

# DEVELOPING AND APPLYING RUBRICS FOR COMPREHENSIVE CAPSTONE PROJECT ASSESSMENT

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## ABSTRACT

The capstone project in the Diploma in Multimedia and Infocomm Technology trains students to put their technical and soft skills into practice, through the development and presentation of their applications and solutions. This paper presents the design and implementation of a suite of comprehensive rubrics-based assessments for most aspects of the capstone project. This suite includes assessments of components such as project presentations and project report documentation. While it is common to assess projects using scoring guides and rubrics, the varied nature of the projects and the personalised nature of the supervision methods used, presents differing operational considerations of applying such rubrics in assessments. This paper also shares on the pre-implementation preparation, implementation planning and experiences, supporting IT application and tools, rubrics' evolvement as well as feedback from faculty and students.

## KEYWORDS

assessment, rubrics, pedagogy, capstone project, CDIO Standards 7 & 8

## INTRODUCTION

In their final year of studies, students from the Diploma of Multimedia and Infocomm Technology (DMIT) in School of Engineering (SEG), Nanyang Polytechnic (NYP) are required to complete a 12-week full-time capstone project. The capstone project enables students to put into practice the knowledge and skills that they have acquired from the course to develop real-life innovative solutions. Project specifications range from industry or competitions' requirements to lecturer or student-proposed projects. Industry projects are usually exacting in nature with well-crafted specifications while competition projects allows a greater degree of creativity and innovation. Lecturer-proposed projects are usually geared towards a specific technology area while allowing students some freedom in terms of application scenarios. We also encouraged students to propose their own projects as this would enhance their sense of project ownership.

Students work closely under the mentorship and supervision of lecturers (also known as supervisors) in their project development. Most students are assigned to work on individual projects. Through the 12-week stint, in addition to acquiring technical knowhow, hard and soft skills for project development, project work also instils life-long learning skills to prepare students adequately for their entry into the workforce. Students also develop their project report writing and presentation skills.

Students are assessed on their attitude, technical product, project management, report writing and presentation skills. To ensure fair assessment as well as to guide and motivate the students towards a successful project outcome, we have defined a clear assessment process and developed a set of assessment rubrics. As mentioned by Gray [2], there are major challenges in such an endeavour.

## ASSESSMENT CRITERIA AND CDIO SYLLABUS

The criteria used by the School for the assessment of the capstone project are shown in Table 1. Each criterion has an accompanying description to illustrate the focus area(s) of the assessment.

Table 1. Assessment Criteria and Description

Criteria	Description
Attitude	Student should show interest and participate actively in the project. Student should show strong commitment and sense of responsibility.
Initiative	Student should look for means to solve problems diligently
Knowledge	Student should show that they understand the project well. Student should be able to apply relevant knowledge acquired in school and show competency in solving the problem.
Product	Student should design and implement a product/an application that meets specifications, is functional, reliable and practical
Documentation	Student's project report should express ideas and concepts orderly, comprehensively and logically. Student should explain technical specifications and achievements clearly and comprehensively.
Presentation	Student's presentation should have good flow, is relevant, comprehensive and clear. Student should use aids that are relevant and clear. Student should show a good command of language and manage his presentation time well.

These criteria cover the major topics in the CDIO Syllabus v 2.0 [1], (refer to Table 2)

Table 2. Mapping CDIO Syllabus to Assessment Criteria

	CDIO Syllabus version 2.0*					
	2.1	2.4	3.2	4.3	4.4	4.5
Attitude		●	●			
Initiative		●	●			
Knowledge	●	●	●	●	●	●
Product	●			●	●	●
Documentation			●			
Presentation			●			

\* Topics in CDIO Syllabus version 2.0 are as follows:

- 2.1 Analytical Reasoning & Problem Solving
- 2.4 Attitudes, Thoughts and Learning
- 3.2 Communication
- 4.3 Conceiving, Systems Engineering & Management
- 4.4 Designing
- 4.5 Implementing

The six criteria are assessed through three overarching components: product, presentation and report. Each assessment component covers two or more criteria.

