Managing the Senior Capstone Design Project for Undergraduate Students at King Abdulaziz University

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Hani Sait(✉)
King Abdulaziz University, Rabigh, Saudi Arabia
hhsait@kau.edu.sa

Nadim Turkman
King Abdulaziz University, Jeddah, Saudi Arabia

Raja Ishaq
University of Technology, Johor, Malaysia

Abstract— Graduates from engineering colleges lacks the practical experience and leadership skills that are needed in the labor market. Throughout engineering academic curriculum, it is rarely to find courses that fulfill these needs. Senior capstone design project (SCDP) and Internship training can give students lot of practical experience and skills if they are well managed and assessed. Therefore, mechanical engineering department at King Abdulaziz University (KAU) led the effort in organizing the SCDP course to inherit the students with the practical engineering experience and leadership skills to prepare them well for the labor market. This paper presents an overview of a SCDP experience that has been practiced well for two KAU engineering colleges in Rabigh and Jeddah, Saudi Arabia for many years. This paper delineates the process, leadership skills, ABET involvement and evaluation. The SCDP presented here has provided overall satisfaction for faculty members, students and labor market. The working opportunities for students have been increased. Moreover, course management improvements led to a more cost-efficient program.

Keywords— Capstone; Senior Project; Engineering

1 Introduction

A senior capstone design project (SCDP), sometimes referred to as the capstone design project or simply "Capstone", is the pinnacle achievement of any graduating college of engineering senior, who has completed the course. Figure 1 symbolizes the final design project by featuring it as the crowning capstone of a pyramid built on the foundation of other academic courses. In the Capstone, the students utilize all the knowledge and practice gained during their previous or current studies to create a project worthy of the Capstone designation. The SCDP is usually a mandatory course that students take before they finish their bachelor's degree in most engineering col-

leges. While some engineering colleges offer it for one semester; others have it set up for two semesters. Usually the SCDP course counts as four credits. It is not always mandatory. Some institutes present the course as an option for both its students and faculty members. Most students contact a faculty member they like and register the course with him or her. Then, all tasks, assignments and evaluations come from their senior capstone design project advisor (SDPA), who is also the professor who teaches the SCPD class.

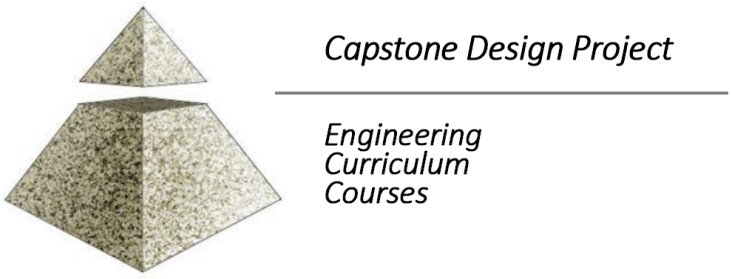


Fig. 1. Capstone design project acts a cap for the engineering curriculum course

The department may or may not assign an examining committee (ExC) to evaluate the work for its students at the end of the year. This group's role is to give their feedback to the SCDP program students, advisors, sponsors, and other associated faculty. However, some issues can arise. Students may not be able to find a faculty member available to register with. There may not be enough in the budget to support the project. Moreover, unfairness may occur in evaluating a student's work.

The standard practices and current state of capstone design education throughout many universities have been described [1] and several surveys were conducted [2-4] to evaluate Capstone teaching. Engineering courses should conduct project-based learning [5-7]. Industry should involves in Capstone projects and has its input on course design [8]. However, Hoole [9] stated that engineering colleges should dispense with senior projects and "should concentrate on teaching the theory, leaving the completion of the engineer's education to industry" [9]. He justified this statement by saying:

In providing in-house senior design programs, universities have imposed the fiction that they provide true industrial experience and have encroached into what industry can do better. –S.R.H. Hoole

Multidisciplinary engineering capstone design courses were discussed by [10, 11], and all agree that leadership and other skills should be provided to students in the designed courses to satisfy industry needs [12-14]. Nevertheless, the issue of managing the Capstone is seldom mentioned in most engineering colleges and needs to be addressed [15]. Weak management of the Capstone can lead to an imbalance of the skills needed by graduate engineers. The management of the Capstone must include timing, selection, advertising the projects, one-on-one supervising, coordinating, assessment, and materials submission such as project portfolio, meetings minutes,

presentation and final report. This paper combines the academic requirements with leadership features into a well-organized plan to get the best practice in SCDP.

In the Jeddah and Rabigh engineering colleges at King Abdelaziz University (KAU), some of the issues mentioned here still need to be addressed. Moreover, SCDP should follow one of the worldwide accreditation bodies, such as the National Commission for Academic Accreditation and Assessment (NCAAA), the Institution of Chemical Engineers (IChemE) or the Accreditation Board for Engineering and Technology (ABET). Since the engineering colleges at KAU are all accredited by ABET, the SCDP there was required to follow the ABET criteria. The main objective of this paper is to delineate the process, leadership skills, ABET involvement and evaluation that are needed to manage the SCDP course successfully to achieve the required outcomes from it. The following methodology is followed to achieve the objective of the paper.

- Delineate the SCDP' requirements
- Develop flow chart for the SCDP life.
- Define the skills that students need during the course.
- Implement ABET criteria.

2 Project Requirements

To fulfill industries' demand criteria, the university must prepare its students to achieve these criteria. In the SCDP, students and professors begin with the requirements, which the Accreditation Board for Engineering and Technology (ABET) has set.

