An Interactive Decision Support Application for Grade Performance Analysis

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ABSTRACT

This paper presents a functional application that meets the needs of both the instructor and students in a class setting. For the instructor, the focus of this interactive application is on the management of class learning assessment. This interactive spreadsheet application is independent of grading scale for course items, and is based on course item weights, and weighted scored percentages. A demonstration of a grade performance analysis for a Database Management System course reflects class achievement of instructional goals under equitable learning achievement option plans. For a self-regulated student learner who seeks to improve class performance, this application facilitates the action of making adjustments in learning strategies. This application bridges the concept of a self-regulated learner with learning outcomes through its tracking, "what-if" and "goal-seeking" capabilities. The goal-seeking feature in this application allows students to know the required minimum grade achievement for a specific course item to maintain or improve current grade standing in class. A survey of this application revealed perceived usefulness of this application in areas of decision support and increased understanding of learning criteria used by instructor to assess class performance.

Keywords: equitable learning achievement option, self-regulated learner, class learning assessment, interactive spreadsheet application

1. INTRODUCTION

The role of grade in learning assessment and methods of assessing student performance in learning has been investigated and discussed from social development, cognitive learning, and pedagogical research directions. The common understanding that the grading system in educational institutions is a necessary evaluative component of the student learning process parallels a perspective of the grading system as an "appraisal system that provides orientation and confirmation of achievement of learning attempts." (Haagen, 1964, pp. 89).

Criticisms on standardized test assessment, which refers to objective tests (or multiple-choice tests), include emphasis on factual recall and "one" answer system, inherent bias in the wording and content of test items, and limitations in assessment of higher levels of thinking skills such as application, analysis, synthesis and evaluation in Bloom's taxonomy of learning objectives (FairTest, 2006).

According to Sherman (1985), effective learning is influenced by stable variables, institutionally-controlled variables and learner-controlled variables. Stable variables such as learner's socioeconomic status and standardized test scores are widely used as predictors of academic success. Examples of institutionally-controlled variables that may have an impact on learning are class size, temporal organization of course materials, academic standards, learning skill programs, and instructional techniques.

The learner-controlled perspective to effective learning is a focus on the management of learning process. Learning is a cognitive

activity that is an executive function of the learner for which self-regulating learning strategies are theorized to be employed in an academic learning environment. A behavioral-oriented strategy such as checking solutions in practice problem solving provides feedback for achieving a sense of self-efficacy in learning for the learner (Zimmerman, 1989). Self-regulating strategy is emphasized in the development of a decision-support application that aids a student in monitoring and exploring the grade performance situation in a class setting. The decision support application in this paper recognizes that the interactions between the learner and the learning environment to achieve a desired grade outcome in a class setting are through employment of self-regulating learning strategies. The interactive application can be regarded as an alert system that allows for grade performance analysis. The functions of updating, monitoring, what-if and goal-setting in this application allows a student, who is also a decision maker, to consider a possible shift in strategy to move closer to attaining an outcome.

2. GRADE PERFORMANCE DECISION MAKING PROCESS

Given the above scenario, a grade decision support application developed in Excel provides a way for a student to monitor his or her grade performance. This application supports a student in the process of deciding in a learning resource allocation situation. Resource is defined to be both external and internal to the student, and is within the control of the student. Such resources include personal time commitment to learning, application of learning skills, and use of learning resources and influencing strategies to improve or maintain a course grade level. Influencing strategies could focus on collective effort such as forming a study group and participating in an online learning community, or an individual effort in seeking more feedback from instructor on learning task definition. It is expected that a student who is oriented towards academic achievement and faced with competing demands for his or her time will need to know the impact of each graded component on the overall or summative course grade.

This is similar to the scenario where a decision maker faced with the responsibility to evaluate courses of actions, will need to consider situational factors. Situational factors may and usually do, lead to a compromise on an acceptable outcome that is associated with a chosen course of action. The satisficing principle in decision-making theory describes the behavior of a rational decision maker when resource constraints exist. These constraints are regarded as "uncontrollable" from the decision-maker's perspective. A student who chooses to opt out of an extra credit term paper or an optional test that may improve a current "B" grade standing to an "A" grade due to other situations that compete for his or her time and cognitive resource is an example of a learning resource allocation decision that is satisficing in principle.