A panel of assessors conduct presentation assessments for the students at week 6 and 12 of the project schedule. Project supervisors are responsible for assessing the product/application and project documentation of their own students.

Other than the descriptions given in Table 1, there were no further grading guidelines on the differentiation between an average, good or excellent project. While the existing guidelines do enable projects to be graded in a comprehensive manner, it does not adequately aid faculty and students in having a common and specific understanding of its requirement.

The team thus set out to develop a set of rubrics, for the three assessment components, that is used to assess the students throughout the project duration. In this paper, we would be sharing on the rubrics that are used, namely, the presentation, the report and the technical assessment components.

## **RUBRICS**

The objectives for the design and usage of the rubrics are firstly to ensure fair assessment across projects, students and faculty. In this respect, it would be desirable for students and faculty to share a common and clear understanding of a detailed set of scoring guidelines. Secondly, students' attitude and motivation towards a better project outcome could be improved by a heightened awareness of their mid-project performance through a scoring sheet and faculty's feedback.

## **PRESENTATION ASSESSMENT**

A clear outcome of the project module is to develop students to become confident presenters. During the course of the capstone project, students will have at least three opportunities to present their projects to an audience. They are required to do two formal presentations to a panel of assessors. The presentation assessment rubrics were developed to enable the faculty to achieve a fair and consistent assessment. The rubrics assess the students on their presentation skills as well as four other criteria: attitude, initiative, knowledge and product. This is achieved by assessing the students' ability to articulate their achievements and technicality of their projects.

Table 3 shows the mapping between the presentation assessment rubrics categories and the topics set out by CDIO syllabus version 2.0. The complete presentation assessment rubrics is shown in Figure 1.

Table 3. Mapping of the Presentation Assessment Rubrics to CDIO Syllabus

Presentation Rubric Categories		CDIO Syllabus version 2.0					
		2.1	2.4	3.2	4.3	4.4	4.5
Presentation Mechanics	Delivery		▲	○			
	Question and Answer		○	○	▲	▲	▲
Presentation Content	Organisation		▲	○			
	Material (eg. illustrations, diagrams)	○	▲	○	○	○	○
Technical Competency	Level of Technical Understanding	○	▲		○	○	○
	Soundness of Design	○	▲		○	○	○
Initiative: Drive, Originality and Independence in Problem Solving		▲	○	▲	▲	▲	▲
Scope Fulfilment		▲	▲		▲	▲	▲

○ : Direct Assessment, ▲ : Indirect Assessment

Figure 1. Assessment Result Sheet for Student



Admin Number: [REDACTED]

Student Name: [REDACTED]

	Level of Achievement				
	Below Expectation	Approaching Expectation	Satisfactory	Good	Excellent
Presentation Mechanics - Delivery - Q&A	Presentation is not comprehensible by audience and/or does not match slides	Audience has difficulty following presentation and flow of information can be improved	Audience is able to follow presentation which is delivered well but too heavily scripted	Audience is able to follow presentation which is delivered well and smoothly	Presentation is interesting, eloquently delivered and with enthusiasm
	Unable to handle most Q&A	Able to handle some Q&A	Able to handle most Q&A	Able to handle all Q&A well	Able to handle all Q&A well and able to anticipate questions
Presentation Content - Organisation - Supporting Materials	Illogical sequence without agenda	Agenda exists, but major disconnects in organisation / sequence	Agenda exists, but only minor disconnects in organisation / sequence	Agenda exists and coherent organisation / sequence	Agenda exists, coherent & interesting organisation / sequence
	Little or no supporting materials, eg. visuals	Supporting materials are used but not explained or put in context	Supporting materials are used and explained in context	Supporting materials are effectively used and explained in context	Supporting materials are effectively & innovatively used and explained in context
Technical Competency - Level of technical understanding - Soundness of Design	Does not comprehend project's technicalities	Able to explain some project's technicalities	Able to explain most project's technicalities	Able to explain most project's technicalities and understands associated technical limitations	Able to explain all project's technicalities and overcome associated technical limitations
	Design is not able to achieve project objectives	Design is able to achieve some project objectives	Design is able to achieve most project objectives	Design is able to achieve all project objectives	Design exceeds all project objectives, takes into account future
Initiative - Drive, originality & independence in problem solving	No observable interest and effort shown in project	Make some attempts according to supervisor's recommendations	Persisted in making repeated attempts as recommended by supervisor	Experiments on his own with reliance on supervisor for guidance	Experiments on his own exhibits independence and drive, and shows originality in his solution
Scope Fulfilment - Scope Fulfilment	Barely fulfilled the project scope	Fulfilled some of the project scope but with significant portions missing	Fulfilled some significant portions of the project scope	Fulfilled most of the project scope	Completely fulfilled or exceed the project scope