2.1 Selection of the project

The project should reflect a real-life design problem related to industry or society. A situation should be clearly described by the advisor(s) or customer. The design problem should be defined by the students and should involve coaching from the advisors. The project should involve a problem that has no single solution. More than one solution should be discussed by the students for a situation. A comparison should be performed between the alternatives in a methodical way (e.g., quality function deployment (QFD)). The roadmap of thinking and the rationale of the selected design project should be clarified (high-level plan). Students and advisor(s) should summarize on one sheet of paper the curriculum sources that contributed to the accumulated knowledge used to address the design project problem. Each project should include a section to assess the impact of the project on the environment including, but not limited to, air, water, soil, etc. The final product in some projects might have a direct or indirect short-, medium- or long-term impact on some sector(s) from the local, national and/or international society. In this case, the project report should assess the acceptability of the proposed design by the neighboring and/or end-user society. Each project should include a cost estimate of the design and its implementation, including

time and material. Each project should address the marketability of the product, which could be a manufactured product or service product.

2.2 Project Supervising:

Each project should have at least one advisor from the KAU faculty and, preferably, one advisor from an industry. Adopted design specifications, regulations and standards should be clarified in each design project and documented. Professor(s) should emphasize teamwork among students.

2.3 Managing the project

The simple one-page project management (OPPM) sheet or mind mapping (MM) that can be used for a capstone design project is shown in Figure 2. Either one can help to draw a road map for the project life and should contain all the required activities.

2.4 Project Evaluation

The project is evaluated by three partners, 1) the senior capstone design project advisor (SCDPA), the senior capstone design project committee (SCDPC), and the department-appointed examining committee (ExC). The ExC consists of a department chair-appointed consultant (could be a faculty member), a representative from the industry planning team to participate, the adviser, and perhaps a couple of students who are like team captains or a graduate student who is working with the professor. The final evaluation committee would have the authority to approve.

2.5 Professional ethics:

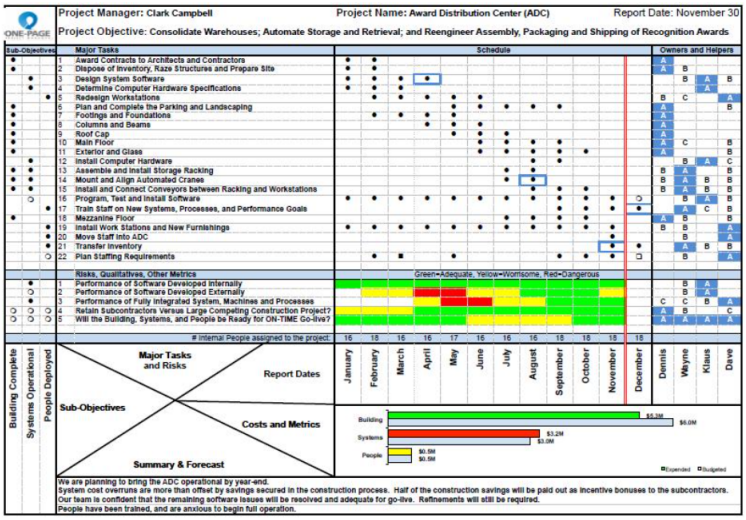
General requirements for all kinds of projects can be summarized as follows

- All work should be original and not copied from others.
- In the case of the project team's work scope, the work should be divided equally between all members.
- Grade should be given on individual basis based on the effort and performance of each student, as well as on the team level.
- All reference materials should be documented.
- Professional ethics should be implemented and enforced by the professor(s) and students.

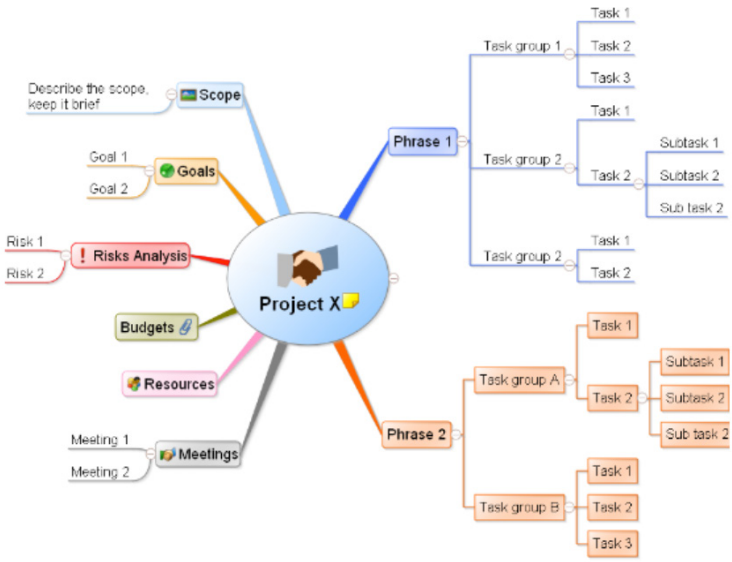
2.6 Final Product:

- Either a full-scale prototype or a scaled model of the product must be manufactured and tested.

- A technical report should be written in clear English.
- A multimedia presentation should be prepared.
- A poster should be prepared including an executive summary, the problem statement, design approach, and important findings with illustrations.



(a)



(b)

Fig. 2. (a) &(b) Project schematics and posters based on a simple one-page project manager (OPPM) or mind mapping (MM).

3 Process and Procedure

The project usually starts by outlining the method which the project will follow based on the project team formulation. The process of the senior project design, shown in Figure 3 starts when the students register for the course. A kick-off meeting is conducted for the registered students and advisory committee. The high-level requirements and detailed constraints are explained in the meeting. The students are asked to prepare a business problem, which is evaluated by the advisory committee. The project can be an industrial project or non-industrial project. Either one is fine for a project to be considered. However, the industrial project will require a further project process as shown in Fehler! Verweisquelle konnte nicht gefunden werden. The senior project department committee will examine the team and evaluate the project. The senior capstone design project coordinator (SCDPC) will conduct an almost weekly meeting with students to enhance their administrative and leadership capabilities. They will be instructed on how to manage the project and achieve the team's business and technical goals.

