

# Reflections in CSE Teaching Approaches & Assessment Principles

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**Abstract.** In the area of Computer Science Education (CSE), there is an increased focus on using digital tools to deliver course content. These tools, while effective, can become a hindrance if traditional approaches of gauging teaching effectiveness are neglected. Even in the digital age, there is a need to critique our course delivery, using classical pedagogical models, to ensure that our teaching methods remain effective. This paper provides a platform for pedagogical analysis of teaching strategies and assessment mechanisms using traditional pedagogical models. The analysis and findings presented here provides a useful aid for other CSE practitioners to gauge the effectiveness of their own course delivery.

**Keywords:** Computer Science Education, Pedagogical Models.

## 1. Introduction

This paper is an attempt to gauge teaching effectiveness in teaching and assessment of the subject - “Enterprise Application Development” (ENAD) over a semester. This is a third-year subject at a IT college in Singapore. Enterprise Application Development (ENAD) is a third-year subject that covers the creation and usage of Java Enterprise Beans. The subject is delivered using a combination of lectures, tutorials and lab sessions.

## 2. Critical Analysis of Teaching Strategies

### 2.1. Effective Learning Strategies

The most critical learning objective in ENAD is to “write applications using services provided by enterprise beans”. It requires students to recall and create enterprise beans using close to 30 rules before it can compile and run properly. The targeted level of learning for this objective, in terms of SOLO taxonomy [1] should be relational, where students can understand the rules as a whole and how they relate to another.

As such, we have crafted the lectures so that the rules are represented and grouped in terms of categories and their location within the code. Rules that are related or follow a similar pattern are mentioned together. Students responded to this approach, and are able to understand the rules without much memorization.

To practice implementing the Enterprise Bean rules using Java codes, we make sure that enterprise beans are the deliverables in our practical labs and our first subject assignment as well. The rationale is based on Edgar Dale’s Cone of Learning Model [2], which says the best way to learn something is to “do the hands-on”. The hands-on during the practical labs allows students to take “baby steps” to code enterprise.

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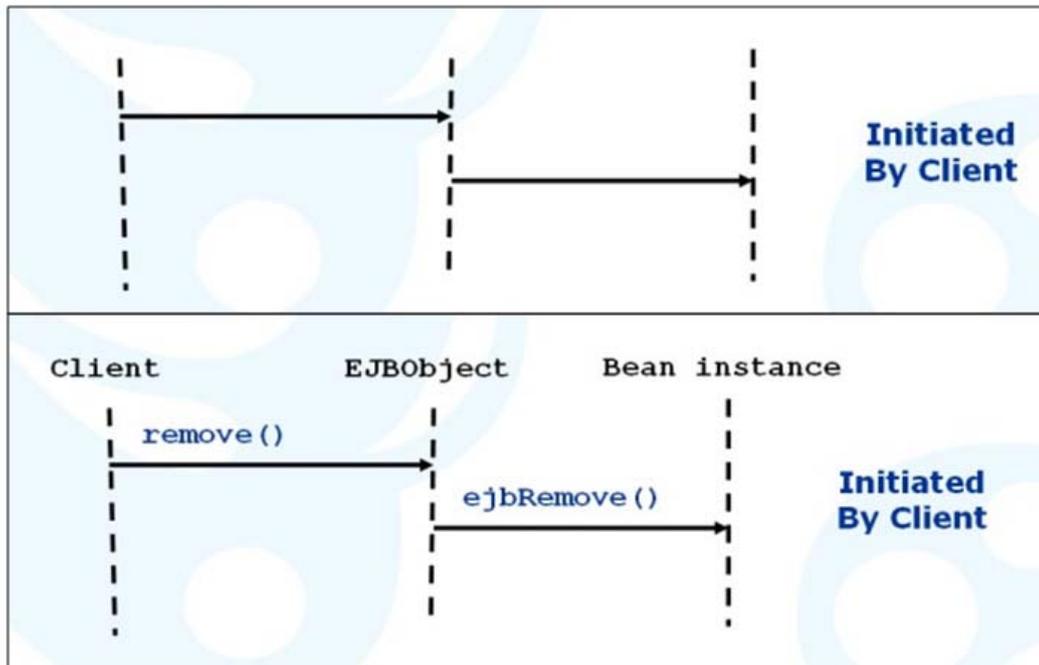


Figure 1 – Missing Information encourages students to think hard about what is missing.

The VARK model [3], particularly visual learning, is used to deliver another learning objective - “Charting life cycles of enterprise beans”. The main teaching materials used are “flow diagrams” (See Figure 1), diagrams that shows the life cycle transitions of the enterprise beans. To appeal to the visual learners, the teaching team would deliberately hide some aspects of the diagrams and asked the students to fill in the blanks.

