

GovHack: An engineering assignment

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Introduction

The complexities of the changing work environment that graduate engineers will be working in, is at front of mind when putting together curriculum and educational activities for students studying for a professional degree. There is an ever-increasing demand on the academic to develop authentic assessment items (Cavenett, 2017; Li, Öchsner and Hall, 2019) and provide opportunities for students to develop the professional and personal attributes (communication skills, agreed values and positive and respectful attitude) required to effectively work in teams (Missingham and Matthews, 2014). This challenge requires the academic to search for non-traditional avenues of providing these experiences. Scaffolding the learning and growth of the student using a pedagogical approach that takes into consideration how the student processes the information (Boles *et al.*, 2010) to achieve the identified learning outcomes is also required. This paper reports on two years of such an attempt through the *GovHack* weekend event.

GovHack is an event run by volunteers across Australia and New Zealand (26 and 29 locations in 2018 and 2019, respectively) and supported by government agencies to make their data more open and usable for decision making. These agencies identify challenges they would like the participants to explore, which are presented on the Friday evening of the event. The participants have until 5PM on the Sunday to submit their solution to the challenge.

A research framework has not been set up and no formal ethics approval has been obtained to measure the efficacy of this approach over the two years that the *GovHack* has been used as a compulsory assessment item in the Engineering Research Methodology (ENG403) course in the engineering curriculum at the University of the Sunshine Coast (USC). This is a required course in two of the disciplines offered at USC (Civil and Mechanical) and is programmed in the third year as a core subject. In the absence of a research framework this paper presents the authors' experience and observations of the students in the *GovHack* events over 2018 and 2019.

Background

A hypothesis has been framed that the experiential learning environment of the *GovHack* event will enhance the learning outcomes for the students undertaking the ENG403 course (Figure 1). The objectives are informed by the Engineering Stage 1 Competencies engineering students needs to master before commencing their Capstone project (EA, 2017):

1. an appreciation for the multi-disciplinary nature of the tasks they will be required to undertake as a practicing engineer,
2. the confidence to clearly articulate a problem statement and range of alternative solutions,
3. the skills to identify relevant data to address the problem, bring datasets together, assess its quality and apply appropriate analyses techniques, and
4. demonstrate the ability to work effectively in a group environment.

GovHack was introduced into ENG403 in 2018 as an assessment item weighted at 40% of the course. The first offering was the first introduction to *GovHack* for the lecturer, engineering support staff and students. Some of the engineering staff involved had previously been exposed to the Techstars Startup Weekend environment as an experiential

learning experiment to develop entrepreneurship skills in students (Fairweather *et al.*, 2017). The staff felt equipped with sufficient knowledge from this experience to prepare the students to successfully compete in the *GovHack* event and meet the requisite learning outcomes.