3. SELF-REGULATED STUDENT LEARNER

Learner-controlled perspective in learning is found in self-directed learning and self-regulated learning literature. Long (2006) defines self-directed learning as "a purposive mental process, usually accompanied and supported by behavioral activities involved in the identification and searching out for information. The learner consciously accepts the responsibility to make decisions about goals and effort, and is, hence, one's own learning change agent." Simply, a self-regulated learner is someone who employs purposeful use of strategies to achieve academic goals. Such strategies are actions and processes that include using methods such as self-evaluating, organizing and transformation, goal-setting and planning, seeking information, self-consequating, and rehearsing and memorizing (Zimmerman, 1989). Self-regulation, according to O'Neil and Abedi (1996), is made up of three constructs, which are meta-cognition, effort and anxiety. Meta-cognition is the "conscious and periodic self-checking of whether one's goal is achieved, and when necessary, selecting and applying different strategies" (O'Neil et al., 1996, pp.3-4). Their paper concluded that planning, cognitive strategy, self-checking or monitoring, and self-awareness are valid measures for state meta-cognition. In addition, a positive relationship was found to exist between the level of state meta-cognition with academic performance and learning task complexity.

This paper presents an illustrative use of a software application that provides support

for a self-regulated learner in making conscious decisions that lead to use of appropriate strategies to achieve an acceptable outcome. "Late bloomers" or "late starters" may benefit from the use of this application as they are being alerted to corrective action for an improved grade performance before it is too late. A strategy such as making use of key learning resources may help to improve grade standing. This may be as simple as understanding the rubric system used by the instructor, using document template prescribed by instructor for a report or term paper, and reviewing a portfolio consisting of samples of student work made available by the instructor. In addition, learning resources can also include class notes, recorded lectures, practice solutions, and use of Internet and library resources that a student can rely on for defining learning task. According to a study by Elton and Laurillard (1979), learners who are able to coordinate learning resources with learning task demands seem to have a greater chance of success in learning achievement, and an individual's learning behavior can be quickly influenced by changing learning assessment form or format. This coordination can only be realized through an understanding of criteria used for a basis for learning assessment.

4. LEARNING ASSESSMENT

Prevailing factors that have an impact on academic settings such as nontraditional characteristics of students need to be addressed through course design and learning-centric assessment approach. About 75 percent of undergraduate students in 1999-2000 are considered to be nontraditional students according to the National Center for Education Statistics (2002). Nontraditional students have at least one of the following seven characteristics or risk factors: financial independence, part-time attendance, delayed enrollment, full-time work, dependents, single parenthood, and lack of a high school diploma. Nontraditional students are classified to be minimally, moderately, or highly nontraditional student depending on the number of characteristics that are identified with the individual. These risk factors are found to be negatively associated with persistence and degree attainment.

The common practice of principally lecture-based classroom environment with standardized test assessment has given way to alternative forms of assessment that focus on applications of knowledge and skills in "real situations". Alternative assessment is defined in MSN Encarta dictionary to be "any form of measuring what students know and are able to do other than the traditional standardized tests". Alternative assessments according to Herman, Aschbacher and Winters (1992) require students to create or produce something that tap their higher-level thinking or meta-cognitive skills. The types of learning evaluation in assessment are termed as formative and summative evaluations. Summative evaluation focuses on grading, such as that of standardized tests, and does not provide useful information about teaching and learning (Broad, 1995). In contrast, formative evaluation focuses on the learning process and describes evaluating learning tasks that are more complex in which the basis of such tasks is on building or development of knowledge and thinking skills. Assessment methods that focus on formative evaluation are learning-centric assessment methods.

As an example, a learning task in a Database Management System course includes an understanding of the normalization theory. This is necessary for knowing the reasons for normalizing tables in database design. Learning-centric assessment methods such as in-class and homework exercises, test questions, database design reporting, and learning summary are documents that are related to achievement of understanding normalization theory.