**Comments from Assessors**

Michael Cheong: Good presentation, clear, good voice and pace. Push harder on developing new features for a better grade. You can stretch a bit more.

Tan Ching Wai: Good presentation skills.  
Excellent command of English.  
Each assessor should get a copy of the survey form.

Benson Wan: Good Presentation.  
You report is mainly on correlation between 2 attributes. How about finding relationship among 3 or 4 attributes?  
You may also want to think about how the findings can be used by the poly in recruiting students

## REPORT ASSESSMENT

The report assessment component allows us to directly assess students on their project documentation, knowledge and attitude. Some level of initiative and product quality can also be assessed through the report assessment component.

The resulting rubric, through developing the report assessment criteria, is a rubric that assesses students based on the six categories listed in Table 4.

Table 4 shows a mapping between the assessment criteria we used to assess our students for their capstone project report and the topics set out by CDIO syllabus version 2.0. A key feature of this rubric is the inclusion of timeliness, to factor responsibility (attitude) as part of the assessment component.

Figure 2 and Figure 3 shows the major categories and the minor categories that are assessed in a report respectively.

Figure 2. Major Categories of Report Assessment Rubrics

Final Year Project – Report Assessment Rubrics		Level of Achievements				
	Below Expectation (1)	Approaching Expectation (2)	Satisfactory (3)	Good (4)	Excellent (5)	
<b>Technical Writing</b> • Level of technical understanding • Correctness in technical explanation	<ul style="list-style-type: none"> <li>• Technical coverage indicates lack of understanding of technical concepts</li> <li>• Incorrect usage of technical terms indicating lack of understanding</li> </ul>	<ul style="list-style-type: none"> <li>• Technical coverage indicates basic understanding of technical concepts</li> <li>• Some inaccuracies in usage of technical terms that results in poor explanation</li> </ul>	<ul style="list-style-type: none"> <li>• Technical coverage indicates good understanding of some technical concepts</li> <li>• Technical terms used are mostly accurate and aids in explanation</li> </ul>	<ul style="list-style-type: none"> <li>• Technical coverage indicates good understanding of many of the technical concepts</li> <li>• Technical terms are used appropriately &amp; accurately and helps to explain technical details</li> </ul>	<ul style="list-style-type: none"> <li>• Technical coverage indicates good understanding of all of the technical concepts</li> <li>• Writing indicates a strong grasp of technical concepts (Eg. Technically accurate and with explanations that simplify difficult concepts)</li> </ul>	
<b>Writing Mechanics</b> • Content • Conciseness • Coherence	<ul style="list-style-type: none"> <li>• Insufficient content to show that required topics are met</li> <li>• Plain listing of information without regards to structure and/or flow</li> <li>• Structure is missing or attempted but not obvious to the reader</li> </ul>	<ul style="list-style-type: none"> <li>• Some gaps in coverage of required topics</li> <li>• Contains repetitions and redundancies;</li> <li>• Structure is evident, but inappropriate transitions disrupt the progression of ideas</li> </ul>	<ul style="list-style-type: none"> <li>• Covers most required topics</li> <li>• Contains minor repetitions &amp; redundancies;</li> <li>• Structure is evident, with some effort made in using transitions to link ideas together</li> </ul>	<ul style="list-style-type: none"> <li>• Covers all required topics</li> <li>• Clear and concise</li> <li>• Structure is clear and appropriate to the purpose; Appropriate transitions help to link ideas together</li> </ul>	<ul style="list-style-type: none"> <li>• Covers all required topics well and maintains reader interest with a logical coherent flow</li> <li>• Clear and concise</li> <li>• Structure is clear, appropriate and effective to the purpose. Transitions are effective, allowing ideas to flow</li> </ul>	
<b>Spelling, Grammar and Punctuation</b>	<ul style="list-style-type: none"> <li>• Major lapses in grammar, spelling and punctuations that reduces the clarity of the report</li> </ul>	<ul style="list-style-type: none"> <li>• Some major lapses in grammar, spelling and punctuations that distracts the reader from the report</li> </ul>	<ul style="list-style-type: none"> <li>• Some minor lapses in grammar, spelling and punctuations</li> </ul>	<ul style="list-style-type: none"> <li>• Few lapses in grammar, spelling and punctuations</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal or no lapses in grammar, spelling and punctuations</li> </ul>	

