Are We Asking Our Students to Do Too Many Projects? It Depends

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Abstract

We have all heard our students groan as we assign them a project. Most of us accept this sound as the natural order of things, but have we really listened to what the students are telling us? Have they been the first to recognize that we are asking our students to do too many projects?

The impetus for utilizing projects in a wide variety of courses comes from many sources. Industry prefers to hire graduates who have experience working in teams. They are also interested in graduates who have the skills to combine knowledge from a variety of areas and synthesize this knowledge to complete a project. In order to meet a variety of ABET criteria such as, the ability to function effectively on teams and the ability to apply creativity in the design of systems, components, or processes, educators have added projects to their courses. With projects appearing in nearly every course, from Economic Analysis to Design of Machine Elements to Circuits, has the use of projects to meet external customer requirements affected the learning experience of our internal customers?

There is no doubt that projects are useful, interesting, and challenging additions to the learning experience. However, the questions still remain:

-Are We Asking Our Students to Do Too Many Projects?
-Has the use of projects to meet external customer requirements had a negative impact on the learning experience of our internal customers?

In order to gain insight and more definitive answers to these questions, members of the Engineering Technology program at the University of Dayton conducted a survey of engineering technology programs nationwide. An analysis of the results, as well as suggestions for improvement are included in this paper.

Survey Response

Throughout November and December we received 50 responses to our survey questions. Those responding were from a variety of programs including but not limited to

Information Technology, Industrial Engineering Technology, Manufacturing Engineering Technology, Mechanical Engineering Technology, Electronic Engineering Technology, and Construction Technology. Respondents were department chairs, program directors and professors, both part and full time, from 2 year and 4 year institutions. Note that not all questions were answered by all respondents. Below is a summary of the responses to the questions. Following that are insights that we gathered from comments made by the respondents.

-How many projects do your students complete in their entire curriculum?
(<5, 5-10, >10)
-What is the duration of a majority of these projects?
(1/2 term, full term, full year)
-Which courses in your curriculum require projects?
-Do you feel the use of projects to meet external customer requirements negatively affects the learning experience of your internal customers, the students? If so, how?
-Do your students use project management skills to manage their projects?
(Yes No)
-In what course are they taught these skills?
(separate course, same course as project)
-If students are taught project management skills, does it aid in keeping the projects on track? If so, how?

Figure 1. Survey Questions

-How many projects do your students complete in their entire curriculum?

The answer to this question depended on whether or not the respondent considered the entire curriculum or just their own courses. If only their own courses were taken into account, the answers were predominantly 5 or less (21 responses). If the entire curriculum was taken into account, the answers were predominantly 10 or more (15 responses). Though the responses did not always reveal whether or not the respondent was from a 2 or 4 year institution or which program they represented, given the data available, the number of projects did not appear to be affected by these variables.

-What is the duration of a majority of these projects?

'All of the above' would be the most appropriate summary of the responses to this question. Nearly all respondents had a mixture of both full-term projects and projects lasting a few weeks. Only one respondent said their students completed a full year project.

-Which courses in your curriculum require projects?

This list, containing over 30 courses, was quite comprehensive, encompassing courses from microprocessors and circuits, to kinematics and machine design, to manufacturing processes and computer-aided manufacturing, to construction and contract documentation, to human factors, economic analysis, and quality assurance. Responses revealed that projects were more prevalent in upper level courses.

-Do you feel the use of projects to meet external customer requirements negatively affects the learning experience of your internal customers, the students? If so, how?

Answers to this question also depended on whether or not the respondent considered the entire curriculum or just their own courses. If they focused on just their own courses, the answer was a resounding 'No'. If they considered the entire curriculum, then the answers were more mixed, though still favoring 'No'.

Comments accompanying this question revealed two issues that will be covered in more detail in the discussion portion of this paper. One issue is that there was only a very tenuous link between external customer requirements (ABET and those who hire graduates) and the use of projects. The other issue brought up by several respondents involves students experiencing 'project overload' and time management issues at the end of each semester.

-Do your students use project management skills to manage their projects?

Responses were very mixed for this question Yes (15), No (13), Should (13). Regardless of their answer most respondents went on to clarify that students should use the skills but usually don't. The response that best summarizes responses to this question was: 'We'd like to think so.' Several respondents, though they listed projects throughout their curriculum, said that project management skills were expected to be used in only the capstone course or senior design course. Other respondents reported the project management skills were taught too late in their curriculum to be fully effective. When respondents discussed the types of project management skills they expected to be utilized, the focus was on project/team scheduling rather than on project proposals, plans, or control. The comments will form part of the discussion that follows this summary of responses.

-In what course are they taught these skills?

Once again, there was a mixed response between a separate course (12) and the information being taught on an as needed basis in the same course as the project (18) and not being taught at all (7).

