The paper chase; learning design and construction management in study groups

John L. Heintz, j.l.heintz@tudelft.nl
Faculty of Architecture, Delft University of Technology
Matthijs Prins, m.prins@tudelft.nl
Faculty of Architecture, Delft University of Technology

Abstract

The expectations placed on educators are increasing to the point where many academics are beginning to feel that they are unrealistic. We face the expectation that we can deliver more knowledge, quicker, with fewer resources, and fewer teaching hours, and make it easier and more fun for students at the same time. This was our mandate when we were asked to develop a new first year master’s course in design and construction management at the faculty of architecture of TU Delft. We chose the working title “everything you ever wanted to know about design and construction management in seven weeks”.

Inspired by the film The Paper Chase, in which American law students collaborate to cover an enormous amount of literature in a relatively short time, we decided to adopt a teaching method based on the use of study groups, or more precisely formal learning groups. In short, we assigned the much more literature than a single student could cover in the allotted time, and assigned the students to work in groups, teaching each other the essentials from their share of the assigned readings.

The course is divided into seven themed weeks – roughly following the design and construction process. Each week has a specific reading list, and is concluded with a workshop assignment that serves to illustrate how the knowledge drawn from the readings can be applied in practice. The week begins with an introductory lecture to inspire the students and help them orient themselves. Working in groups of 7, the students are each assigned a portion of the total literature for that week. On Friday morning the students meet to discuss the readings, and are then assigned their workshop task. At the end of the afternoon, the results of the workshop are presented and discussed with the students. At the end of the period the students sit a closed book examination.

We have now run the course twice. After the first run, the course was evaluated through the University’s quality assurance process, and by the departmental student association. While the feedback has clearly indicated areas for improvement, the students were enthusiastic about the study group concept and the way working as a group allows them to cover a large amount of literature. This feedback was used in substantial improvements for the second runoff the course. Informal feedback from the second run continues to support the use of study groups.

Keywords: Design and construction management; Study groups; Formal learning groups, Course design; Learning methods
1. Introduction & Background

In 2010 the authors were confronted with a seemingly impossible task: to develop a 7 week half time course that would deliver the content previously delivered in courses totaling 16 weeks full time. This paper is about how we attempted to accomplish this.

1.1 Background

The department of Real Estate and Housing was established 1992 within the faculty of architecture of Delft University of Technology, in response to the demand from practice for a broader range graduates. A Dutch government report made clear that although more than 80% of the students of the faculty graduated with a design profile less than 50% got an employment as architectural or urban designer (Verkenningscommissie Bouwkunde, eindrapport, 1988). The report advised the faculty to broaden its’ scope suggesting profiles including process and project managers.

The curriculum for this new department, Project and Real Estate Management (Bouwmanagement & Vastgoed Beheer), was based on the faculty model of two years of shared basic courses, followed by three years in the departmental track, with each year divided into five periods or modules. The Project and Real Estate Management program was consisted of 4 core modules, two modules of electives, and 4 combination modules, one for each of the other departments in the faculty: Architecture, Urbanism, Building Technology and Social Housing. The core modules had an emphasis on the acquisition of knowledge, the combination modules an emphasis on insight and skills. The program culminated in a year-long thesis project.

From 1999 the Department had to adapt to the new Bachelor Master structure (BaMa) in conformance to the Bologna Declaration (Joint declaration of the European Ministers of Education convened in Bologna on the 19th of June 1999, 1999) calling for the harmonization of educational systems. At the same time the Department of Social Housing merged with the Department of Project and Real Estate Management to form the Department of Real Estate and Housing (REH). The change to the BSc MSc system also entailed change to a three year BSc program for the entire Faculty of Architecture, followed by a two year MSc degree program in each of the faculty’s departments. At the same time, the Faculty switched to a 2-semester system. The result was that what had previously been a three-year program in project and real estate management became a two-year program in project management, real estate and social housing. With the retention of the final thesis year, the course component of the program was reduced by half, while having to incorporate an additional discipline. Streaming in the second semester mitigated this somewhat.

