades d) All of the above		
Type my quizzes Save my grades	Type my quizzes Present my lessons	Type my quizzes Present my lesson

Do you use any technological tool to help you in your assessment tasks?		
No, I didn't find one in my school	No	No, I am not acquainted with such programs and my school doesn't have such programs.

What is the most burdensome part of the assessment process? Do you wish for a certain utility that might help you in the assessment / evaluation process?		
Correction. M y school focuses on varying learning and teaching techniques rather than assessment techniques.	Assessment is not burdensome. It is a tool to assess students as well to assess the teacher's work.	Correction of subjective tests .i.e, open ended questions.

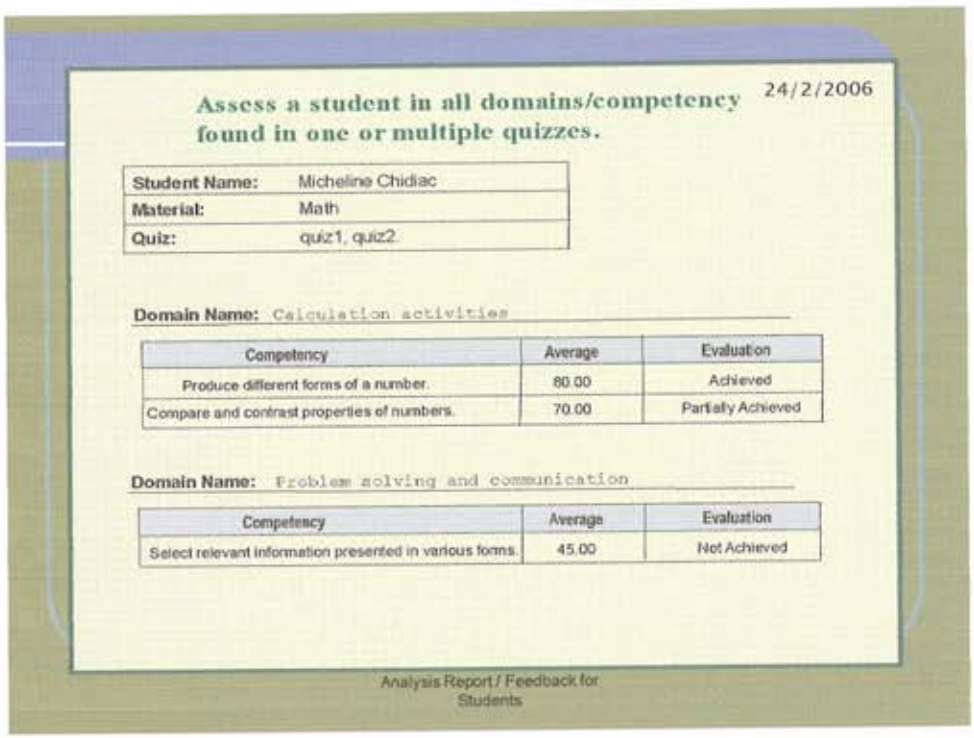
Appendix D

Pedagogical Guide – Reporting Module



Norm–referenced interpretation: reflects an individual's status compared with the performance of other individuals. This report can be used to:

1. Provide summative data of learning.
2. Rank Students.



Assess a student in all domains/competency found in one or multiple quizzes.

24/2/2006

Student Name:	Micheline Chidiac
Material:	Math
Quiz:	quiz1, quiz2

Domain Name: Calculation activities

Competency	Average	Evaluation
Produce different forms of a number.	80.00	Achieved
Compare and contrast properties of numbers.	70.00	Partially Achieved

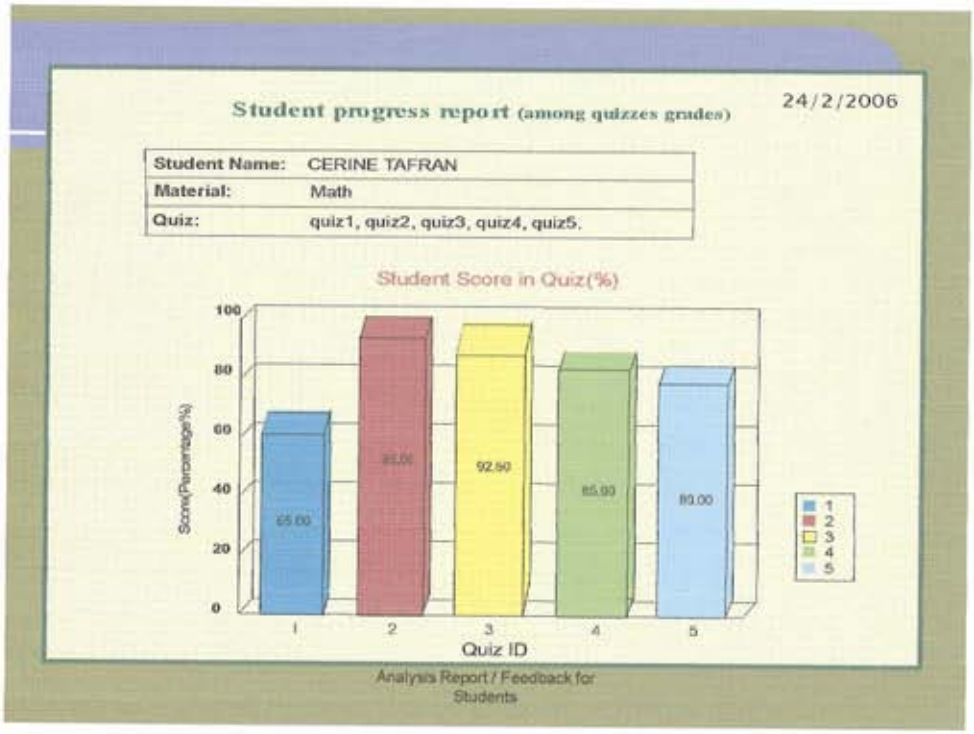
Domain Name: Problem solving and communication

