Gifted First Year Engineering Students – High School Curriculum Reflections

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Abstract

This paper reports on the reflections of gifted and talented first year engineering students as part of a research project looking at curriculum differentiation preferences. Students were asked to rate the effectiveness of curriculum differentiation options experienced in high school, and consider which parts of the high school curriculum worked for them. These student reflections offer suggestions to first year curriculum writers as they design curricula for a first year cohort of increasingly diverse abilities and achievements.

Introduction

A challenge for curriculum writers of first year university units is determining at what level to aim the unit. Apart from the new content, the type and amount of revision, the pace at which the content unfolds and how much can be assumed about students' prior knowledge need to be considered. The first year cohort has a wide range of abilities, achievements and experiences. Although high school leavers still make up most (60.5%) of the Australian first year cohort, the numbers of mature age students, TAFE graduates and students entering university through special access programmes is increasing (Department of Education Employment and Workplace Relations, 2008, p. 31), and they will have different prior knowledge to school leavers. Curriculum development for the writer of first year units is a challenging balancing act.

Amongst the first year cohort will be a group of students who are highly performing, have higher than average potential or learn material more quickly than their age peers. These students have often been identified as gifted and talented in primary or secondary school, and in line with Education Department Policy, would have had the opportunity to study a modified or differentiated curriculum. (e.g., [WA] Department of Education, 2009; Department of Education, 2010; Senate Employment Workplace Relations Small Business and Education References Committee, 2001). Once at university, however, curriculum differentiation for those identified as gifted and talented is rare, with the same curriculum delivered to all first year students regardless of ability. This 'one-size-fits-all' curriculum might not be of concern to gifted and talented students at university, who may be satisfied with the level of the offered curriculum (Peine, 2010). Alternatively, curriculum uniformity could indeed be a problem (Benbow & Stanley, 1996), so the challenge for the curriculum writer is to determine what would be appropriate curriculum differentiation. The voice of the student may be valuable here. Curriculum differentiation options that students found useful in high school could be considered as possible options at university.

Session Aim

The aim of this nuts and bolts session is to report the findings and implications of gifted and talented first year engineering students' reflections of their experiences of curriculum differentiation in high school.

Definition and Identification of Gifted and Talented

In Australian primary and secondary schools, the Gagné (2003) definition of gifted and talented – in the top 10% of age peers – is typically used (e.g., Gross et al., 2005; State of Victoria (Department of Education and Early Childhood Development)). Formal identification as gifted and talented, however, requires subsequent testing (Gross, et al., 2005 Module 2). Appropriate curriculum can then be developed based on the test results.

In this study students were not asked if they were gifted and talented, rather "Have you been identified as gifted and talented?" so that those who had been formally assessed as gifted and talented could be identified. Some students may not have had the opportunity to be tested, so a second question, "Do you think you are gifted and talented? (i.e., in the top 10% of your age peers)" allowed these students to reflect and identify themselves as gifted and talented.

The acronym SIG is used in this study to describe those *S*elf-*I*dentified as *G*ifted and talented. The acronym SInG is used in this study to describe those *S*elf *I*dentified as *N*ot *G*ifted and talented.

Method

The method chosen to gather the data was a survey of an entire first year engineering cohort at the end of their first semester using an on-line questionnaire.

The survey response rate was 21% (n = 767, with 162 completed surveys). Eighty five (85) of the survey respondents identified themselves as gifted and talented, and 77 survey respondents identified themselves as not gifted and talented.

Fifty (50) students experienced curriculum differentiation in secondary school: 27 at a government school, 17 at an independent/private school, 4 at schools overseas, and 2 at Catholic schools.

A summary of the curriculum differentiation options experienced by the students at high school are listed in the table below. The most frequent options were (i) acceleration and (ii) more advanced work.

High School Curriculum Differentation Options Taken	SIG	SInG
Accelerated in one or more subject	14	2
Small group with more advanced work in an average class	13	8
My secondary school was a selective school	11	1
Leadership Programme	8	3
Honours Class	6	3
Extra subjects / units	6	0
Entered high school early	3	0
Independently studying university courses online	3	0
Independent Project	2	1
Independent Study Plan	2	4

Advanced Placement	2	0
Skipped a Year or more	1	0
Independently studying university courses by correspondence	1	1
Extension class *	1	1
Awarded an academic scholarship *	1	0
I just worked ahead of the advanced class independently *	1	0

Table 1: Curriculum Differentiation Options Experienced in Secondary School (n = 50) Asterisked items were added by students in an open-ended text box labelled "Other".

