# Full Paper

## Introduction

Young engineers coming into a practice-oriented field, like Project Management, often struggle to relate to the concepts that they had only read in books.  It is also difficult for lecturers to impart real-life experiences to inexperienced engineers by just explaining concepts, talking in lectures or showing a couple of videos. Similar to case studies, the use of posters can instil experience into young engineers in an effective manner. Unlike case studies, use of posters requires students to actively summarise, collate, organise information in a logical and intuitive manner and present them to an audience. The experience develops several skills in the cognitive domain, affective domain and behavioural domain mapped using Bloom's taxonomy (Krathwohl 2002). Prior research into the educational value of posters have been done in other fields but not specifically in Project Management (Deonandran et al. 2013, Bargard et al. 2014).

This paper details feedback gained from a group of masters level students who undertook a case study analysis of a major project and presented their findings through the development and presentation of a poster.

## Problems faced in Project Management Education

One of the major problems often cited by all educators, lecturers and tutors, in general, are large class sizes. With large class sizes, it is difficult to give individual attention to students. A second common problem often faced by engineering students, in general, is that project management subjects tend to be different from the typical quantitative problem-based engineering subjects. As in other management studies, students are expected to learn about concepts involving organisation and human behaviour and then apply them in case-based learning activities. The assignments and exercises are typically essay-type questions which require analysis and reasoning on the part of the students. Some students, especially overseas students see this approach as a challenge as they may already be experiencing language difficulties in expressing and communicating concepts and ideas. Thirdly, in order to give a real world feel to the assignments and exercises, group work in often required. This component simulates working in project teams. However, group work may add to the difficulty of gauging an individual student's progress, performance and skill acquisition.

## Insights into how students learn - An Overview of Bloom's Taxonomy

In relation to the problems faced by project management educators, it will be interesting to review and apply some of theories of how people learn to the area of project management. Bloom's taxonomy (Krathwohl 2002) provides a theoretical framework for how people learn. The first learning dimension or learning domain is the cognitive domain which categories learning into remembering, comprehension, application, analysis, evaluation and creation. These cognitive process can be applied to four knowledge dimensions of factual knowledge (basic facts), conceptual knowledge (interrelationships between objects in a larger structure or system), procedural knowledge (knowledge of how to do something) and metacognitive knowledge (Self-awareness and knowledge of one's own knowledge). All of these four knowledge dimensions are widely found in the field of project management. The second domain, the affective domain (Krathwohl, Bloom and Masia 1964), deals with receiving, responding, valuing, organising and internalising. In this domain, the learner appreciates, feels

enthusiasm or motivation for learning. In a project management environment, this translates into abilities to value opinions, have feelings of engagement or enthusiasm and internalising knowledge. The final learning domain is the behavioural or psychomotor domain (Simpson 1966) which deals with physical movement and manual tasks. It includes how people perceives non-verbal cues, responses to different situations, proficiency in movement or habit formation and adaptation based on existing skills. In the project management, this translates into a project manager's behaviour under different situations.

## Poster Design as Experiential Learning

Poster education is an experiential learning activity which requires the learner to actively participate in order to gain skills which can be mapped to the three skill domains in Bloom's taxonomy, These skillsets being in a) the cognitive domain in areas such as collating information, synthesising facts and making decisions; b) the affective domain such as receiving information, giving information, and c) the behavioural domain such as working collaboratively, responding to questions and communicating succinctly. It is contended that the use of posters has advantages in that since they can more accurately reflect project management reality than a written report style assignment.

## Research Purpose

This research aims to uncover how the experience of a poster preparation helps inexperienced young engineers develop project management skills in the various skill domains mapped using Bloom's taxonomy (Krathwohl 2002). It helps to uncover which specific aspect of skill development is best achieved through the use of poster design. Through active learning (Freemana et al. 2014), poster exercises help stimulate thinking by forcing students to make judgements about what are the important key issues in real life situations. It also forces students to participate in group activities such as team meetings and oral presentation. These may have a direct impact on individual behaviour in project teams and in front of peers.