The most recent reform was the decision to eliminate streaming, and to implement a fully integrated REH curriculum. The resulting curriculum consisted of one semester of courses devoted to knowledge acquisition in the three disciplines, project management (now renamed design & construction management), real estate management, and housing policy, and two additional subjects – management fundamentals and research methods. This was followed by a semester of department broad skill building courses covering the application of the knowledge acquired in the previous term, and then the year-long thesis. With this final reform, the time allotted to the acquisition of the basic knowledge
of design & construction management had now been reduced from nearly half a year full-time to 7 weeks of about 40% of the students’ time.

1.2 Real Estate and Housing Curriculum

In depth knowledge of the core domains of RE&H is the essence of the first year of the new curriculum. This is caused by the mission of the department to integrate the various core subjects and to provide students with a broad knowledge of the whole domain of RE&H.

In the first semester emphasis is placed knowledge acquisition, more specifically on general management knowledge (for instance from project to portfolio and program management, general management, governance, policy, leadership, teambuilding and team behaviour) that is valid for all focus areas of RE&H.

In the second semester the program focuses on skills acquisition. Students gain skills by experiencing practice roles and by describing, analysing, researching and improving practice based professional behaviour, based on design, gaming and case studies covering the whole range of the department.

In the third semester the students start with their individual MSc graduation project accomplished with an in departmental program on research methodology and their free electives program, which might be used to deepen their knowledge on the graduation subject chosen. The fourth semester is in total dedicated to the individual MSc thesis project. In this phase synergy between the work of staff and students is key, while most students do their thesis work connected to practical issues with public and private organizations.

By providing a program that explicitly starts and ends with professional profiles, with a strong focus on integration, fundamentals and academic quality, the department is determined to offer a distinguished program for all those with a bachelor in architecture, building, construction, environmental and real estate sciences a polytechnic or academic background, who would like to complement their basic knowledge of the domain with an extensive broad managerial MSc course, aiming at the top of applied knowledge on excellent leadership to add value to the built environment.

Within the new curriculum only 7 ects was left to provide the students with the basic knowledge of design and construction management. This course would run parallel to a course in Management Fundamentals in which in a general introduction to management and project management is provided.

1.3 Everything you want to know about design and construction management

In designing the course we chose to be guided by the working title “everything you ever wanted to know about design and construction management in seven weeks”. The exact time available to us was 7 ECTS or 196 study hours. A further limitation was the faculty standard for the maximum hours of student staff contact – 33% or 63 hours in the case of this course. Finally, institutional regulations regarding maximum permissible proscribed student work-load limits instructors to assign no more
than 5 pages an hour of material upon which students may be examined. Assuming we use our maximum on contact hours, group work and workshop time the amount of pages is thus limited to a maximum of 665 pages.

The aim of the course was to provide students with a thorough understanding of project management based mainly on PMI standards, and additionally with insight into how this knowledge applies to the practice of construction projects in general and design projects in particular. We also wanted to confront the students with recent, or controversial research papers in order to provide the students with insights into the ongoing areas of investigation and controversy in project management research, with the intention that students develop an ability to think critically about project management literature. Our goal was to maintain high academic standards while achieving an increased efficiency in delivering the knowledge components of the Master’s degree program.

2. Advantages of cooperative learning

Inspired by the distant memory of the film The Paper Chase (Bridges, 1973), in which students formed study groups in order to deal with the extremely demanding ‘Socratic’ methods of a charismatic law professor, we decided to implement a similar strategy. Obviously Hollywood provides neither convincing evidence for the effectiveness of study groups, nor guidance in how to implement them. For these we turned to more authoritative sources.

The basic concept of the study group, or more broadly of cooperative learning arises in part from the work of Kurt Lewin and John Dewey (Schmuck, 1985), and their independent interest in the importance of learning to cooperate in modern societies. In their view the validity of a teaching activity or a group exercise arises from the belief that learning to cooperate in school would facilitate cooperative activity in society as a whole. Through cooperative learning in which students are trained to be good group members, are graded as a group, and are continuously evaluating themselves in their function as group members the education experience is shifted from traditional competitive learning situations (win-lose) to collaborative learning situations where students success is mutual (win-win).