In an academic class setting, performance standards are course requirements set by the instructor using absolute weights on various learning achievement tasks. Intuitively, the measurement of learning achievement is not an exact science when one considers the variability in instructor's ability to match instructional goals with learning achievement tasks. A student's prior knowledge and skills play a role in the understanding of learning tasks and expectations over time, thus some students may take longer time to achieve a learning task. Criterion-referenced assessment is emphasized in the AACSB International standard on learning assurance, which focuses on learn-

ing goals and assessment of learning outcomes through course embedded assignments and rubric systems for evaluating course knowledge and skill content. Aviles (2001) provided a case for assessment of grade performance that is based on criterion-referenced method over norm-referenced method. According to him, norm-referenced methods that resulted in grade curving based on mean and standard deviation measures may lead to a lack of perceived need or considerations for improving teaching skills, course content, and student learning assessment. This may further impair efforts in curriculum planning and management.

Criterion-referenced assessment is also associated with the goal of improving assessment of learning of defined knowledge and skill competencies in academic settings. This approach requires an explicit articulation of criteria for evaluating student work. It has been argued that the assignment of letter grades in qualitative assessment of a report-writing assignment, such as a "B" for a report that is "coherent" and "B+" for a report that has evidence of "originality" is however, subjective, experience-conditioned, knowledge-related, culture-bound, and emotionally influenced (Saliu, 2005). An intervention treatment study based on participation in assessment workshop revealed that students who attended the 90-minute workshop performed significantly better in grade performance than those who did not attend the workshop (Rust, Price and O'Donovan, 2003). The results of this study demonstrated that a knowledge transfer process is required to communicate both explicit and tacit knowledge about assessment.

5. GRADE PERFORMANCE ASSESSMENT OPTION

For many college and university environments, student subpopulations such as traditional and nontraditional students pose challenges to assessing students using a fixed system of weights for evaluative criteria. A more flexible course design that accommodates several assessment options provides students with choices in how they would prefer to be assessed for their learning performance in class. In a flexible course design class, there should not be any perceived inequity within the assessment options; neither should there be any perceived trade-off between learning objectives and standards with the assessment options. Assessment options suggested here can be compared to health insurance options. A typical HMO provider offers tiered options for medical benefit coverage, which is set against the amount of deductible and coverage for within network or out-of-network healthcare providers. However, with assessment options for learning achievement, the student have to choose an option that maximizes his or her strengths in applying specific learning skills with consideration for availability of personal time for learning tasks that involve peers in a group project. Although there are studies that have pointed to advantages of peer learning and the importance of developing collaborative skills while in college, many real class situations reveal that students generally find group work to be negative learning experiences. Reasons such as group member's lack of preparation and contribution, external time responsibilities, lack of group work experience, age and cultural differences are examples of concerns expressed by students about group work (Barfield, 2003). His investigative study on the influence of social processes on student groups in sections of two courses, Group Interaction and Decision Making and Conflict Management, revealed that age and number of hours worked per week were significantly related to group satisfaction and perceived fairness of group grade received.

The instructor can provide grading options for various learning tasks that can improve learning satisfaction and performance. As an example, an instructor may offer students with two grade performance assessment option plans in a course; Plan A with 60% of the course grade evaluated in individual work, which may consists of a combination of tests, assignments, and summary report, and the remaining 40% of the course grade evaluated based on a group project outcome, and Plan B, with 70% of course grade for individual work and 30% of course grade on a group project outcome. The rationale for different assessment plans can be viewed from self-direction in learning perspective in which the "learner assumes the primary responsibility of planning, implementing and evaluating the learning process," with the instructor assuming the role of the facilitator of the process (Brockett and Hiemstra,

1995). Also, it can be argued that, "one size does not fit all" can be applied to the interrelated concepts of assessment and learning, and that "fairness" and choice can have similar meaning in certain situations.

6. ASSESSMENT OF GRADE PERFORMANCE

The concept of weight as described in the above course assessment plans are expressed in quantitative models, and implemented in many evaluative techniques such as the weight-scoring sheet for evaluating alternatives, and the beta risk factor which estimates the volatility of stock against a broad market index in the Capital Asset Pricing model. Weights could be exact or imprecise, and they could be either statistical or subjective estimates. A simple expression of weights is the min-max normalization of numerical values to the [0,1] range. The weights for emphasizing on the importance of course items in this application are preset by the instructor, and are regarded as instructor's subjective estimates of the relative importance of items to achieve learning of the subject based on Bloom's higher order thinking skills (Faculty Innovation Center, 2006). Thus the distribution of pre-set weights on items also projects instructor's preferred instructional goals for developing certain cognitive skills. The examples provided in this paper will demonstrate a learning achievement assessment option plan in an actual course setting.