Competency	Average	Evaluation
Select relevant information presented in various forms.	45.00	Not Achieved

Analysis Report / Feedback for Students

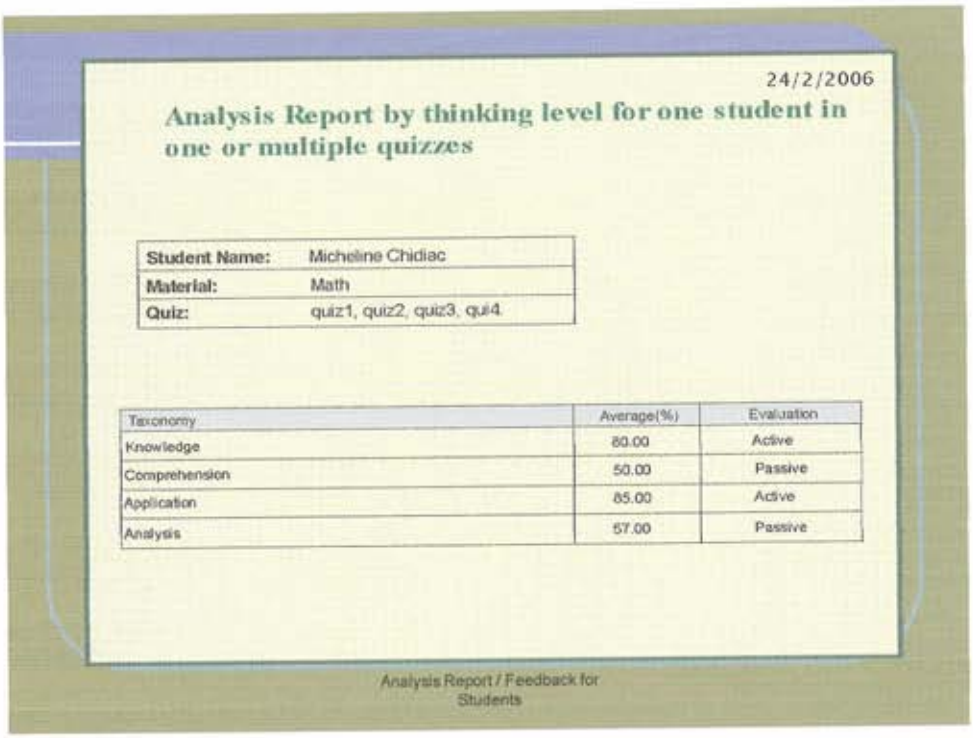
Criterion–referenced interpretation is used to reflect an individual's status in a certain domain. This report can be used by multiple stakeholders for the following purposes:

1. Teachers can highlight important learning outcomes.
2. Students get feedback of what they can or can't do (what objectives were achieved or not)
3. Teachers can identify strengths and weaknesses of students
4. Provide teachers with a guide to intervention plans
5. Provide data for parent-teacher conferences