As our students are already familiar with group based problem solving, based on their design studio experiences in the shared bachelors curriculum, our interests in group learning was in the benefits it can offer in improved learning course content, and acquiring knowledge. A review of the literature on active learning concludes that collaborative learning, here defined as “any instructional method in which students work together in small groups toward a common goal […] ‘works’ for promoting a broad range of student learning outcomes. In particular, collaboration enhances academic achievement, student attitudes, and student retention. The magnitude, consistency and relevance of these results strongly suggest that engineering faculty promote student collaboration in their courses.” (Prince, 2004, p. 223 & 227). The same study goes on to conclude that cooperative learning, defined as “a structured form of group work where students pursue common goals while being assessed individually […] that cooperation is more effective than competition for promoting a range of positive learning outcomes. These results include enhanced academic achievement and a number of attitudinal outcomes.” (Prince, 2004, p. 223 & 227) Another author remarks that “… regardless of the subject
matter, students working in small groups tend to learn more and demonstrate better retention than students taught in other instructional formats.” (Davis, 2009, p. 190)

In addition to these benefits we were attracted by the belief that group based learning helps to motivate students. When learning in groups students are mutually reliant and each member feels responsible to and dependent on the others. No one can succeed unless all in the group succeed (Davis, 2009).

Two forms of learning groups were of interest to us: formal learning groups and study groups. Formal learning groups undertake specific assigned task(s). Students work together until the task(s) is finished, and their work is evaluated. Groups may function for from several weeks to the entire term. Study groups are primarily used to encourage students to provide support encouragement and assistance to each other. Study groups operate informally outside scheduled contact hours, and typically run for an entire semester. (Davis, 2009, p. 191) One can see these two groups as providing formal and informal opportunities for cooperative learning respectively.

In choosing to employ study groups, or formal learning groups, three factors were decisive. The first was the need to cover a large body of material and to do so in a way that could encourage a critical engagement with the material. The second was to stimulate the students to begin their work early, and to maintain a good work rate throughout the course. The third was to encourage a more effective and engaged learning process through requiring students not merely to read a series of texts and write an examination, but to summarize and share the knowledge they drew from their readings with other students. The intention was to draw students into an engagement with the material through obliging them to discuss their readings with their colleagues.

We believed that group leaning with it’s promise of greater effectiveness and motivation would be especially helpful in our mission to deliver, and help students learn, a large quantity of knowledge in a brief period.

3. Action research

The development of the new course was undertaken according to the principles of Action Research. Action Research was an approach to conducting research developed by Kurt Lewin and his associates in areas where there was little certain knowledge, little opportunity for controlled experiment, and a need to understand the implications and outcomes of applying ideas in practice. Lewin and his followers developed a program of intervention based research focused on group dynamics and cooperation (Deutsch, 1949; Lippitt, 1947). This approach “combined generation of theory with changing the social system through the researcher acting on or in the social system.” (Susman & Evered, 1978) The authors had experience with action research from a previous project in the application of blended learning in a project management course for first year BSc students (Prins & Heintz, 2009). Key to our approach was the notion of structured reflection in action (Schön, 1983).

The development of the course was therefore seen as cyclic process in which one moves through the stages of diagnosis, action planning, intervention, evaluation, reflection, and finally diagnosis for the
The course designers reflected upon the changes in student behaviour, student work, evaluations by students, and upon the instructor’s own experience to develop generalizable insights in the use of cooperative learning, and to evaluate the success of the new course design with an emphasis on what further improvements could be made. In planning for the new course we developed the following action research questions:

1. To what extent will students accept cooperative learning in the form of formal learning and study groups as a desirable means to learn about design and construction management?

2. To what extent can cooperative learning in the form of formal learning and study groups motivate students to learn a large body of knowledge in a short time?

3. How effective can cooperative learning in the form of formal learning and study groups be in helping students to learn a large body of knowledge in a short time period?

4. To what extent can the insights developed from the answers to the above questions be used in educational practice?

Criteria for evaluation of the success of the intervention (the use of formal learning and study groups) included:

1. Level of student participation

2. Quality of student reports

3. Quality of discussion and debate in group meetings

4. Performance of students in exams

5. Student satisfaction as expressed in questionnaires and reflections.

Evaluation was performed with the assistance of the University’s quality assurance team, the departmental student association, and informal feedback provided directly by students. Reflection took the form of discussions among the course designers and other instructors over their experiences and observations in teaching the course, evaluating student work and examinations, and in conversations with students.