Respondents brought up several interesting issues. The responses reflected a tendency to expect students to learn project management skills on an 'as needed' or 'learn it as they go along' approach. Project management teaching methods appeared the most solid when utilizing project management skills was considered a critical component of the project itself. Though not necessarily titled "Project Management", separate courses were found primarily at 4 year institutions. Several respondents stated that the requisite skills were often taught several semesters after projects were required in certain classes. Other respondents stated that project management skills were taught too late in the curriculum, usually in conjunction with a senior design or capstone course. Surprisingly, a few respondents reported that even when project management skills were not taught, students were expected to use project management skills for their projects.

-If students are taught project management skills, does it aid in keeping the projects on track? If so, how?

Theoretically, project management skills, whether taught in a separate course or on an as needed basis, should aid in keeping projects on track, however, many respondents commented that the application of project management skills was dependent on the individual student or team. They went on to say that although their students were taught project management skills, very few thought the students were actually applying these skills to their projects. Many respondents reported that they had hoped and expected students to have developed and utilized better project management skills than they did. A few respondents required the use of project management skills for student projects and skill use was verified through the use of specific assignments. Based on the responses, project scheduling skills receives the most emphasis. Overall, respondents felt that when students used their skills the projects progressed more smoothly.

What the survey revealed

Without a doubt, projects are a vital component of the educational experience. Projects enable instructors to judge how students apply their acquired knowledge and skills to solve problems and resolve issues similar to those they will face following graduation. Engineering Technology programs strive to create graduates who are prepared to apply technical and managerial skills to design, develop, install, implement, test, and improve complex systems, processes, and products. Projects integrated into their courses and curriculums enable students to apply the appropriate analytical, computational, and people skills to practical situations. Based on the survey results, the question may be more complex than whether or not students are doing too many projects. The surveys revealed four key themes. Because of the thoughtful answers provided by survey respondents, responses to these themes, shown in italics, emerged at the same time:

1. Project management skills are not used extensively by students regardless of whether the skills are taught either in the course containing the project or in a separate course.

-Project management skills should be taught early in the curriculum.

-The use of project management skills should be expected and encouraged for all projects regardless of size or course.

2. Training in time management and people skills is needed.

-Appropriate project management skills, including people and communication skills, need to be taught in a coordinated manner in order to be effective.

3. Very little correlation exists between external customers (the people who hire graduates, ABET) and the nature of the project.

-Realistic projects related to real-world situations enable the greatest learning.

4. The issue may not be too many projects, but rather an uncoordinated allocation of projects throughout a curriculum.

-Project assignments should be coordinated throughout a curriculum or at the very least, faculty members should be aware of the requirements in other courses.

1. Project management skills are not used extensively by students regardless of whether the skills are taught either in the course containing the project or in a separate course.

One of the key points brought up by respondents to the survey is the fact that project management skills, regardless of when and where they are taught, are not being consistently applied by students to projects. Project management skills remain weak despite the number of projects given. A variety of reasons were cited for this point, including the limited emphasis placed on the use of project management skills by instructors. This in turn, could be due to the inconsistency with which project management skills are taught. For the most part, as the survey revealed, students receive project management skills training on an ad hoc, as needed basis. In some cases, this training comes late in the curriculum, often appearing in the capstone course, though projects have been required much earlier in the curriculum. This mismatch between what is taught and when it is taught and what is needed and when it is needed will have an effect on the students' ability and desire to use their skills.

Teaching project management skills earlier in the curriculum and then stressing the use of these skills throughout the curriculum will help students solidify their learning and practice their skill set. Skill set development takes time. The comments accompanying this survey reveal how critical it is to reinforce learned skills through required application. Instructors reporting greater success with student project skill implementation were the ones who also reported that they place requirements on their students to apply their skills to the projects given in the class, whether short or long. These individuals were in the minority. Most of the respondents reported a laissez-faire approach to project management. Many of these same people reported that they were disappointed that students didn't use the skills they had learned. Integrating the use of specific project management skills into the project requirements reinforces and refines

the students' ability to use their acquired skills. During this process, students become increasingly aware of their own capabilities and limitations. Repeated application of their skills on a variety of projects will enable them to learn to set realistic expectations, manage their time, enhance their strengths and improve upon their weaknesses. This cycle of continuous learning is essential for their future success in industry.

2. Training in time management and people skills is needed.

Several respondents pointed out that there is a need to teach students the softer side of project management. Though the use of Microsoft Project is prevalent, used to create Gantt charts and manage project schedules, students need insights into how to work together with other people. Many respondents reported having to deal with team behavior problems, often acting as a referee. Group dynamics include being able to deal with difficult people and situations without being a difficult person. More time should be focused on teaching students basic team management skills, such as, how to hold people accountable for assigned work, how to motivate individuals to participate in team activities, and conflict resolution. Most importantly, they need to learn how to communicate clearly with each other.