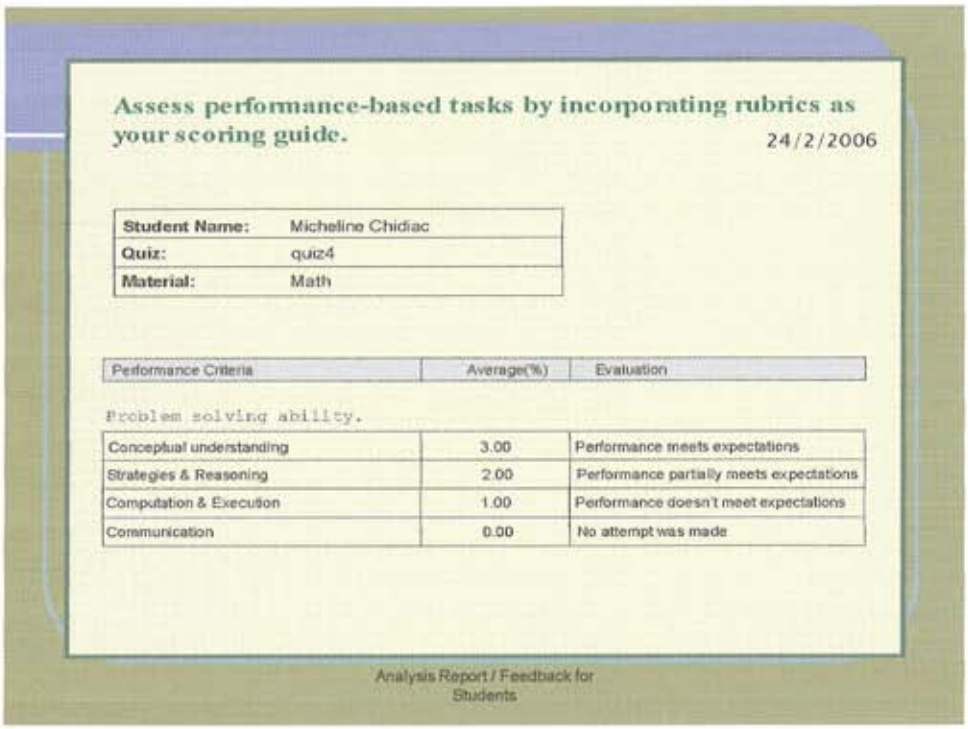


Growth–referenced interpretation is used to compare the student's performance with his/her prior performance. That is, how much a student has improved?

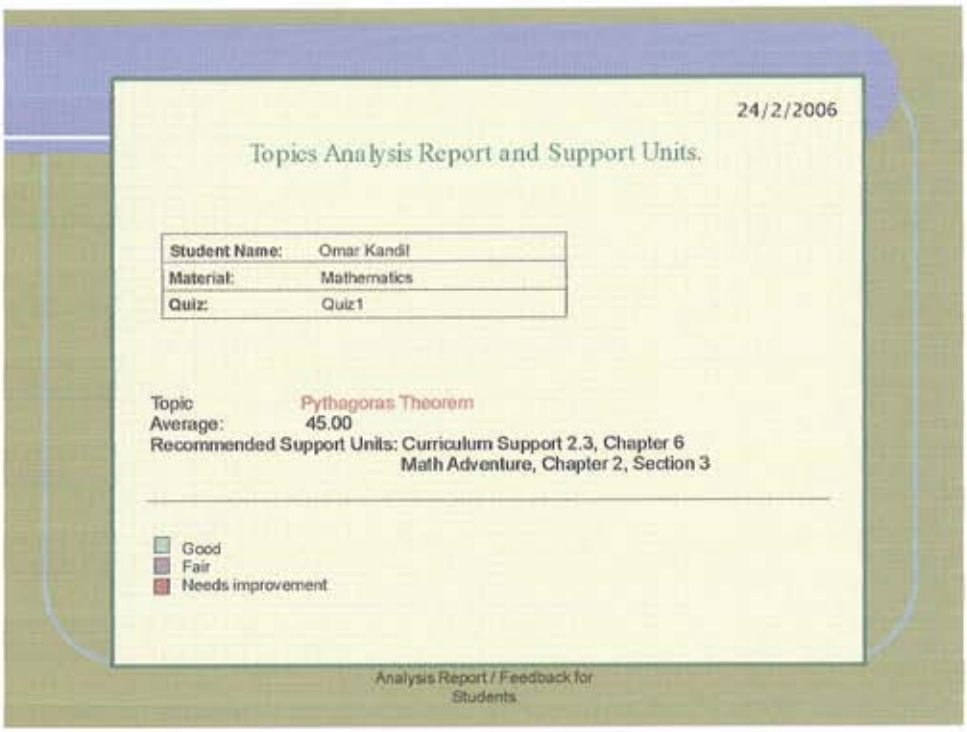
This report is used to motivate or alert students and can also be used in parent-teacher conferences.



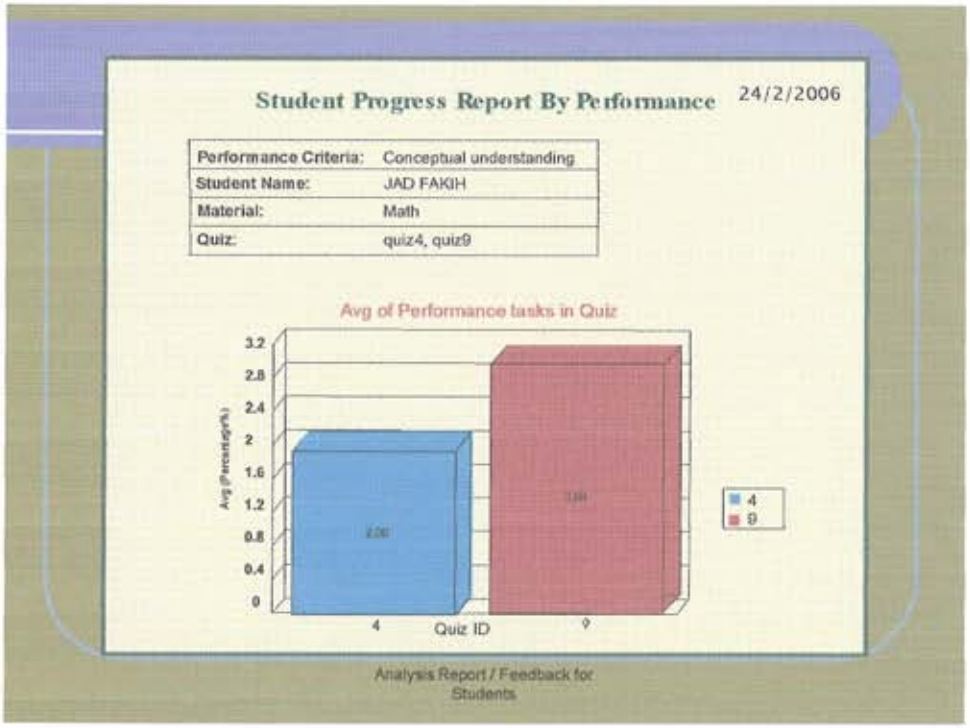
This report tells students what thinking level they are able to operate. That is, what type– according to Bloom's cognitive domain-- of problems are they capable of solving. By revealing this particular information, students are urged to practice more on the deficient type of problems.



