Project-oriented education for a project management course at the undergraduate level: experience of pedagogy — a case study from Nankai University in China

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Abstract

With the aim of changing the traditional passive learning style in higher education in China, the Center for Project Management Research at Nankai University (CPMRNK) has spent ten years studying the pedagogical approach of project-oriented education, and has had some success with this in its project management course. Its project-oriented education is a new initiative that comprises: teaching in class by teachers first; designing projects after class by students; presenting the designs in the next class; using the designs as cases and doing the case study in the class; correcting the mistakes in the designs after that class; and continuing these cycles until the course is finished. The course implementation effect and feedback from the students using Course Experience Questionnaire (CEQ) are analysed after the introduction of teaching methodology. All the teaching skills and techniques used in their project-oriented education are also discussed in this paper.

Keywords

project-oriented education; project management; course experience questionnaire

1. Introduction

Project-oriented education is grounded in constructivism, by supporting student engagement in problem-solving situations (Doppelt 2003). It is an educational model that organises learning around projects, which are complex tasks, based on challenging questions or problems, that involve students in design, problem solving, decision making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations (Jones et al. 1997; Thomas et al. 1999). As early as 551-478 B.C., the great Chinese educator Confucius had already conceptualised constructivism (Savery & Duffy 1995) in his theory of “learning by doing”. Unfortunately, it did not receive due attention until the industry gradually started demanding college graduates with more hands-on experience and social skills. This change in need of the type of human resources necessitated a reform in pedagogy in tertiary education.

The application of and academic research in project-oriented education at the college level is most seen in Europe, where Aalborg University and University of Twente are two of the best research programs. Research in this area in China is also in progress. However, few publications about the latter can be found in international journals due to the language barrier.

During the past ten years, the Center for Project Management Research in Nankai University (CPMRNK) has been studying the pedagogical approach of project-oriented education and has had some success with this in its project management course. It received the “national excellence” award from the education ministry for being a paradigm of pedagogical innovation in undergraduate education.

The project-oriented educational method presented by CPMRNK is a new initiative that comprises: teaching in class by teachers first; designing projects after class by students; presenting the designs in the next class; using the designs as cases and doing the case study in the class; correcting the mistakes in the designs after that class; and continuing these cycles until the course is finished.

Project-oriented education has been adopted in a variety of educational disciplines including business, education, law and engineering (Blumenfeld et al. 1991; Gijselaers et al. 1993; Brito & Tenente 1999). However, many well-publicised examples of project-oriented educational models across the world do not offer transferable approaches that could be readily adopted elsewhere — they often operate with high financial input, small class sizes and depend on access to intensive support and specialist expertise/equipment (Graham 2010). In contrast, the CPMRNK example operates on low budgets, accommodates relatively big class sizes, and does not require significant levels of expertise/support/equipment for its successful operation. Consequently, it offers a robust, successful and transferable pedagogical approach.

2. Factors influencing project-oriented undergraduate education

Although there have been positive findings from previous research on the learning outcomes of project-based teaching approaches (Chard 1992; Tharp & Gallimore 1988), several factors for success in changing to project-based educational pattern still need to be emphasised.

2.1 Support from university leadership

There are many cases all over the world where institutions have regulations for their own pedagogies involving all the elements in the curriculum such as outcomes, learning methodologies, selection of contents and assessment. It may be difficult to influence

institutional policy. However, dialogue with leadership still needs to occur in order to open up the possibilities for enhancement of higher education

For CPMRNK, such difficulty does not exist. It has had great support from its university since project management discipline was newly introduced into China and there was a pressing need for the course development at the time it started to consider the project-oriented pedagogical approach.

2.2 Instructor with real project experience and sufficient teaching assistants

As demonstrated by Arai (2001), in project-based education, in order to be able to correctly convey the meaning and merit of a project, instructors must have a certain amount of project experience. If the instructor does not have any real project experience, it is difficult for him or her to go beyond what is in the textbooks. In addition, sufficient teaching assistants are also essential since group work is generally used in project-oriented education and hence more instructors are needed to supervise all the student groups.

In the CPMRNK case study, the main instructor is a leading authority in the project management field in China. He has had many years of experience as a top executive in both domestic and joint venture companies before becoming an academic. His real-life experience with project management helps to inspire course participants and prevents class projects from becoming divorced from reality. Furthermore, two doctoral candidates supervised by him are employed as teaching assistants for this course by the university. They are responsible for facilitating the group work among students and familiarising them with the techniques necessary in project-based learning.

2.3 Change in the instruction and assessment parts

Barron et al. (1998) urged that in following a project-based learning approach for instruction, it is necessary to change not only the curriculum, but also the instruction and assessment processes for instructors and students. The traditional method of lecturing to passive students should be replaced with a new way of instruction by encouraging motivation, tutoring, providing resources and helping learners to construct their own knowledge. At the same time, an assessment method congruent with the instruction needs to be developed to gain better learning outcomes. In the case of CPMRNK, both instruction and assessment methods are project-oriented, which ensure the achievement of teaching goals. The details will be discussed in the next section.

