

# **From Impressions to Inference: Holistic Assessment in PBL**

## **A case study from the Republic Polytechnic, Singapore**

*Ranga Venkatachary and Friso Kluit*  
*Republic Polytechnic, Singapore*

### **Abstract**

Using a description of holistic assessment scheme as implemented in the PBL process at the Republic Polytechnic, Singapore, and some preliminary data from a small sample from the same institution, this paper discusses the reasons for and means of student performance assessment in PBL environments.

### **Introduction**

Learner –centred pedagogical methods emphasise that learning and assessment are to be viewed as integral parts of a whole rather than two separate compartments of education. Problem-based Learning stresses upon this idea further because it views learning as a performance. In order to be authentic and reliable, assessment of such learning must be situated within the scope of the given performance and must be done against multiple evaluative criteria. In other words, the curriculum, the learning and assessment need to be aligned. This paper uses a small pool of data from the implementation of holistic assessment at the Republic Polytechnic, Singapore as a base for a discussion on certain key questions: they are:

- How can we define a holistic judgment in assessment?
- Can we find common patterns in such holistic judgment across facilitators and across modules?
- Can performance assessment indicate levels of ability among students?
- Can context-dependent assessment be objective?

### **Background**

#### *Alignment between assessment and learning*

What is seen as a good pedagogical design often rests on how the system is conceived. The intersection between the teaching, learning and assessment processes in education presents us with an interesting paradox. The traditional models of teaching –learning tend to be caught up in a didactic paradigm where transmission and transfer of knowledge and skills are the dominant modalities. In such contexts, the assessment process samples the pool of acquired knowledge and skills. The logic seems to be based on the assumption that if one produces, on demand, evidence of having mastered such assimilated knowledge then one can use it whenever required – theoretically in an infinite number of new situations. This assumption is the fundamental reason behind the lack of alignment between teaching, learning and assessment in this pedagogical design.

A major component in this design is that assessment is a separate process from teaching- learning – the former carried out when the latter is finished. In many cases, the effective purpose of the examination is to rank order the students, heavily dependent on the ability of the person being tested to recall and symbolically represent knowledge, on demand, in decontextualised situations. The system seems to tell us ‘who is better than whom’ at learning but little about what has been

learnt. There is no necessary connection between learning outcomes of a course, the teaching methods and the assessment.

Problem-based learning (PBL) addresses the issue of alignment through a holistic approach to teaching-learning and assessment. The basic premise in PBL is that in real life, in any professional setting, one engages in performances that contribute to the solution of problems; rather than producing, on cue, symbolic samples of one's repertoire of knowledge/abilities. Holistic assessment in PBL focuses on one's ability to solve problems in context and in teams –using the knowledge and skills of one's own as well as leveraging upon those of others in the team.

### *Learner centred pedagogical design*

Learner-centred pedagogical approaches (including PBL) are framed by the growth of two major theoretical positions: phenomenography (Marton and Saljo, 1976; Marton and Ramsden, 1986; Marton and Booth, 1997) and constructivism (in many forms: individual, social, cognitive, and post modern) (Duffy and Cunningham, 1996). The common element (despite many differences) between two theories is the belief that meaning (as in learning something new) is not transmitted by direct instruction but is created by the students' learning activities, their 'approaches to learning'. To quote Shuell (1986), PBL believes that what the student does is actually more important in determining what is learnt than what the teacher does. From this view, there are three steps in designing an aligned system of teaching- learning and assessment.

- Stating the learning outcomes in a context/unit of learning
- Designing 'learning activities' for the students to engage in so that the outcomes may be achieved
- Deciding if the outcomes are achieved in a reasonably effective manner (i.e., establishing a grading system of what is learnt: the grade categories of 'A', 'B', 'C', 'D', should define degrees of reasonableness for unit in a module) (Feletti, 1997)

### **One day one problem approach at the Republic Polytechnic**

The implementation of PBL at the Republic Polytechnic, Singapore is characterised by division of a given curriculum (say, of a module) into 16 PBL problems. A module is transacted in a semester and a semester comprises 16 weeks of contact study time. In effect, students work in teams on a given PBL problem for the span of a whole day (8 hours approximately). Each PBL problem carries a set of learning outcomes, a context for learning activities and exploration (articulated in the problem statement) and scope for assessment.