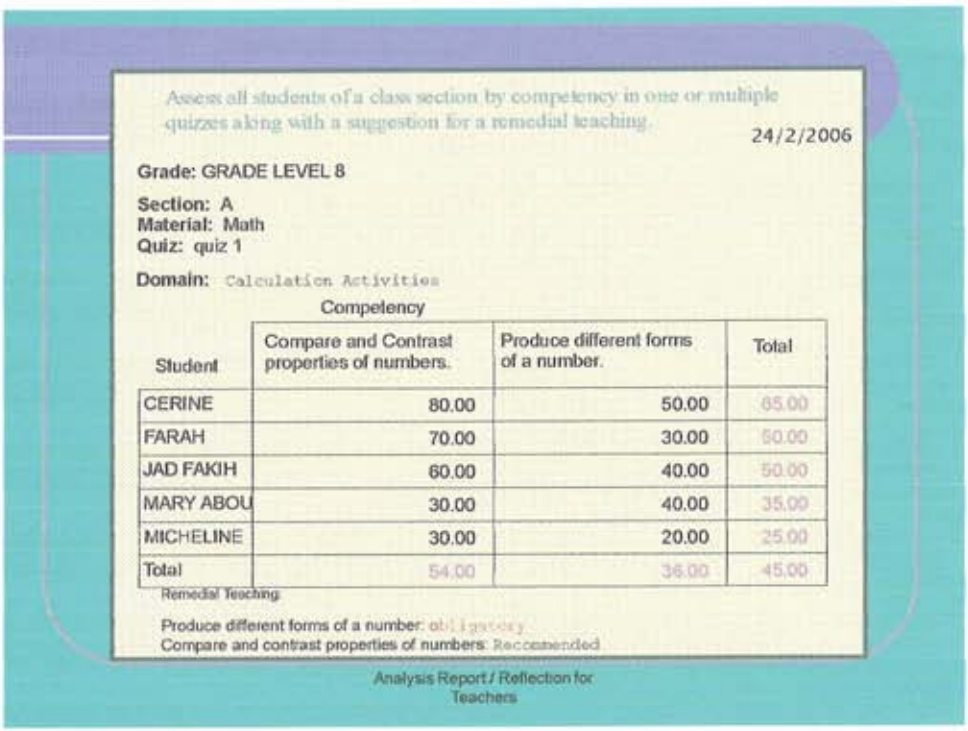
Performance-based assessment and constructed-response type of questions require performance criteria to grade. Students can use this report to know what are the important aspects of a specific task, to identify their strengths and weaknesses, and to diagnose the cause of a problem.



Once the problem (not achieved competency, deficiency in certain type of problems, or lack of certain quality criteria) is identified, students may use this report to help them select focused support units that help them overcome the obstacle related to a certain topic.



By providing specific and meaningful feedback to students and encourage them to regulate their own learning, teachers encourage students to enhance their sense of self-efficacy and self-confidence, important determinants of motivation. An increased motivation can result in improved learning as well as improved attitudes about learning in general.

