Communicating Teamwork?
A Student View of Learning

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***Abstract**: In the engineering industry it is apparent that the future of project work is becoming dependent on teamwork and the ability of engineers being able to adapt to working in teams. To emphasise the importance of understanding and developing teamwork skills, first year engineering students were introduced to aspects of teamwork in a combined Design and Communication course at one Australian university. Students were introduced to the practicalities of team work through in class exercises, bibliographic research, critical reading, discussion and assessments. Students were also introduced to theories which can be applied to assist in understanding different people's personality types, learning styles, needs and motivations and as tools to ensure effective teamwork. This paper is an examination by one these students of his experience in the course and in particular his understanding the use of Myers-Briggs Personality Indicator to assist students in their learning in teamwork.*

Introduction

The engineering industry continually adapts new methods of productivity and currently teamwork is one relatively standardised means for completing projects, as well as ensuring efficiency and positive project outcomes. To emphasise the importance of these concepts, first year engineering students were introduced to aspects of teamwork in a combined Design and Communication course at one Australian university. Students were introduced to the practicalities of team work through in class exercises, bibliographic research, critical reading, discussion and assessments. The approach used was grounded in social constructivism and 'scaffolded learning' (Wood, Bruner & Rose, 1975) , beginning with the student's prior experience and knowledge of teamwork then devising and facilitating learning opportunities from which students could build on their knowledge. The final learning aspects involved undertaking two major communication projects, in teams of five or six members, in which students were required to research and discuss the application of different theories to further their understanding of developing effective teams in engineering.

The stereotypical image of a conservative engineer is one who sits behind a desk all day and oversees tradesmen from an office above a work site. Little importance has previously been placed on the relationships between the tradesmen, clients or even fellow engineers within companies that follow these customary practices. These traditions have steadily been changing over the last few decades with a greater importance being placed on teamwork as well as collaboration with other, non-engineering, members of a company (Taninecz, 1996). Current industry standards not only require graduates that are capable of applying their field of knowledge to engineering projects but who can also work competently within a multifunctional team (Coates et al, 2007; Chan et al, 2001; Thompson, 1996). Chen and Lin (2004) insist that for a successful multifunctional team, team members have not only the

knowledge in their own functional department, but also have some knowledge in other functions.

Chen and Lin (2004) also identify five characteristics of members from a successful team as being functional expertise, teamwork experience, communication skills, flexibility in job assignment, and personality traits. In many cases, it is likely that personality differences are the most misunderstood of the five characteristics. To assist in the understanding of personality differences, which may affect individual approaches to working in teams, students in the course were asked to examine the Myer-Briggs Personality Type Indicator. Students were also required to investigate two other theories relating to aspects of human behaviour in order to be able to apply critical reading and analytical skills to research discussions.

This paper briefly discusses the importance of teamwork in engineering and the primary author's experience, as a now second-year undergraduate engineering student, of which teamwork issues have been covered extensively alongside considerable experience in tasks involving teamwork throughout course work. A first year course introduced students to a range of theories (or tools); and associated exercises were devised to assist them in understanding and developing skills relating to teamwork. Three diverse theories were investigated; Maslow's Hierarchy of Needs which prompted students to examine peoples needs and motivations, Kolb's Learning Styles to facilitate students understanding of how people may learn and the Myer-Briggs Personality Type Indicator. This discussion focuses on how an understanding of Myers-Briggs Type Indicator (MBTI) can be used, by each team member, to accommodate for the personality dynamics that may otherwise cause problems in teams. Students were asked to complete a MBTI survey and the results are also discussed in this paper. The discussion concludes with comments from the principal author's class colleagues on their individual experience and impressions of using MBTI.

Importance of Teamwork and Engineering

As engineering companies strive to complete larger engineering projects, an increasingly higher dependence is being placed on teamwork to accomplish these works within a reliable time frame (Coates et al, 2007). Companies have quickly come to realise what benefits can be gained in team-based projects. Taninecz, (1996) claims that team-based projects can increase corporate revenues of newly introduced products, for example, studies of companies within the five years prior to the research show revenue increases from 10% – 18% up to 30% – 50% following the introduction of team work.

If a company is to meet success however, engineering teams must also extend themselves so that they meet the needs of the client, company and each member within the team by forming strong relationships (Taninecz, 1996; Varvel et al, 2004). 'Interorganisational Teamwork' is the collaboration and cooperation between project members, contractors and clients in a manner that allows each participant to feel that they have made a significant contribution towards the end goal (Chan et al, 2001). Taninecz (1996) suggests that successful project completion is due to a combination of a team's ability to understand the company's goals and the client's needs and most importantly, one another within the team. It is through a team's successful application of inter-organisational teamwork that engineers will be able to stand out and achieve success. For this reason, the engineering industry is constantly seeking graduate engineers that meet a list of skills which not only include the technical 'know-how' of their field, but also the ability to form friendly business relationships with other employees and people outside of the company.