## Methodology

In this study, students in a Project Management Practices class are given a case study of a typical large engineering project (F-35 Joint Strike Fighter project). The students were organised into groups, given sufficient information and reports relating to the project. The groups were then given topics relating to specific concepts in Project Management. The students had to work in groups outside of the class time to develop a poster and use some tutorials for discussions. They also have to make a ten-minute presentation to the rest of the class by the end of the semester. The students were told that the learning objectives of this exercise was the ability to analyse a selected topic in a real project management situation and present the relevant information in an engaging manner which will facilitate meaningful discussions. The poster and the presentation were graded exercises which made up 10% (7% for poster and 3% for presentation) of the final marks for the subject . In a way, the readings, poster preparation and discussion resemble the flipped classroom pedagogical methods where students do some preparatory readings before actual lecture or class (Kim, Heo and Lee 2015). In the poster exercise, the students were given a list of project documents for pre-reading at their own time. During one of the subsequent tutorials in class, they were then given time to discuss the topic, given guidance on how to organise the information and to present it in an engaging manner.

At the completion of the exercise, the students were asked to reflect on their experiences in the poster design activities and presentation. A survey tool mapping on learning using Bloom's

taxonomy was administered. The data was collected during class time using a secure online tool.

There were five topics assigned to each group of students. Each of these five topics dealt with a practical aspect of project management such as roles, systems management and procurement strategy. The posters were marked by a panel of six judges based on the following criteria:

1. Content
    a. Scope coverage
    b. Insight
2. Presentation
    a. Explanation
    b. Use of poster in presentation
    c. Style (oral)
    d. Timing
    e. Answering the questions.

## Survey and Data Collection

Data was collected from the students using the survey tool shown in Appendix A. Students were given a link to a secure online site. The survey consisted of 22 questions and could be completed within 15 minutes. The survey measured students' perception of the education value of the poster exercise in various areas measured on a five-point Likert scale. The first section measured students' perceptions of the usefulness of the exercise in terms of gaining an understanding of project management practices and practical presentation skills. Students were then asked to compare the education value of the poster exercise against that of a written assignment, which was given as a separate graded task. The third section of the survey measured students' perception of the poster exercise in helping them gain abilities in cognitive (mental), affective and behavioural domains of Bloom's taxonomy.

## Results

Of the 192 students in the class, 65 students responded and provided complete answers to the survey tool. The demography and profile of the respondents are provided in Figs 1 to 3.
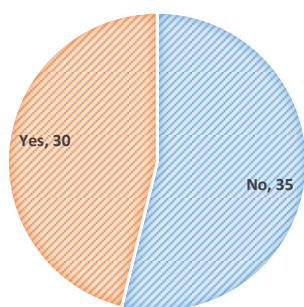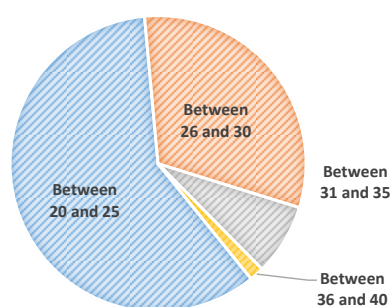


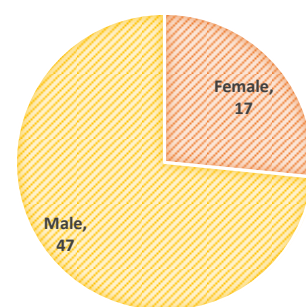Figure 1: Poster experience       Figure 2: Sample age       Figure 3: Sample gender

The gender of respondents was approximately 75% male with the dominant group being aged between 20 and 25. Just fewer than half the respondents had previous experience in the use of posters. Some 54% of the respondents have no prior project management experience.

The specifics of the questionnaire are provided in the attachment and a statistical summary of the responses to the survey is tabulated in Table 1 below.

Table 1: Statisitical summary of the survey responses

| Dimension | Variable | Z (n=65) | Significance |
|---|---|---|---|
| Cognitive skills | Analytical ability | 6.91 | 0.000** |
| | Ability to apply the learnt concepts | 6.48 | 0.000** |
| Affective domain | Collaboration with others | 8.04 | 0.000** |
| | Reading skills | 4.80 | 0.000** |
| | Listening skills | 3.07 | 0.001** |
| | Ability to respond to feedback and questions | 4.92 | 0.000** |
| Psychomotor | Presentation skills | 5.02 | 0.000** |
| | Communicate succinctly | 9.36 | 0.000** |
| | Knowledge of the expected behaviour | 5.12 | 0.000** |
| | | | |
| The merits of a poster assignment compared with a written report style assignment | Requires more work | 2.17 | 0.015* |
| | More research rigour | 2.75 | 0.003** |
| | Relates to real situations | 3.79 | 0.000** |
| | More relevance for career development | 1.44 | 0.075 |
| | Better understanding of actual work | 3.78 | 0.000** |
| | Helps think of my own behaviour | 4.40 | 0.000** |