## 2.2. Poor Learning Strategies

Another key learning objective is “to design transactional support for applications”. The current teaching delivery is resource-based learning, where students are to use internet resources to write a report. We feel that there is a mismatch: The learning objective stated that students are to design something, but the internet resources are mostly descriptive, and are not about designing an application for transactions. A better learning strategy would be to provide resources that are design-related, and the students have to design some applications either via role playing or problem-based learning.

## 2.3. New Strategies to Consider

Dale [4] mentioned that rapport is a very useful tool for communication and motivation of students. The teaching team feels that the rapport with the weaker students are not well enough. After several lessons, they have decided to avoid the class. The team feels that it is easy to build rapport with the better students, and hard as well as discouraging when approaching students who do not show interest. This becomes a vicious cycle, leading to distant relationships with the weaker students. Rapport with students must be treated as a tool, not just something that a lecturer finds enjoyment in.

Socratic Dialogue [5] can be used on our school students, who tend to be street smart and anti-authoritarian. We do this by questioning the objectives – “Why we are doing a (particular lecture, lab and tutorial)?” It appeals to the students to think about what they are doing. The teaching team would then interject and provide a sound reasoning for the lecture/tutorial/lab, thus capturing the attention of the students.

We also feel that the Stracklom Model [6] is useful for programming labs. A lab session to write enterprise session beans will contain six pages of instructions, but with little reflective questions. Such questions can be inserted at the end of the lab, first to let the students consider why they did a particular item (“So What?”), and then to consider the application of their new knowledge (“Now What?”)

## 3. Appropriateness of Assessment

### 3.1. Projects

Projects in ENAD are a form of “performance assessment technique” [7], allowing students to produce web sites that will be relevant to their working life. Biggs [8] has also stated that “learning outcomes and the types of assessment should be aligned with each other.” Therefore, the validity of project assessment means that the learning outcomes must be correctly linked to the project work itself. The learning objectives used for project assessment are:

- Develop web applications using an industry Web Application Framework;
- Use a client-side scripting language to perform dynamic web presentation;
- Write applications to consume web services;
- Problem Solving to work out solutions;
- Interpersonal & Team Skills so as to work well in a team.

In the project, each team will be building an online shop web site. To build the web site, they would need to fulfil the learning objectives above (develop using a framework, perform dynamic web site presentation and to consume web services). Also the project score includes a group score, which assesses their collaboration as a team. Finally, problem solving skills would be needed to trouble-shoot programming errors. Therefore, a project is suitable for assessing the objectives above.

The reliability of the project as a form of assessment can be compromised if the teaching team is not careful. Firstly, since the project is a group work, it is possible that a stronger member may “carry” a weaker member to complete the project. One way of overcoming this is to test the understanding of each student during project presentation. The second reliability issue is that criteria for aesthetics (like web design and user interface) can be quite subjective. This may result in different graders giving different scores for the same quality of work. The solution is for all markers to look at previous years’ projects, before grading, to standardize the grades for an excellent, average and bad design.

### 3.2. Lab Tests

In ENAD, an open-book lab test is conducted as a form of individual assessment, with only lecture notes for reference, without access to the internet. The learning outcomes related to this assessment are:

- Develop web applications using an industry Web Application Framework;
- Problem Solving to work out solutions;
- Comprehending the knowledge learnt in web application development

The lab test requires the students to answer structured questions by filling in missing sections of a web application. In the time given, the student would need to fill in the gaps so that the solution is a running and correct application. This form of assessment is considered a valid assessment when compared to the abovementioned learning outcomes. The reliability of lab tests is also high as it requires students to fill in missing sections of code, which requires a clear-cut answer. There is no deviation and subjectivity when markers are marking the script.

However, in terms of validity, lab tests can sometimes be inaccurate. Students tend to panic when codes don’t work and affects their overall performance. Also, the lab test questions are interdependent: This means that if students could not get an earlier question to work, the students have little chance of getting the next few questions right as well. There is a validity issue here is as in terms of learning objectives, we do not require students to become good and confident coders under time pressure. In fact, it is quite frequent to see capable students only able to do well without the stress or time constraint. Unfortunately, tests must have time limits, therefore the best way to counteract this is to give verbal assurance during the test, or to create the test without interlinked questions.

## 4. Conclusion

In review, this paper represents a return to classic pedagogical models to analyze effectiveness in CSE course delivery. For our subject ENAD, we have isolated effective strategies, such as the usage of SOLO Taxonomy to link concepts, the VARK model for visual learning, Edgar Dale's Cone of Learning Model to emphasize hands-on learning, the Socratic Dialogue to question concepts taught, and the Stracklom Model to guide students to the next step of the learning process.

In terms of assessment, the subject team need to check if the course's learning approaches continue to align to the learning objectives. Also, the subject needs to ensure that the assessment methods, be it projects or lab tests, continue to be both valid and reliable.

To conclude, the strategies presented here have been helpful and effectiveness for the next run of ENAD, and we hope that it will be effective for other CSE practitioners as well.

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