3. CPMRNK's project-oriented educational method

The project management course is a compulsory course for sophomores in the Business School of Nankai University. Through this course, students are expected to acquire basic competence in the nine knowledge areas of PMBOK, get acquainted with the main tools and techniques of project management, and be able to apply them in real-life practice. To achieve these goals, CPMRNK decided to adopt the project-oriented pedagogical approach and facilitate students' learning by tutoring them synchronously with the developing progress of their chosen projects.

3.1. CPMRNK's Project Management Course Model

CPMRNK's project-oriented educational method for project management course was based on two classic models: Kolb's experiential learning cycle and Participant Centered Learning and the Case Method from Harvard Business School. According to Kolb's model, the learning cycle is a continuous movement of four steps: concrete experience, observation and reflection, forming abstract concepts, and testing in new situations.

Although it was suggested that Kolb's learning cycle often begins at concrete experience, Kolb argued that the learning cycle could begin at any of the four steps. Considering that undergraduate students do not have any real experience in project management, CPMRNK designed the students learning cycle to start with forming abstract concepts, and the course structure as a combination of lectures, project design and periodic workshops corresponding to each step of Kolb's model (shown in figure 1).

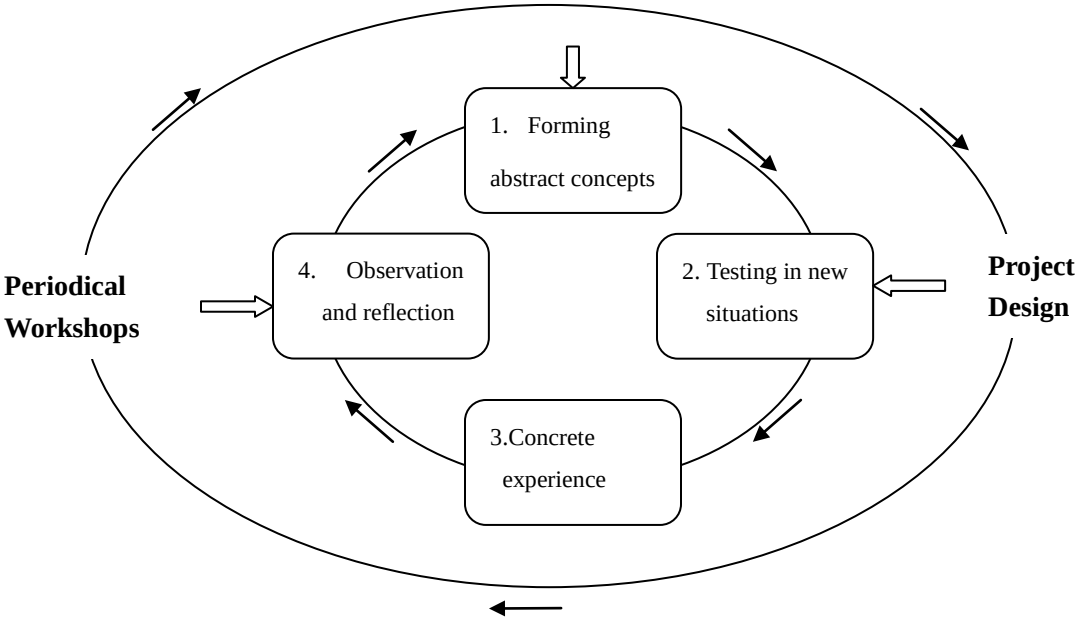

Figure 1. Project-oriented course structure according to Kolb's learning cycle

Lectures

It should be recognised by educators that the education of experienced and inexperienced individuals requires different styles. For inexperienced people, we need to impart primary concepts and techniques at the initial stage of learning. In the lecture portion, CPMRNK adopted the case method from Harvard Business School in order to facilitate students' understanding by contextualising the project management knowledge in commercial settings. The lecture portion comprises 12 lectures, with each lecture introducing a specific area in project management.

Through these 12 lectures, students get a rough understanding of all aspects of project management. However, the skills and techniques as well as a thorough understanding of project management are mainly developed in their project design work.

Project design

The project design work is assigned to students in stages, accompanying the progress of the lectures. After the introductory lecture, students are divided into groups, with each group consisting of about 10 people who work together throughout the course duration. Each group is required to nominate a project manager to help organise the teamwork, so that members can cooperatively finish the project design outside regular class hours.

After each lecture on a particular aspect of project management, the groups need to finish the corresponding assignment on their respective projects. CPMRNK believes that it is easier to obtain explicit project design deliverables for four of the nine areas of knowledge in project management, namely, project scope, time, cost and risk management. Therefore, milestone assignments are given after these four lectures. Furthermore, a final project design report is required after all the lectures are given and suggestions for revision are considered from workshops. The specific procedure is shown in the "project design" section of Figure 2.

