

Student Diversity: Identifying student sub-groups in an applied research subject.

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Abstract

As educators we are aware of differences amongst our students. Differences are more evident in a statistics-based course where prior knowledge, aptitude and willingness to learn vary, particularly amongst marketing students. This paper demonstrates that gaining specific feedback on attitudes to a team-based major project within a market analysis course enhances our ability to develop and track student sub-groupings. This enables levels of student engagement with the 'live' topic to be monitored, helping to maintain a balance across the groups between learning, challenge and relevance. 'Interest in the topic' is one aspect that changed most notably across the years. So while generic feedback on individual student learning is helpful, this assessment-focused sub-grouping approach allows for more specific course micro-management.

Keywords: student diversity, market analysis, sub-groups, clusters, student experience

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Introduction

As educators we are aware that there are differences amongst our students. They come into a course with differing abilities, prior knowledge and willingness to learn. Whilst a course is similarly delivered to all students, individuals will engage with a course to different extents. Student difference becomes more pronounced in a maths-based course given that students could range from having had bad past experience with mathematics to those with an aptitude and liking for numbers. Grouping students, based on factors contributing to diversity (e.g. learning styles, social styles and engagement) is useful for course planning and management as it helps to adjust and fine tune aspects of course delivery. Monitoring of the sub-group characteristics, make-up and size, over time helps to identify context specific responses to assessment. Using six years of data from a yearly survey of attitudes to a team-based major project we have been able to explore patterns of student sub-groups. To some extent the survey reflects other research on student diversity, however it was purposely designed to support teaching within this stats-based core marketing course. After briefly highlighting some of the literature addressing issues in student diversity, the learning context in this applied marketing statistics course is described. Brief details of the methodology used to form the sub-groups are given. The sub-groups are then characterised, and contextual factors shaping the individual year groupings discussed highlighting the usefulness of this approach to support course design and management.

Student Diversity

When dealing with maths-based courses, many factors come into play. Student diversity has been identified at an individual, group and situation level. Students may enter a course with individual differences, they can also “have radically divergent perspectives of the same experience” (Appleton-Knapp, Krentler 2006, p. 24). Students may have prior negative attitudes, anxiety and lack of confidence, weaker quantitative skills and an inability to comprehend the complexity involved in understanding statistics (Briggs, Sullivan, Handelsman 2004; Forster, Chua, Patterson, 2006; Reid, Petocz, 2002). These factors may pre-dispose students to be disengaged. The call has been to create ‘authentic learning environments’ (Fitzsimmons, Williams, Ma 2005) to address problems of fear especially amongst the “numerically-challenged”. Gender is an issue in shaping attitudes to maths-oriented courses, male students being more at risk of underachievement (Smith, 2004). Hu and Kuh (2002) reported that males are more likely to be either disengaged or highly engaged. International students add further complexity (Plewa, Sherman 2007).

Dimensions of student diversity identified in relation to group work include: “language skills, academic goals, external commitments, personality traits and prior relationships.” (Fitzsimmons, Williams, Ma 2005, p.3182). Other studies focussed on student perceptions of team learning experience and communication styles (Amato, Amato 2005), learning styles (Morrison, Sweeney, Heffernan, 2003), social styles and business majors (Schlee, 2005). Examples of behaviours that may impact on the group effectiveness and engagement include ‘social loafers’ (Dommeyer, 2007), ‘control freaks’ and an outlier known as the ‘lone wolf’ (Barr, Dixon, Gassenheimer, 2005). Our survey represented a few germane questions directed only at evaluating the main assessment task. These reflected previous studies and centred around how easy/hard it was; how much they had gained and how relevant it was to them.

Learning Context

The context of this study is a second year stats-based subject. The course aims to increase student knowledge and understanding of statistical techniques, increasing their quantitative literacy (Briggs, Sullivan, Handelsman, 2004). Overall it aims to encourage deep learning and overcome the reluctance of some of our students to tackle a statistics course (Fitzsimmons, Williams, Ma, 2005). Students, particularly marketing students, favour interactive, non-traditional and experiential learning (Ulrich, 2005) supporting our use of a 'live' case as the basis for the major project (Kennedy, Lawton, Walker, 2001). This is a team-based assessment designed to provide sufficient challenge to students, encouraging them to apply their statistical knowledge, to think about their results and to take ownership of their efforts (Barr, Dixon, Gassenheimer, 2005; Chapman, Van Auken, 2001; Deeter-Schmelz, Kennedy, Ramsey, 2002; Hogarth, 2008; Kates 2002; Reid, Petocz, 2002). Techniques included descriptives, group difference analysis, cohort and conjoint analysis. To make the assessment relevant to students, the 'live' project aligns tasks to research analysis theory (Biggs, 1999). Such group/team work can provide an opportunity to take responsibility for learning that leads in turn to increased student satisfaction with a course (Amato, Amato, 2005; Curran, Rosen 2006).

