



Seattle

122nd ASEE Annual
Conference & Exposition

June 14 - 17, 2015
Seattle, WA

Making Value for Society

Paper ID #14366

Integration of Simulation Tools in Manufacturing Processes Course

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Group Dynamics and Project Management in EcoCAR 3

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Abstract

The EcoCAR 3 competition challenges student teams to operate in multi-disciplinary groups to re-engineer, construct, and market a hybrid Chevrolet Camaro. This work analyzes group dynamics and communications that have been observed between the Embry-Riddle Aeronautical University EcoCAR 3 sub-teams specific to the different disciplines. An Ambivert Personality Continuum Scale is used to predict the types of communication that is likely to work well between specific subteams and then to propose a new intra-team communication structure to improve the overall team efficiency.

Introduction

Group dynamics is the evaluation and integration of group set, and how it performs as a whole¹. In many groups there are different personalities and traits. Some contrast and some may align with the group thinking and communications. Project management's job is to solve this puzzle, so that all the members are in clear commination, and working with maximum efficiency. Unfortunately this cannot always be achieved. This paper analyzes the group dynamics of the Embry-Riddle Aeronautical University (ERAU) EcoCAR 3 team and proposes communication structures to improve management of this complex team.

EcoCAR 3, the premier student automotive competition, is sponsored by the U.S. Department of Energy and General Motors and challenges student groups from 16 universities in North America to re-engineer, construct, test, and market a Chevrolet Camaro to increase energy efficiency and reduce greenhouse gas emissions. Fairly uniquely among engineering student competitions, EcoCAR 3 also requires the student teams to perform tasks related to communications, marketing and project management. The ERAU EcoCAR 3 team is composed of approximately 50 students in over 8 majors and is structured into subgroups which handle the engineering, communications, and management tasks. Students of all academic levels from first-year to Ph.D. are involved with the team. Some students receive academic credit while others are volunteers or are working on graduate research projects, resulting in a complex mixture of abilities and motivations.

Group Dynamics & Communications Analysis

To be effective, project managers first need to identify the elements of a person or group's personality trait set. It is important to remember group members and people do not belong to one set of characteristics and to identify these personalities' strengths and weakness. Being able to correctly identify strengths and weaknesses with in a personality assists the project manager in making decisions on how to link personalities to complement strengths or to help the group/individuals improve their weak areas⁴.

Communication is the biggest obstacle seen when it comes to group dynamics, and the different subsets within the group⁴. The project manager's role is to mold the best communication forms to his/her team's strengths. Most communication breakdown comes from misinterpretation of the message⁴. Although a message may be clear to the sender, its intended receiver may have a difficult time interpreting the message and meaning. Different types of personalities have different ways of communicating. Although the group may already have a norm/standard way of communicating, this particular method of communication may be confusing and result in low productivity. The most important challenge for a project manager is to provide clear and concise communication within the group network by understanding every individual or group's strengths and weaknesses⁴.

The ERAU EcoCAR 3 team operates largely as a group of semi-autonomous subteams that are responsible for aspects of the project, as shown in Figure 1. The six subteams are managed by a student Engineering Manager and a student Project Manager. Outside of the main hierarchy are the faculty advisors who provide guidance and retain ultimate project authority and the GM Mentor who provides the team's interface to General Motors and the competition organizers. As the overall team operates heavily through the subteams, the analysis of the group dynamics for the ERAU EcoCAR 3 team will be conducted by analyzing the personality traits of the subteams and the interactions between the subteams.