Performance requirements for the course are usually included in the syllabus. Such requirements can be reported based on points possible for each item as in the following class scenario:

- 3 tests @ 100 points = 300 possible points
- 5 homework assignments @ 20 points = 100 possible points
- 1 database report = 100 possible points
- 1 oral presentation = 50 possible points

Let's assume that the cutoff grade percentage for the overall course performance is 90% for the letter grade "A", 80% for the letter grade "B", and so on. In the above case, the total possible points for the course is 550 points, and the weights for each item can be easily reported as well. The student should have no problem computing the current standing in grade percentage by taking scored points for assessed items and divided by the sum of possible points for these items. As an example, say two tests have been assessed with scores of 75 and 85, and three homework assignments assessed with scores of 17, 18, and 15 respectively. The student grade standing is therefore 80.77%, which is equivalent to the letter grade "B". A student concerned with what he or she has to make for the remaining items in order to make a "B" course grade will have no problem figuring that an overall minimum of 80% work must be achieved for the remaining items. This is based on calculating or estimating the course weight for these assessed items, which is 47.27%, or about 50.00%. To calculate the course weight for these assessed items, you divide the total possible points for one test and three homework assignments by the total possible points for all the items. But the situation is less clear when one third of the course is assessed at a grade standing of 65%. A formula to compute the overall minimum grade percentage for remaining items is provided as follows:

$$WP_{\min} = \frac{OGP_{desired} - WP_{attained}}{100\% - WP_{attained}}$$

where $WP_{\min}$ is the overall minimum. From this formula, the answer is an overall minimum of about 73% on the remaining items is required to maintain a "C" letter grade for the course.

Without the use of the above formula, an overestimation of an expected overall minimum for remaining components is a likely outcome. This of course, does not have a negative impact for the student in that he or she will at least need to try harder to earn a better grade. However, the formula presented does not provide an answer to the question, "What do I have to make in percentage score for an upcoming test to improve my current grade standing from 85% to 90%?" The "goal-seeking" feature in Excel is employed in the proposed grade application to provide an answer for this question.

7. DECISION SUPPORT APPLICATION

An example of the interactive decision support application for grade performance assessment is illustrated for an introductory course in Database Management System. A course grade performance assessment application is designed for student use. A set of instructional and learning goals for this course are expressed as follows:

1. Demonstrate understanding of the objectives of a database management system, relational data model concepts, relational database design theory, physical database design, and database administration issues
2. Construct a database design by applying normalization techniques and using extended entity relationship diagramming technique
3. Implement a complete database system with interactive form and reporting applications in Microsoft Access
4. Document the process of design and implementation of the database system
5. Communicate learning experience from system implementation and demonstrate the functionality of the system in oral form

The course is designed to incorporate both theory and practice, and student learning is based on the alternative form of assessment. The requirements for this course consists of 3 tests weighted at 15%, 15% and 20% respectively, homework assignments for which the total weight is 20%, and a database project weighted at 30% of the course grade. Tests are a combination of multiple choice and problem-solving questions. In this application, the number of homework assignments need not be fixed. For this course, it is expected that there will be a minimum of 5 homework assignments, one assignment for each topic covered in the course. Homework assignments differ in complexity in terms of time consequence and perceived level of concept difficulty. As such, the points assigned to individual homework reflect instructor's perceived level of challenge of the assignment to the average student. Based on student performance and feedback, instructor has the option to increase the number of homework assignments for more practice. For example, the normalization concepts and procedure are harder for students to grasp than concepts about the relational data model concepts. The worksheet design allows the instructors to add more homework assignments deemed necessary to develop a better understanding of difficult concepts.