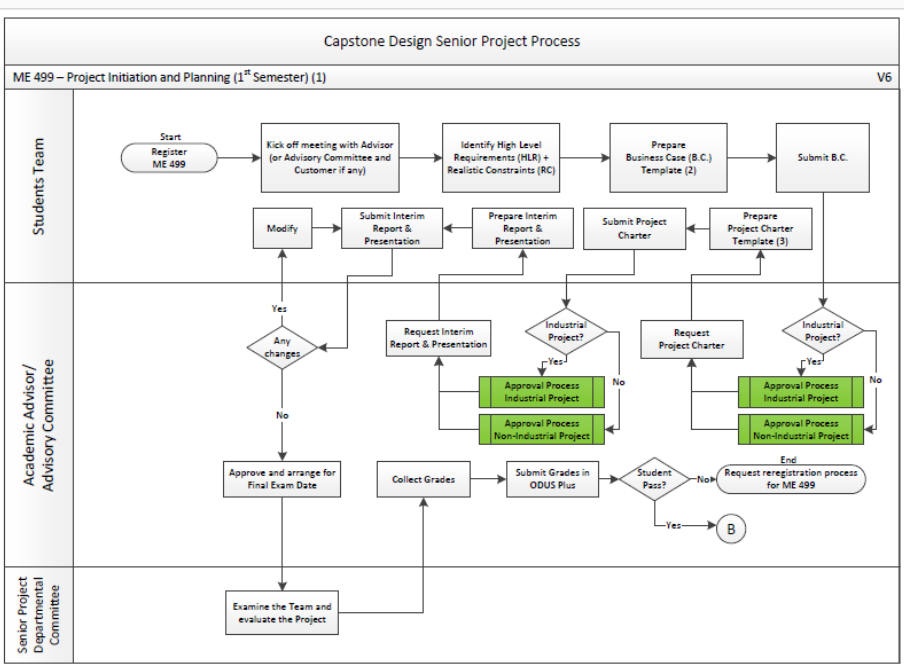


Fig. 3. Flow chart for Senior Project Design I &II

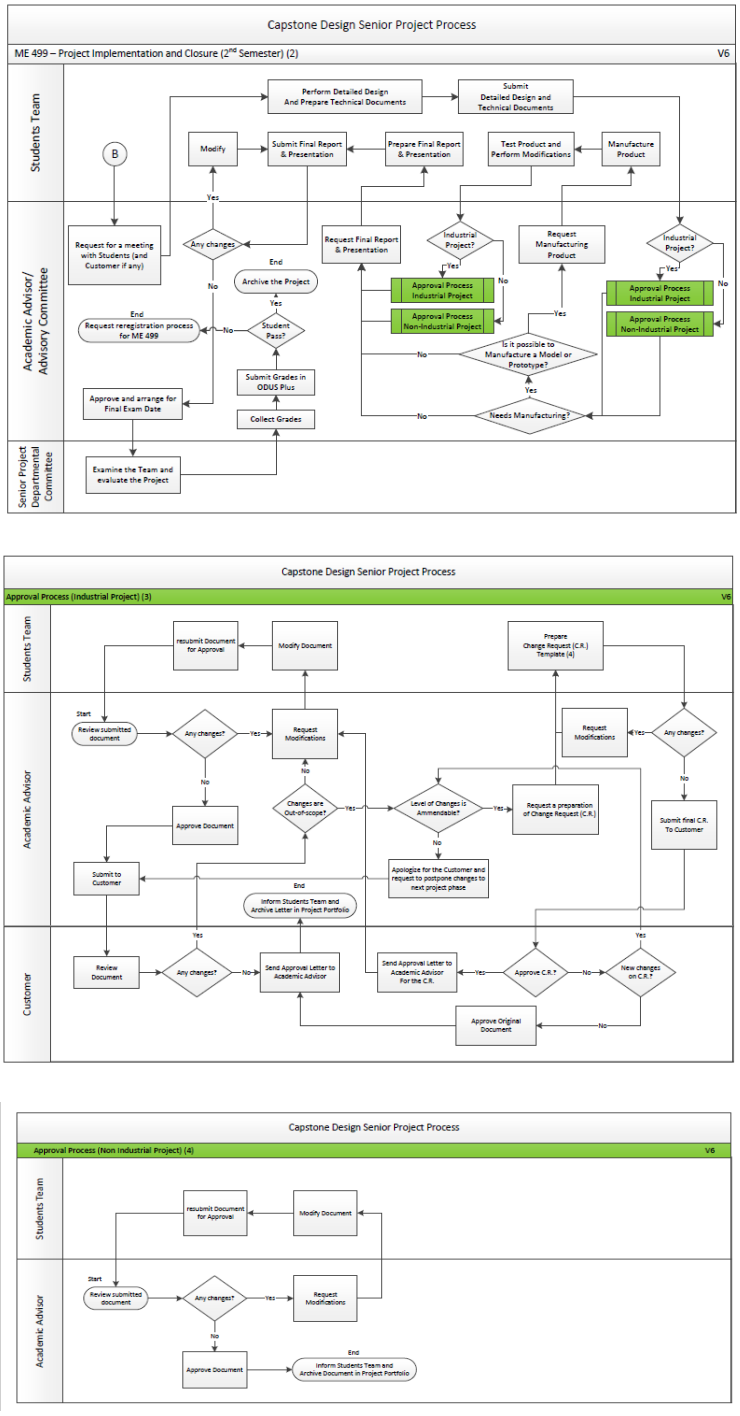


Fig. 4. Flow chart for the Senior Project Design with industry involvement

During the project, students must conduct several meetings to achieve the required milestones of the project. The team must meet with their advisor weekly, as well as before and after the advisor meeting to prepare and follow up, respectively. Students are expected to use the available form in Table 1 for minutes and meeting preparation. To have fruitful meetings, the team should prepare the points that must be discussed such as technical issues related to design, operation, and inventory (items that need to be purchased or fabricated). The place and time should be carefully selected to suit all team members and the project advisor. The team leader has to assign a time keeper and a recorder for the meeting. The team meeting should preferably be conducted in the place of the experiment or in the software availability lab if it is a simulation project. All meeting minutes should be kept in the project's portfolio after they are signed by the SCDPA and SCDPC.

Table 1. Time Table for the Weekly coordinator meeting

Senior Project: MENG/MEP 499: Capstone Senior Design Project						*Fall 2016*
Instructor	*Prof. Mostafa Hamed*		mushamed@yahoo.com	*Office 24F43*	*Classroom 206*	
Instructor	*Dr. Nedim Turkmen*		kaumep499@gmail.com	*Office 34D62*	*Classroom 219*	
Classes	*U T*	*11:00 - 12:20*	*Lectures*	*Engineering Bldg 40*		
	R	*11:00 - 12:50*	*Advisor Meeting*	*Engineering Bldg 40*	*TBA*	
			https://sites.google.com/site/me499f16/			

Week	*Date*		*Lecture*			*Deliverables*
1	18-Sep-2016	17/12/1437	*Introduction*	*Weekly Reports*	*Hands on Weekly Reports*	*First Week Reports and Forms*
2	25-Sep-2016	24/12/1437	*Team Management*	*Project Management*	*Project Management Tools*	*Weekly Reports (WR)*
3	2-Oct-2016	01/01/1438	*Business Case*		*Advisor Kick-off Meeting*	*Weekly Reports (WR)*
4	9-Oct-2016	08/01/1438	*KTDA*	*Quality Function Deployment (QFD)*	*Client Kick-off Meeting*	*Weekly Reports (WR)*
