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Workshop: Implementing Cloud Collaboration using Fusion 360 into a First-Year Engineering Design Course

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Workshop: Implementing Cloud Collaboration using Fusion 360 into a First-Year Engineering Design Course

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Abstract -
Industry and the world at large is becoming an ever-connected state where there is greater importance on atypical collaboration. The type of collaboration needed is radical in nature. Radical collaboration for a first-year engineering education curriculum needs to focus on effective learning strategies. This type of collaboration includes timely intervention by instructors, ease of learning for students, and access to professional level tool sets. All of which can create a platform for more engaging and effective peer-to-peer collaboration among students from different branches of engineering, design, and business. Cloud collaboration is a way for distributed, virtual teams to work efficiently on a common project. This workshop will teach faculty the benefits of cloud collaboration using an Autodesk Inc. product, Fusion 360, and the collaborative systems embedded within the platform. The workshop will entail four elements: (1) Pre-Workshop Signup/Team Formation, (2) A Case Study, (3) Interactive Design Session, and (4) Question and Answer segment. The goal of the workshop is for faculty to feel excited and empowered to implement new technology into their engineering design projects and have students who are novice in 3D modeling increase their skills dramatically. Faculty will leave with a handbook guiding them through the process of utilizing Fusion 360 in their design-based courses with examples.

Index Terms – engineering design education, first-year engineering, radical collaboration, technology

INTRODUCTION

First-year engineering programs have the opportunity to highlight to incoming students the breadth of engineering and to instill excitement in their journey to pursue a degree in engineering. One of the most common and dynamic ways to highlight multiple areas of engineering is through a design project incorporated within a first-year course. Going through the engineering design process helps students to understand engineering involves solving open-ended problems with no clear solutions **[1]**. Additionally, utilizing the engineering design process highlights the importance of developing the professional skills, including collaborating on a team **[2]**. As the world at large increases the way in which we are connected, there is great importance on the varying ways of collaboration and communication in engineering teams **[3]**. Therefore, if the way in which members of a team and stakeholders in general exchange information is thought of as being part of the design process, the nodes of exchange will become more efficient and effective.

This exchange of information leads to a model of collaboration that is radical in nature. Establishing a network to share knowledge, research, and outputs will make it easier to access materials and increase quality of work within a team setting, as well have design participants actively thinking about the way in which they communicate **[4]**. The coming together of different components that normally would not interact, understand or utilize each other's expertise is an important tenet of radical collaboration. It is not only different disciplines, but also animate and inanimate components working in sync to deliver a more efficient learning experience. Radical collaboration for a first-year engineering education curriculum needs to focus on effective learning strategies. This type of collaboration includes timely intervention by instructors, ease of learning for students, and access to professional level tool sets. All of which can create a platform for more engaging and effective peer-to-peer collaboration among student teams.

DEVELOPMENT OF AN ORGANIZING FRAMEWORK FOR RADICAL COLLABORATION

We define radical collaboration as using current 21st century technology to both enhance and create new opportunities for the exchange of information within the engineering design process. This form of collaboration takes everything that is currently in place and makes it more efficient, allowing for more effective communication between all the stakeholders involved within a project. As a result, we are in the process of developing an organizing framework as well as a

classroom module in which to infuse radical collaboration and increase design communication thinking into the engineering curriculum. Our research question that drives our work is: How can the exchange of information within engineering design teams be presented in order to effectively enhance the way in which engineering teams collaborate?

Developed in part from the work of **[5]**, that framework is currently consisting of the three themes: Communication, dynamic roles, and participant interactions. An initial concept is presented in Figure 1.

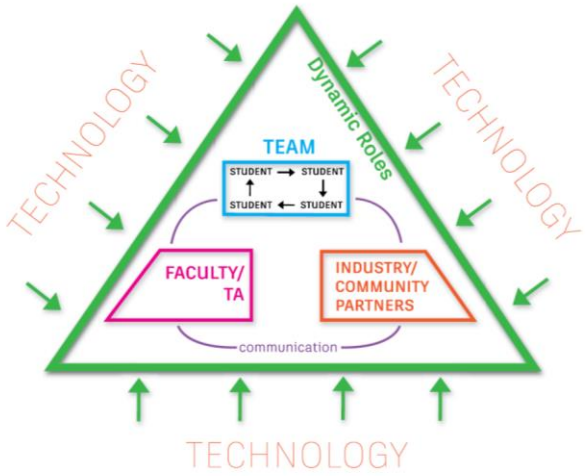

FIGURE 1: AN ORGANIZING FRAMEWORK FOR RADICAL COLLABORATION

Communication is the cornerstone of radical collaboration. In a project environment, open-ended communication between students, instructors, and industry/community partners is vital to any design's success. Modern day communication tools allow these parties to share thoughts and information simply and effectively.