All survey participants were also asked to reflect on their secondary school experiences and the different or extra options available – 'what did you find worked very well for you? What did you not like, and why?' The responses to this open question were coded and analysed.

There were 97 responses to this open question, 58 from SIG students, and 39 from SInG students. Seven themes were mentioned 5 or more times: challenge, choice / independence, one on one teacher interaction, pace, broadening, like minded peers and small groups.

Challenge

Fourteen respondents, both SIG and SInG, acknowledged the benefits of being challenged by harder content or extra work. Typical comments from SIG students: "It was better than normal class as we learnt things that are harder and more appropriate for people who are in top 20% or so", and "doing 6 TEE subjects as opposed to the usual 4 or 5 TEE subjects".

SInG students also found academic challenge favourable: "The extension program meant that I was doing a more challenging course that interested me", and "The top pathway ie. first stream in maths, science which were available were made to challenge us. Which i was fond of." Another SInG student expressed his unhappiness with lack of challenge: "I was left in a normal stream science class, which I aced effortlessly, but found very boring, and not sufficient to fulfil my thirst for knowledge."

Choice / Independence

What worked for the eleven SIG and one SInG student in high school was having more educational choice and greater independence. This included the ability to choose non-TEE subjects "Private Study period to replace our sixth TEE subject if desired, which worked superbly"; "i did materials technology as my only non-tee subject as a bit of a release from study and i loved it"; "did not work for me: packed timetable". Being able to work independently was valued: "I really liked the atmosphere of learning because i had the independence as i never felt the pressure of teachers and parents while i was learning"; "I found this independent sort of extra work useful as it allowed me to work further on existing projects and aim to better my work on a more personal level..."

One on One Teacher Interaction

Six SIG and six SInG students commented on the teaching and learning relationship they had with their teachers. The availability of one on one teacher time was important for the SIG students: "The best part of high school was the teacher interaction and so when we didn't understand something the teacher would help us". The SInG students valued their teacher's guided exercises and explanations: "I dont prefer self study as i will not get much confident

as getting information from teachers", and smaller classes which gave greater access to their teachers: "I prefered the smaller class sizes and the encouragement to work".

Pace

All eight responses (seven SIG and one SInG) highlighted the importance of being able to work at one's own pace. In one case, working at one's own pace was to avoid tedium; in another, "I found that simply giving me the chapters of a book to learn from was the most beneficial way for me to learn, where I can study in my own time, at my own pace". The response from the SInG student showed he appreciated the differences in pace among the students: "Also alot of our subjects were streamed, allowing a more competitive and motivating working environment, and allowed the more able students to work at a faster pace or higher level. These weren't really extra options, but on reflection they were very helpful." Two of the SIG students compared the pace of learning at high school with university, reflecting that pace at university is quicker than they were expecting.

Broadening

Only SIG students raised this as an area that was useful in high school. Non-TEE subjects were seen as a release, as enjoyable, as helpful and fascinating. "Music and Computing Extension classes combined with 2 LOTE classes helped me become a more rounded person by giving me skills in a broad area of subjects."

Like-Minded Peers

Four SIG and one SInG student raised the importance of like-minded peers in their high school classes. "Being in the academic extesion classes helped because I was with like-minded people, who were geared towards their school studies."

The one SInG response also highlighted the benefits of like-minded peers: "Advanced Maths and Science classes, gave me more challenging topics and surrounded by like-minded peers."

Small Groups / Small Classes

Five SInG students commented on the benefits of small classes, usually because teachers were more accessible: "small classes in government schools gave a better learning experience and more one on one tutoring with teachers". None of the SIG students commented on the benefits of small classes – their focus was more on the one on one teacher connection.

Conclusions

Catering for the needs of a larger student cohort with a diverse range of abilities and educational achievements is a challenge for first year university curriculum writers. While some principles of first year curriculum design have been well researched (e.g., Sally Kift's recent report for the Australian Learning and Teaching Council (2009)), catering for diversity is still poorly implemented. University curriculum writers could benefit from the research and lessons from a similar education setting, the secondary school, especially when catering for the best and brightest, some of whose voices we heard in this session.

Session Outline

- **Individual / Group Activity** (10 min): What do you know already about gifted education?
- **Facilitator** (5min): Overview of study and curriculum differentation options.
- **Group Activity** (5 min): How do your best and brightest cope? What has been your feedback?
- **Facilitator**: (5 min) Seven suggestions for curriculum differentiation.
- **Group Activity** (5 min): Activities to follow up when back at work …

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