4. Course Design

In designing the course we began with the intuition that students would be confronted with a large body of knowledge that could only be learnt though the application of cooperative learning in the form of formal learning groups. Our first step, therefore, was to define the body of knowledge to be learned through selecting the principle readings. We choose three books: *The Gower Handbook of Project Management* (Turner & Simister, 2000) consisting over 800 pages to cover general project
management, *Managing Construction Projects* (Winch, 2002) consisting over 500 pages to cover the application of project management to construction projects, and *Getting There by Design* (Allinson, 1997) consisting of over 200 pages to cover project management issues in design projects. In addition to this a number of research papers and other shorter readings were assigned, bringing the total number of pages to be digested to approximately 2000. We purposefully allowed for overlap and differences between sources in order to encourage students to make comparisons between different points of view, and to confront the constructed nature of project management knowledge.

With this as a departing point we next started to search for didactical methods to provide students with the rich amount of content we’d like to offer them, while enhancing student motivation to undertake an admittedly challenging course, complying with the Faculty’s regulations regarding acceptable workloads.

Our idea was rather simple: if we divide our students into study groups, in which each of the members is responsible for a distinct part of the readings, which has to be summarized, analyzed and commented on, at such a level the other group members can acquire the required knowledge based on the condensed results of the other group members, we were able to let them study much more pages as the usual norm.

Within Black Board, the faculties learning system, each of the groups is asked to build a so called ‘Wiki’ (like Wikipedia) of the materials to be studied. At the end the wiki’s have to be combined into one course wiki, on which the examination is made. Groups might make suggestions to the teachers on examination questions. A fundamental aspect of this course is the use of a wiki to summarize the readings and to provide students with a single text to study in preparation for the exam. Participation in the creation of the wiki is essential to the course and will be monitored. Participation includes not only uploading summaries of assigned texts, but correction of the summaries already posted, addition of comments and links indicating connections between the various readings, links to external material that is directly relevant to the readings, and reflections on the content of the readings.

The study groups will function to amplify the students’ ability to read and study the large range of literature relevant to the aims of the course. Each week, the students will be assigned a series of texts. Each student must take a share of the texts and prepare notes or a summary. The students then share notes and discuss the texts with each other in the study group. Planned (and required) study group meetings are scheduled for Thursday afternoon each week. The students will then participate in the construction of a wiki in which students will consolidate their notes on each of the assigned texts. In this way, we can assign a broader range of readings than would otherwise be possible.

Each student would be assigned to two groups.

1. The first, ‘real’, ‘study group’ functions both as formal learning group and as project team. During each week students would study their assigned readings, share them with their group members, and apply the knowledge gained in a thematically related workshop task derived from a real case derived from the actual practice. Each week a leader would be assigned who would have the responsibility to ensure that all the assigned material is covered during the study group
meetings. The ‘leader’ will also ensure that the other students know what work has to be done during the week and that students understand their role in the workshop. In the unscheduled weeks before the examination it was expected that this group would continue to function as a study group.

2. The second, ‘virtual’, group is the wiki-group. Students in a wiki group would be assigned the same literature during the course and would be collectively responsible for providing summaries of this literature in the wiki. Wiki groups would also prepare and submit exam questions on the reading material, some of which may be used in the final exam.

The study groups and wiki groups would be active throughout the course. First, during the contact weeks, the study groups will focus on knowledge acquisition. Then during the self-study week, the study groups will focus on review and consolidation of the knowledge acquired in the contact weeks.

Each of the seven course weeks would be structured around a theme running roughly sequentially through a project. The selections from the main texts and additional readings were assigned by, and each week taught by different instructors based on their expertise. Each week (in practice the last 2 and ½ days of each week) would be structured around an introductory lecture, 1½ days for reading, a meeting of the study group for knowledge exchange, and the performance of a case based task in a workshop setting. The week was to conclude with the submission of a task report and a discussion. The seven weeks of course work were then to be followed by two unscheduled study weeks and an examination. The wiki was intended to serve as the ‘real’ textbook for the course – that is, officially the students would be examined on the wiki. In designing the examination, instructors were required to pose questions based on the literature, to which they could find the answers in the wiki constructed by the students.

5. The course in practice

5.1 The first round

The first round of the course was conducted in as described above. The Students were invited to evaluate the course through a focus group evaluation organized by the departmental students’ association, and by a questionnaire organized by the university’s quality assurance group. The questionnaire took the form of a rating of a list of aspects of the course on a 5 point scale.