Assessment of student learning in this setting takes place at two levels – each student is given a grade daily based on the facilitator's judgment of the quality of learning in the classroom within the scope of a given PBL problem. The daily grade is accompanied by diagnostic feedback and the facilitator's decision on a student's deserved grade is gleaned from and supported by evidence collected through a variety of channels:

- Observation of student interaction in the classroom
- Presentations (or other forms of work) by student teams
- A Reflection Journal entry (from each student)
- Quiz Scores (from each student)
- Self evaluation (from each student)
- Peer evaluation (about each student from the members of his/her team)

Support framework for the daily assessment is provided in the form of holistic rubrics for assessing team presentations and reflection journal entries. The self and peer evaluation of students are done on a rating scale. Quiz questions are accompanied by answer keys. A significant design aspect of this assessment scheme is that facilitators focus on the criteria – (i.e., what is being learnt and how well is it being learnt) rather than a prioritisation of criteria (i.e., who tops the class in, say, presentation skills or answering questions and so on). The rubrics have criteria descriptors and anchors in the form of explanations of criteria.

For example, there are multiple criteria for assessing the team presentation in the daily work such as:

- Statement of strategy for proposed solution to problem
- Information collation and analysis
- Rationale for problem solving strategy (statement of how the solution was reached)
- Ability to address questioning (for justification of proposed solution)
- Ability to compare and analyse multiple solutions/perspectives
- Communication or presentation skills (spans the other five dimensions)

The scale is descriptive and the anchor descriptors are Exceptional, Commendable, Satisfactory and Rudimentary. There is no numerical weighting given to the scale.

The assessment of Reflection Journal entries is supported by criteria such as:

- Clarity in reasoning
- Strength to take and express a stance
- Evidence of milestones
- Awareness of learning preferences

These criteria are used by the facilitators in inferring the quality of student learning within the scope of a PBL problem.

In effect, each student gets 16 daily grades (in the event that there is 100% attendance: absent students are given an X) which can range between ‘A’ to ‘D’ (a conditional pass) falling within points 4, 3, 2 and 1 respectively.. [FK1]

Each module also carries 4 formal tests (internally known as ‘Understanding Tests’) administered once in every four weeks. The module grade (pass/fail status of a student) is computed from a combination of the two sets – the Daily Grades (DG) and the Understanding Tests[FK2] (UTs).

### **The Case Study**

The discussion in this paper uses the analysis of data from two classes from two modules across one semester (July – October 2003) in year 1 of the three year Diploma Programmes on offer.

#### *The sample*

The performances of two sets of students (for the purpose of this discussion, Class A and Class B) were taken up for study. The students from these two classes have taken the Core Area of Study of Information Technology (Business Computing and/or Information Technology). In the first semester, their areas of study included three General Modules and two Core Modules[FK3]. For the purposes of this discussion, student performance in a General Module (G101: Cognitive

Processes and Problem Solving I) and a Core Module (C101: Computing Mathematics I) compared.

The sample population size was 44 students spread across two classes. Their grades for comparison are drawn from 16 weeks for the modules on Cognitive Processes and Problem Solving I and Computing Mathematics I.

The aims of the modules were similar in so far as they intended to provide a foundation (in different disciplines) for further study through the programme. The learning outcomes and the learning activities are qualitatively different due to the domain specific aspects of knowledge and inquiry.

#### *Method of analysis*

Using a descriptive statistical framework, comparison of daily grade patterns across the two modules over 16 weeks is used to find patterns of similarity and difference across two modules and facilitators using average student performance – in terms of their daily grades and UT scores. Correlation between Daily Grade and Understanding Test averages among the students has been done to establish the linkages between the ongoing performance assessment (Daily Grade) and the more formal tests to verify mastery of learning and understanding.

#### **Key findings and discussion**

Our key findings are summarised as follows:

In the population there is a certain pattern in which students fall within certain bands in terms of the average daily grade distribution.