Figure 1 illustrates a sample worksheet for analyzing course grade performance assessment by a student at some point during the semester. Grading scales can be different for course items in the same group. For example for Exam 1, 40 multiple-choice questions were graded at 1 point each and 5 problem-solving and short-essay questions were graded at 5 points each. Thus, the total points for this test is 75 points. In the 2nd exam, the test has 50 multiple choice questions at 1 point each and 8 problem solving questions at 5 points each, adding up to 100 possible points for this test. The points assigned to different type of question are based on the instructor's estimation of the relative demand on higher order thinking skill. Solving a problem by showing the steps in a solution demonstrates greater understanding of concept compared to responding correctly on a multiple-choice question. In the grade performance assessment management application, each incoming graded course component will result in a newly computed overall course grade. The overall course grade is considered to be the target. The goal-seeking feature in Excel can be used to compute the score for a future course item to achieve a desired overall course grade.

[Figure 1]

The grade application worksheet in Figure 1 is a snapshot of the completed course requirements as of a certain point of time during the semester. The "!" symbol to the far right of the worksheet indicates missing grade information for course requirements that have not been entered or evaluated. "NA" stands for non-applicable; as in this case the totals for the three columns have no useful meaning. An important understanding about this grade assessment application is that the weights assigned to various course items are assumed to somewhat reflect good assessment knowledge and application of higher order thinking skills. A summary of the features in this application is provided as follows:

1. Overall grade performance reporting is based on the "as of now" concept
2. Performance target can be changed by individual over time
3. The possible scores for individual items can be based on any number scale
4. The weighted percentage for an item is the achieved level of performance based on assigned weight for the item
5. The totals for score, possible, and score in percentage are "NA" or non-applicable as these summaries do not provide any useful information because of the different weights assigned to items and the allowance for any number scale for each item

The weighted percentage for an item, WP_i is computed by the following formula:

$$WP_i = W_i * SP_i$$

where for item i, W_i is the weight in percentage, and SP_i is the scored percentage. The weighted percentage is used instead of score percentage for several reasons. The most important reason is the naïve and incorrect assumption that the average of score percentages for all items is equivalent to the actual average grade performance level when there are different assigned weights for some of the items. An example of this situation is provided in Figure 1 in which 15% is assigned to the 1st two tests and 20% weight is assigned to the 3rd test. In another possible situation, the instructor may provide an optional comprehensive examination for a course that is structured to focus more on application of knowledge and skills in project-related requirements. The options provided to students are option A, which is 15% for all three tests, and option B in which 10% course weight is assigned to the 1st two tests and 25% for the comprehensive test.

The overall grade in percentage for a course with at least one item that has a different assigned weight is given by the following expression:

$$Grade_{overall} = \frac{\sum_i WP_i}{\sum_i W_i}$$

When $\sum_i W_i = 1$, or 100%, i.e., all the items have been evaluated and assessed, then the overall grade is the course grade earned by the student. An advantage of using weighted percentages for items is that the "as of now" grade performance can be easily computed using this application. Thus, at any time, a student can evaluate his or her grade standing or performance in the course with respect to completed course items. Mid-term reporting mandated by some institutions, will see that the grades reported at mid semester accurately reflects the current grades with respect to the actual completion of course requirements.

Another interesting feature of this application is the flexibility of number scale that can be used for grading. Grading is an exercise that requires judgment, experience, and expertise in the subject. The process of assigning points to problems in different sub-topics is based on the instructor's assessment of the level of concept difficulty. Difficult subtopics should be supported by instructional effort spent in formative assessment of concept learning. Instructional effort can take the form of additional class time spent in learning activities and development of learning guide to facilitate learning of more challenging concepts. Therefore, if the test only consists of two problems in which problem B is assessed to be two times more difficult that problem A, and the test is graded out of 100 possible points, then the solution to problems A and B will be assigned 33.33 points or 33.33% of test grade, and 66.67 points or 66.67% or test grade respectively. A different scale that imparts the same weight percentage information is 30 possible points assigned to problem B, and 15 possible points assigned to problem A. In this case the test is graded out of 45 possible points.

Assessment options can be probed by changing the weights for allowed items. The shift towards focusing on learning assessment rather than instructor's teaching performance is a continuous improvement approach to development of course curriculum. Learning is a process that requires continuous update of knowledge base. This applies to both instructor and student in their respective roles. The ability to match instructional goals with learning assessment and

instructional strategies is an experiential process. Grade curving methods, which include fixed proportion of grades, and statistical derivation of final grades based on mean and standard deviation measures lack interpretative power when the grade distribution is not a normal distribution (Echauz,1995).