Figure 3. Minor Categories of Report Assessment Rubrics

	Below Expectation (1)	Approaching Expectation (2)	Good (3)
Neatness and Formatting	• No concept of formatting which makes the report untidy and difficult to read	• Formatting exists, although some parts of the report are not well arranged, making it hard to read	• Formatting exists that helps to bring out the structure of the report
Timeliness	• Submit report more than <i>four</i> working days after due date  • Shows no sense of ownership to the report submission	• Submit report between one to four working days after due date	• Report is submitted on time or earlier
Plagiarism	• Substantial content are copied and without any referencing	Mostly written in their own words but some content are copied and with referencing	• All information are written in their own words or referenced when required

Table 4. Mapping of the Report Assessment Rubric Categories to CDIO Syllabus

Report Rubric Categories	CDIO Syllabus version 2.0					
	2.1	2.4	3.2	4.3	4.4	4.5
Technical Writing: Level of Technical Understanding and Correctness in technical explanation	○	▲	○	▲	▲	▲
Writing Mechanics: Content, Conciseness and Coherence		▲	○			
Spelling, Grammar and Punctuation		▲	○			
Neatness and Formatting		▲	○			
Timeliness		○				
Plagiarism		○				

○ : Direct Assessment, ▲ : Indirect Assessment

## TECHNICAL ASSESSMENT

The technical assessment component allows us to assess students on their technical knowledge and their ability to apply skills that they have learnt in previous semesters.

Table 5 shows a mapping between the assessment criteria we used to assess our students for their technical competency and the topics set out by CDIO syllabus version 2.0.

A non-negotiable outcome for the capstone project module was for students to stretch themselves and complete at least an implementation of a single module of a large system or concept demonstrator within the 12-week timeframe that was given. We also recognised that students are at different technical skill levels. As such, the complexity of the projects are tailored to the students and taken into consideration for the assessment. This results in a rubric as shown in Figure 4, with a complexity multiplier factor that is applied to the technical competency, project implementation and scope fulfilment categories designed to reward efforts put in by academically stronger students attempting projects that has high level of difficulty and the rest of the students for doing well in a simpler project.