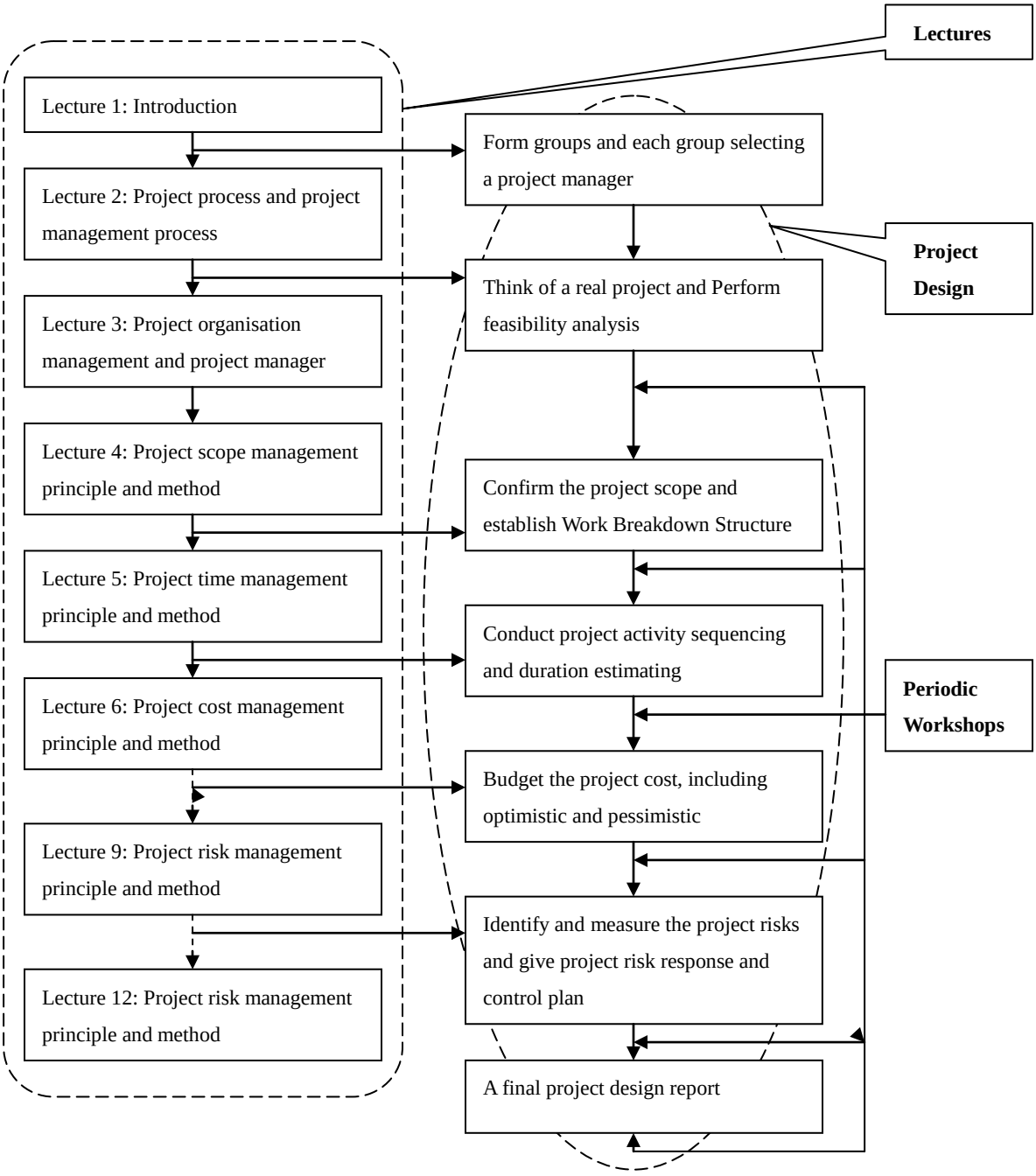

Figure 2. flowchart of project management course design

Periodic workshops

The workshop is held after each milestone project design assignment is completed by students on schedule as seen in Figure 2. It consists of three parts — group presentation, classroom discussion, and suggestions for revision from the instructor.

Group presentation: Advanced presentation skills play an increasingly important role in business communication of modern companies. Hence, for students majoring in business management, the better equipped they are with these skills, the more prepared they are for their future career. For this reason, the instructor trains the students to practise their presentation skills. As is shown in Figure 2, the periodic workshops are held six times in all. At every workshop, the instructor requires two different students in each group, to represent their team and report their project design to the class. This policy is not only an opportunity for every student but also a constraint for their participation in teamwork.

Classroom discussion: After each group makes its presentation, the instructor initiates a classroom discussion. To encourage student participation, the instructor should not interrupt their free discussion by making any direct comments. With his in-depth, real-life project experience, it is not difficult for the instructor to identify the errors and deficiencies in student project design work. However, in participant-centered learning pedagogy, it is better for the instructor to work as a facilitator in effecting knowledge transfer and leave room for the students to develop their own skills.