Methodology

Students were asked to complete a "Student Experience Survey" (SES) at the end of each session. The survey gathered their perceptions of the difficulty of, interest in, and benefit of, the major team-based project. Additional questions addressed the importance of certain aspects of the assessment design and a range of classification variables (e.g. gender, their major, international/local student status). Data was collected for years 2003-2008, with the class size ranging from 160 to 180 students. Completion of the survey was optional, with response rates ranging from 74% to 97%. Each year was similar demographically in terms of gender composition and student status ($p > 0.05$).

Analysis of student sub-groups was based on their responses to eight variables relating to their attitudes to the project (Table 1). Attributes were measured on a five point semantic differential scale. Factor analysis identified two related factors: 'Challenging' (representing challenge and lack-of-ease variables) and 'Understanding/thought' (representing increase in statistical understanding and encouragement of independent thought). K-means cluster analysis, to identify subgroups, was based on the four unrelated variables and two surrogate variables representing the factors: 'Challenging*' and 'Increased statistical understanding*'.

Cluster analysis was run on the six-year cohort sample to provide an overview of the sub-groups existent among the students. Five clusters provided the best characterisation of this combined sample (Table 1). Cluster analysis was run for each individual year, the optimal solution consistently five clusters (Table 2). Comparison of the individual year's clusters/groups to those for the combined sample along with analysis of other attitudinal and demographic variables helped both to name, and characterise sub-groups as they changed from year to year.

Results

Across the six-year cohort, students' experiences with the project were rated as shown in Table 1. 'Challenging' 'Easy/difficult' 'Not time intense' 'Increased statistical understanding' and 'Encouraged independent thought' had the highest (or lowest) overall means. Other cluster attributes tended to the midpoint. In terms of what is of 'importance' to them in an assessment task they identified positively with: 'relevance to future' (4.1); 'a realistic scenario' (4.1); 'challenge' (4.0) 'topic relevance' (3.9) and 'ownership' (3.7). On average students reported that they were unlikely to work in Marketing Research (2.7) and even less likely to work in Market Analysis (2.4), not an unexpected finding.

Amongst the six-year cohort there was likely to be more males represented in the 'Disengaged' groups and more females in the 'Engaged' group ($p=.008$). There was a tendency for International students to be more prevalent in the two polarised groups the 'Engaged' and the 'Disengaged' ($p=.08$).

Table 1: Cluster means for sub-groups for the six-year cohort, 2003-2008.

Cluster Variable	Overall	Disengaged	Disengaged [too hard]	Challenging [topic interest]	Benefited [more direction]	Engaged
Challenging*	4.0	3.9	4.0	4.2	4.0	3.9
Easy/difficult	1.9	2.2	1.9	<i>1.8</i>	1.9	2.0
Not time intense	1.6	3.7	1.3	1.3	1.3	1.4
↑ Statistical understanding	4.0	2.7	2.2	4.1	4.5	4.5
Encouraged independent thought*	3.7	2.8	3.1	3.6	4.0	4.1
Relevant to student	3.1	2.8	2.7	2.2	3.7	3.6
Topic interesting	3.1	2.9	2.9	4.1	2.7	2.8
Clear task definition	2.8	3.1	2.9	2.3	<i>1.7</i>	3.7
Group size %	(<i>n=865</i>)	8.6	12.5	22.1	22.5	34.3

NOTES: 1. Scale of all variables is 1-5 and each variable has at least one group that is significantly different to others. ($p<0.001$) 2. Bolding and italics are used to highlight aspects that characterise the subgroup. [**Bold** – highlights highest subgroup means, *Italic bold* – lowest subgroup means].

Within both the 6-year cohort (Table 1) and the individual year analyses, the 'Engaged', 'Challenging' and 'Disengaged' clusters are found consistently (Table 2), though their relative size varied. 'Other' groups emerge or disappear most probably in response to student interest in the topic set for that year, and to our fine tuning efforts on assessment design and course delivery. For example, when the clarity of the task definition was increased and the range of statistical techniques covered by students reduced, there was a resultant loss of the 'Benefited' [more direction] cluster - disappearing as a separate sub-group after 2006. The year by year variation in the 'Other' group of clusters (Table 2) was largely related to their interest in the object (topic) of the research. The range of topics included Paddington

Markets, Sydney, through to the Coffee Cart and the Optometry Clinic, UNSW. Most projects were exploring issues around awareness and consumption patterns of these entities.