Figure 4. Technical Assessment Rubrics

Final Year Project – Technical Assessment Rubrics					
	Level of Achievement				Scores
	Below Expectations (1)	Satisfactory (2)	Good (3)	Excellent (4)	
<b>Technical Competency</b> • Level of Technical Understanding • Aesthetic and Design	• Does not understand project's technicalities and associated technical limitations	• Able to understand some of project's technicalities and associated technical limitations	• Able to understand most of project's technicalities and work around associated technical limitations	• Able to understand all of project's technicalities and work around associated technical limitations	3
	• Design is able to achieve some project objectives	• Design is able to achieve most project objectives	• Design is able to achieve all project objectives	• Design exceeds all project objectives, takes into account future enhancements to the project	2.5
<b>Project Implementation</b> • Approach • Implementation Specification	• Approach to the problem statement chosen misses the objectives of the project	• Approach to the problem statement chosen meets the objectives of the project generally	• Approach to the problem statement chosen meets the objectives of the project effectively	• Approach to the problem statement chosen is innovative and meets the objectives of the project effectively	3.5
	• Implementation does not meet the needs of the projects	• Implementation is largely specific to the needs of the projects but caters little for possible future enhancements	• Implementation is specific to the needs of the projects and caters for some possibility for future enhancements	• Implementation is specific to the needs of the projects and robust to cater for future enhancements	2.5
<b>Scope Fulfilment</b>	• Fulfilled some of the project scope but with significant portions missing	• Fulfilled some significant portions of the project scope	• Fulfilled most of the project scope	• Completely fulfilled or exceed the project scope	3
<b>Initiative</b> • Drive, originality & independence in problem solving	• No observable interest and effort shown in project	• Persisted in making repeated attempts as recommended by supervisor	• Experiments on his own with reliance on supervisor for guidance	• Experiments on his own exhibits independence and drive, and shows originality in his solution	3
<b>Complexity of Project (Multiplier to yellow highlighted boxes)</b>	Simple (0.9)	Average (1)	Difficult (1.2)	Complex (1.3)	1.2
<b>Complexity of Project</b> • System Components Integration • Complexity & Adaptation of Algorithms • Involves working with multiple stakeholders	• Number of components / design elements to be integrated • Nature of APIs / design tools & techniques (Complexity in understanding and usage) • Does this involve adaption and/or modification of published algorithms? • Does the project involve working with multiple stakeholders and needing to meet differing requirements from the stakeholders?			<b>Total Score</b> (Base Score is 30)	20.4

Table 5. Mapping of the Report Assessment Rubric Categories to CDIO Syllabus

Technical Rubric Categories		CDIO Syllabus version 2.0					
		2.1	2.4	3.2	4.3	4.4	4.5
Technical Competency	Level of Technical Understanding	○	▲		○	○	○
	Aesthetics and Design	○	▲		○	○	○
Project Implementation	Approach	○	▲			○	○
	Implementation Specification	○	▲		○	○	○
Scope Fulfilment		○	▲		○	○	○
Initiative: Drive, originality & independence in problem solving		▲	○		▲	▲	▲

○ : Direct Assessment, ▲ : Indirect Assessment

## APPLYING RUBRICS

We emphasise on awareness and understanding of the rubric for both faculty and students as an important part of the process in the application of the rubric. As mentioned in Boden [3], awareness and understanding can better equip the faculty with knowledge on where to focus their training effort for their students. Students too will have a better knowledge on the areas they should improve on. Finally, we also emphasise a consistent set of operating procedures to ensure all students are assessed as fairly as possible.

### **Raising Awareness and Understanding of Assessment Criteria**

Before mandating the use of the assessment rubrics, the team conducts briefings for all assessors. The assessors were brief on how to conduct the assessments and apply the rubrics to the assessment components. The team also provided samples to aid the assessors in scoring the rubrics.

The team also conducted briefings for the students on the assessment criteria set out in the rubrics. The briefings are usually conducted one to two weeks before their assessment. The students are provided with samples that represent 'good'/'excellent' standard in their assessment component. In fact, the school houses 'excellent' standard projects in an exhibition room, accessible by both faculty and students.