5	16-Oct-2016	15/01/1438	*Job Requirements*	*Capstone Design Requirements*	*Advisor Meeting*	*1st Draft of Business Case Presentation & WR*
6	23-Oct-2016	22/01/1438	*Ethics of a Muslim Mechanical Engineer*	*BC Presentation Review*	*Advisor Meeting*	*1st Draft of Business Case Report & WR*
7	30-Oct-2016	29/01/1438	*Project Charter*		*Advisor Meeting*	*Ethics Case Presentation & WR*
8	6-Nov-2016	06/02/1438	*Team Presentation for Ethics*		*Advisor Meeting*	*Ethics Case Report & WR*
9	13-Nov-2016	13/02/1438	*Technical Report Guidelines*	*Technical Drawings*	*Advisor Meeting*	*Final Draft Business Case Report and Presentation & WR*
10	20-Nov-2016	20/02/1438	*BC Presentation Review*		*Advisor Meeting*	*1st Draft of Project Charter Presentation & WR*
11	27-Nov-2016	27/02/1438	*BC Presentation Review*		*Advisor Meeting*	*1st Draft of Project Charter Report & WR*
12	4-Dec-2016	05/03/1438	*Project Charter Presentation Review*		*Advisor Meeting*	*Weekly Reports (WR)*
13	11-Dec-2016	12/03/1438	*Project Charter Presentation Review*		*Advisor Meeting*	*Final Draft Project Charter Report and Presentation & WR*
14	18-Dec-2016	19/03/1438	*Team Presentation Rehersal*		*Advisor Meeting*	*Weekly Reports (WR)*
15	25-Dec-2016	26/03/1438	*Team Presentation Rehersal*		*Advisor Meeting*	*All Approved Interim Presentations, Interim Reports*
16	1-Jan-2017	03/04/1438	*Interim Presentation & Interim Technical Report*			*Weekly Reports (WR)*

The project advisor should prepare project progress reports and keep them in his course file. The weekly project status report is expected to meet the preset objectives of the final report.

3.1 Project Student Portfolio

Each team should prepare a project portfolio as shown in Tables 2 and 3 to organize their projects. The project portfolio should be organized as follows:

1. Cover page should contain the following data:

a) Course title
b) Project title

c) Names, ID and signatures of team members
d) Advisor(s) name(s)
e) Semester and year

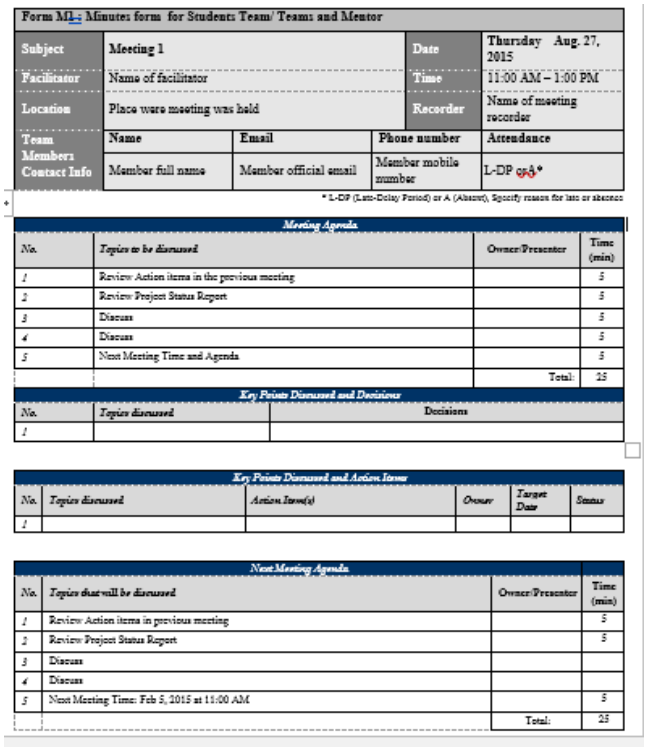
2. Divide the portfolio into the following sections, using separators, and organize them as follows:

a) Cover page
b) Project proposal
c) Weekly project status report
d) Project plan on Gantt Chart:
   i. Current week expanded
   ii. Other sections suppressed
      a) Advisor meeting minutes
      b) Team members meeting minutes
      c) Client meeting minutes (If the project is sponsored by a client)
      d) Technical report
         i. Business problem
         ii. Project charter
         iii. Final design
         iv. Manufacturing and testing
         v. Conclusion and recommendations
         vi. Technical drawings
      e) Assembly drawings
      f) Sub-assembly drawings
      g) Working drawings
         vii. Presentations, six slides/page
         viii. Draft work of the team
         ix. Miscellaneous

3. Update the work in each section weekly and arrange the updated materials in each section such that the recent work is always on top.

4. Project portfolio should be submitted weekly to the course coordinator in his office right after Sunday lecture, and it should be picked up from his office on Wednesday.

Table 2. Meeting minutes form



Forms M1 – Minutes forms for Students Team/ Teams and Mentor				
Subject	Meeting 1		Date	Thursday Aug. 27, 2015
Facilitator	Name of facilitator		Time	11:00 AM – 1:00 PM
Location	Place were meeting was held		Recorder	Name of meeting recorder
Team Members Contact Info	Name	Email	Phone number	Attendance
	Member full name	Member official email	Member mobile number	L-DP or A*

* L-DP (Late-Delay Period) or A (Absent), Specify reason for late or absence

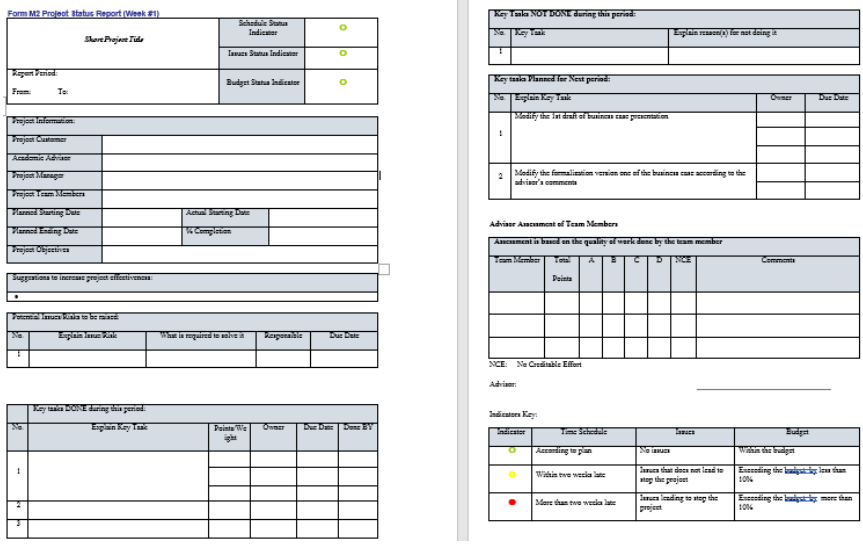
Meeting Agenda			
No.	Topics to be discussed	Owner/Presenter	Time (min)
1	Review Action items in the previous meeting		5
2	Review Project Status Report		5
3	Discuss		5
4	Discuss		5
5	Next Meeting Time and Agenda		5
		Total:	25

Key Points Discussed and Decisions		
No.	Topics discussed	Decisions
1		

Key Points Discussed and Action Items				
No.	Topics discussed	Action Item(s)	Owner	Target Date	Status
1					

Next Meeting Agenda			
No.	Topics that will be discussed	Owner/Presenter	Time (min)
1	Review Action items in previous meeting		5
2	Review Project Status Report		5
3	Discuss		
4	Discuss		
5	Next Meeting Time: Feb 5, 2015 at 11:00 AM		5
		Total:	25

Table 3. Weekly Project Status Report



Form M2 Project Status Report (Week #1)

Short Project Title	Schedule Status Indicator	
	Issues Status Indicator	
Report Period: From: To:	Budget Status Indicator	

Project Information:	
Project Customer	
Academic Advisor	
Project Manager	
Project Team Members	
Planned Starting Date	Actual Starting Date
Planned Ending Date	% Completion
Project Objectives	

Suggestions to increase project effectiveness:

-

Potential Issues/Risks to be raised:

No.	Explain Issue/Risk	What is required to solve it	Responsible	Due Date
1				

	Key tasks DONE during this period:				
No.	Explain Key Task	Points/Weight	Owner	Due Date	Done BY
1					
2					
3					

Key Tasks NOT DONE during this period:

No.	Key Task	Explain reason(s) for not doing it
1		

Key tasks Planned for Next period:

No.	Explain Key Task	Owner	Due Date
1	Modify the 1st draft of business case presentation		
2	Modify the formalization version one of the business case according to the advisor's comments		

Advisor Assessment of Team Members

Assessment is based on the quality of work done by the team member

Team Member	Total Points	A	B	C	D	NCE	Comments

NCE: No Creditable Effort

Advisor: _____

Indicators Key:

Indicator	Time Schedule	Issues	Budget
	According to plan	No issues	Within the budget
	Within two weeks late	Issues that does not lead to stop the project	Exceeding the budget by less than 10%
	More than two weeks late	Issues leading to stop the project	Exceeding the budget by more than 10%

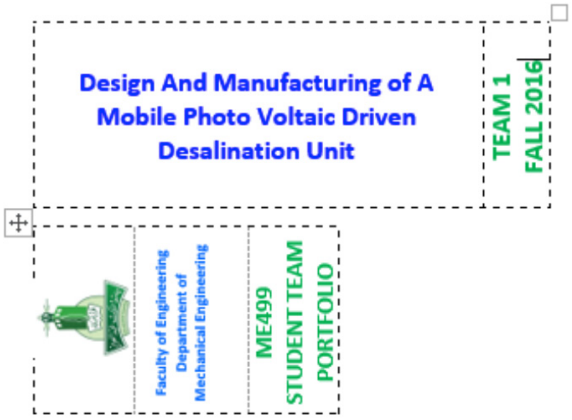


Fig. 5. Sample of the cover for the Portfolio

4 Leadership Skills

One of the most important elements of any project is to adopt leadership skills. Those skills start from the initiation of the project team and end with submitting the final requirement of the project and getting the grade. During the work flow, important issues related to team formation are highlighted.

4.1 Team Formation

Team formation is the first important step in determining the future success of the project. Being able to move the team towards the goals is not an easy task. Many elements must be considered in the team building process. The team leader and members are encouraged to participate in a short training course about forming an effective team, which is available though many websites [16-18] or through some university programs.

Project Management: Three constraints that might slow down or even halt the project are cost, time, and work scopes. More importantly, a few core pillars need to be raised for any project to succeed.

Pillar #1: Stakeholders—The first pillar is the stakeholders of the project, which include mentor/s, team members, the department chairman, and the college's vice dean, dean, engineers, technicians etc. In addition, anyone who can affect the project, in either a positive or negative manner, is also considered a stakeholder. Dealing with stakeholders in the correct manner will determine the success of the project. The owner of the project (students) must know how to approach and deal with these stakeholders based on their authority and contribution to the project. These are skills that students can acquire from this project. These skills are very important and will become even more valuable after the students graduate and go to work in a company environment. Figure 7 shows the stakeholder approach and is based on keeping each person's influence and interest.

Pillar #2: Benefits—The second pillar of the project is the benefits of the project. Each member in the team has to be convinced about the importance of the project and its expected benefits. By understanding this, each member in the team will work hard and contribute towards achieving the objective of the project.

Pillar #3: Work Scope—The third pillar is the work scope, which must be realistic and clear with frequent reviewing. It is better to have work scope statements which include all elements of the project than a few broad goals that leave too much to the imagination.

Pillar #4: Risk Management—The fourth pillar is risk management. Risks are a part of any project and should be expected. How participants deal with the risks will determine the successfulness of the project. Defining a risk from the beginning can help the team avoid it. Preparing suitable solutions for them using a SWOT analysis is a helpful tool for this issue. Here, you have to define strength (S), weakness(W), opportunities (O) and threats (T) before the start of the project and deal with them accordingly. Figure 7 illustrates the commonly used SWOT analysis template.

Pillar #5: Schedule Adherence—The fifth pillar is to build and stick with the schedule your team develops. A Gantt chart (Fig.8) is a very helpful tool, which can clearly show the progress of the project, i.e., whether it is on track or not. By having an updated Gantt chart, immediate action can be taken to keep the project on track or identify an immediate solution to the potential problems that might drag the project off schedule. A Gantt chart can be built using Microsoft Project Manager. Figure 9 shows a sample Gantt chart built with a plan and activity monitoring.

Pillar #6: Team Performance—The final pillar is the team performance. The leader of the group should watch all team members and evaluate their performance. Tasks should be clearly defined to assure success in achieving the team's objective. Figure 9 shows the project management flow from start to the end.

Fig. 6. Stakeholder Approach [18]

