Like-ability peer interactions and grouping in an engineering classroom

Jolanta Szymakowski[a].
University of Melboourne[a]
Jolanta.szymakowski@unimelb.edu.au

Introduction

One feature of an Australian classroom is the diversity among the student body. Students clustered into classrooms display a range of abilities, motivations, beliefs, previous experiences, and achievement. A recent study of 58 Victorian primary and secondary schools, the Realising the Potential of Australia's High Capacity Students (REAP) Project (Harding, Griffin, Graham, English, & Nibali, 2018), found that, for any one year level, student achievement was measured across up to 10 achievement levels. In the study, the maximum number of achievement levels seen in any one classroom was six. Catering for this diversity in student achievement levels in a classroom requires attention and intention, for under the Australian Curriculum, students are entitled to a relevant learning program no matter their level, requiring teachers to provide personalised learning (Australian Curriculum, 2019).

At the tertiary level, the student body is similarly diverse in abilities, motivations, beliefs, previous experiences, and achievement. This was particularly evident in an engineering master's unit, Engineering Practice and Communications, at an Australian university. Having discerned this diversity, perhaps applying the REAP project findings to the engineering classroom would lead to better students' outcomes. The tutor, in her second and third iteration of the unit, applied one of the REAP project findings – acknowledge the range of student achievement levels in any classroom of students - and two of the four REAP project recommendations: (i) facilitating like-ability peer interactions, and (ii) the use of online curriculum. This paper describes the observations and reflections from applying the finding and the first recommendation, facilitate like-ability peer interactions, using them to inform student grouping.

Like-Ability

Student ability and like-ability is a contentious issue in education, and a clarification of terms is needed to set the scene.

Insights into what is meant by student ability can be gained by considering the area of gifted and talented education. In the most commonly accepted definition of gifted and talented (Australian Curriculum, 2017; State of Victoria (Department of Education and Training), 2019c), 'gifted' refers to student potential or ability, while 'talented' focuses on achievements such as knowledge and skills (Gagné, 2003, 2010). A gifted student may be described as highly able, of high ability, high capacity. A talented student may be described as high achieving. A key intention of the gifted and talented classification is to recognise that, in an age-based curriculum, some students have already mastered the required age-based concepts and require an alternative, relevant, more advanced curriculum. It is not about creating an elite or superior group of students or focusing on high IQ – it is simply to drive the provision of a relevant curriculum for these students.

More recently, two trends in gifted and talented education have been noted. Firstly, early research into gifted and talented education focused more on the qualities or characteristics of giftedness that helped identify whether someone was gifted (Roeper, 2013; VanTassel-Baska, 1998). More recently, the discourse in this area has swung towards the talented or achievement side (Ziegler & Phillipson, 2012). Secondly, there is a move away from calling

students gifted and talented. These students are now described as high-ability (State of Victoria (Department of Education and Training), 2019a), exceptionally able (Department of Education, Western Australia, 2019b) or high achieving (State of Victoria (Department of Education and Training), 2019b). Achievement at a high level, rather than 'being gifted', seems to be the current focus of gifted and talented education.

This helps our understanding of the REAP project recommendation to facilitate like-ability peer interactions. While facilitating 'like-ability' peer interactions could be understood literally, suggesting perhaps students of similar high IQ, for example, be grouped together, in practice like-achievement, rather than like-ability, shapes peer interactions. Visible high achievement is taken as evidence of latent high ability.

In any group of students, there are those who achieve at the average or expected level of the class, those below and those above. For those achieving above the average level of the class, the REAP project recommended that some of their learning activities are with students who are also achieving at that same level.

Defining like-ability, like-achievement and high achievement in the engineering classroom was the next step.

Engineering classrooms – ability, achievement, constructs

In the REAP project, student achievement was used to indicate student ability. Similarly, in the engineering classroom, student achievement was used to indicate student ability. In the REAP project, student achievement was measured by an online test of the latent constructs of numeracy and reading comprehension (Assessment Research Centre, 2019). In the engineering classroom, relevant latent constructs needed to be drawn out.

Two possible latent constructs for this engineering unit were (i) engineering practice and (ii) engineering communication. The skills and knowledge developed in engineering practice deal with planning, researching, and proposing and evaluating a number of solutions for a client. The skills and knowledge developed in engineering communication focus on written reports and summaries, as well as verbal presentations, verbal summaries and contributions to meetings. Further, engineering communication needed to be in professional Australian English.

A measure for the latent construct 'engineering practice' has yet to be developed. Nonetheless, an indication of student's initial achievement level in 'engineering practice' could be estimated from the student's background. There are five typical backgrounds for students in this unit:

1. International students who already have a Masters of Engineering from outside Australia and who may have worked as an engineer outside Australia and are completing a masters in Australia to be accredited to work in Australia or other countries that are signatories to the Washington accord;
2. International students who have completed a Bachelor of Engineering overseas who seek to complete a masters to be accredited to work in Australia or other countries that are signatories to the Washington accord;
3. Domestic students who have completed a Bachelor of Engineering in Australia who seek to complete a masters to upgrade their qualification;
4. International students who have completed a non-Engineering undergraduate degree;
5. Domestic students who have completed a non-Engineering undergraduate degree.