5.1.1 First round evaluation

In the focus group students were generally quite positive about the course and course design. Students in particular valued the study group approach. They found that studying with their peers reinforced good study habits, brought them into a more engaged relationship with the study texts. Students were more critical about the wiki, finding that the purpose of the wiki was not clear. They wanted more guidance in what was expected of them in preparing the wiki. Specifically, as the wiki itself was not graded, students felt that they did not share an adequate incentive to produce quality work in the wiki. The questionnaire results echoed the focus group. The study group was the most highly valued aspect
of the course, whereas the wiki was scored a bit lower. In the context of the overall evaluation of the Department’s new curriculum, and benchmarked against the scores of other MSc courses within the Faculty, the students score for our new course was relatively high.

5.1.2 First round reflection

The course staff was quite positive about the course design. The staff clearly appreciated seeing students working in groups in the assigned studio space, whereas normally our students work away from the faculty. In class and in study groups, the students were enthusiastic, and hard working. And performance on the contextualizing tasks was fairly good. From student comments during the course and in the evaluations it was clear that they attributed more importance to the contextualizing task than was intended, and where the task did not incorporate the entire range of the literature for the week, students understood the remaining literature to be extraneous. Both staff and students were unsatisfied with the examination – a multiple-choice examination with only fact based questions. The exam was not challenging enough for the students, and did not serve to differentiate between them.

The instructors observed that there was a very high degree of participation with almost no absenteeism. To the instructors’ eyes the students working in groups were enthusiastic and focused.

The quality of student reports from the weekly tasks was good, in that the students demonstrated the ability to apply the knowledge acquired during the week to the assigned task. However, the reports did not display the desired level of reflection on the difference between reading about design and construction management and performing a task in this context. The discussions similarly lacked the desired reflection.

All students passed both the semester work and the examination. However, the instructors judged that the examination in particular had not served to adequately distinguish between the relative performance of different students.

5.1.3 First round diagnosis

What was clear, however, was that the students did not always understand in depth how the course was supposed to work. They consistently focused their energies on the completion of the weekly task rather than on knowledge acquisition. They attended to the readings strategically selecting those passages that applied directly to the assigned task. Further their contributions to the wiki were designed primarily to generate good metadata – i.e. to have visibly contributed many words to the wiki, rather than to distill and re-present their readings to their colleagues. The wiki was not made to study from and was not found to be an effective study aid.
5.2 Second round

5.2.1 Second round planning

The most important improvement for the second round was to improve the description of how the course was structured and intended to work. Students were instructed in the intended functions of the formal learning groups and the wiki groups. For the second cycle the weekly themes were revised. The readings and the tasks for each week were chosen to better reflect the weekly theme, and to ensure a more even workload from week to week. Students were given more extensive instruction on the wiki. The importance of revising wiki entries was emphasized, as was the point that quality of input rather than volume would be valued. (We still do not plan to directly evaluate the wiki.) Finally, the decision was taken to more carefully structure the end of each week, with the deliverables to be submitted in time for a quick review by the instructors before a concluding discussion on both the task and the knowledge covered during the week.

5.2.2 Second round evaluation

Questionnaire results showed a marginal improvement over the previous round. In open questions students particularly valued the connection between theory and practice, and the way the course worked to capture the students’ interest. The focus groups were more specific. Students indicated that they did discuss the literature in their study groups, and valued the fact that by dividing the readings among the students each student was assured a chance to contribute. On the other hand, students did not discuss the readings in their wiki groups, preferring to divide the work amongst the group members. Comparison of success rates for students between the two cycles is difficult as the exam was redesigned to include both insight oriented multiple choice questions and open questions. Due to this, and perhaps due to the precedent set by the unfortunately too easy first exam, the students performed significantly more poorly on the exam in the 2nd cycle. However, the staff received surprisingly few complaints about this.