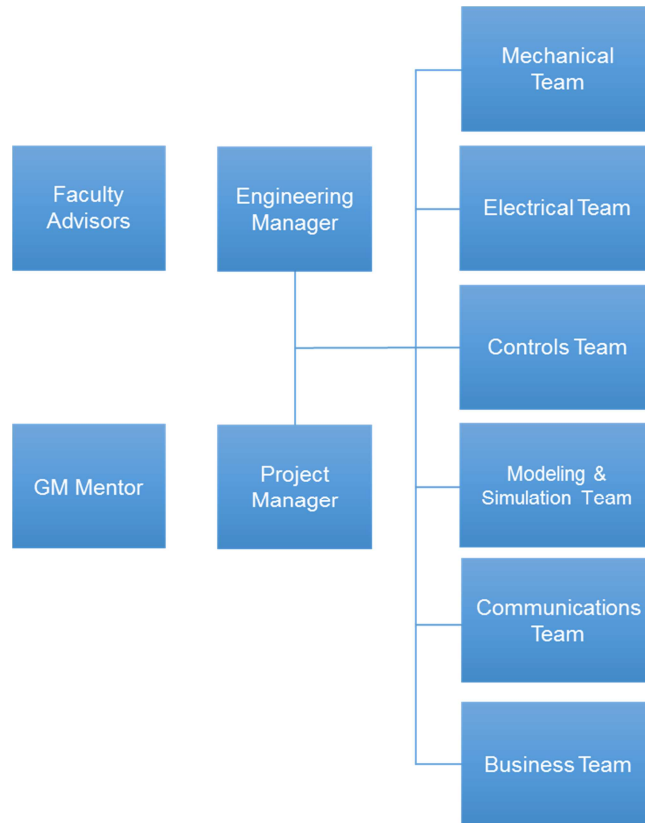


Figure 1: ERAU EcoCAR 3 Team Structure

The team's current path of communication as observed by the Project Manager is shown in Figure 2. The two-way arrows represent communication back and forth between group members. The topic of communication is listed by the arrows. Most information flows through and to the Engineering Manager or from the Faculty advisor outward. Weak points include two-way communication and that other engineering teams being cut out of the communications flow to the Engineering Manager. Ideally, information should be flowing from all engineering teams to the Engineering Manager and vice versa. The Project Manager and Engineering Manager should also be in constant communication with the Faculty Advisor and GM Mentor at the same time. This would ensure that the managers are receiving the non-conflicting information to pass along.

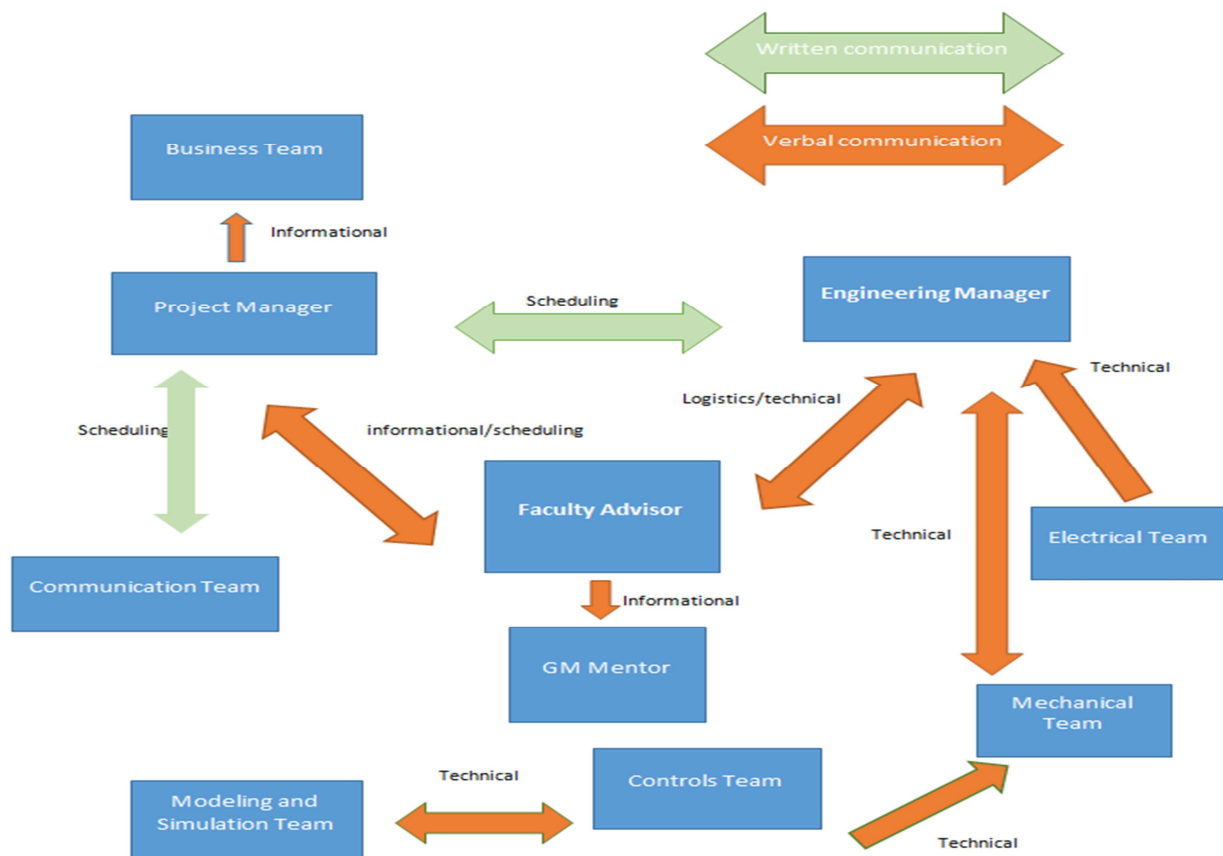


Figure 2: Current Team Communication

Personalities and Their Traits

Thousands of personalities and traits that have been documented. It can be hard to identify an individual and their specific traits. The easiest way to evaluate a personality is to compare and contrast them on an extrovert-introvert type scale called the Ambivert Personality Continuum Scale (shown in