Myers-Briggs Type Indicator in Engineering and Teamwork

A large degree of a team's ability to successfully apply inter-organisational teamwork to a project depends on the individual team members working together without conflict or misunderstandings. The leading problem of bad teamwork is predominantly due to the internal dynamics of teams themselves. Culp and Smith (2001) has identified 'poor communication' as 'an overly broad label for a range of

personality differences that can create tensions and misunderstandings between project personnel'. As the industry pushes engineering teams to increase efficiency and decrease project time schedules, personality dynamics will start to emerge as a common problem. Bad team combinations would not occur so frequently if team members were taught how to recognise the personality traits of themselves and of each other.

As explained on the official MBTI website (2009), psychiatrist C.J. Jung was the founder of the theory behind MBTI. Jung realised that particular human behaviours could be used to classify people. Isabel Myers and Katherine Briggs continued Jung's work by creating a reliable tool that could be used to categorise individuals based on the theories that Jung had proposed. MBTI breaks down an individual's personality into four distinct preferences where each preference is further broken down into two poles. Most individuals will normally exhibit behaviours that will place them closer to one particular pole for each preference. The respective poles of each of the four preferences are:

- Introversion (I)/Extraversion (E)
- iNtuition (N)/Sensing (S)
- Thinking (T)/Feeling (F)
- Judging (J)/Perceiving (P).

The I/E preference determines how individuals orientate themselves around others. An individual may prefer to spend their time living in the physical world and interacting with people around them (E) while others may spend more time inside their head, slightly separated from reality (I). The N/S preference determines the process by which we prefer to take in information. Individuals may prefer to see the 'big picture' when learning something new (N) while others may prefer to process the smaller details before seeing how all the combined ideas will come together (S). The T/F preference determines the criteria that we prefer to base our decisions on. Some people make decisions that usually follow a logical and sometimes impersonal pattern (T) while others may consider how they feel about a situation and how their decision may impact on others (F). The J/P preference determines how we coordinate ourselves with the world around us. Some individuals like living spontaneously and leaving their options open (P) while others will prefer to keep themselves organised and prepared ahead of time (J).

A combination of the four favoured poles from each preference is combined to give a four-lettered anagram of the personality type within MBTI. For example, an individual might result in having the pole preferences Extraversion, iNtuition, Feeling and Judging resulting in the MBTI type; ENFJ. Each MBTI type has unique characteristics that explain why people behave and think in different ways. Understanding MBTI may allow individuals to understand themselves more wholly and help to identify areas that may be lacking in comparison to the stronger aspects of their personality. By identifying strengths and weaknesses, an individual may be able to address limitations and improve their capacity. Importantly, understanding MBTI may provide team members with insight into potential reasons on behavioural differences of others within the same team. It should be noted, however, that while MBTI is a useful instrument, it remains a tool which can not be solely relied upon when determining an individual's personality.

Culp and Smith (2001) identifies many real life situations in which MBTI provided a means of clarifying the cause and solutions to a problem. One particular example explains how an engineer, as the project manager with strong extraversion and feeling preferences, was able to easily gain the trust and respect of clients when acquiring projects for a consulting firm. This engineer also had an intuitive preference and could easily plan out the conceptual phase of a project with the client. However, once the project was secured the engineer appeared to lose interest, when the finer details of the project became the focus, resulting in project deadlines not being met. A solution was found whereby an assistant project manager with strong sensing and thinking preferences was assigned to help complete the detailed work and keep the project 'on track'. This solution also allowed the project manager to focus on maintaining the relationship with the client; thus optimising both individual team members' particular skills.

Awareness of one's own MBTI type as well as the personality types of others may bring understanding of why people behave and perceive things differently from one another. A mutual understanding of MBTI types can therefore be used to solve differences and progress team growth beyond what may normally be considered possible (Varvel et al, 2004). Culp and Smith (2001) found that a surprisingly large majority of the engineers selected for a survey in the US are comprised of the ISTJ (23%) and INTJ (14%) personality types, although they are not exclusively limited to these types. Culp also found that over 50% of the 218 engineers tested had thinking and judging preferences. It is also commonly known that engineers are typically introverted people. As Thompson (1996) states, "[Engineers] are often 'lone eagles' who have been schooled to tackle projects on their own terms. They are uncomfortable with the collaborative nature of team work because it asks them to function in a mode that is not instinctual to them." Understanding that a stereotypical engineer will exhibit these characteristic tendencies, the formation of engineering teams may be planned to ensure that individuals with these typical preferences will be balanced with engineers who exhibit alternative preference types.

White and Leifer (2007) affirm that 'the right combination of members to be included within a team is very difficult to specify, and therefore a significant challenge exists in forming a good project team.' Chen and Lin (2004) also clarify how a combined mix of personalities makes for the most effective performance within a team. He identifies how a balance of personality types can complement the strengths when two or three preferences are shared in common between team members. Teams who can recognise the preferences of each member can utilise each other's strengths to overcome problems that could be overlooked if the team was consisted purely of individuals with the same particular set of MBTI preference. Chen further states that individuals with either sensing or intuition preferences as well as thinking or feeling preferences can be beneficial to one another as they are capable of using their preferred function at a heightened level.