Suggestions for revision from the instructor: At the end of the classroom discussion, the instructor provides feedback in the form of suggestions for revision to all students. This section is also used by the instructor to do case study teaching, drawing on the experience from Participant Centered Learning and the Case Method from the Harvard Business School. However, there is a difference in that the business cases used by CPMRNK are projects designed by the students. The advantage of this strategy is that students tend to be more interested in their own projects and keen to get suggestions from their instructor on what they had discussed earlier, which can help to accelerate knowledge transfer.

In traditional education, knowledge transfer is a one-way, point-to-multipoint information transmission that only occurs when an instructor gives lectures to his students. However, in CPMRNK's project-oriented educational model, bidirectional information links exist between any two people in the class. The contrast is clearly shown in Figure 3.

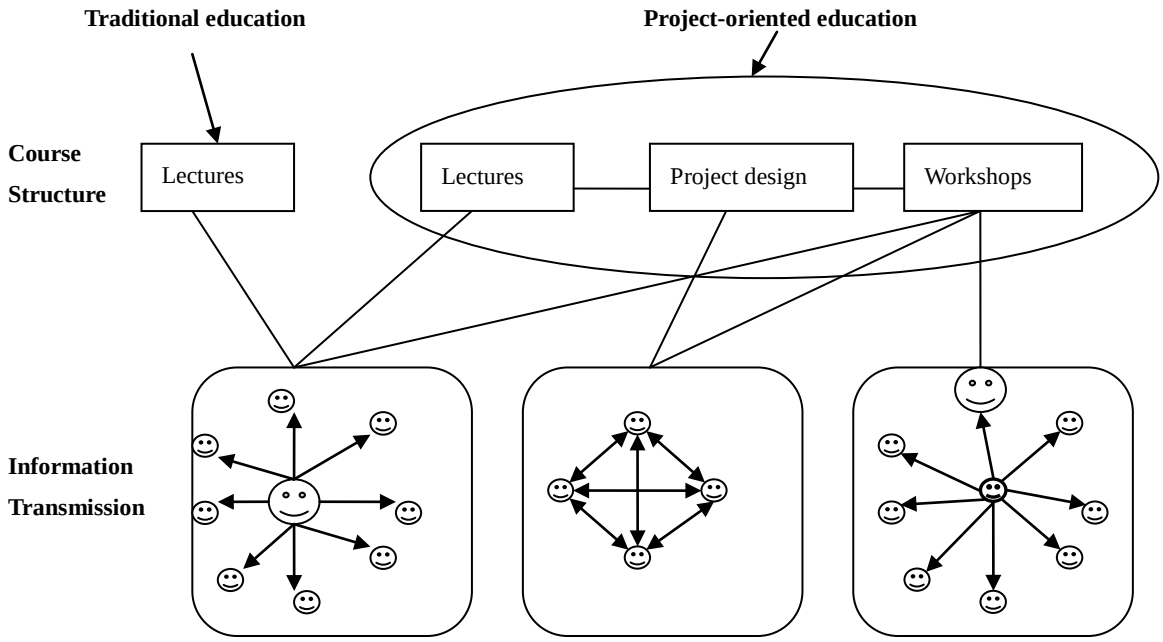

Figure 3. Contrast of information transmission under different course structures of traditional and project-oriented education

Note: the big face represents the instructor and the smaller faces represent the students

3.2. Use of technology

Experienced educators hold that students learn best through a project-based approach in which they are able to discover things for themselves and take advantage of technological tools (Blumenfeld et al. 1991; Clinchy 1989; Linn et al. 2000; Lebow & Wager 1994). Although technology can be valuable in supporting students and teachers in projects requiring higher level thinking (Blumenfeld et al. 1991), it is not the type of technology that matters the most, but how it is used (Dyrli & Kinnaman 1994; Ehrmann 1995; Green & Gilbert 1995). This section will explain how technologies are fully utilised in the course.

The three main categories of technology employed in this course include multimedia, networks and computer software.

Multimedia

Multimedia is used both in lectures and workshops. Multimedia Display Courseware is created with PowerPoint to make lecture outlines, which students can review outside of class. Students also use multimedia to make presentations explaining their project designs and ideas.

Network

Network, IM software and Mail system are adequately applied in the course. The instructor and two teaching assistants check their emails every day so that they can respond to students' problems promptly. Online group discussions are frequently organised by project managers with the participation of the teaching assistants when there is a difficulty in physical locations.

Computer software

Computer software refers to the project management software commonly used in commercial projects, such as P3, Artemis Viewer, ProjectScheduler, SureTrak and so on. Students are encouraged to learn to use these to facilitate their design work. For example, one group successfully used Microsoft project software for part of their project design, and is happy to have mastered an advanced skill that might prove useful in their future careers.