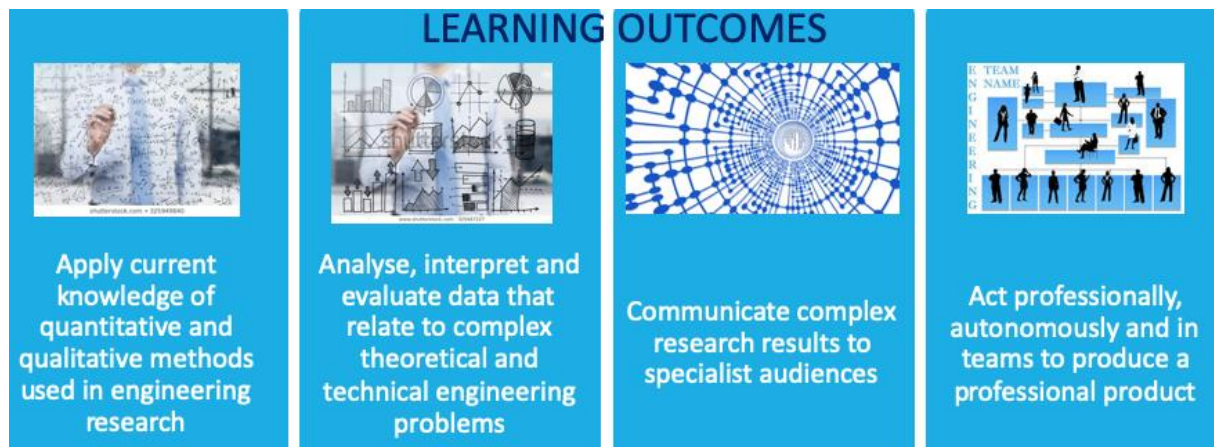


Figure 1. Learning outcomes for ENG403.

The first event in 2018, proved to be a rich learning environment for the staff, as much as for the students! In hindsight, the preparation for the students to participate in the event was minimal and there was no framework provided for the students to effectively engage in group work. Students were able to self-select into teams prior to the commencement of the event and advised of the advantages of including external participants in their teams. However, only two of the teams formed by the USC students included outside participants. As well as the USC students there were a small number of external participants (12), with 10 of these coming from the local primary school. The teams from the local primary school also combined into two teams without any external participants.

Assessment

The intent of incorporating the *GovHack* event into the third year, ENG403 course, was to develop an authentic assessment task where students apply knowledge of engineering research processes and methods and demonstrate skills in data techniques. The three required assessable outputs were:

1. A technical report on the problem the group tackled, their solution and data analyses.
2. A video pitch of their 'hack'.
3. A self and peer review.

Two additional outputs were optional for the *GovHack* submission and were not assessed:

1. A source code repository.
2. A homepage if a website was developed.

The self and peer reviews were delivered through a Microsoft Excel spreadsheet in 2018 and the Sparkplus (Willey and Gardner, 2009) tool in 2019. The reason for moving to the Sparkplus tool was that many individuals ranked their team members to have each performed at the top level (rank of 5 out of 5) for all criteria with the same comments provided; this in spite of being warned they would be marked down. Students felt considerably aggrieved at this, particularly if they did well at the *GovHack* event in 2018.

The Sunshine Coast node of the *GovHack* event was very successful with the participation rate increasing by 437% with a total of 70 participants in 2018 and 69 in 2019. The student groups from USC were very successful in winning many of the prizes at the local, state and national levels in 2018. Judging has not been completed for the 2019 event. Despite this success, feedback obtained through the student evaluation process for the 2018 event

clearly demonstrated that work was required to better scaffold the students to achieve the learning outcomes that were being sought.

Based on the 2018 feedback, changes were made to the structure of the course to allow for better preparation for the *GovHack* event, which occurs in week seven of the 13-week semester. The organisation for the event in 2019 was also led by the engineering staff at USC. Though this added a layer of coordination responsibilities, it also provided more flexibility in the preparation of the students.

Three local organisations (the Sunshine Coast Council (SCC), Regional Development Australia (RDA) Sunshine Coast Inc and the urban institute [ui!]) provided sponsorship totalling more than \$3000 for prizes and catering in 2019. The SCC also provided funding for several pre-event workshops to better prepare participants to effectively engage in the activities of the weekend.

The course content is covered in a 13-week period in semester two, through a weekly two-hour lecture and two-hour workshop. This workshop is repeated to accommodate the total cohort. In 2018, the lectures and workshops were delivered by two sessional staff, but in 2019 the course coordinator delivered most of the content with several guest presenters covering some of the content.

Pre-event workshops - 2019

The first workshop supported by SCC was embedded in week five of the course during the timetabled workshops. These two-hour workshops were held 1.5 weeks prior to the *GovHack* event with a follow-on four-hour workshop on the subsequent Saturday (one week prior to the *GovHack* event). As these workshops were supported by the SCC they were open to the public and the Saturday event attracted mostly external participants.