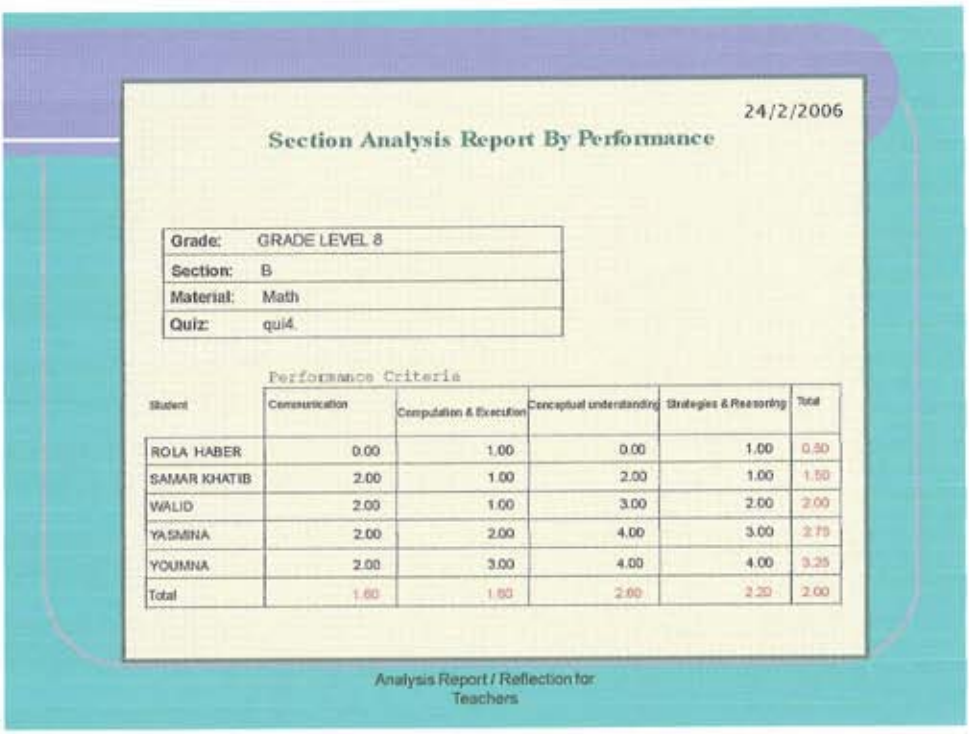


Teachers can use this report to answer the following essential questions:

Did my students achieve the preset competencies?

What are the strengths and weaknesses of my students?

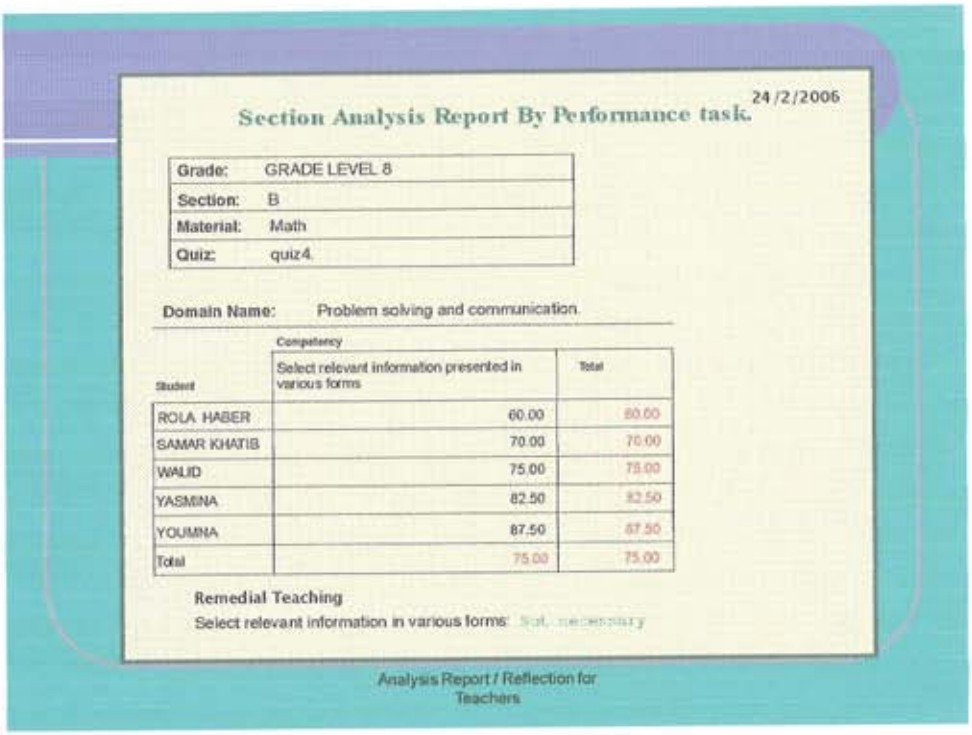
Does the teacher need to review anything the class didn't understand? Prompt for remedial teaching.



Teachers can use this report to answer, for example, the following essential question:

What criteria of a performance-based task the students lack?

Identifying the criteria that students lack, helps and guides the teacher towards focused intervention plans.



Section Analysis Report By Performance task. 24/2/2006

Grade:	GRADE LEVEL 8
Section:	B
Material:	Math
Quiz:	quiz4

Domain Name: Problem solving and communication

Student	Competency: Select relevant information presented in various forms	Total
ROLA HABER	60.00	60.00
SAMAR KHATIB	70.00	70.00
WALID	75.00	75.00
YASMINA	82.50	82.50
YOUMNA	87.50	87.50
Total	75.00	75.00