Personal class teaching experience revealed that actual or realized student learning outcomes may not be at the expected level based on several factors such as lack of basic or required knowledge and skills in students, mismatch of instructional goals with methods of instruction, and inappropriate learning assessment methods. Variability in student learning and understanding of subject, task definition, grading criteria and instructor standards over time means that assessment of learning performance at different times should take into account the learning curve experience factor. The emphasis on continuous improvement in teaching for the instructor implies that some measure of flexibility in learning assessment is necessary. Corrective actions that involve major or minor revisions of course curricular design apply to future classes. An approach to incorporate tacit assessment knowledge for the current class situation is the adjustment of weights on course items.

The weight emphasis in this interactive grade application allows an instructor to adjust weights on items based on reflective thinking on possible factors influencing the performance level of the class. Such reflective thinking may also be triggered by an analysis of the grade performances of students in class. By changing the weights for course items, the instructor can see the impact of changes on the overall grade performance of students. Figure 2 illustrates the use of weights in exploring the final course grades for a hypothetical Database Management System class. The worksheet is set up to allow the instructor to probe changes in course item weights based on averages in percentage for these items found in the last row of the worksheet.

[Figure 2]

[Figure 3]

Reducing the item weight for the 1st exam from 15% to 10%, and increasing the item weight for the project report grade from 20% to 25% in the weight table shown in Figure 3, resulted in upgrading of students with ID numbers: 2, 3, 10, 13, 15 and 19, to the next higher grade level. The advantage of adjusting weights in this class scenario is that it draws upon making tacit information in assessment explicit with justification for such adjustment. The set of original and revised set of weights represents equitable learning options that address student subpopulations such as traditional and nontraditional students. Justification documentation in the context of learning outcomes, instructional goals, and assessment methods provide important information for continuous improvement in curriculum design and teaching. The grade worksheet application in Figure 2 is set up to allow for analysis at any time during the semester when the course requirements are partially completed. Values for item weights in percentage are entered into the weight table when course items for students have been graded and entered into their respective grade columns in Figure 2.

This goal seeking is a feature in Excel that employs a linear or non-linear optimization technique to generate an approximate solution for a variable to achieve a specified target level for a goal variable. Goal-seeking can be regarded as an accelerated "what-if" analysis in spreadsheet analysis. In "what-if", scenarios are generated by changing values in input cells to probe into changes on an output cell. This output cell is an expression of the input cells and is typically a performance measure. When the level of achievement of performance measure is "known" or expected, then the goal-seeking analysis is appropriate. A goal-seeking illustration of the interactive grade performance assessment application is provided in the following scenario:

> "In Figure 1, a student would like to know what score is needed for the project report to make the "A" course letter grade. The student must first enter an arbitrary value for possible points for the project report before the initiating the goal-seeking algorithm. By clicking on "Goal Seek" in the Tools menu, the student provides the information for the 'Set cell', 'To value' and 'By changing cell' and obtain a score in percentage result of 93.35% for the project report. The 'Set Cell' and the

cell that contains the formula for the overall performance level which is the goal variable, and the 'By changing cell' refers to the cell reference in the Score column that corresponds to scored points for the course item in question. This feature can be used to probe any specific course item to analyze assessment options available, for example whether to take an additional comprehensive test option, and application of appropriate learning strategies to improve grade standing."

8. PERCEIVED USEFULNESS OF APPLICATION

To assess the utility of this interactive application, an e-mail survey was administered to students that are currently enrolled in the Decision Support Systems course and to students that have completed this course in the last two semesters. The Decision Support Systems course is a senior-level course for the MIS degree program. The choice for this course is based on in-class illustration of the grade application worksheet as a decision support application at the beginning of the semester. The concepts in the application were explained and students were required to set up the application. This exercise reinforces student understanding of decision-making, and the "what-if" and "goal-seeking" spreadsheet analysis. The questionnaire was sent out to all 14 students currently enrolled in the course and to students who have completed the course in the last two semesters and whose e-mail accounts still exist in the university e-mail directory. The results of the survey are tabulated in the following table:

[Figure 4]

The survey also included a section for further comments by students. A summary of these comments are provided as follows:

- "Excellent tool, I agree that this tool should be given to you in every class."
- "This is a wonderful tool that can be used to estimate where a student stands (grade wise) in the class that allows the student to make decision on study habits."
- "I think that the DSS grade application is a useful tool but at the discretion of the user. "
- "I have tested different scenarios using hypothetical test scores to help me to understand what I can achieved under these situations."
- "I believed this is a good way for students to see where they are and also see where they need improvement by asking the professor what they can do to improve in that area."
- " This is a very informative tool for the class."
- "I think that the Excel grade application is an excellent tool that can be used throughout the college or graduate school."