Group work scaffolding

In 2018 it was evident that students were not adequately prepared for the group work required to be effective in *GovHack*, particularly around setting up the ground rules for group participation, developing a shared expectation for group performance and giving thoughtful and constructive feedback after the event. In 2019, a workshop was delivered to scaffold the students for effective group work. This workshop was based on the UTS group work charter tools (Federman Stein and Hurd, 2000) and a series of questions developed for each individual to work through, before coming together to agree on a group charter to guide their activities for the entirety of the assessment.

Results

In 2018 there were 14 teams based at the Sunshine Coast venue. The participants included 58 students from the ENG403 course who were required to attend as part of their task 1 assessment and these students made up 12 of the 14 teams. A total of three external participants joined two of the USC student teams. The remaining two teams were made up of students from the local primary school. The number of students enrolled in ENG403 in 2019 increased by only one to 59 and three external participants joined two groups. In 2019 a total of 69 participants registered for *GovHack* with seven of these being from the local primary school. The USC students formed 15 teams. The mode of the group size for the USC student teams in 2018, excluding external members, was four, and the mode in 2019 was five. Across both years the team size ranged from three to seven (Figure 2).

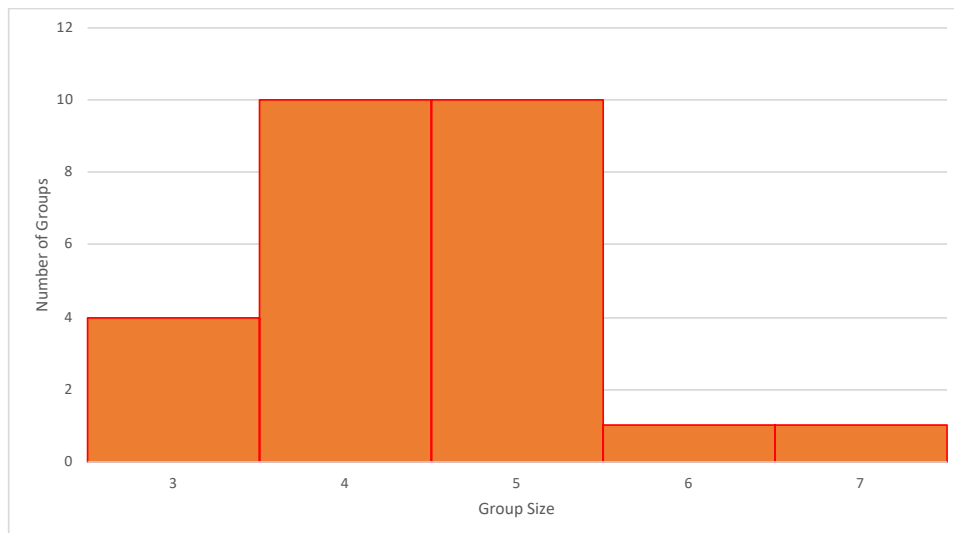


Figure 2. USC student group size distribution from both 2018 and 2019.

The response to the preparation workshops was mixed; the engineering students had not been exposed to much of the material covered (eg. version control tools (github) and programming in JS). In contrast the external participants appeared to have a much higher level of understanding of these tools, which are typically used in a *GovHack* event. During the course the engineering students had been receiving tuition in Excel, Matlab and R through the RStudio environment, however, this was focussed more on the analyses side of the tasks, rather than data capture, data fusion and building interfaces (apps or web pages). Anecdotally, some of the students seemed overwhelmed that they would be required to master these skills prior to participating in the event. It was reinforced to the students that for their assessment the important focus was on using tools they were familiar with to demonstrate they had achieved the required criteria in relation to data analyses.

It is hard to measure the impact of the preparatory workshops beyond the observation that in 2018, only three of the 12 USC teams completed a homepage URL, while five of the 15 teams registered a homepage in 2019. In 2018, 10 registered a source code repository which increased to 12 in 2019.