5.2.3 Second round reflection

While students and instructors remain very positive about the use of formal learning groups, it is clear that the desired effectiveness has not yet been fully reached. Students in particular continue to express the belief to their instructors that the formal learning groups were very beneficial. Instructors observed again in the second cycle the high rates of participation among the students. In particular the quality of the discussions at the conclusion of each week was much improved over the previous round. However, the balance improved between the two rounds, students continued to place too much emphasis on the task as opposed to the acquisition of knowledge. Most importantly, the students have not uniformly embraced either the notion of critically comparing the different sources nor the use of the wiki as an effective study aid. While some groups did engage in critical comparisons, and did create summaries of the readings for use in the wiki, they reported that they relied more heavily on their own summaries rather in the class wide wiki in preparation for the examination.
One factor in student performance seems to have been the grading scheme. Many students seemed to follow a carefully calculated strategy – focussing only on the work that was directly evaluated. With approximately half the final grade generated by the group work, the focus on the task should perhaps not be very surprising. The fact that staff did not grade the wiki itself created a large distinction between the earning of grade points for the task, and the earning of grade points in the examination. The course designers and instructors concluded that only grading the wiki itself would make the connection between the learning to take place during the instruction weeks, and the learning in preparation for the examination. A second consideration was the generally high performance of students on the examination during the first round. Students may have well believed that the examination did not require a great degree of effort to prepare for – especially after having achieved relatively high grades for the work during the course. If this is true than the changes made to the examination – to make it function more effectively to test the course material and to distinguish student performance – may have caught the students by surprise. The students were informed of these changes, but whether they anticipated the difference in degree of difficulty is hard to assess.

Looking forward to future rounds, the course designers while being confident of the success of the formal learning groups will need to re-evaluate the use of the wiki. In one sense, that of fitting the ambitious course goals within the constraints of curriculum and workload regulations, the wiki is crucial. On the other hand, it has yet to be successfully implemented as a study tool.

6. Conclusions

In terms of the criteria for evaluation of the course we can conclude partial success. Student participation and work rates were high during the instruction weeks for both rounds. The quality of task reports was also high in both rounds. The quality of concluding discussions was much improved from round one to round two. It is not possible to make any conclusion about student performance on the examinations as the difficulty of the examination changed dramatically from the first to the second round. Finally, students expressed a high degree of satisfaction with the formal learning groups and with the course in general, while remaining critical about the wiki.

In terms of the action research questions, the following conclusions may be drawn.

1. Students will accept cooperative learning in the form of formal learning and study groups as a desirable means to learn about design and construction management.

The students in the two rounds of this course readily accepted the use of formal learning groups, and these groups were reported to continue past as study groups in preparing for the examination.

2. To what extent can cooperative learning in the form of formal learning and study groups motivate students to learn a large body of knowledge in a short time?

Students displayed high degrees of motivation in their group work – devoting considerable effort to acquire the knowledge from the readings they deemed necessary to complete the workshop task.
However, the attention of the students needs to be drawn to the goal of more general knowledge acquisition.

3. No conclusion may yet be made about the effectiveness of using cooperative learning in the form of formal learning and study groups in helping students to learn a large body of knowledge in a short time period.

No direct comparison could be made to earlier learning patterns, while the difference in difficulty between the two examinations did not permit any conclusions to be made over the duration of this research.

4. Insights developed from the experience of developing and running this course are applicable in educational practice.

Here the question is which insights. It is hardly surprising that researchers conclude that they can endorse the use of formal learning groups. Such groups are already in use in many settings. The most valuable insight generated here is that the design of the course around the formal learning group may be the most important factor. Students easily grasped what was needed to perform well in their groups. More crucial to the success of the course was structuring the tasks to be performed and the grading incentives to direct the student efforts towards the desired ends. Although the instructors have identified a number of areas for improvement in both the design of the tasks and the grading incentives, we were satisfied that we had achieved substantial success in our ambitions to deliver to students a substantial body of knowledge of design and construction management in a very brief period of time. Collectively, the students in each formal learning group read over 2000 pages of literature, including not only textbooks, but also current research papers. Although there is clearly still room for improvement in the use of the wiki, given the student feedback, we are confident that we have been successful in developing a means of engaging the students with a large body of didactic and scientific literature, including original source materials, recent doctoral dissertations, journal and conference papers. Students were confronted with a range of different departure points and paradigms, stimulating them to understand differences in scientific and practical approaches. Despite the heavy work-load, students remained enthusiastic about the subject, and keen to learn more in the following semesters. We therefore believe we may claim that we have indeed found a way to deliver quite a lot of “everything you ever wanted to know about design and construction management in seven weeks.”

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8. References