It was assumed that the more experience a student has with engineering, either through previous work experiences or studies in engineering, the higher their starting point in the construct 'engineering practice'.

Similarly, a measure for the latent construct 'engineering communication' has yet to be developed, although there are constructs and measures for written expression (Australian Council for Educational Research, 2019; Department of Education, Western Australia,

2019a). An indication of student's initial achievement level in 'engineering communication' was more difficult to estimate – being a native English speaker was no guarantee of higher level engineering communication skills. It was thus assumed that all students began the unit with a low starting point in the construct 'engineering communication'.

Facilitating like-ability peer interactions

The engineering classroom described in this unit consists of up to 24 students who meet weekly in a two-hour workshop. Students are placed into groups of up to four that stay together for the length of the unit – a home group. The groups of four are not teams as they do not undertake true team-based learning or team work - activities can be completed even when a group member does not contribute (Bennett, Rolheiser, & Stevahn, 1991). Many workshop activities redistribute the students so they work with students from other groups. The home group is the small community of three or four that students work with for assessment purposes.

The recommendation to facilitate like-ability peer interactions was applied to group formation. Other factors also informed group formation: intended grade at the end of the unit, and previously completed engineering studies.

Intended grade at the end of the unit.

In previous semesters, students had expressed their greatest frustration as being a student who sought a High Distinction for the unit and being placed in the same group with a student who just wanted a pass (Lloyd & Szymakowski, 2017). The intended grade reflects ambition and confidence rather than ability but making this explicit in group formation helped address many students' anxieties at the beginning of the unit. Students were advised that, although they may be aiming for a High Distinction, there was no guarantee that they would achieve it.

For semester 2, 2019, every student indicated their aim to achieve a High Distinction. This factor thus played no role in group formation.

Previously completed engineering studies.

In previous semesters, students had also expressed frustration with the broad heterogeneity of their assigned group. The heterogeneity is typically justified by alluding to the engineering workplace and the diversity of engineering workplace teams, referred to in Engineers Australia's Professional Engineer Competency 3.6 (Engineers Australia, 2013). However, other student feedback has noted that

> *"group work in a university class setting is nothing like group work in real world engineering and does not develop the skills industry is looking for. HR staff complain bitterly about the 'group work' examples they hear over and over in Grad job interviews." (Szymakowski, 2013, p. 106).*

In contrast, homogenous grouping produces positive gains for the high achievers without harming the achievement of their peers (Kulik & Kulik, 1997).

In this unit, group work is for learning and assessment, unlike an a workplace group or team of various professionals (engineer, technician, linesman, manager, finance) hired to complete a project. Applying 'like-achievement' meant home groups consisted of people with similar previously completed engineering studies. This facilitated an atmosphere where group members, in their home groups, were genuine academic peers who could share and relate to similar experiences. The sharing did not stop with the home groups. For many workshop activities, students worked with others who were not in their home groups.

Australian English fluency

In previous semesters, students possessing a high level of Australian English fluency had expressed concern about being allocated to a group of poor English speakers and writers,

acting as defacto English tutors. This was also considered when allocating students to groups.

The students

The composition of the class across the two trialled semesters was similar. Around 70% of the class had already completed engineering studies at either masters or bachelor level. Twenty percent of the class were international students who had completed broad undergraduate studies and, in the first semester, the remaining 10% were domestic students who had completed broad undergraduate studies. No domestic students were present in the class for the second semester. At least 15% of the students had also worked as engineers overseas.

Results

Observing and reflecting upon student learning over three iterations of the unit, Engineering Practice and Communication, it was reassuring to note no negative impacts. The one concern was around the one or two students each semester who did not complete the unit. Rather than graduating from the unit with a low grade instead of the high distinction they sought, students opted to abandon the unit and retry in a later semester, hoping to achieve a higher grade.

Surveys

Mid semester and at the end of semester students completed a 10 item peer review survey where students are asked to rate each of their group members e.g., “This member's work for the team is of high quality” as well their own assessments “I am happy to work with this team”. The comments in the free form comment field are very telling. In the first iteration of this unit, where like-ability/like-achievement grouping was not implemented, greater dissatisfaction and much greater acrimony was expressed. The many email complaints sent to the tutor and conversations with disgruntled students about their group members corroborate this dissatisfaction. In the second iteration, students were more settled and reported fewer complaints and dissatisfactions with their group members. One group presented a complaint in the first week of semester, and once that was addressed, no further complaints or dissatisfactions with group members were noted. In the third iteration, students reported even greater levels of satisfaction.

Students were also asked to complete a short survey asking what the tutor did well and what the tutor should do in future workshops. Only a handful of responses across the two semesters was received – the one comment about grouping suggested a mid-semester shuffle of students would allow students the opportunity to develop better communication skills.