Remedial Teaching

Select relevant information in various forms: Not necessary

Analysis Report / Reflection for Teachers

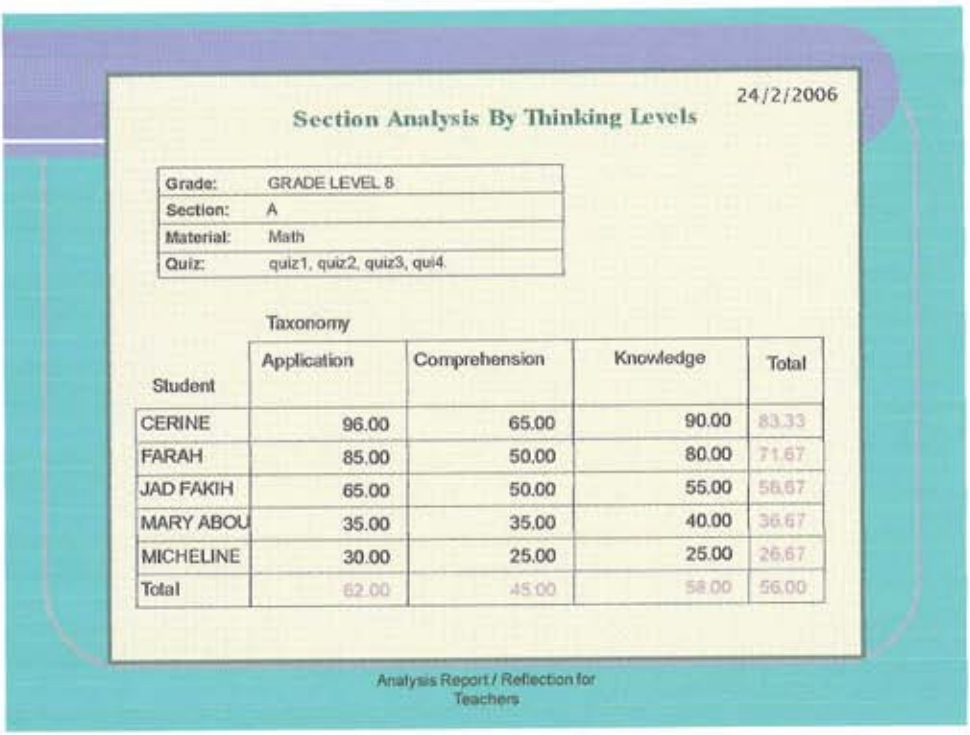
Teachers can use this report to answer the following essential questions:

What students can do and can't do?

Are my students capable of conducting performance based tasks?

Does the teacher need to review anything the class didn't understand?

What type of practice do the students need?



24/2/2006

Section Analysis By Thinking Levels

Grade:	GRADE LEVEL 8
Section:	A
Material:	Math
Quiz:	quiz1, quiz2, quiz3, qui4

Student	Taxonomy			
	Application	Comprehension	Knowledge	Total
CERINE	96.00	65.00	90.00	83.33
FARAH	85.00	50.00	80.00	71.67
JAD FAKIH	65.00	50.00	55.00	56.67
MARY ABOU	35.00	35.00	40.00	36.67
MICHELINE	30.00	25.00	25.00	26.67
Total	62.00	45.00	58.00	56.00

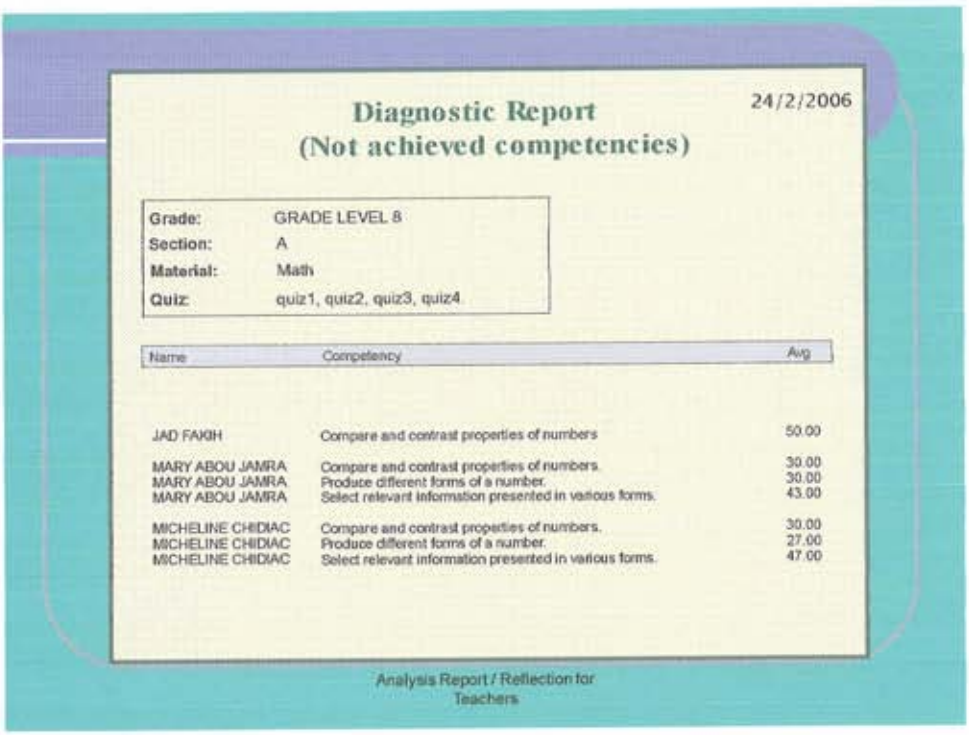
Analysis Report / Reflection for Teachers

Teachers can use this report to answer the following essential question:

Are my students capable of operating at high-order level of thinking?

What prerequisite knowledge do the students lack?

What are the strength and weaknesses of my students?



Teachers can use this report to answer the following essential questions:

Which students need extra help?

Which topics or objectives need to be reexamined?