Comparison across the yearly averages of individual variables clearly revealed significant differences, which are reflected in the sub-group composition patterns. For the sake of clarity and conciseness, only the proportional representation by year of the sub-groups is provided (Table 2).

Table 2: Individual sub-groups representation (%) by year.

Group		Disengaged	Disengaged [too hard]	Indifferent and [...]	Challenging [topic interesting]	Benefited [more direction]	Benefited and [...]	Engaged
Year	<i>n</i> =							
2003	138	4	22			27	29 ⁽ⁱ⁾	19
2004	122	9		13 ⁽ⁱ⁾	21	31		25
2005	156	8	10		14	36		31
2006	150	11			15	24	14 ^(i, iii)	35
2007	164	4	15	28 ⁽ⁱⁱ⁾	18			35
2008	135	7	18	7 ^(iv)	41			26
6-year Cohort	865	8.6	12.5		22.1	22.5		34.3

NOTES: Additional qualifying attributes (i) Topic not interesting (ii) Topic interesting (iii) Engaged (iv) relevant to student

Discussion

Diversity among students in a course is accepted and is acknowledged to impact on student engagement in learning. These individual experience differences, in combination with their confidence and understanding of mathematics/statistics prior to the course, can predispose students to less than favourable outcomes, such as disengagement. Meeting individual need is problematic in large undergraduate classes. However, as we demonstrate characterising sub-groups of students, on the basis of a simple set of attitude questions reflecting on the team-based project, not only enhanced our understanding of the student need, it afforded an opportunity to fine-tune assessment design and course delivery. Monitoring of the sub-groupings over time provided feedback on the effectiveness of assessment/course changes, knowledge of where these changes are impacting on student attitudes, and highlighted the influence of contextual factors on sub-group composition.

The six year cohort analysis identified the existence of five sub-groups which differed in terms of interest in, and engagement with assessment. Understanding the differing levels of engagement of students is critical since "... engaged students are good learners and that effective teaching stimulates and sustains student engagement" (Handelsman et al, 2005, p.184). Some of the variation in the composition of the 'Engaged' and 'Disengaged' groups may be attributable to differences in terms of individual characteristics such as gender and local/international status, rather than specific aspects of the course or project. Previous research has highlighted that males and females differ in the way they engage with the learning process (Smith, 2004) and level of engagement may be related to race (Hu and Kuh, 2002; Li and Campbell, 2008). Future exploration of these aspects may be worthwhile.

Though the pattern of subgroups changes yearly, there is still a consistency. Three broad sub-group types emerge: 'Disengaged', 'Others' and 'Engaged'. The characteristics of the

middle-ground 'Others' groups were directly impacted by contextual factors. Various sub-groups form or disappear - in response to course refinements or to the context provided by the project set for that year. Results support that oversight of the sub-group composition helps to track the impact of aspects of course micro-management. In particular, changes implemented have positively influenced the number of the students in the 'Engaged' cohort. It appears that there has been little effect on the presence of a small 'Disengaged' group. However we did find that the 'Disengaged [too hard]' group, who thought the project/course was too hard, shifted to being more engaged once they were provided with more direction and/or found the topic to be more interesting and student-relevant.

The impact of contextual factors on group composition can not be discounted. For this study, key contextual factors which came to light were the project topic, staffing/administration of the course, and clarity and scope of the assessment requirements. As mentioned above, interest in the topic may help stimulate a connection with the course – it provides a bridge for some students to become more engaged. Another influence on differences in the pattern of sub-group types may relate to how the course was administered. The first four years ran with an experienced team actively working to improve the student experience of this “feared” subject. A change to less experienced staff, not as familiar with the course, in the last two years reduced the team capabilities to proactively promote a connection between the students and the project/course. Hence the potential impact staff have on the engagement of students cannot be negated. Changes to assessment requirements to adjust for perceived difficulty and challenge alone may not result in increased levels of engagement. Though some students crave clarity and direction, others become less engaged when ambiguity/challenge is decreased (Gute and Gute, 2008).

Limitations and future research

The inability to link group membership to performance limits our contribution to further understanding of student engagement and its impact on learning outcomes. This is an area that has obvious merit for future research. Also of interest is the presence of the 'Disengaged' group who continued in small numbers despite all efforts to connect them to the course content. This group tended to be male and of international student status indicating that further exploration of these student characteristics is required. However, this study clearly demonstrates that a better understanding of student diversity through sub-group analysis is useful in micro-managing course design and delivery.

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