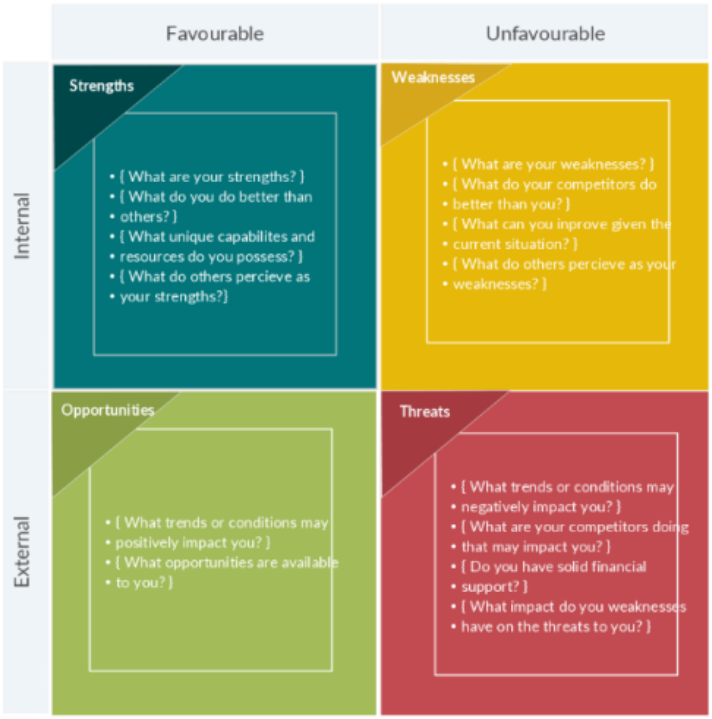


Fig. 7. SWOT Analysis Template

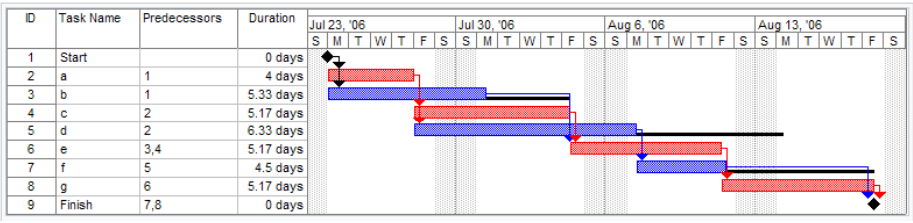


Fig. 8. Example of Gantt Chart

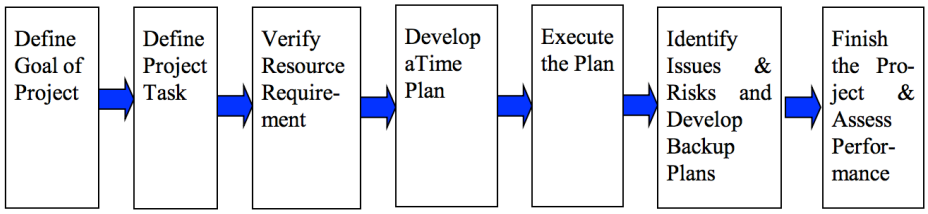


Fig. 9. Common Project Management Flow Chart

4.2 ABET Involvement

ABET has constraints that students should be aware of during their project. Products must be:

- Economical
- Environmentally friendly
- Sustainable
- Manufacturable

The product intent and workplace protocol must meet industry standards, which pertain to:

- Ethics
- Health and safety

ABET has set outcomes mentioned for the engineering program, which are shown in Table 4. When the student graduates, he is expected to fulfil most of the ABET outcomes. Most of the engineering courses cover certain technical outcomes, namely those shown in Table 5, lines a, b and e. However, lessons in ethics and leadership are not a required component of regular engineering courses.

In the Capstone, students often spend several hours perfecting the design of the project and interacting regularly with other team members and the advisor. This is when the other ABET outcomes such as those shown in Table 4, lines d, f and g are fulfilled. The evaluators of each outcome are also shown in Table 4. The SCDPA is the senior capstone design project advisor, the SCDPC is the senior capstone design project coordinator. The ExC is the department-appointed examining committee.

Table 4. ABET student outcomes for engineering [19]

	Outcomes	Evaluator
a	An ability to apply knowledge of mathematics, science, and engineering	SCDPA, ExC
b	An ability to design and conduct experiments, as well as to analyze and interpret data	SCDPA, ExC
c	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, and ethical considerations; also to assure compliance with industry standards on health and safety, manufacturability, and sustainability	SCDPA, ExC
d	An ability to function on multidisciplinary teams	SCDPA
e	An ability to identify, formulate, and solve engineering problems	SCDPA, ExC
f	An understanding of professional and ethical responsibility	SCDPA, SCDPC
g	An ability to communicate effectively	SCDPA , SCDPC, ExC
h	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	ExC, SCDPC
i	A recognition of the need for and an ability to engage in life-long learning	ExC, SCDPC
j	A knowledge of contemporary issues	ExC, SCDPC
k	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	ExC, SCDPC

Each outcome has Key Performance Indicators (KPI), which are also the essential elements as shown in Table 5.

Table 5. Sample of KPI for ABET outcomes (rubrics)

#	KPI	Essential Elements of the KPI
c.1	Define the Problem / Opportunity	State the desired needs
		Identify all applicable realistic constraints
		Convert all needs into well-defined requirements and specifications
		Convert all constraints into well-defined requirements and specifications
c.2	Develop and Compare Alternative Designs	Develop substantially different alternative designs
		Perform basic analysis for each alternative so that each one meets all requirements and specifications
		Develop a selection criteria that is based on requirements and specifications
		Select the best alternative design by using a decision analysis technique
c.3	Implement Iterative Analysis and Synthesis to Finalize the Selected Alternative	Carry out a detailed design of the selected alternative
		Identify the standards used
		Perform iterative analysis until all potential improvements are achieved

5 Project Evaluation

5.1 Presentation of the Projects

The students should prepare a report and present their work to the exam committee assigned to them by the department. Their report should follow the university's standard format[20]. The presentation should be clear, organized and presented in the English language. The draft report and presentation are evaluated equally with 50% of the grade depending on each (50% from report and 50% from presentation). The score breakdown is shown in Table 6.

Table 6. Report and presentation evaluation criteria

Report Evaluation		**Presentation Evaluation**	
Criteria	***Score***	***Criteria***	***Score***
Organization (title, contents, lists of tables and figures)	10	Organization (title, outline, smooth transfer of information)	10
Introduction and literature review	5	Content (objective, methodology, results and conclusion)	10
Clear objective	5	Clarity (Slides)	5
Methodology	10	Language skills and pronunciation	10
Results	10	Eye contact and positive outlook	5
Conclusion and recommendations	5	Presentation within the assigned time limits	5
References	5	Answering questions if any	5
Total	50%	Total	50%

5.2 Score Distribution

A student's final grade depends on his or her overall activity during the course. The senior capstone design project coordinator (SCDPC) will evaluate the teams for their discipline in submitting the papers related to the SP portfolio, such as minutes of the meeting, proposal, Gantt chart and the overall appearance of the portfolio. The department appointed examining committee. evaluates the team for their performance during the presentation and the draft report. The senior capstone project administrator (SCDPA) will evaluate the student work during the whole course and will also evaluate the final report. All percentages of score values based on their weighted distribution in evaluation are shown in Figure 10.