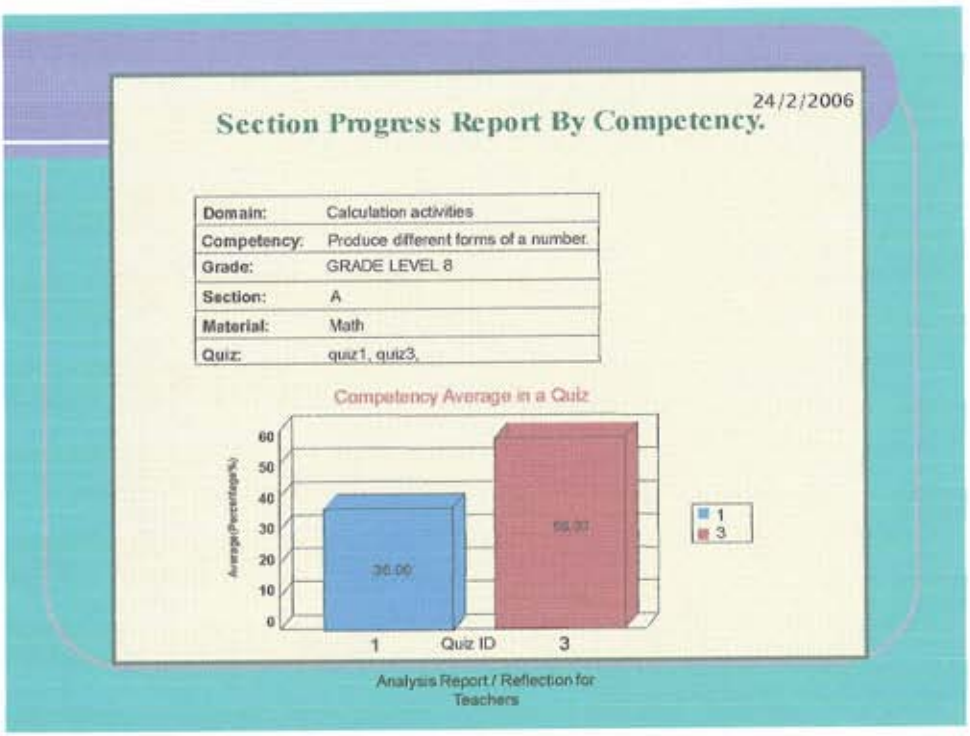


Table reports are used to display data relevant to a certain situation; graph reports are used to show the progress of intervention plans.

The above report shows the progress– from quiz1 to quiz3-- of a class section according to a certain competency.

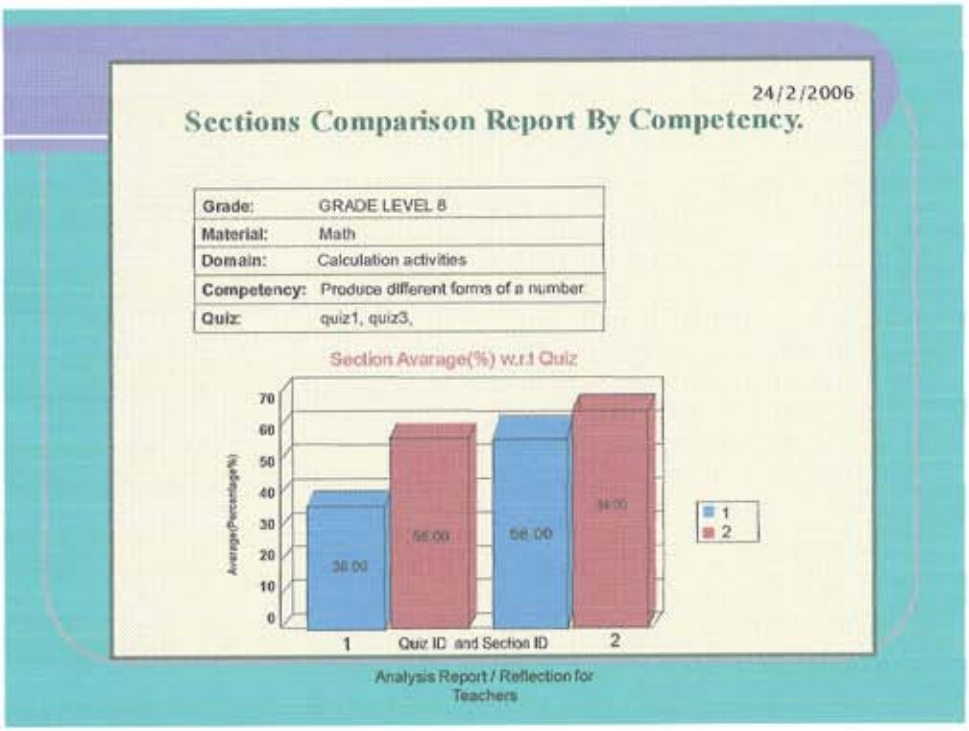


Table reports are used to display data relevant to a certain situation; graph reports are used to show the progress of intervention plans.

The above progress report shows a comparison of two class sections based on the same competency.