Figure 3). This scale measures personality type by labeling people as extroverts, introverts, or stages in-between extrovert and introvert. Extrovert personalities are out going, and contrasted to that are introvert personalities who keep to themselves and are usually quite (comparatively) individuals⁵.

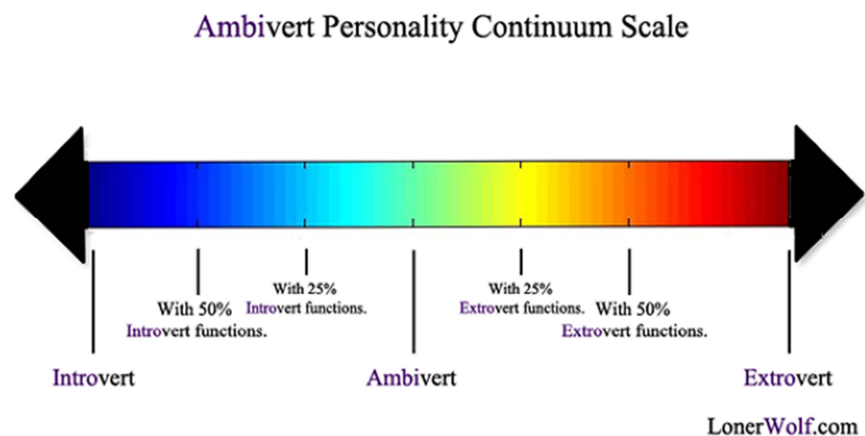


Figure 3: Ambivert Personality Continuum Scale⁵

Extroverts are shown to have high organizational skills and are open minded, will try new experiences, attempt to finish work early, and have an open forum of communication⁵. Their weakness include a tendency to be late for meetings, poor listening skills, and a lack of proper interpretation of messages if the message is not communicated face to face³. Introverts strengths include, getting tasks completed by themselves with little outside help, structuring methods of completing tasks, listening well, and having good written communication skills³. Their weaknesses include social communication; creating their own deadlines, and a single mind structure of completion for tasks³. All of these strengths and weaknesses are not absolute for these personality traits, but they do represent a population of the individuals with these personalities⁵.

There are two different trains of thoughts when seeing who may work well with others in this scale⁷. One train of thought is that introverts would work well with other introverts. This reasoning comes from this theory because there is a belief that introverts have the same personality traits and would be able to understand each other better⁷. The other train of thought would be that the introverts could work alongside extroverts. Although this may seem like a clashing of personality traits, the idea is that both personalities would complement each other. The extrovert tends to speak out about his mind and communicates mostly through verbal interaction throughout the day, and the introvert uses other means of communication, such as email, text, any secondary form of communication. With both communicating different ways, this may insure that their ideas are communicated to other through various modes of communication⁵. Working together can be challenge with many different personality types and the traits associated with them⁵. Individuals who have similar traits and personality types are

most likely drawn to each other, with subconscious recognition that they are doing so⁵. However, this does not mean that they are drawn away from the opposite of their personality types, the individual just identifies with those like him/herself surrounding them⁵. This is how some “cliques” may be formed within big dynamic working groups⁵.

By identifying these personalities there are many combinations that can be effective within a team. It has been noted by the authors that the individual subteams have different personalities. In concert with the communications analysis, the Ambivert scale was applied on a subteam level to the ERAU EcoCAR 3 team, as shown in Figure 4. The codes are based on the Project Manager’s observations of the subteam behavior characteristics.