### **Continuous Feedback Process**

The students are provided continuous feedback on their progress from various channels. Aside from their supervisors, students are provided constant feedback by the panel of assessors. The main feedback and assessment schedule can be found in Table 6.

Table 6. Major Assessment and Feedback

<b>Time</b>	<b>Milestone</b>	<b>Feedback Method / Assessment</b>
Week 2	Project Proposal Pitch	Immediate feedback on the project objectives, scope and schedule
Week 6	Progress Update Presentation	Immediate feedback on the students' progress and application Feedback & Assessment through Report Assessment Rubrics
	Project Documentation	Feedback through Report Assessment Rubrics
Week 12	Final Presentation	Immediate feedback on the students' performance and quality of work Feedback & Assessment through Report Assessment Rubrics
	Technical Documentation	Report Assessment Rubrics
	End-Project Application/Product Delivery	Technical Assessment Rubrics

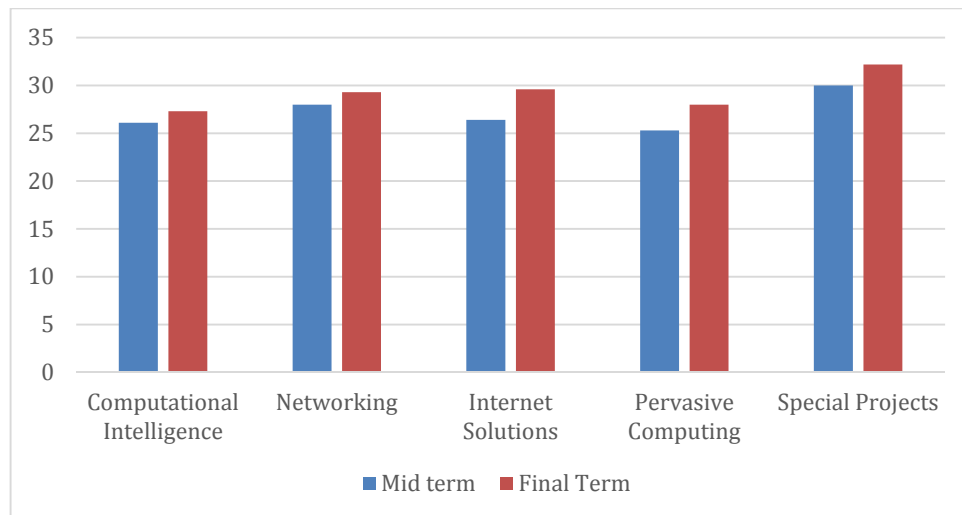
In Week 6, the presentation assessment rubrics are used to assess their progress update presentation. Within a week after their assessment, a copy of the rubric with the panel's evaluation on their presentation is returned to the students and their supervisors. The scored rubrics, used as a form of feedback, aim to allow students to know where their strengths and areas for improvement are so that they may work on their presentation skills with their supervisors for the final presentation assessment held in Week 12.

This feedback process has also improved the quality of the students' presentations regardless of the projects they were working on. This can be seen in the improvement of average scores that students attained between their mid-term and final-term presentations as shown in Chart 1.



Students are required to submit a mid-semester project report during their presentation assessment. This report serves to enable them to consolidate and document their project specifications, initial design and progress thus far. In doing so, it also helps them to start their project documentation process and lessen the amount of effort to be expended at the end of the project. Additionally, the report rubrics are also used to give them an assessment on their project documentation. This mid-semester project report has proven to be useful and beneficial in practice.

Chart 1. Average Presentation Scores attained by Students Categorised by Technology Group of their Projects



## OBSERVATIONS

To ascertain the effectiveness of the presentation rubrics from both the students and faculty's perspectives, we conducted surveys immediately after the release of the mid-term presentation assessment results. As for usage of the report and technical assessment rubrics, survey results will be available at the conference.