Myers-Briggs Type Indicator and First Year Engineering Students

In an attempt to better prepare engineering students for the Australian engineering industry, the importance of engineering and teamwork was taught as part of the level one course. A brief introduction of how MBTI may assist a team's ability to work effectively was included in the course. To better understand the composition of the students within the Design and Communication course, 217 subjects were asked to complete a simple MBTI test that was freely available on the internet. The students were also provided the opportunity to use this new understanding of themselves and their friends as they completed assignments in groups.

The results of the MBTI testing, as represented by the pie chart in Figure 1, display a relative predominance of ISTJ (16%) and INTJ (14%) personality types among the first year engineering students. These results correlate with those gathered by Culp and Smith (2001) where it was found that among a survey of US engineers, the majority consisted of ISTJ (23%) and INTJ (14%) personality types. It should also be noted that the results gathered from the first year engineering student group may differ significantly in the senior years of their degree. It is hypothesised that the results will become more defined toward the ISTJ and INTJ personality types due to the nature of engineering being more suited to these preferences, and the possibility of student retention in engineering studies also reflecting these preference types. Interestingly, the results of a similar albeit more intensive study, to the study discussed here, conducted at the University of Nebraska-Lincoln (Varvel et al, 2004) revealed similar preference dimension bias among engineering students. The Nebraska study was conducted with final year engineering students who were completing team based design projects. Results indicated that the "average' final year student exhibited ISTJ preferences, of introversion, sensing, thinking and judging, a finding consistent with the hypothesis presented here.

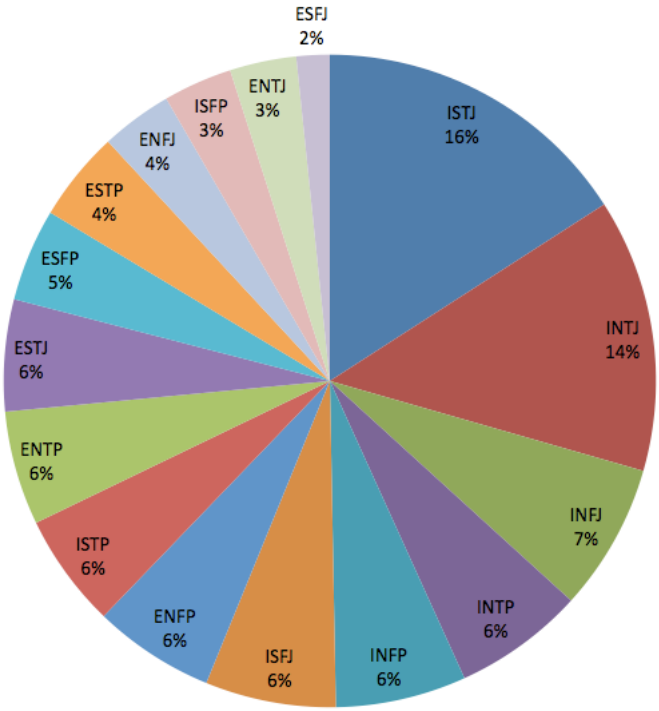

Figure 1: Percentages of Myers-Briggs Types among First Year Engineering Students, 2008.

Students undertaking the first year Design and Communication course initially had mixed reactions to the task, of investigating teamwork and engineering in relation to the three theories nominated, including some cynicism on the usefulness of undertaking a MBTI test.

"What's the point of doing this (MBTI) test? If I do it again next week I will get a different answer."

"I continue learning of human diversity all the time and in a way that is more explicit and practical than any assistance either Myers or Briggs (sic) ever provided."

However, after completion of the tasks and despite some dissention;

"The only possible advantage that MBTI has is helping someone to understand just how diverse humanity is. However, if you really need Myers-Briggs to help you with that, you're living with your head in the clouds."

students were much more open to possibilities that some knowledge of theories that may assist in understanding the varying needs, motivations, learning styles and personalities of both themselves and others as well as the potential application of this knowledge to improving team efficiency.

"MBTI has helped provided insight into many of the teamwork situations that were encountered during the completion of our robotics project (a project undertaken in the subsequent second year semester) *and assisted in understanding between members of the team."*

"…in a team, one must learn to be "all things to all people". If someone else is emotionally driven, I must learn to communicate emotions and become in tune with their emotions. Just because I am not by nature emotionally driven, that does not mean I cannot become that way."

"[MBTI] could be beneficial if you know what personality type [team members] are before you work with them but rarely do you see people exchanging personality types so they can go off and read about them. It's hard to tell to begin with cause(sic) they can be pressing all the right buttons according to you then half way into the project they become more [like themselves]."

"[MBTI] hasn't helped in the way of changing what I do, but it is interesting to read up on it and see how well it fits you. Some things you try hard not to believe but chatting amongst friends they're quick to inform you, [how] much like that personality type [you really are]."

Conclusion

It is apparent that the future of engineering is becoming dependent on teamwork and the ability of engineers being able to adapt to working in teams. MBTI offers one alternative in introducing the importance of teamwork and an understanding of personality differences which may assist engineering students develop necessary people skills. While MBTI is not a definitive solution in developing the proficiency and understanding needed for the industry, it can still be considered useful as an aid for engineers.

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