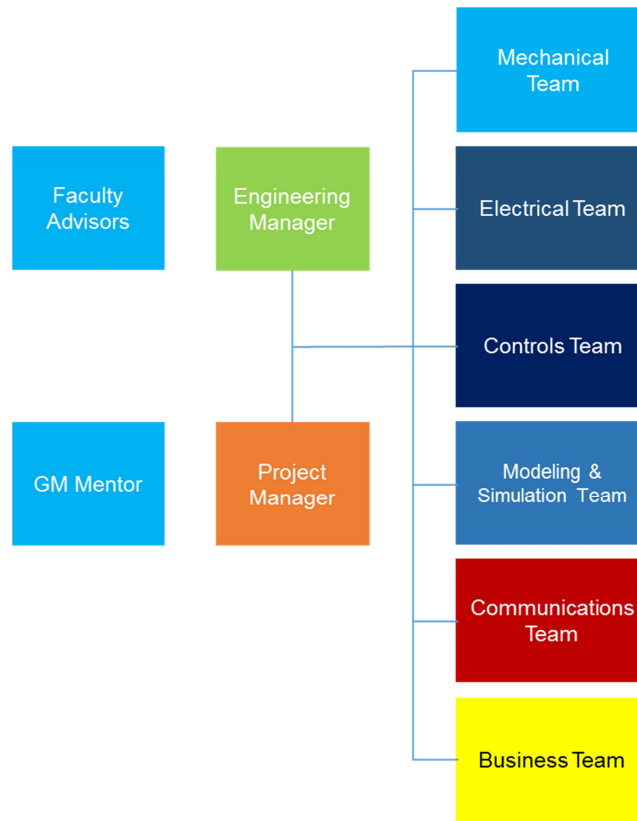


Figure 4: Team structure color-coded with observed personality traits

The observed range covers the full spectrum of the Ambivert scale from high introversion levels characteristic of the Controls and Electrical teams to the high extroversion levels of the Communications team. While individuals within the groups vary, these observations also exhibit a tendency to match the literature-identified strengths and weaknesses. The Controls team, which performs software development, typically focuses on highly-focused individual tasks and is composed primarily of introverts. The Communications team, whose responsibilities include outreach activities and public interaction, tends to be primarily composed of extroverts.

Proposed Communications Structure

Barriers of communications within a group vary. The types of barriers include sending of the message, receiving the message, message overload, emotion with receiving, emotion with sending, and forms of communication not understood³. Sending message barriers consist of sending a message with wrong information and confusing information that the receiver tries to understand. Receiving the message barriers consist of message misinterpretation.

The most common mistakes in large groups when they are receiving a message that is non-verbal, is the interpretation of emotion⁵. Often messages are misinterpreted because the receiver is displaying some emotion when reading the message. For example, if the receiver receives an email, but before the email was read, he or she was involved in some type of conversation that made him, mad, sad, etc. Now the email (message) is being interpreted with emotion that is false⁶. This the message is lost and misinterpreted.

The same can happen when sending a message. The sender can relay information in a different emotional state to where the receiver cannot interpret the message properly or the sender communicates incorrect information¹. Another form of communication barrier is message overload⁵. Message overload consists of the receiver trying to interpret too much information at once. This causes confusion with in the message and cannot be interpreted properly. Understanding these communication barriers and how they apply to different personalities can help with breaking down the wall to communication barriers.

The analysis of the subgroup Ambivert types has been combined with the analysis of the current communication modes to present a recommended intra-team communication structure. This structure describes modes of communication that may generally be expected to be successful. It should be noted, however, that individuals within the sub-teams may have different communication types and that this plan may, and probably will, have to be adjusted by the project manager based on the personnel actually involved.

Figure 5 shows the proposed communication flow chart for the team. The Engineering Manager now communicates with all of the engineering teams on a two-way base communication system. All of the engineering teams are also on a two-way base communication cycle with each other.

The Ambivert analysis shows that the engineering teams tend towards the introverted personality type. As introverts have been shown to be more comfortable with and more responsive to written communication, it is recommended that the Engineering Manager and the engineering team communicate primarily using written communication for technical information. However, to ensure that the information is understood and it is still important that the technical information be followed up with verbal communication. This will allow technical information to be confirmed by other members and for the Engineering Manager to know the true status. Due to this need for

initiation of verbal communication as well as written technical communication, it is recommended that fairly neutral personality be selected as the Engineering Manager.