Students also need to understand the importance of applying good time management skills to their own personal schedules. Being able to recognize and plan for overload situations, such as those that occur at the end of a term, is a critical skill for their future employment success. Being able to plan for and balance the demands that are placed on you while working increases your effectiveness, yet, based on the respondents' comments, students are not learning and applying critical time management skills. Appropriate project management skills, including people, time management, and communication skills, need to be taught in a coordinated manner in order to be effective.

3. Very little correlation exists between external customers (the people who hire graduates, ABET) and the nature of the project.

The question: *Do you feel the use of projects to meet external customer requirements negatively affects the learning experience of your internal customers, the students?* was asked in order to determine whether or not a link existed between the expectations of people who hire graduates or ABET and the nature of the projects. The answers to this question revealed that there exists limited correlation between the types of projects assigned and external customer requirements. Though many of the answers were detailed, as we reviewed the surveys we were not able to determine why this was so.

Projects remain one of the best learning tools available to link real world expectations with training and education. Projects that are closely linked to industrial situations provide the students with insight into the types of work they could be doing upon graduation. Assignments like these may even help students discover what type of work they like or dislike. These types of projects, since they are more open-ended in nature,

give students experience with problem-solving and decision-making otherwise unavailable. Projects that mirror industrial experiences excite student learning. The link between external customers, the people who hire your graduates, is a critical one. This link can be enhanced by developing and assigning industry-based projects of varying size and complexity. Consistent interaction with industry representatives either through an advisory committee or technical societies will improve the quality of projects. When selecting projects, consider the question: does this project add to the students ability to apply course content knowledge and competencies? Project objectives should be clearly defined and focused appropriately.

4. The real issue may not be 'too many projects', but, rather an uncoordinated allocation of projects.

There is a lack of coordination between the projects assigned in an individual course and the number of projects assigned in an entire curriculum. Taken individually by course, the number of projects doesn't appear to be too great or too time-consuming. As an entire curriculum, there is the potential for overloading the students particularly if all the projects come due at the end of the semester. Perhaps the question is not so much about whether or not too many projects are assigned, but how the projects are integrated into the courses and the entire curriculum. With the great learning potential offered by projects, more and more courses are making them a required element. It may be necessary for programs, program chairs or department chairs to review the overall program or department and determine whether or not students are being overloaded. Some areas that should be investigated include: what projects are being assigned within courses, when projects from various courses are due, time commitments expectations related to the projects, skills set expectations, etc. Discussions on these topics could be expanded to include the use of peer reviews, project team grading, performance expectations, project methodologies, report templates, etc. By enhancing inter-departmental coordination, students' effectiveness in both skill application and work load balance would improve.

Conclusion

At the beginning of this effort, we were curious about finding the answers to the following questions:

> *-Are We Asking Our Students to Do Too Many Projects?*
> *-Has the use of projects to meet external customer requirements had a negative impact on the learning experience of our internal customers?*

The results of this survey revealed that the answer to the first question is far more complex than a simple yes or no. Project management is a critical job skill. Students

need to understand the project management process, acquire basic project and people management skills, and practice those skills in an educational setting. Project work is important and is seen as such by the respondents. Projects give students a taste of the real world and enable students to apply their knowledge. However, there is a lack of coordination between the projects assigned in an individual course and the number of projects assigned in an entire curriculum. Taken individually, the number of projects doesn't appear to be too great or too time-consuming. Taken as an entire curriculum, there is the potential for overloading the students. The question is not so much about whether or not too many projects are assigned, but how the projects are integrated into the courses and the entire curriculum. Students could be bettered served by coordinating projects required within their curriculum.

In order to enhance the student experience with projects, this survey points out that programs must:

-Teach project management skills early in the curriculum.
-Expect and encourage the use of project management skills for all projects regardless of size or course.
-Teach appropriate project management skills, including people and communication skills.
-Provide realistic projects related to real-world situations.
-Coordinate project assignments throughout a curriculum.

We'd like to thank all respondents for your well thought out answers, concern and advice. Much of the advice has been incorporated into this paper. At one point, we decided that some of the respondents felt we were asking these questions because we, at the University of Dayton, were having project issues. That is not the case. Through past attendance at ASEE meetings, this topic had come up several times in conversation so we thought we would investigate.

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Biography

Charlie P. Edmonson is an Associate Professor and Program Coordinator of Industrial Engineering Technology at the University of Dayton. Prior to joining the faculty at UD, he retired from the U. S. Air Force after 30 years of engineering design, industrial engineering, and experience at various levels of management.

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