Modern cloud-capable software facilitates dynamic roles, which lets students have access to all of a group's information at all times. This allows students to contribute in all areas of a project regardless of their defined role and allows student roles to change dynamically to meet the needs of the group as the project progresses. Additionally, the roles of both the faculty and partners can dynamically change as well. Implementing radical collaboration allow previously static roles for both parties to change immensely.

Modern communication and cloud software give participants new tools to respond effectively to new ideas, suggestions, and problems more quickly and easily than ever before. In addition to communication between students, this software also gives instructors the ability to monitor group progress and identify where students are having difficulties. In the same respect, industry partners can also monitor group progress and give feedback on current design work. These communication pathways that have been established are what we call participant interactions, which come in four different forms: Student-to-Student (Team), Team to Faculty, Team to Partners, and Faculty to Partners.

We are displaying two new pieces of the collaboration paradigm with our research. First, most know of technology tools that facilitate more effective communication between student teams, such as group text messaging. However, within the 3D modeling space, there were no ways in which communication between students in a team and across stakeholders was happening in a streamlined and efficient manner. Secondly, to our knowledge there is no systematic framework in which to organize how technology enhances the collaboration of all stakeholders within a project. Therefore, we are in the process of creating our radical collaboration framework. In addition, we are also working on a classroom module that will take the principles of the radical collaboration framework and guide students thinking about engineering design communication utilizing the design process itself.

PURPOSE OF WORKSHOP

The purpose of the workshop is to demonstrate an effective strategy for radical collaboration using cloud computing where multiple teams work on a common platform and exchange notes and views via a smartphone, browser, and/or the software platform. Engineering education faculty interested in learning about radical collaboration is the intended audience for the workshop. We propose to demonstrate a new way of teaching skills in CAD while imparting team building as well as professional skills development. The workshop will help attendees develop ideas for future projects to be included within their First-Year program by showing the potential of cloud computing and its implementation in larger classrooms where collaborative projects are managed by multiple stakeholders. We will provide workshop attendees with a booklet on how to implement radical collaboration using Fusion 360 into their first-year engineering design courses.

WORKSHOP DETAILS

Therefore, we propose a workshop around cloud collaboration. Cloud collaboration is a way for distributed, virtual teams to work efficiently on a common project. This workshop will teach faculty the benefits of cloud collaboration using an Autodesk Inc. product, Fusion 360, and the collaborative systems embedded within the platform. The workshop will entail four elements: (1) Pre-Workshop Signup/Team Formation, (2) A Case Study, (3) Interactive Design Session, and (4) Question and Answer segment.

The first part of the workshop will be a pre-workshop signup and team formation. Depending on participation, we will group participants into teams of 4-5 attendees together along with a Fusion 360 content expert. After introductions and team composition, the workshop lead author will present a case study on how Fusion 360 was implemented into a First-

Year Engineering program of approximately 250 students. Details of the two-course sequence, along with learning resources, homework and project assignments, undergraduate teaching assistants management, and quantitative and qualitative feedback from students and teaching assistants will be presented.

The main portion of the workshop will entail an interactive design project in which each team will design one component to be part of a final project. For example, if the final design is to be an office chair, individual teams will create the back, seat, frames, base, or armrests. The Fusion 360 expert will be creating each component based off feedback from the team members. The demonstration will then showcase how to render the final product to simulate distributed teams working collaboratively via cloud computing. The session will close with a question and answer time.

The goal of the workshop is for faculty to feel excited and empowered to implement new technology into their engineering design projects and have students who are novice in 3D modeling increase their skills dramatically.

RATIONAL FOR WORKSHOP

Youngstown State University was in the need of a 3D modeling curriculum that would benefit students by helping them gain valuable skills in a more technology driven, collaborative work environment. Therefore, we implemented Fusion 360, an Autodesk 3D modeling cloud-based platform within the first-year engineering design course sequence. We gave students videos to watch for homework in which they had to re-create the products shown in the videos. Students then "shared" their models with undergraduate TA's for grading. TA's were able to give quick feedback using their smartphones, and directly comment on the student's drawings. We will discuss student feedback as part of the case study, which we will present during the workshop.

ANTICIPATED RESULTS FROM WORKSHOP

A better understanding of collaboration among students using a cloud-computing environment for 3D modeling is the overarching goal for attendees. Essentially democratizing the design process so that different stakeholders can participate using a variety of input as well as interaction methods. By utilizing such cloud computing tools it can help faculty not only monitor student teams but also assist the TA's in mentoring, assessment, as well as timely intervention.

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