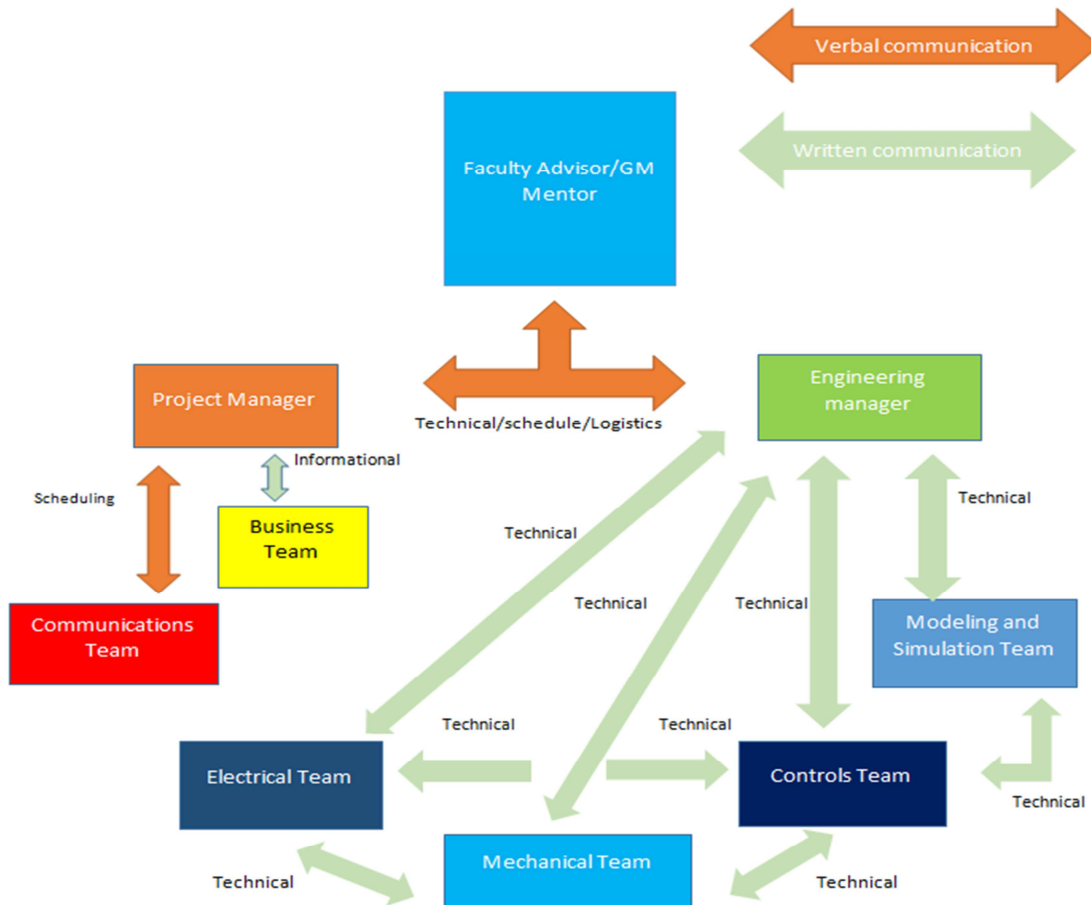


Figure 5: Proposed communication structure

The Project Manager handles primary communication with the Communications and Business teams. As these teams tend more towards the extroverted types, it is recommended that the majority of this communication be verbal. The Project Manager should be selected as a more extroverted personality type to ensure that this communication is effective. The Project Manager is now also able to better recognize logistical issues that may arise.

The Project Manager and the Engineering Manager are now handling communication with the Faculty Advisor and the GM Mentor. This is to ensure proper information is being relayed to the Faculty Advisor and that the Project Manager and Engineering Manager are not being bypassed. These three positions meet twice a week for lead meetings and all team member meetings. All technical, scheduling, and logistical information is discussed among the faculty advisor and Project Manager and Engineering Manager. The information flows down from the Faculty

Advisor, Project Manager, and Engineering Manger during team meetings. The information is then received by the all sub-team members. Any questions and comments can be relayed back through the communications flow chart in the mode that is most appropriate for the sender. The process above is continuous and fluid, the information chain never has a defined end.

The chart has colored different teams specific colors depending on where they tend to be on the Ambivert Personality Continuum Scale (see Figure 3). These positions will vary based on individual team members, but a pattern of personality traits usually tend to stay in these positions. These positions can change and may result in team's communication flow needing to change along with its recommended mode of communication techniques. For instance, the written communication and verbal communications between certain teams may change, depending on the most effective method for specific team members in a particular position.

Conclusion

The group dynamics and intra-team communications of the ERAU EcoCAR 3 sub-teams have been analyzed using an Ambivert Personality Continuum Scale based on observed behavior. Inefficiencies and communication types likely to be inefficient based on personalities were observed. A new communication structure has been proposed that re-orientes communication flow and changes recommended types to correlate with the observed personality profiles. This new structure is expected to improve team efficiency when implemented moving forward through the EcoCAR 3 competition.

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