9. CONCLUSIONS

In an academic classroom setting, the decision makers are both the instructor and the students. This application is designed to meet the instructor's need in assessing learning performance of students based on defined learning goals (criteria). In the example of the homework assignment for the Database Management System course, the interactive spreadsheet allows instructor to flex on the number of homework assignments. In an assessment system that is based on points, the addition of one homework assignment would not be possible, as this requires the instructor to change points allocated to other course items such as exams or project. The key to this grade performance application is the focus on weights on course items. Another advantage of the application is that the instructor is not confined to a fixed-point scale for grading. The same exam can be graded out of 100 points or 60 points. This increases the flexibility for the instructor to add a test question to an exam from previous semesters that focuses on an important concept that has not been sufficiently covered or well understood in a prerequisite course. An exam that was graded out of 60 for 6 questions at 10 points for each question will now be graded out of 70 points for that one additional question. The application implemented with exam weight and computation of weighted percentage will automatically compute the overall grade performance. In addition, this application allows for consideration for equitable assessment options to address learning needs of subpopulations as in traditional and nontraditional students in a class.

For the student, the emphasis on the use of the application shifts from content based assessment issues to tracking of grade performance in class and making conscious decisions on adjusting use of learning strategies to improve grade standing. Additionally, for a student receiving financial aid, the decision to maintain a required minimum overall GPA is a concern. By being able to know interim grades, a student can act appropriately in this case. This application offers continuous monitoring of grade performance that allows for modification of learning behaviors that may lead to learning improvement and performance. It is also assumed that students who are self-regulated learners will find this application to be beneficial.

When the application is set up as a grade workbook with rows for students and columns for various course items and computations of weighted percentage and overall performance as in Figure 2, the instructor can explore possible changes in weights for course items based on perceived level of success in employing of teaching strategies that improve student learning, or achievement of instructional goals. Weight adjustments for course items imply degree of challenge in teaching topic-specific or skill-specific requirements that can be addressed through future teaching strategies or curriculum revisions.

The emphasis on student learning outcomes in the current assessment-learning trend in higher education requires instructors to be more reflective in their assessment strategies. This implies that class performance needs to be carefully evaluated with reflective thinking derivative on achievement of instructional goals and learning process. The practice of course grade curving without further analysis on class performance does not lead to any degree of understanding on what is lacking in assessment and student learning for future improvement. Equitable assessment options need to be provided for students exhibiting nontraditional characteristics who have employment and family commitments, albeit challenges in implementing self-directed learning plan at undergraduate level. The proposed interactive grade performance analysis application can be regarded as a supporting tool for students and instructors in the assessment of learning and instruction.

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FIGURE 1

Your overall performance level as of			*8/20/06*	88.78%	B	
Target overall performance level				90.00%		
Deviation from target level				***-1.22%***		
Computed weight %				55.00%		
Weight Assigned	Item	Score	Possible	Score in %	Weighted %	
15.00%	E1	85	***75***	113.33%	17.00%	
15.00%	E2	79	***100***	79.00%	11.85%	
20.00%	E3			0.00%	0.00%	!
20.00%	Hmk1	45	***50***	90.00%	2.73%	
	Hmk2	72	***75***	96.00%	4.65%	
	Hmk3	95	***122***	77.87%	4.98%	
	Hmk4	50	***50***	100.00%	3.37%	
	Hmk5			0.00%	0.00%	!
	Hmk6			0.00%	0.00%	!
				0.00%	0.00%	!
				0.00%	0.00%	!
				0.00%	0.00%	!
2.50%	Project Proposal	8	***10***	80.00%	2.00%	
2.50%	Project Progress	9	***10***	90.00%	2.25%	
20.00%	Project Report			0.00%	0.00%	!
5.00%	Project Oral			0.00%	0.00%	!
100.00%	Total	*NA*	***NA***	*NA*	48.83%	