3.3 Assessment method

In project-oriented education, students have been assessed in a variety of ways, from traditional paper-and-pencil tests to new modes of assessment such as case-based assessment, self- and peer assessment, performance-based assessment and portfolio assessment. The assessment method in this course is a combination of project design work (20%), presentation (10%) and the final test (70%).

Project design work

The project design work is comprised of six milestone assignments (shown in Figure 2) to be presented in the electronic format by each team. It can be viewed as a portfolio that contains exhibits showing the stages in the learning journey a group has gone through and the stages of their growth in project experience. The assessment of project design work will give a score to each group as an evaluation of their overall team performance, which makes up 20% of the final grade for each student.

Presentation

As mentioned, the periodic workshops are held six times in this course and each time there are two different students representing their group to do presentation. With each team containing 10 or 11 people, every student has at least one chance to give a report. Taking into consideration that students generally put more effort into the work they report on and also the importance of presentation skills in project management, the presentation

accounts for 10% of the final individual grade.

Final test

The final test is still a paper-and-pencil test; however, a new method of project-oriented examination is being developed. In the final test, 40% of the score is for students' understanding of basic concepts and approaches of project management, while the remaining 60% is for students' explanation of their project design work based on the main aspects of project management, such as project life cycle, project work structure, work breakdown structure, project cost management, etc. Another objective of the project-oriented examination is to assess individual students' contribution to the group's work and to discourage free riders.

Figure 4 shows the assessment method. It can be seen that 72% of the score is project related and 80% is determined by individual performance. The assessment method is congruent with the project-oriented course structure and can be tightly structured.

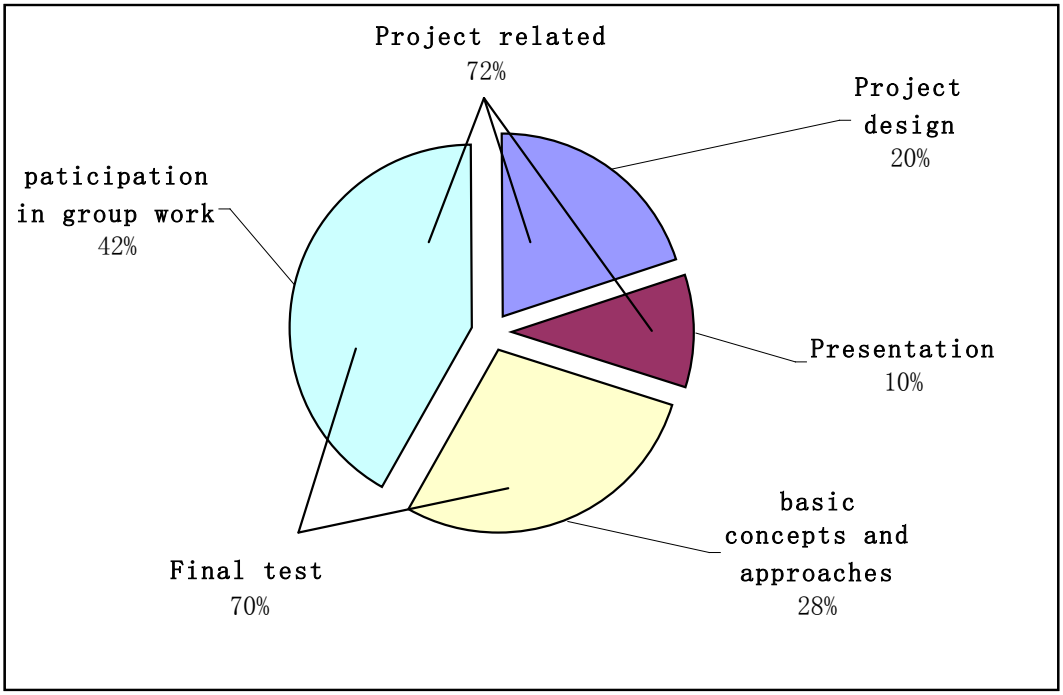

Figure 4. Assessment method

4. Feedback from students

According to Ramsden (1991), performance indicators based on students' evaluations of the quality of teaching are especially appealing in the context of difficulties with other measures of teaching quality. It is a direct measure of consumer satisfaction with higher education and therefore is employed in the evaluation of teaching performance. Considering its relatively small sample size (41), CPMRNK applies a classic and well-developed scale called Course Experience Questionnaire (CEQ) rather than developing a new one to access effective feedback from students.

The version of CEQ used in this research is the eighth edition in a series that began with the 1993 survey of the course experiences of students who graduated from Australian universities in 1992 by the Graduate Careers Council of Australia (GCCA). Reliability and validity of the scale was found to be high in the large sample statistical analysis of yearly data from more than 50,000 respondents. The CEQ consists of 25 items, with each item scored on a 5-point Likert-type scale from “strongly disagree” to “strongly agree”. Respondents express their degree of agreement or disagreement on the scale with 24 statements about five facets of their courses: the quality of teaching, the clarity of goals and standards, the nature of the assessment, the level of the workload and the enhancement of their generic skills.