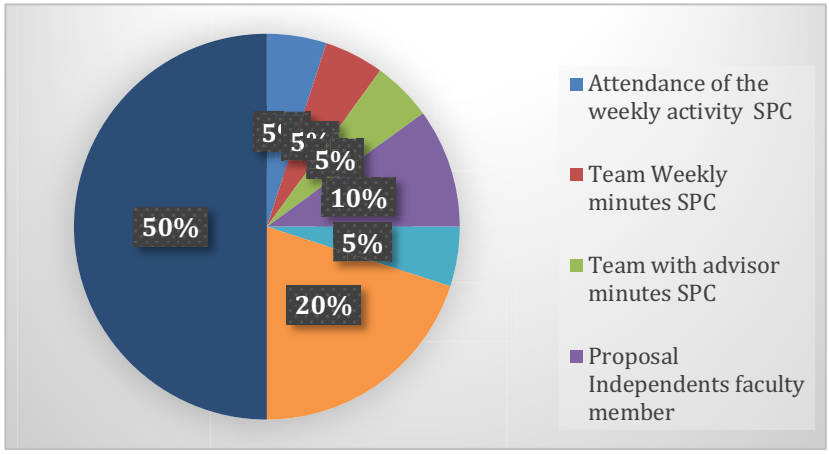


Fig. 10. Scores distribution of the senior project course (SPC)

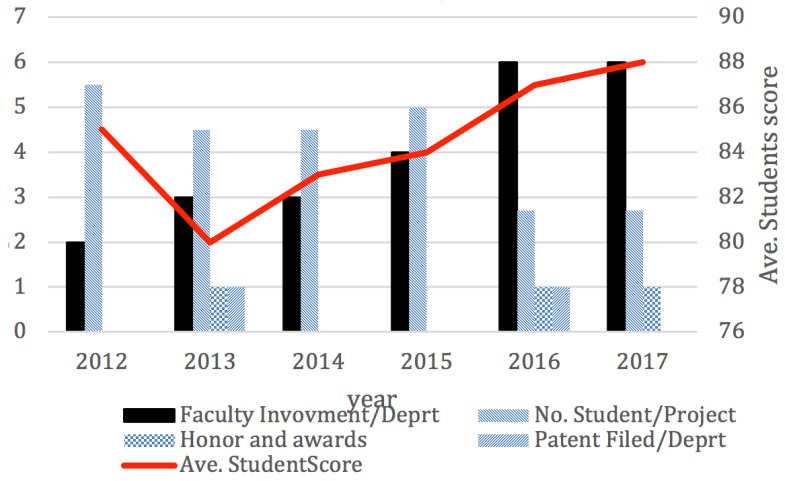


Fig. 11. Evaluation of the Impeded Aspect of SCDP on Students Performance of departments in Rabigh Engineering College

6 Achievement

The SCDP allows senior-level students to gain professional engineering design experience through an opportunity to practice teamwork, quality principles, communication skills, life-long learning skills, realistic constraints and awareness of current domestic and global challenges. Throughout the successive design weekly reports while following the Gantt chart, the students are required by the end of the course to communicate, clearly and concisely, the details of their design both orally and in writing through a functional artifact/prototype (if any), a design notebook (if any), an A0 project poster, a final oral presentation, and a final report.[21] After two years of Capstone study and activities, implementing these features had positive impacts on students, faculty and the department. Graduates students from the engineering colleges were hired by well-known companies in the region and have interacted well with employers and fellow employees. Plus, many of them were able to continue their studies and practice in the academic field. In 2012, 15 students produced acceptable journal papers that showed an awareness of both contemporary issues and ethical responsibility. [22]

In addition, for engineering faculty at UKA-Rabigh, the Capstone effect was more noticeable, since the time gap between learning the aspects of the program and practicing them were very short. Figure 11 shows some advantages of involving students in the Capstone program. A notable increase of faculty involvement occurred in each department. It also shows the number of students reduced to between 2 and 3 members per team. Moreover, the students' scores, honor and awards increased during the first years of implementing the new aspects of SCDP.

7 Conclusions

The capstone design project at KAU focus on preparing the students for their future career. This paper provides a complete instruction guide to managing the Senior Capstone Design Project (SCDP) course. The process for all the steps required for SCDP are provided. The leadership skills that a SP team needs were emphasized. The team formation process was defined. The importance of frequent meetings and well-kept records as well as the constraints set by ABET and the outcomes were delineated in the narrative and supported by several figures and tables designed to capture the essential components needed to achieve successful SPD outcomes. The program is always being updated to comply with the latest requirements, especially from industries.

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9 Authors

Hani Sait is member of American Society of Engineering Education (ASEE) and the American Society of Mechanical Engineer (ASME). He works as an Associate professor at King Abdulaziz University (KAU)-Rabigh, in the department of Mechanical Engineering since 2010. He used to act as Vice dean for graduate studies and scientific research for the KAU-Rabigh for the periods of 2012-2014. Before that he worked for Jeddah college of technology as a Trainer in A/C Deprt. for 6 years since 1995 before he was promoted to assistant professor in 2005 after he got his PhD in Mechanical Engineering from University of Missouri-Columbia in 2004. He acted as chairman for the mechanical technology Deprt. for four years and then as vice dean for training for 2 years. His areas of interest are in thermofluidic, heat transfer, HVAC and in engineering education.

Raja Ishaq is with University of Technology, Johor, Malaysia

Nadim Turkman is with King Abdulaziz University, Jeddah, Saudi Arabia

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