### **Student Survey Results**

Table 7 shows the tabulated results of a survey on the usage of the presentation rubrics. The rating includes that of "Disagree" and "Strongly Disagree" but this is not shown in the table as there were no students with those feedbacks. The survey result generally shows that the rubrics do help the students to understand the assessment criteria and focus. Additionally, students generally agree that the rubrics help them to obtain specific feedback on their performance and progress.

In the same survey, students also responded with encouraging comments towards how the rubrics have helped them as well as sharing on areas for improvement. These comments were shared with all faculty, to motivate them as well as to encourage them to spend time with their project students to debrief them on their performance through the rubrics. At the same time, it was also impressed upon assessors that students do appreciate and value their written comments.

Table 7. Survey Results on Presentation Rubrics

Questions \ Ratings	Strongly Agree	Agree	Neither Agree Nor Disagree
The rubric helped me to understand what I am assessed on for my project	13%	72%	15%
The rubric gave me guidelines on what/how I should focus on for my project	15%	72%	13%
The mid-term feedback based on the rubrics helped me to identify my strengths and weaknesses	20%	70%	10%
I was able to better prepare myself for the final presentation based on the assessment rubrics scoring	22%	43%	35%
I feel that this set of rubrics is also applicable whenever I do a presentation on a project in the future	20%	63%	17%

*Question 1: Share with us the one thing that you felt most strongly that the rubric has helped you with*

- Helps me to identify what I should focus on when presenting and areas that I need to improve on.
- It encourages me to be better prepared for the final presentation.
- Let me know where my weakness is so that I can improve on it :)
- Enable us to set achievable goals
- Give me more confidence in my project after knowing my performance
- Helps me to enhance my project in the different ways that a project is assessed.
- We can use it as a guide to understand what the assessors are looking for.

*Question 2: Share with us one item you felt that the rubric was lacking in*

- More comments from the assessors
- The rubric would not be good enough, lecturers should spend slightly more time to guide and explain more about it to the students.
- Further details in the results
- Comments on where and how we can do better.

### **Faculty Survey Results**

Faculty raised concerns about the assessment of projects with differing technical complexity with respect to the criteria on initiative and scope fulfilment. However, they also noted that when their students are acutely aware that they are being assessed on these criteria, their sense of innovation and work rate seems to improve.

Another concern relates to the time spent in paper administration relating to the scoring results. This feedback is addressed through the development and usage of an assessment web application, which is described in the next section.

## IT SUPPORT

A web-based assessment application for the scoring of the capstone project via rubrics was designed and developed to support faculty, both in the mid and final project presentations. The faculty is able to input of scores for students under their charge directly during presentation. The application also provides the auto-generation of scores for the compilation of results as well as indicative assessment results for the students. The timely introduction of this application also helps to enable the acceptance and implementation of the rubrics-based project assessment.

Figure 5. Assessor's Scoring Page

Home Assess Student Admin Change Password Logout  
 You have logged in as Edmund Teo. Your last login time was 1/23/2014 9:28:35 PM.  
 Academic Year: 2013 FYP Path: A2 Assigned Group: PCG Assessment Type: Mid Term Presentation  
 Retrieve Clear