A final item asked respondents to indicate their overall level of satisfaction with the course on the same five-point scale.

4.1 Item response data from course participants

The number of respondents to the CEQ from all the course participants (43) was 41 and the response rate 95.35%. Table 1 summarises the CEQ responses of course participants. It contains the wording of each of the items on the questionnaire, together with the percentages of students responding to each categor**y.**

Table 1. CEQ item response percentages (N = 41)

		Responses in each Category (%)					
		Strongly		to		strongly	
		disagree				agree	**%**
No.	**CEQ Scale/Item**	1	2	3	4	5	**Agree**
Good Teaching Scale							
3.	The teaching staff of this course motivated me to do my best work.	0.0 .	2.4	4.9	63.4	29.3	92.7
7.	The staff put a lot of time into commenting on my work.	0.0	2.4	26.8	58.5	12.2	70.7

No.	CEQ Scale/Item	Responses in each Category (%) Strongly disagree 1	2	3	4	to strongly agree 5	% Agree
15.	The staff made a real effort to understand difficulties I might be having with my work.	2.4	9.8	14.6	61.0	12.2	73.2
17.	The teaching staff normally gave me helpful feedback on how I was going.	0.0	2.4	7.3	51.2	39.0	90.2
18.	My lecturers were extremely good at explaining things.	0.0	2.4	2.4	53.7	41.5	95.1
20.	The teaching staff worked hard to make their subjects interesting.	0.0	4.9	2.4	53.7	39.0	92.7
Clear Goals & Standards Scale							
1.	It was always easy to know the standard of work expected.	0.0	19.5	12.2	53.7	14.6	68.3
6.	I usually had a clear idea of where I was going and what was expected of me in this course.	0.0	7.3	17.1	65.9	9.8	75.6
13.*	It was often hard to discover what was expected of me in this course.	0.0	41.5	36.6	22.0	0.0	22.0
24.	The staff made it clear right from the start what they expected from students.	0.0	2.4	12.2	70.7	14.6	85.4
Appropriate Workload Scale							
4.*	The workload was too heavy.	0.0	48.8	34.1	12.2	4.9	17.1
14.	I was generally given enough time to understand the things I had to learn.	2.4	34.1	29.3	31.7	2.4	34.1
21.*	There was a lot of pressure on me to do well in this course.	4.9	48.8	36.6	7.3	2.4	9.8
23.*	The sheer volume of work to be got through in this course meant it couldn't all be thoroughly comprehended.	2.4	56.1	19.5	17.1	4.9	22.0
Appropriate Assessment Scale							
8.*	To do well in this course all you really needed was a good memory.	22.0	58.5	9.8	7.3	2.4	9.8
12.*	The staff seemed more interested in testing what I had memorized than what I had understood.	14.6	68.3	17.1	0.0	0.0	0.0
16.	The assessment methods employed in this course required an in-depth understanding of the course content.	0.0	7.3	7.3	63.4	22.0	85.4
19.*	Too many staff asked me questions just about facts.	4.9	80.5	9.8	4.9	0.0	4.9
Generic Skills Scale							
2.	The course developed my problem-solving skills.	0.0	0.0	7.3	63.4	29.3	92.7
5.	The course sharpened my analytic skills.	0.0	2.4	4.9	70.7	22.0	92.7
9.	The course helped me develop my ability to work as a team member.	0.0	2.4	7.3	61.0	29.3	90.2
10.	As a result of my course, I feel confident about tackling unfamiliar problems.	0.0	4.9	24.4	56.1	14.6	70.7
11.	The course improved my skills in written communication.	0.0	4.9	36.6	53.7	4.9	58.5
22.	My course helped me to develop the ability to plan my own work.	0.0	0.0	12.2	80.5	7.3	87.8
Overall Satisfaction Item							
25.	Overall, I was satisfied with the quality of this course.	2.4	0.0	2.4	48.8	46.3	95.1

Table 1 shows that 95.1% of students expressed overall satisfaction with the quality of this course, which is much higher than the 69% in the 2000 Survey of Australian bachelor's degree graduates and the 60.1% among those who received lecture-based education. The results show the effectiveness of project-oriented educational mode in achieving student satisfaction. Only two positive items (item 14 and item 11) have an agreement percentage lower than 60% and none of the negative items have an agreement percentage higher than 25%. Thus, the course received an overall satisfactory feedback from its participants.