Legend:    * Significant with alpha <5%        ** Significant with alpha <1%

The findings are further detailed as: a) the effectiveness of the poster approach in building understanding (refer Fig 4); b) the skills acquired, developed and applied (refer Table 2); and c) the relative merits of a poster based assignment compared with a written report style assignment (refer Table 3).

Figure 4: The effectiveness of posters in building understanding of the case study (n=65)
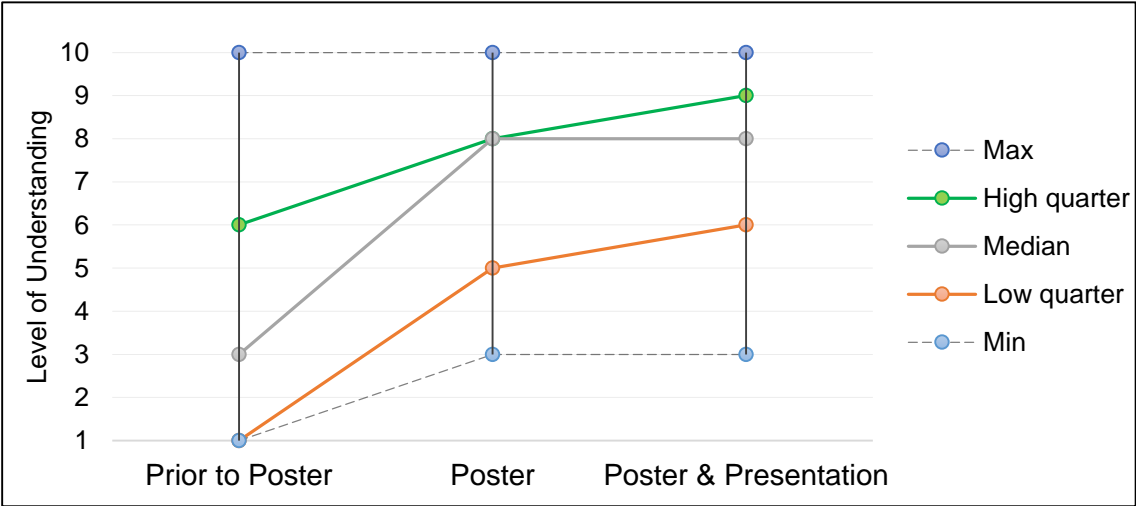
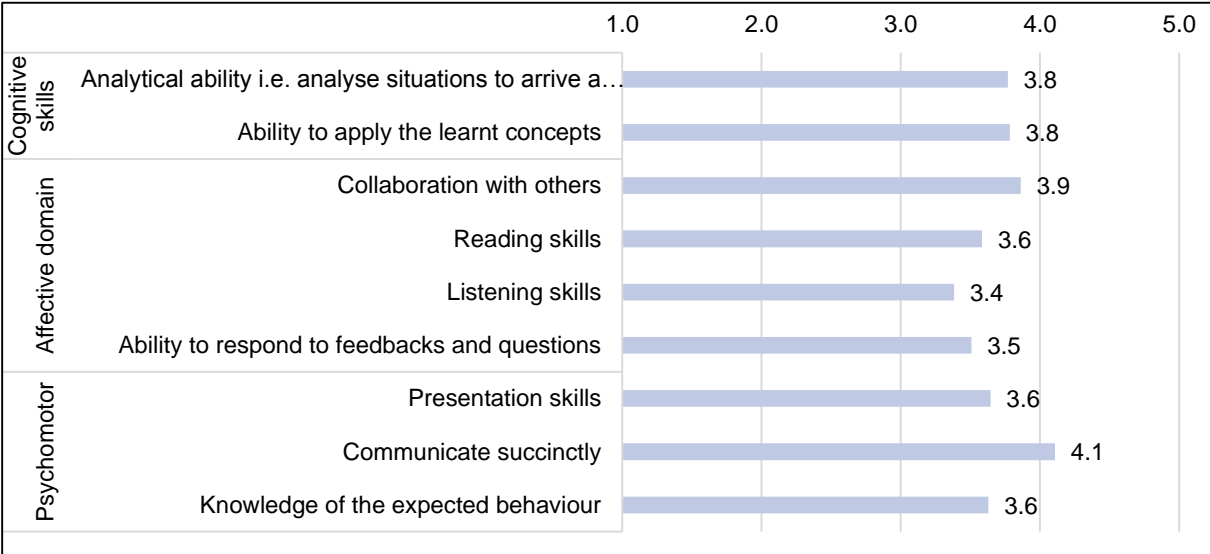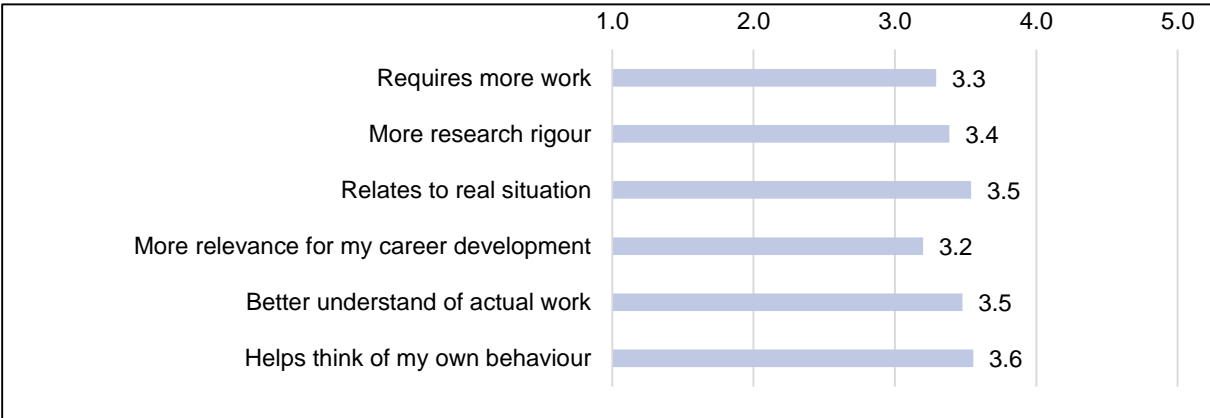Table 2: Learnings acquired, developed and applied during poster assignment