Figure 1: *Module C101: Daily Grade Average Distribution*

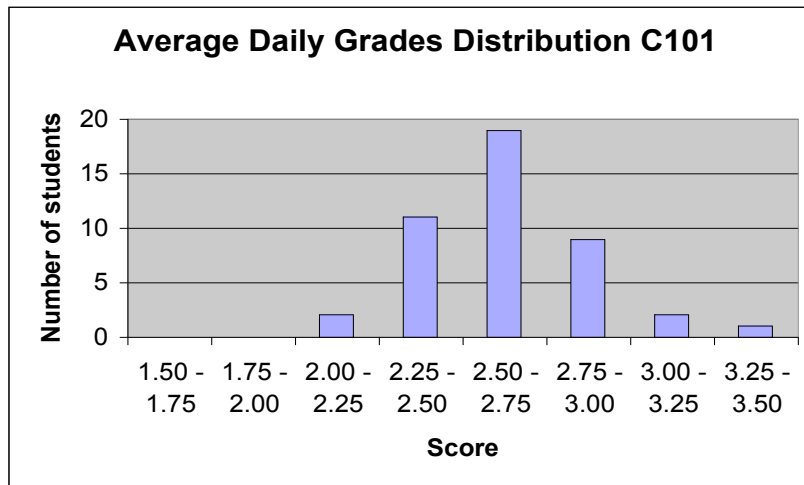
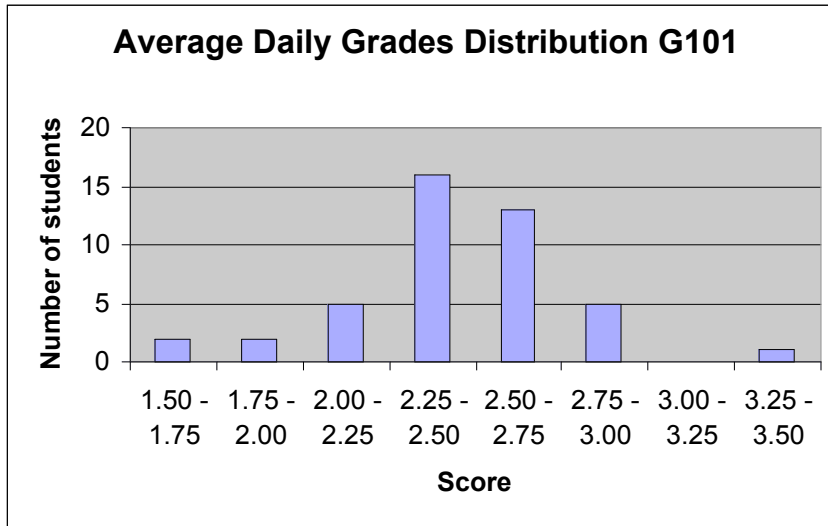


Figure 2: *Module G101: Daily Grade Average Distribution*



The majority of students fall within 2.25 and 2.50 in G101 while the distribution in C101 is between 2.75 and 2.25.

