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# Students Perception Towards Using a Creativity Competition to Build-up Teamwork

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## ABSTRACT

A focus group was carried out with students in the 3rd year of Mechanical Engineering, Computer Aided Design and Product Development Design undergraduate degrees, to test their perceptions of developing teamwork skills through participation in a simple creativity competition.

## BACKGROUND / CONTEXT

Teaching approaches have a high impact on students' learning. Traditional approaches in engineering courses produce graduates with high technical ability and, in the majority of cases, teamwork and communication skills are either limited or neglected (Kamarudin et al, 2012, Halizab and Zuwawi, 2015). For this reason, engineering courses should be revised and modified to incorporate learning and design techniques, where communication skills are essential in developing strong working relationships and achieving operational goals. Skills, such as critical thinking, collaborative skills, connectivity and creativity, are essential and must be developed by students in the higher education (Breivik, 2005), with research finding that these skills can be enhanced by undertaking teamwork activities.

Unfortunately, the majority of the academics in the area of engineering tend to be appointed focused on knowledge, research capabilities and number of publications, rather than on the ability to teach and pedagogic practices (Kamarudin et.al, 2012). As engineering educators, we need to produce graduates that are capable of solving problems and we need to enhance and promote teamwork, creativity and critical thinking among other skills. As an example of how to enhance these skills, a creativity competition was introduced to a multidisciplinary third year module at undergraduate level which involved Mechanical Engineering, Computer

Aided Design (CAD) and Product Development Design (PDD) students. To evaluate their perceptions towards the activity, 8 students with differing demographic backgrounds, such as age, potential future career and student origin, i.e. home student, EU or international, were invited to participate in a focus group.

Questions in the focus group followed the AIDA Model of Information Processing (i.e. Awareness, Interest, Desire and Action) and a qualitative approach was used to analyse the results. The most significant finding was that, in general, mature students were able to perceive the benefit of the competition to build teamwork skills, whilst younger students focused on the fact that the competition did not reflect individual capabilities. They also did not take the opportunity to challenge themselves, in terms of their project management and communication.

## LITERATURE REVIEW / RATIONALE

The purpose of this research is to provide students a relaxing and fun task to explore their creativity and built their team-workability to build a strong relationship for future complex work assessment as part of the module.

For a team to be effective, not only are communication and social skills required but motivation and the ability to develop trust are also essential (Sharma and Mishra, 2009). To demonstrate this, Gilbert et al, (2017) listed the soft skills required by scientists and engineers to promote teamwork, with moral trust, emotional intelligence and strategic thinking highlighted as the most important skills for effective collaboration in a research team.

However, the focus on 'soft skills' pre-dates the 21st century – accreditation criteria, for engineering programmes in the United States, specified the inclusion of not only a 'broad education necessary to understand the impact of engineering solutions in a global and societal context but also the 'ability to function on multi-disciplinary teams' (Vanasupa et al, 2009). Developing this theme, these authors developed a Four-Domain Diagram, which included both left-brain associated (cognitive and psychomotor functions) and right-brain associated factors (social and affective functions), which, they posit, combine to stimulate student interest, autonomy and perceptions of overall value of an activity. On applying this model to engineering, the factors translate to systems thinking, understanding, engagement / active learning and moral / ethical development (ibid), which, the authors specify, correlate to student perceptions of relatedness and mastery, which, in turn, are positively correlated with motivation.

They do warn, however, of the need for 'sufficient instructor support' or 'scaffolding' for the learning process, both in terms of the academic content and also the management of the

group process. Where these are not perceived as adequate, they found that the impact of the group learning process was reduced (ibid, 2009).

Additionally, Nisbet et al (2016) identified a gender difference in initial group-participation roles. They found that equal-gender inclusion, both in courses and group-work, had a significantly positive impact on the experience in both, with males, initially, recognising that female group members rendered the process more efficient and managed. However, this study identified that this impact was transitory and, by the second trimester of the study, female participants not as eager to undertake heavier group roles, thereby engendering, in participants, a more equal attitude towards gender inclusivity and balance.

It is evident, then, that incorporating group-work, involving diverse teams, in engineering education can assist students in developing a wide range of skills, which are not limited to the activities which are incorporated. However, Gross et al (2018) highlight that 'their success may not be a one-size fits all' approach – these authors refer to previous experiences influencing participants' perceptions, whereas Lee et al (2018) introduce the notion of Emotional Intelligence (EI), which, they state, is strongly correlated with teamwork skills. The competencies they cite as components of EI are self-awareness, self-regulation, motivation, empathy and social skills, which reinforces the factors involved in the Vanasupa et all 2009 study. However, Lee et al (2018) recognise that 'empathy and interpersonal interactions are not conventional topics in most STEM undergraduate' programmes and they recommend further investigation to address this deficiency.