| Domain | Skill | Score |
|--------|-------|-------|
| Cognitive skills | Analytical ability i.e. analyse situations to arrive a… | 3.8 |
| Cognitive skills | Ability to apply the learnt concepts | 3.8 |
| Affective domain | Collaboration with others | 3.9 |
| Affective domain | Reading skills | 3.6 |
| Affective domain | Listening skills | 3.4 |
| Affective domain | Ability to respond to feedbacks and questions | 3.5 |
| Psychomotor | Presentation skills | 3.6 |
| Psychomotor | Communicate succinctly | 4.1 |
| Psychomotor | Knowledge of the expected behaviour | 3.6 |

Table 3: The merits of a poster assignment compared with a written report style assignment

| Item | Score |
|------|-------|
| Requires more work | 3.3 |
| More research rigour | 3.4 |
| Relates to real situation | 3.5 |
| More relevance for my career development | 3.2 |
| Better understand of actual work | 3.5 |
| Helps think of my own behaviour | 3.6 |

## Discussion

Whilst the response rate was only 37% it is considered that a sample of 65 participants ranging in age from 20 to 40 years old provides a representative of the cohort's perception of the poster exercise. The relatively low response rate may be attributed to the fact that the survey was optional and was collected after the last class of the semester.

Compared to the written assignment, 57% agreed that that posters positively help them relate to real-world project situations and 57 % reported that it had positively helped them think about their own behaviour as project managers and 58% reported that it positively enhanced their knowledge of the behaviour of a Project Manager. However the respondents reported the greatest educational effect in the affective domain, confidence in dealing with others (71%), reading abilities (60%), listening skills (54%) and giving and responding to feedback (55%). The educational effects were marginal in the cognitive learning domain. Posters when coupled with the presentation exercise enhanced the abilities to communicate succinctly (79 %).