Conclusion

The findings from a recent study of high achieving students in Victorian primary and secondary schools suggested that, to support their high achieving students, teachers acknowledge the variety of student achievement contained within their classrooms, with two recommendations being to facilitate like-ability peer interactions, and to use online curriculum. The tutor of a master’s engineering unit, Engineering Practice and Communication, considered the variety of student achievement in the workshop, and adopted the two recommendations. This paper focused on facilitating like-ability/like achievement peer interactions.

No causality is implied between facilitating like-ability/like-achievement peer interactions and positive student outcomes. However, it is always reassuring to note that a change of educational practice did not lead to reduced student outcomes. Fewer group work problems were noticed, and the groups settled quickly. This and other recommendations will be trialled in later iterations of the unit.

References

Assessment Research Centre, Melbourne Graduate School of Education. (2019). ARC Online Tools [Programme]. Retrieved from https://education.unimelb.edu.au/about/educational-software-suite/arc-online-tools

Australian Council for Educational Research. (2019). Overview - Higher Ability Selection Test - ACER. Retrieved from https://www.acer.org/au/hast-secondary

Australian Curriculum, Assessment and Reporting Authority. (2017). Gifted and talented students. Retrieved from https://www.australiancurriculum.edu.au/resources/student-diversity/gifted-and-talented-students/

Australian Curriculum, Assessment and Reporting Authority. (2019, 26/10/2018). Student diversity | The Australian Curriculum. v8.4. Retrieved from https://www.australiancurriculum.edu.au/resources/student-diversity/

Bennett, B., Rolheiser, C., & Stevahn, L. (1991). *Cooperative learning : where heart meets mind*. Toronto, Ontario: Educational Connections.

Department of Education, Western Australia. (2019a). Application process - Department of Education. Retrieved from https://www.education.wa.edu.au/application-process

Department of Education, Western Australia. (2019b). Gifted and Talented - Department of Education. Retrieved from https://www.education.wa.edu.au/gifted-and-talented

Engineers Australia. (2013). *P05PE Australian engineering stage 1 competency standards for professional engineers* (P05PE). Retrieved from https://www.engineersaustralia.org.au/sites/default/files/content-files/2016-12/doc21_p05pe_ea_stage_1_competency_standards_for_pe.pdf

Gagné, F. (2003). Transforming gifts into talents: The DMGT as a developmental theory. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (3rd ed., pp. 60-74). Boston: Allyn and Bacon.

Gagné, F. (2010). Motivation within the DMGT 2.0 framework. *High Ability Studies, 21*(2), 81 - 99. doi:10.1080/13598139.2010.525341

Harding, S.-M., Griffin, P., Graham, L., English, N., & Nibali, N. (2018). *Findings and recommendations from realising the potential of Australia's high capacity students*. Retrieved from https://education.unimelb.edu.au/research/projects/realising_the_potential_of_australias_high_capacity_students

Kulik, J. A., & Kulik, C.-L. C. (1997). Ability Grouping. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2nd ed., pp. 230-242). Boston, USA: Allyn and Bacon.

Lloyd, N. A., & Szymakowski, J. (2017). Student experiences in first-year engineering classrooms – exploring issues of gender in an Australian programme. *Australasian Journal of Engineering Education, 22*(1), 23-31. doi:10.1080/22054952.2017.1365328

Roeper, A. (2013). Asynchrony and sensitivity. In C. S. Neville, M. M. Piechowski, & S. S. Tolan (Eds.), *Off the charts: Asynchrony and the gifted child* (pp. 146-157). Unionville, NY: Royal Fireworks Press.

State of Victoria (Department of Education and Training). (2019a). New Student Excellence Program: Supporting high-ability students to excel. Retrieved from https://www.education.vic.gov.au/about/programs/Pages/student-excellence-program.aspx

State of Victoria (Department of Education and Training). (2019b). Selective entry high schools. Retrieved from https://www.education.vic.gov.au/parents/going-to-school/Pages/selective-entry-high-schools.aspx

State of Victoria (Department of Education and Training). (2019c). Teaching gifted and talented students. Retrieved from https://www.education.vic.gov.au/school/teachers/learningneeds/Pages/gifted.aspx

Szymakowski, J. (2013). *Asking Genius Friend Worked: Students' Experiences of Threshold Concepts*. Retrieved from Perth, Western Australia:

VanTassel-Baska, J. (1998). Characteristics and needs of talented learners. In J. VanTassel-Baska (Ed.), *Excellence in educating gifted and talented learners* (3rd ed., pp. 173-191). Denver: Love Publishing Company.

Ziegler, A., & Phillipson, S. N. (2012). Towards a systemic theory of gifted education. *High Ability Studies, 23*(1), 3-30. doi:10.1080/13598139.2012.679085

Copyright statement

Copyright © 2019 Jolanta Szymakowski: The authors assign to AAEE and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to AAEE to publish this document in full on the World Wide Web (prime sites and mirrors), on Memory Sticks, and in printed form within the AAEE 2019 conference proceedings. Any other usage is prohibited without the express permission of the authors.