Table 2 shows the descriptive statistics of CEQ items. Where the wording of an item had a sense opposite to the meaning of the scale (items 4, 8, 12, 13, 19, 21 and 23) the scoring was reversed. For example, strongly agree was coded 1, strongly disagree was coded 5, and so on. The consistency of interpretation of all CEQ item means is facilitated by this approach. Values less than 3 reflect disagreement, and means larger than 3 indicate agreement, with the means of the scales formed from the individual items. All CEQ item means are in the range of 3.00 to 4.37 and the Overall Satisfaction Item has a mean value of 4.37. These results demonstrate that the most common response to each CEQ item is positive. The standard deviation indicates the spread of the responses to an item, with a larger standard deviation corresponding to a wider range of responses.

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Table 2. Descriptive statistics of CEQ item

CEQ Scale/Item	N	Minimum	Maximum	Mean	Std. Deviation
Good Teaching Scale				4.11	
3. The teaching staff of this course motivated me to do my best work	41	2	5	4.2	0.641
7. The staff put a lot of time into commenting on my work	41	2	5	3.8	0.679
15. The staff made a real effort to understand difficulties I might be having with my work	41	1	5	3.71	0.901
17. The teaching staff normally gave me helpful feedback on how I was going	41	2	5	4.27	0.708
18. My lecturers were extremely good at explaining things	41	2	5	4.34	0.656
20. The teaching staff worked hard to make their subjects interesting	41	2	5	4.32	0.65
Clear Goals & Standards Scale				3.66	
1. It was always easy to know the standard of work expected	41	2	5	3.63	0.968
6. I usually had a clear idea of where I was going and what was expected of me in this course	41	2	5	3.78	0.725
13. It was often hard to discover what was expected of me in this course	41	2	4	3.24	0.83
24. The staff made it clear right from the start what they expected from students	41	2	5	3.98	0.612

CEQ Scale/Item	N	Minimum	Maximum	Mean	Std. Deviation
Appropriate Workload Scale				3.28	
4. The workload was too heavy	41	1	4	3.27	0.867
14. I was generally given enough time to understand the things I had to learn	41	1	5	3	0.949
21. There was a lot of pressure on me to do well in this course	41	1	5	3.51	0.779
23. The sheer volume of work to be got through in this course meant it couldn't all be thoroughly comprehended	41	1	5	3.34	0.965
Appropriate Assessment Scale				3.91	
8. To do well in this course all you really needed was a good memory	41	1	5	3.9	0.917
12. The staff seemed more interested in testing what I had memorised than what I had understood	41	2	5	3.93	0.648
16. The assessment methods employed in this course required an in-depth understanding of the course content	41	2	5	4	0.775
19. Too many staff asked me questions just about facts	41	2	5	3.8	0.641
Generic Skills Scale				3.98	
2. The course developed my problem-solving skills	41	3	5	4.22	0.571
5. The course sharpened my analytic skills	41	2	5	4.12	0.6
9. The course helped me develop my ability to work as a team member	41	2	5	4.17	0.667
10. As a result of my course, I feel confident about tackling unfamiliar problems	41	2	5	3.8	0.749
11. The course improved my skills in written communication	41	2	5	3.59	0.67
22. My course helped me to develop the ability to plan my own work	41	3	5	3.95	0.444
Overall Satisfaction Item					
25. Overall, I was satisfied with the quality of this course	41	1	5	4.37	0.767
Valid N (listwise)	41				

4.2 Reliability and validity analysis of CEQ

Table 3 shows the result of reliability and validity analysis of CEQ. Cronbach's α, a measure of the internal reliability of the scale, is provided. Because alpha is a measure of the internal reliability of a group of related items, it cannot be applied to a single item, such as the Overall Satisfaction item. In Table 3, the values of alpha range from 0.654 to 0.763. Coefficients of this magnitude are generally considered satisfactory for most analyses of group data in the social sciences. In addition, the internal reliability of all items in CEQ is also calculated. It has an alpha value of 0.860, which demonstrates a high reliability of questionnaire data.

Table 3. Reliability and validity analysis of CEQ

CEQ Scales	CEQ item	factor loading	Eigen-value	% of variance	cumulative %	Cronbach's Alpha
Good Teaching Scale	20	0.750	6.073	25.305	25.305	0.747
	18	0.718				
	7	0.707				
	3	0.663				
	15	0.656				
	17	0.637				
Generic Skills Scale	10	0.890	5.206	21.691	46.996	0.735
	2	0.789				
	9	0.731				
	5	0.627				
	11	0.617				
	22	0.601				
Clear Goals & Standards Scale	6	0.822	1.800	10.501	57.497	0.720
	24	0.736				
	13	0.696				
	1	0.655				
Appropriate Assessment Scale	8	0.801	1.578	9.574	67.071	0.763
	12	0.783				
	19	0.765				
	16	0.755				
Appropriate Workload Scale	23	0.827	1.259	8.244	75.315	0.654
	4	0.700				
	21	0.681				
	14	0.590				

Factor analysis was conducted to validate the analysis of CEQ. A principal components extraction followed by a varimax rotation was used. Five factors have eigenvalues greater than one and account for 75% of the variance in item responses. In factor analysis for individual scales, every scale had only one common factor extracted and factor loadings of each item are shown in Table 3. The factor analysis confirmed previous findings that the items could be grouped into five scales for discussion purposes. The Overall Satisfaction Item (question 25) was kept separate.