Figure 3: *Correlation between Daily Grades and UT scores in C101: Class A*

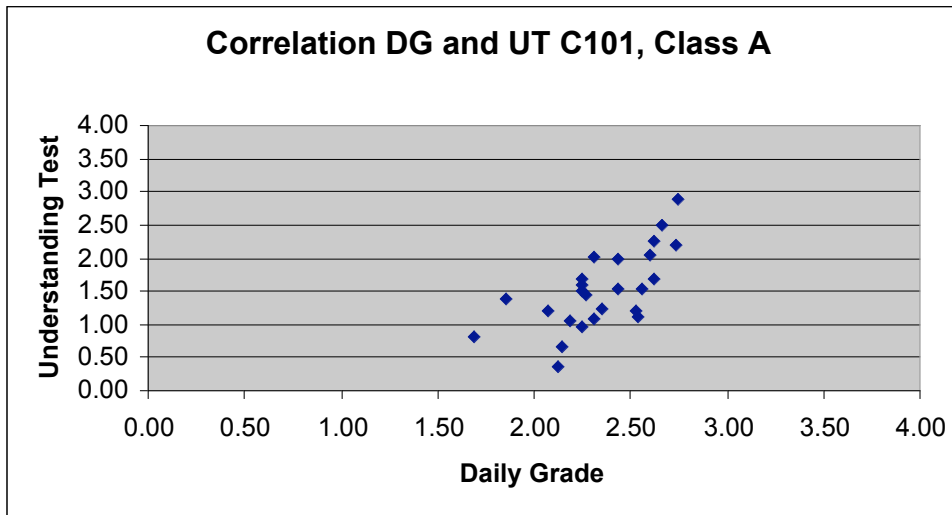


Figure 4: *Correlation between daily grades and UT scores for G101: Class A*

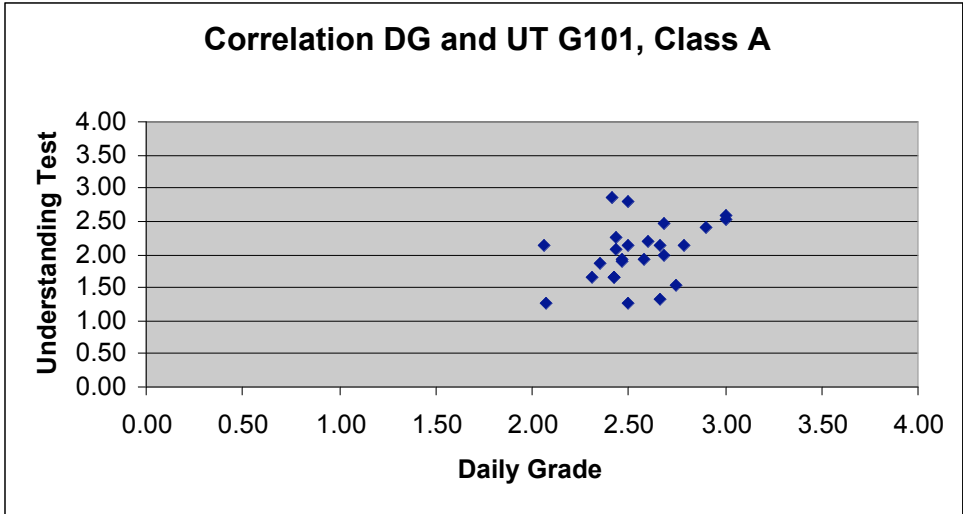


Figure 5: Correlation between daily grades and UT scores for C101: Class B

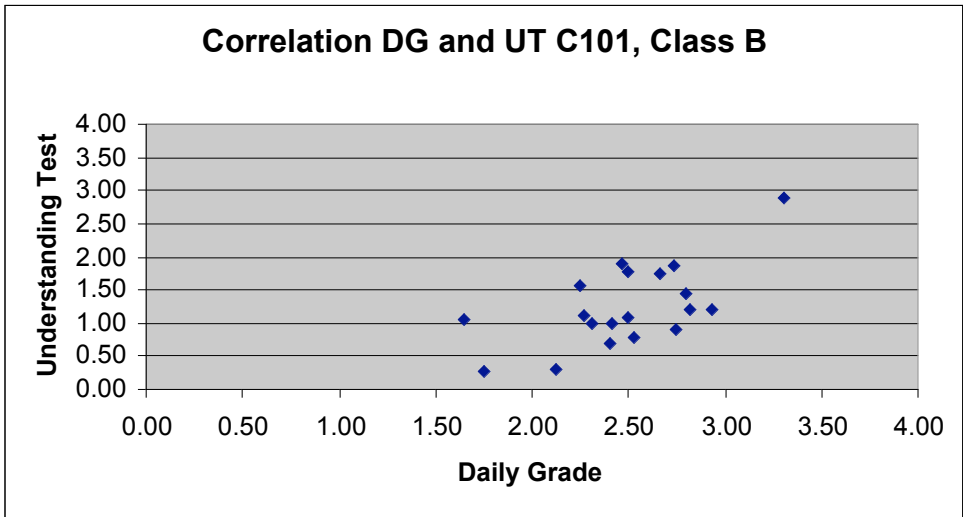
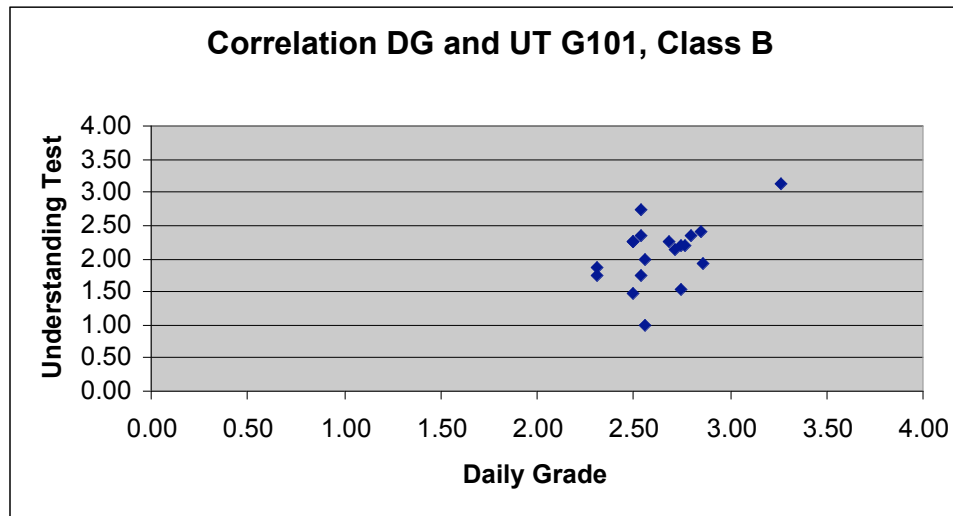