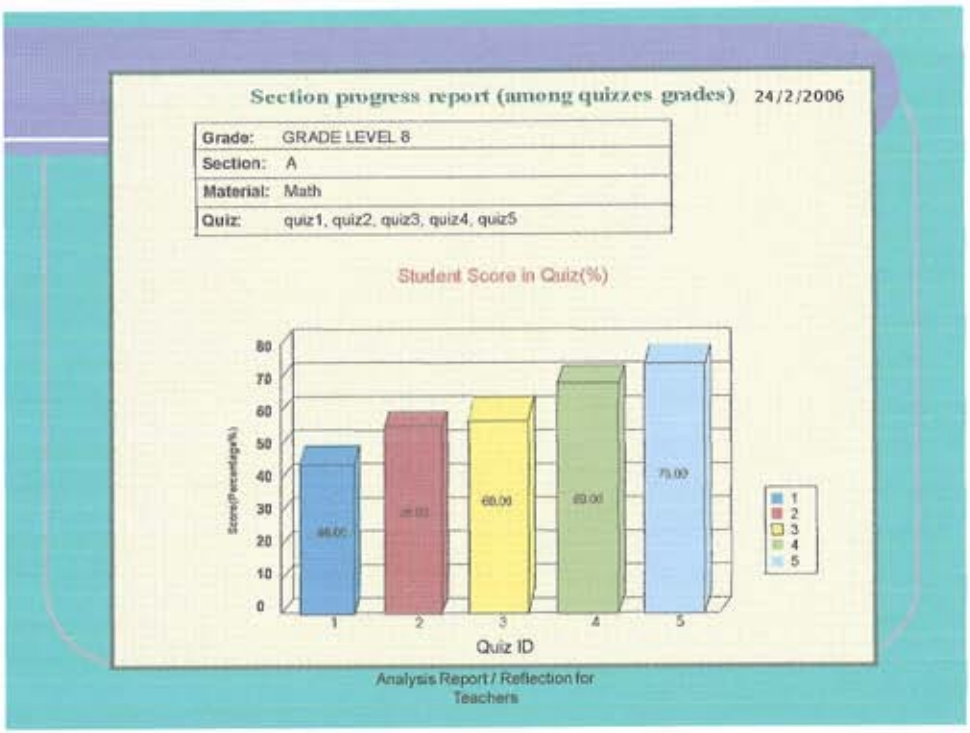


Table reports are used to display data relevant to a certain situation; graph reports are used to show the progress of intervention plans.

The above report shows the progress of a class section from quiz1 till quiz5.

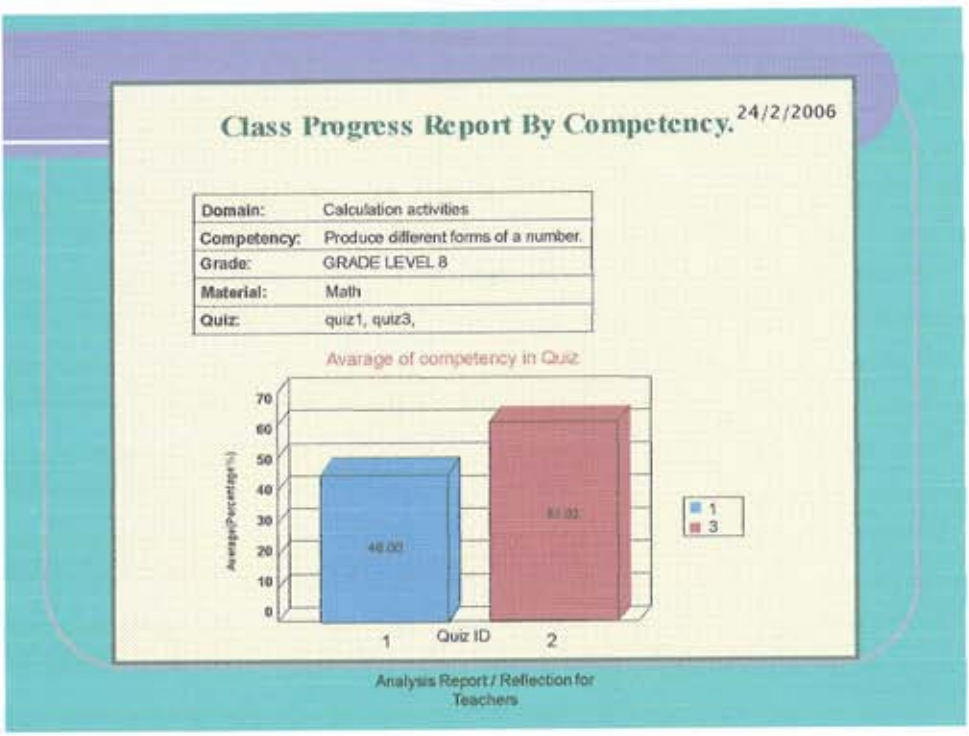


Table reports are used to display data relevant to a certain situation; graph reports are used to show the progress, if any, of intervention plans.

The above report shows the progress of a certain grade level or class (among all its sections) according to a certain competency.

The data-driven decision-making utility can aid school principals, Divisions Heads and subject coordinators to make reliable decisions concerning the above issues. In addition, the DDU will allow school administration to calculate correlations coefficients between scores. For example, the correlation between the scores that students get in their classrooms and those of an external examination such as Brevet exams.