Admin No	Name	Score	Performance Indicator	Below Expectation (1)	Approaching Expectation (2)	Satisfactory (3)	Good (4)	Excellent (5)
Assess 111774P	DZUR'AIN BTE JUMADI	3.5	Delivery	Presentation is not comprehensible by audience and/or does not match slides	Audience has difficulty following presentation and flow of information can be improved	Audience is able to follow presentation which is delivered well but too heavily scripted	Audience is able to follow presentation which is delivered well and smoothly	Presentation is interesting, eloquently delivered and with enthusiasm
Assess 112996L	LEOW SIN YI	3.0	Q&A	Unable to handle most Q&A	Able to handle some Q&A	Able to handle most Q&A	Able to handle all Q&A well	Able to handle all Q&A well and able to anticipate questions
Assess 110936A	BEH YUAN CHENG	3.5	Organisation	Illogical sequence without agenda	Agenda exists, but major disconnects in organisation / sequence	Agenda exists, but only minor disconnects in organisation / sequence	Agenda exists and coherent organisation / sequence	Agenda exists, coherent & interesting organisation / sequence
Assess 114534P	DESMOND TOH JIA JIE	3.0	Supporting Materials	Little or no supporting materials, eg. visuals	Supporting materials are used but not explained or put in context	Supporting materials are used and explained in context	Supporting materials are effectively used and explained in context	Supporting materials are effectively & innovatively used and explained in context
Assess 116247U	SEET CHOON WEE ALVIN	3.5	Level of technical understanding	Does not comprehend project's technicalities	Able to explain some project's technicalities	Able to explain most project's technicalities	Able to explain most project's technicalities and understands associated technical limitations	Able to explain all project's technicalities and overcome associated technical limitations
Assess 111788F	SEAH CHONG YEE	3.5	Soundness of Design	Design is not able to achieve project objectives	Design is able to achieve some project objectives	Design is able to achieve most project objectives	Design is able to achieve all project objectives	Design exceeds all project objectives, takes into account future
Assess 111603A	CHEONG PEI NING JOSELYN	3.5	Drive, originality & independence in problem solving	No observable interest and effort shown in project	Make some attempts according to supervisor's recommendations	Persisted in making repeated attempts as recommended by supervisor	Experiments on his own with reliance on supervisor for guidance	Experiments on his own exhibits independence and drive, and shows originality in his solution
Assess 113505X	SEE JUN HAO	3.5	Scope Fulfilment	Barely fulfilled the project scope	Fulfilled some of the project scope but with significant portions missing	Fulfilled some significant portions of the project scope	Fulfilled most of the project scope	Completely fulfilled or exceed the project scope
Assess 113130C	MUHAMMAD HANAFI BIN HISHAM							
Assess 115504T	SOH WEE BIN							

Comments:  
 1. Need to think through the explanation of the benefits of the system, esp. point 3  
 2. A better example should be used in the System Overview !

## CONCLUSION

The rubrics and its development and application process work together hand in hand for fair assessment of students in their capstone project. Additionally, it is also a tool for training and channelling feedback to students, enabling them to use their knowledge and skills from design to implementation of their capstone project. Judicious usage of the assessment result via the rubrics' scoring sheet facilitates the faculty to impart and inculcate positive learning attitudes more effectively.

The rubrics have served to highlight the capstone project's assessment criteria and enable them to be the guiding posts for students to strive towards not just achieving good results but more importantly, to train them to acquire the course learning outcomes in the process.

Over the next semester, the rubrics will be refined further to take into account feedback from the students and faculty.

## REFERENCES

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## BIOGRAPHICAL INFORMATION

**Flex Tio** is a Lecturer in the School of Engineering, teaching software programming and engineering practices. He was a research and development engineer with the Government of Singapore specialising in Visual Analysis and Text Analysis. He is a member of the Future Learning Working Committee within the school, exploring education pedagogy involving collaboration and the usage of technology.

**Joelle Kong** is a Lecturer in the School of Engineering, teaching data analysis and visualisation and web application development. She is a member of the program management team and is currently involved in curriculum design and reviews as well as improvements in assessment and student outcomes.

**Ryan Lim** is a Senior Lecturer in the School of Engineering and his main research interest is in the area of educational support system, data analytics and pervasive computing. He received his Bachelor and Master of Science with 1<sup>st</sup> Class Honours in Computer Engineering and Computer Science from the University of Illinois at Urbana-Champaign.

**Edmund Teo** joined Nanyang Polytechnic in 2000 and is a Senior Lecturer in the School of Engineering. He graduated with a Bachelor of Applied Science (Computer Technology with Merit) degree from Nanyang Technological University and has a Master of Technology (Software Engineering) from the National University of Singapore. He is currently the program manager.

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