The group charter document was set up as a form in Microsoft Forms and once submitted was reformatted into a word document, which was posted onto the learning management system (Blackboard) for the student groups to review and finally agree on and convert to a pdf document. The usefulness of this exercise was assessed through the inclusion of a 5-point Likert scale question: “Our team found this a useful exercise for setting out our expectations, common goals and ground rules for the Govhack event and assignment.” Without ethics approval it is not possible to report these results except to say that there were no responses that disagreed with the statement.

A gosoapbox™ survey was also constructed to assess the student’s understanding of how *GovHack* contributes to the learning objectives for this course. This survey was delivered one week prior and two weeks subsequent to the *GovHack* event. Again, without ethics approval the full results cannot be provided, but there was an improvement in the responses on the 5-point Likert scale.

Outputs

The challenges tackled by the engineering students were diverse, ranging from congestion management systems, waste management, active and healthy lifestyles and indigenous language support (Table 1). The diversity of the approaches ranged from developing an app, using JS or analyses in the RStudio environment.

Table 1. GovHack Outputs from USC students in 2018 and 2019 (note one of the teams from 2019 is missing from this table).

Year	Team Name	Project Name	Number USC Students	Number External Team Members
2018	The Hackermen	Congestion Management System	4	0
	Get Active USC	Get Active	5	0
	I'm Learning	Academic Connect	5	0
	Unafraid of the dark web	Healthy life	4	0
	Life savers	searching to build	5	0
	Team 200	Cleancity	7	1
	weekend warriors	Cutting the queues	6	0
	Our website brings all the data to the yard	datastat	4	2
	Team 8	weather wizard	4	0
	Running on Caffiene	Health-Hack	5	0
	The Uncivil Engineers	Go Now App	4	0
	Govhackmyself2018	ibins	5	0
	2019	Haxolotl	Quality Air	5
Helen's Angels		Project Bowtie	3	0
LMJD Pty Ltd		Jobs & Growth	4	2
Engineering Hacks		Project 517	3	0
Top Gun		CarPark	5	0
Off the Rails		Gold Coast, Southport Tram Expansion	5	0
Team 520		CoolWalk Sydney	3	0
The Step Dads		My Environment	5	0
Steve's Group		Yours Outdoors	5	0
Sunshine		Water-from source to tap	3	0
The Artful Bodgers		Åndale	4	0
TheKelliFanClub		indigi : The Indigenous Language Learning App	4	0
Triple J T		First Step	4	0
USC Innovative Engineers		AqWatch	4	0

Outcomes

The real-world nature of the challenges was ideal as it provided the students with an appreciation for the complexity associated with data manipulation, analyses and provided an insight into the use of data for decision making.

As the *GovHack* event was a required assessment item for ENG403 there was 100% participation in the event in both years. There was mixed feedback on the use of the event for an assignment with some relishing the experience (particularly those who won awards in 2018!) and some feeling very aggrieved that they were forced to give up their weekend.

Conclusions and Recommendations

The work submitted was generally of a high quality with the lowest mark awarded ~60% in 2018. The 2019 group reports have yet to be marked and some Sparkplus self and peer reviews are still outstanding. More work is required to ensure an authentic multi-disciplinary approach is taken in forming the groups. This is critical if students are to benefit from learning about team dynamics, project planning, establishing connections with external partners and networking.

In 2018 several groups who won awards were aggrieved as they felt their marks did not reflect the success recognised by the judges of the entries. However, a peer review was required, and this was done poorly by most participants in 2018. This was vastly improved with the use of the Sparkplus tool and scaffolding of the group work using the group charter document.

The intention is to continue to use the *GovHack* event for ENG403 and include a similar experiential learning opportunity in a construction subject using participation in a local Techstarts Startup weekend event as a required assessment item. A research project will be established, and ethics approval obtained to formally measure the efficacy of these types of events to improve learning outcomes. The questions that will guide the research will explore student satisfaction and engagement with the event, professional identity and engagement with the profession, employability improvement, perceived authenticity of the tasks and experiences of working in a team.

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