FIGURE 2

Possi-ble	50	75	100	20	50	72	112	80	40	374	25	25	100	50	200	Course Grade	Course Grade	
ID	E1	E2	E3	HMK 1	HMK 2	HMK 3	HMK 4	HMK 5	HMK 6	Htotal	Ppro p	Pgre s	Prep	Poral	Ptotal	Origi-nal	Re-visedl	
1	35	62	78	18	45	67	102	80	40	352	21	18	78	42	159	81.17 %	81.65 %	B
2	32	68	88	17	35	72	110	80	40	354	25	25	95	48	193	88.68 %	90.31 %	A
3	35	59	88	20	46	70	112	75	40	363	25	25	98	48	196	88.71 %	90.11 %	A
4	40	65	78	17	48	61	99	72	0	297	23	23	85	45	176	82.88 %	83.28 %	B
5	25	51	80	11	42	71	99	75	40	338	20	18	72	40	150	74.27 %	75.52 %	C
6	35	65	85	18	45	65	99	75	32	334	21	23	83	46	173	84.31 %	85.14 %	B
7	46	55	75	18	0	65	0	75	0	158	22	21	85	41	169	73.60 %	73.22 %	C
8	33	45	78	15	0	0	67	70	32	184	23	21	69	35	148	66.54 %	66.94 %	D
9	41	65	85	16	48	72	110	80	0	326	19	23	90	40	172	85.53 %	85.73 %	B
10	40	62	92	18	41	72	98	80	35	344	25	25	92	46	188	89.40 %	90.10 %	A
11	21	52	72	18	35	65	89	71	40	318	20	21	81	42	164	72.71 %	74.71 %	C
12	39	65	85	20	47	66	79	58	32	302	22	25	88	45	180	84.85 %	85.45 %	B
13	27	35	75	10	38	68	92	75	0	283	20	21	83	40	164	69.83 %	71.23 %	C
14	41	65	88	19	45	70	89	65	35	323	25	25	93	43	186	88.07 %	88.62 %	B
15	40	60	95	17	50	65	105	78	40	355	25	25	88	46	184	89.58 %	90.18 %	A
16	36	58	78	18	42	68	99	72	0	299	20	18	77	40	155	77.24 %	77.51 %	C
17	36	58	81	20	50	72	88	80	40	350	25	21	86	42	174	83.42 %	84.17 %	B
18	38	62	86	19	45	72	112	78	35	361	18	25	88	43	174	86.40 %	86.95 %	B
19	36	57	75	15	45	72	112	0	0	244	25	25	95	50	195	79.50 %	80.77 %	B
20	29	45	65	9	33	50	57	45	40	234	15	21	70	35	141	64.36 %	64.99 %	D
21	38	50	76	9	37	45	0	0	0	91	21	21	75	42	159	65.32 %	65.49 %	D
22	30	50	75	12	45	70	91	71	38	327	18	25	85	42	170	76.99 %	78.24 %	C
	35.14 70.27%	57.00 76.00 %	80.82 80.82%							297.14 79.45%					171.36 85.68%	79.70 %		

FIGURE 3
Weight Table:

Weights	original	revised
E1	15%	10%
E2	15%	15%
E3	20%	20%
HMK	20%	20%
Pprop	2.50%	2.50%
Pgress	2.50%	2.50%
Prep	20.00%	25.00%
Poral	5.00%	5.00%
	100%	100%

FIGURE 4

Item	Number of responses (total = 20; 11 currently enrolled, 9 graduated or have completed course)				
	Strongly Agree	Agree	Neutral	Disagree	Disagree Strongly
Q1. Overall, the DSS grade application is a useful tool	10	7	3	0	0
Q2. I understand the application well	7	11	2	0	0
Q3. I have used the application to evaluate my grade standing at various times during the semester	9	6	2	3	0
Q4. The application has helped me to focus my effort in improving grade standing	8	5	5	2	0
Q5. I would recommend that this application be used by students in other classes	10	7	3	0	0
Q6. The application has helped me to understand the importance of weights and criteria evaluated in this course performance assessment	8	8	4	0	0
Q7. The excel application is a good illustration of decision support concept	14	5	1	0	0