Overall, then, inclusion of team-work activities appears to be a highly topical subject in engineering education, with the effects, where positive, being wide-ranging, with benefits outwith the academic realm. However, in order to be effective, instructor input, to both content and group-work procedure, appears to be the extremely influential.

## AIM AND OBJECTIVES / RESEARCH QUESTION(S)

This study aimed to:

- Establish baseline perceptions of teamwork, communication and creativity in target group
- Determine gaps identified in current capability levels
- Assess impact of initiative in which students participated
- Determine influence of this activity on future practices
- Assess influence of gender stereotypes in operation, if applicable
- Identify any cultural differences in all of the above

## METHODOLOGICAL APPROACH

In the module activity, students were encouraged to participate in multidisciplinary teams of 6, in order to conduct the creativity activity. Students selected an egg drop challenge, where sustainability, volume, mass and creativity were the main parameters to consider. The activity also included the development of a poster with the purpose to demonstrate communication skills by inviting the university community to attend the challenge.

To evaluate perceptions of the overall activity, a focus group of 8 students, including different ages and nationalities, was conducted in order to obtain and compare their perception towards teamwork and if the selected activity which was considered a simple and fun task could help them build and enhance their team relationship for future teamwork in more complex activities.

Table 1 shows participants' demographic details. The session lasted around one hour, which commenced with a set of projective techniques (Appendix). Questions were structured around the basic communication Model AIDA (Awareness, Interest, Desire and Action) and data was analysed using Thematic Analysis.

Table 1. Demographic details of participants in the focus group

| | **Age** | **Gender** | **Nationality** | **Degree** |
|---|---|---|---|---|
| 1 | 31 | M | Scottish | Mech Eng |
| 2 | 20 | F | Danish | Mech Eng |
| 3 | 20 | M | Scottish | Mech Eng |
| 4 | 20 | F | French | Mech Eng |
| 5 | 27 | F | Scottish | CAD |
| 6 | 40 | F | British | CAD |
| 7 | 30 | M | Scottish | CAD |
| 8 | 21 | F | Spanish | Product Design |

This represents a qualitative approach, which involves questioning ***knowledgeable*** respondents individually, or in small groups, regarding the **'why'** of behaviour. However, whilst this type of research is very interesting, the main limitations should be considered; i.e.

**a) the comparatively small number of respondents involved**
Participants are selected to take part on the basis of their attitudes or behaviour, in order that both can be probed. However, only a small number will do so, thereby representing a large class – but this is justified, due to the deep probing that qualitative techniques allow;

**b) the high degree of subjectivity**

There is no way to separate the researcher from the research – and as the researcher is also an employee in the university, the potential for bias is high. However, this can be controlled, to a certain extent, by making use of a structured set of questions and by recording interviews.

Thus, whilst the findings are of great interest, care should be taken if the findings are to be projected to a wider group.

## KEY FINDINGS

- The majority of the students felt that teamwork was extremely important but, at university level, it can be a highly problematic as not all members make the same effort
  *"Group assessment may be unfair as not all team members put in equal effort to the project"*

- A distinction was made between younger and mature students, with older students feeling that they have to 'take charge' and manage the process, with the younger participants agreeing that this tended to happen
  *"I lost my temper in the end with some of the team and told them that they should just get on with it"*

- The majority of groups worked in a collegiate and democratic fashion, giving each team member their say, ignoring those suggestions with no valid justification
  *"We did it as a group – but some of the team were not of the right mind-set, just suggesting things with no backing or evidence to justify it"*
- All participants were aware of the need for effective communication skills, as well as those of time management and organisation
  *"You can be the brightest person around – if you can't communicate, you won't go far"*

- The majority of the students felt that teamwork is not something that can be taught – they perceived that only experience creates that skill
  *"Teamwork is not something you can teach – managing that process only comes with experience"*

## DISCUSSION

Despite students being encouraged to build multidisciplinary groups with the purpose of having different points of views due to different degree backgrounds, students preferred not to take this advice, choosing to work within their common timetable. This meant that

students within the same degree would be on campus at the same time. Only 2 groups out of the 12 groups were formed with members from the three disciplines and these were formed by Erasmus students living in the same accommodation. Results showed that these groups, formed by French, Spanish and German students, aged 20-22, performed better regarding final project outputs and communication skills, not only on the creativity competition but also in the more complex activities scheduled later on in the term. They also indicated that they were satisfied with the whole experience; i.e.
*"I really enjoyed it – it was challenging and intellectually stimulating"*