An analysis of the affective domain skills, refer Table 2, demonstrated that posters provided positive learning outcomes for all aspects considered (results ranged from 3.4 to 3.9 out of 5). Cognitive skills were deemed to be enhanced through the use of posters (scores of 3.8) and

benefits were measured in the analysis of the presentation and communication skills in the range 3.6 to 4.1.

Interestingly, the respondents rated the poster experience as better than that of a written report (refer Table 3) with attribute scores ranging from 3.2 to 3.6 out of a possible score of 5.

The data suggests that the poster design experience can be a viable and effective alternative to written assignments and there is a strong case for the inclusion of the use of poster design in project management education. In the case of a written assignment, the students develop critical analytical skills mainly in the cognitive areas of knowledge, comprehension, analysis, application, synthesis and evaluation (Krathworl 2002). In the poster exercise involving a real world project management situation, learning to present issues and arguments could have helped in developing behavioural skills on top of analytical skills.

The analysis also identified areas for improvement in the learning outcomes, particularly in the presentation of the posters, refer Fig 4. Specific areas for improvement relate to allowing greater time for presentations and discussions of other groups posters. Comments were also made of the benefits of direct guidance from tutors during the practice classes.

The quantum of the enhanced outcomes from the use of posters was statistically significant against most measures, refer Table 1. Particularly positive learning improvements were identified for communication, collaboration with others and in student's ability to apply learnt concepts and to improve their analysis of project situations.

Some specific comments received as part of the survey included:

"…overall, I consider that the poster assignment a very good experience."

"Posters were a good idea; however, the presentations are so short that sometimes it is hard to get all the ideas of the other teams."

"I would say that more support from the workshop lecturers is useful in order to do the poster activity in the best possible way."

"It helped me get a better insight on the F-35 project, considering the time spent it would be good if we are awarded more percentage of the final mark."

## Recommendations / Implications / Conclusions

This research shows that the use of poster in project management education is a valuable and interesting experience to project management students. It helps encourage active learning through organising and processing large amounts of information in a complex work environment. This is particularly useful for engineers who do not have prior project management experience as it gives a chance to get a deep insight into project management in a non-hostile learning environment.

Of particular note were the measured benefits in terms of cognitive skills developed across all affective domains and enhancements to presentation skills, communication and in the understanding of the expected behaviour of professional project managers.

The feedback also provided guidance on how the use of posters could be further enhanced by providing additional time for students to discuss the posters produced by other student groups.

## References

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# Appendix: Survey Questionnaire

## Demographics

1. Age
2. Gender
3. Have you previous experience in a poster preparation?  Yes/ No

**10 point Likert scale (No Knowledge 1-…-10 Very good knowledge)**

## Education Value

4. Prior to the start of the poster project, how would you rate your understanding of the F-35 project?
5. After the poster preparation, how would you rate your understanding of the F-35 project?
6. After the poster preparation and presentations, how would you rate your understanding of F-35 project?

**5 point Likert scale SD-D-N-A-SA**

## Overall value

7. The poster experience helped me in learning about F-35 project particularly in concepts relating to the given topic.

## Comparison to a written assignment

8. Compared to written assignment, poster requires more work.
9. Compared to written assignment, poster has more research rigour.
10. Compared to written assignment, poster helps me to relate to real project situations.
11. Compared to written assignment, poster has more relevance for my career development.
12. Compared to written assignment, poster gives me a better understanding of real project management work.
13. Compared with written assignment, posters help me think about my own behaviour as a Project Manager.

## Acquired, Developed and Applied Skills

### Cognitive – mental abilities

14. The experience enhanced my analytical abilities in project management i.e. analyse project situations to arrive a decision,
15. The experience enhanced my ability to apply project management concepts

### Affective domain – values, feelings, appreciation, motivations

16. The experience enhanced my confidence in collaborating with others
17. The experience enhanced my reading skills
18. The experience enhanced my listening skills
19. The experience enhances my ability to respond to feedback and questions

### Psychomotor – Behavioural

20. The experience enhanced my presentation skills
21. The experience enhanced my abilities to communicate succinctly (i.e. summarise key points)
22. The experience enhanced my knowledge of behaviour expected of Project managers