The questionnaire survey was anonymously conducted after students were informed of their grades for this course, and thus the truthfulness was assured. The scales exhibit satisfactory levels of reliability and independence, and provide a basis for discussion of the major dimensions of course experience revealed by students' responses.

5. Discussion of teaching skills and techniques

The project management course implementation has been very successful during the past decade, though continuous improvements were made to optimise its efficacy. The experience of the project-oriented teaching skills and techniques is mainly seen in the following four aspects.

5.1 An equation of "Knowledge+Experience=Skill"

Traditional education emphasises "teaching" rather than "learning". Students passively receive knowledge in lectures without any care for whether they have truly understood what the instructor teaches. In this project-oriented course pedagogy, CPMRNK evaluated the requirements for students majoring in management as well as the PMBOK standard and organised the didactical activities balancing knowledge transfer and students' skill development. Students are required to conduct the project design work and software simulations while learning the theories. They are urged to transfer the theories learned in lectures into management skills by practice. All the strategies successfully shift the focus of education from "teaching" to "learning" and activate students' participation in knowledge acquisition.

5.2 Systematic guidance from an orderly, heuristic method of teaching

A set of teaching skills and techniques are used in this course to motivate students' participation in learning and to foster their abilities in knowledge enquiry, innovative thinking and problem solving, the core of which is an orderly, heuristic method of teaching that gives systematic guidance to course participants. The concrete measures include:

- Heuristic questions before explaining theories and principles to evoke thinking and participation of students
- Differentiate and analyse concepts and definitions to facilitate understanding
- "Methods+Cases" to contextualise management techniques in business cases for better mastery
- "Find solutions" for problem-based learning
- "Information sharing between instructor and students" in discussing advanced knowledge to encourage inquiry
- "Research and develop standpoints" with regard to controversial topics

Each measure above can be viewed as one step in enquiry-based learning and has been proven effective in enhancing enthusiasm and inspiring interests of learning.

5.3 Encourage mistakes and learn from failures

In the designed project-oriented course structure, students learn by practice. They are required to progress their project design work on a regular basis. After each milestone assignment is completed, a workshop is held to conduct the feasibility analysis. In each workshop, all groups give a presentation followed by a classroom discussion and instructor's comments. With such a process students first develop a tentative design with faults, flaws and defects, which means "mistakes", then by classroom discussion and suggestions from the teacher they obtain helpful information to perfect their work and gain experience, and that's the stage of "they learn". The instructor's role as a consultant to enlighten students to discover the deficiency of their design work is important in the progress and negative judgements should be avoided since they could severely affect student confidence.

5.4 Assessment method validating student participation in group work

Dierick and Dochy (2001) state that an educational innovation will dissolve itself when the assessment is not congruent with the teaching method. It is therefore very important to use assessment tools compatible with the instruction to gain better learning outcomes. According to recent literature, traditional assessment methods are considered to be less appropriate for project-oriented education since students mainly learn by doing projects (Dori 2003; Frank & Barzilai 2004; Krajcik et al. 1999). More effective assessment methods that can better identify the individual's level of understanding and degree of contribution to group work need to be developed.

In CPMRNK's designed assessment method, individual performance is measured in three ways: representation, project design work (as part of a group) and a final project-oriented test. The final test is not the traditional paper-and-pencil test that mainly contains questions about facts of project management, but is designed to validate student participation in group work. The assessment method is a guarantee of students' commitment to group work and it is explained to students at the start of the course.

6. Conclusion

To change the traditional passive learning style in higher education, the Center for Project Management Research in Nankai University took ten years to develop the pedagogical approach of project-oriented education and achieved some success in applying it to its project management course. The change occurred not only in the curriculum, but also in the instruction and assessment methods. The course structure consists of three parts: lectures, project design, and periodic workshops. Through the 12 lectures, students get a general understanding of all aspects of project management. However, the skills and

techniques as well as a thorough understanding of project management are mainly developed in their project design work. Meanwhile, a periodic workshop is held after each milestone project design assignment is completed by students on schedule. The assessment method of this course is also a combination of three parts: project design work (20%), presentation (10%) and final test (70%). The final test is designed to validate student participation in group work and therefore is a guarantee of students' commitment to group work since the assessment method is explained to students at the start of the course.

The feedback from the students utilising the instrument of Course Experience Questionnaire is generally satisfactory except for item 14 (I was generally given enough time to understand the things I had to learn), which received a relatively low agreement percentage of 34.1%. This is mainly because project management is a complex discipline that may require more time and effort to fully understand. A proposal to extend the course for another semester is being considered to solve this problem.

Project-oriented education is still in its early stages, and its application to different disciplines is in need of further research.

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