It did appear that, from the outset, participants attempted to work in a collegiate and democratic fashion, giving each team member their say. However, students highlighted that some members of the group simply made suggestions, without providing any justification, and these were ignored. 9 out of 12 groups that were consolidated established regular meetings where ideas provided by each member were analysed before a decision was made; i.e.
*"It was fun and I was able to work out how to get my team meshing well together so that we can be a well-oiled machine for future projects. Really worthwhile"*

Despite the easy task involved for the creativity competition, in order to build-up teamwork, it was observed that 7 out of the 12 groups took an easy route and delivered a product which was not reflective of the skills of a level 9 student (Level 9 in Scotland is equivalent to level 6 in England). They replicated past activity / experience, rather than applying engineering knowledge. However, the remaining groups (5) did made calculations and created different prototypes. CAD and PDD students described the activity as challenging due to the calculations involved but they did feel that this was achievable.
*"It was interesting to apply knowledge from the engineering field for calculations to apply formulas, materials and thinking about the way a real product would be developed in real life"*

The main reason that creativity suffered in 7 out of the 12 groups was because of the lack of input from all group members and the prevailing attitude was just to 'get the project done on time' and this approach was more prevalent in groups formed with 100% young members.
4 out of 12 groups had a team member with a dominant personality who acted as the 'leader' and seemed to made decisions autonomously. Because of this, a good idea could be rejected, with the individual who generated it receiving no credit as the group chose not to take it forward. This issue caused friction between group members, especially the young students, who preferred to step back and make no contribution; i.e.
*"Communication between group members was not always the best for making important decisions using Facebook - sometimes there were long response times"*

7 out of 12 groups with a mix of mature and young students struggled to communicate and make decisions. 49 students of 82 (60%) mentioned that from this first group exercise, they learned a lot in terms of managing the group dynamic and assessing the strengths and

weaknesses of fellow students, with this information being used when making choices of groups to join for the next teamwork assessment. However only 25 of the students (30%) mentioned that they were happy with their teamwork, indicating that they were able to solve their communication problems, resulting in them continuing to work together for future assessments; i.e.
*"It was great fun and a good starting point to start working as part of a team"*

10 out of 12 mature students perceived the task as a good way to build-up teamwork as it was a fun activity and an opportunity to understand the dynamic of the group. It must be highlighted that 25 of the students (30%) were involved in a similar task in primary school, and 20 out of these 25 students repeated the same product as was delivered during their primary studies rather than challenging themselves to apply all the knowledge gained along three years of study. By comparison, 57 students out of the 82 were undertaking the task for the first time and they did apply engineering concepts.

## CONCLUSIONS & RECOMMENDATIONS

- The creativity competition approach was better than 'chalk and talk', as students felt it provided an opportunity to be creative and to 'see how ideas can work in practice'.

- 10 out of the 12 groups agreed that the easy task assigned allowed students to work in a more relaxing environment, improving teamwork ability.

- If the groups had worked well, teamwork would have led to a better project but, where difficulties arose, this impacted on the overall performance.

- The majority of the students mentioned that "teamwork is not something you can teach – managing that process only comes with experience" so, with a view to future recommendations, it is clear that it is important to provide students with advice not only on teamwork but also on how to manage conflict in order to enjoy the teamwork experience

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## APPENDIX

Questions set-up for the focus group following AIDA approach

### Awareness

So, generally, how do you feel about teamwork? Experiences?
Communication – is that important in your future degree area? In what way?
Creativity – is that important? How / in what way?
Do you think that those are graduate attributes for your industry? In what way?
Tell me about the challenges involved in creativity Competition
Had you done this challenge before? How did you feel about it?
So how did you change it for 2018?
Did you see how your development would benefit from it? In what way?

**Interest**

How were your groups formed? Did you consider cross-disciplinary groups?
Self-Directed Learning – so how did you start the task off? Individually or as a group?
What worked well?
What would you change?
Did you learn anything from it?

**Desire**

Problem-Solving / Decision making – what happened when you had group discussion?
Did this lead to better results?
Or would you rather have done this on your own?
Overall, did this stage improve the process / outcome? In what way?

**Action**

Final result: how did it all work out?
How do you feel about your teamwork skills, now that it's over? Have they changed in any way?
Your communication skills?
How do you feel you learned from this task? Better than chalk and talk?
Would you recommend it to other lecturers / modules? What would you say?