Figure 6: Correlation between daily grades and UT scores for G101: Class B



For class A, there is a strong correlation (0.69) between DG and UT in the module C101 and there is a moderate correlation (0.37) between DG and UT in the module G101. For class B, there is a moderate correlation (0.63) between DG and UT in the module C101 and a moderate correlation (0.51) between DG and UT in the module G101.

While the sample size is too small and may not be representative enough to draw firm conclusions, the preliminary data analysis does show that convergence evident in the daily grade average distribution across modules. The daily grades are awarded for performance – for criteria which are multifaceted – such as clarity and skill in the cognitive acts as well as social and communication skills. Since the students need to perform in teams, a class of 25 students does exhibit certain characteristics – with regard to their habits of work. This is a possible explanation for the fact that in two different modules representing two content domains and sets of learning outcomes, students do fall under certain clusters in terms of their attainment of daily grades. The focus on criteria is primary while any trends in norm-referencing in a class can be seen as a secondary outcome of the assessment scheme.

The correlation between the Daily grades and Understanding Tests in the two modules is an indicator of the validity of the assessment scheme. Though the two components measure slightly different criteria, they complement each other in terms of their efficacy in assessment of performance.

From this perspective, holistic assessment in PBL focuses on evaluating the ‘learning’ of students – how well they learn and can demonstrate their learning rather than measuring how much of knowledge can be recalled effectively. The scheme is one of evaluation rather than measurement.

However, in order to be reliable an evaluation scheme depends on the accuracy and reliability of measurement at the micro levels. In this discussion, the positive correlation between the daily grade averages and UT scores indicates an attempt to ensure the above.

If assessment in learner-centred pedagogy is about ‘getting to know’ the students (Rowntree, 1988), the holistic assessment scheme in this discussion is perhaps a demonstration of how it can be implemented. The success of this scheme depends on the assessment instruments and the

assessors making a concerted effort to 'get to know' the students in their pursuit of learning which is seen as an enacted performance in specific contexts.

## References

- 1) Biggs J.B (1996), "Enhancing Teaching through Constructive Alignment", Higher Education, 32, 1-18
- 2) Boud D and Feletti, G (eds) (1991), Challenge of Problem-based Learning, Kogan Page, London
- 3) Duffy Thomas M and Cunningham, Donald R (1996), "Constructivism: Implications for the design and delivery of instruction" in David Jonassen (ed) Handbook of Research for Educational Communications and Technology, Simon and Schuster, New York
- 4) Feletti G (1997), The Triple Jump Exercise: A Case Study in assessing Problem based Learning in G Ryan (ed) Learner Assessment and Programme Evaluation in Problem based Learning, New Castle, Australia, Australian Problem based Learning Network
- 5) Marton F and Saljo R (1976), "On qualitative differences in learning II: Outcome as a function of the learner's conception of the task", British Journal of Educational Technology, 46, 115 -127
- 6) Marton, F and Ramsden, P (1988), "What does it take to improve learning?" in P. Ramsden (ed) Improving Learning: New Perspectives, Kogan Page, London
- 7) Ramsden, P (1992), Learning to teach in Higher Education, Routledge, London
- 8) Resnick, Lauren B and Resnick, Daniel, P (1992), "Assessing the thinking curriculum: New tools for Educational Reform" in Bernard R Gilford and Mary Catherine O Connor (eds), Changing Assessments: Aternative View of Aptitude, Achievement and Instruction, Kluwer Academic Publishers, Boston, 37 -75
- 9) <http://www.myrp.edu.sg/CED/home>