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Exercising QS: quantitative skills in an exercise science course

TM Wilson

Queensland University of Technology, Brisbane, Australia.

tm.wilson@qut.edu.au

Abstract

This study seeks to bring the discipline of exercise science into the discussion of Quantitative Skills (QS) in Science. The author's experiences of providing learning support to students and working with educators in the field are described, demonstrating the difficulty of encouraging students to address their skills deficit. A survey of students' perceptions of their own QS and of that required for their course, demonstrates the difficulties faced by students who do not have the prescribed assumed knowledge for the course. Limited results from academics suggest that their perceptions of students' QS deficits are even more dire than those of the under-prepared students.

Keywords: quantitative skills, exercise science, learning support, diagnostic tests, assumed knowledge, biomechanics

1. Introduction

For at least the past forty years there has been discussion of and investigation into the perceived falling standard in mathematical skills of students commencing tertiary study [1]. Studies have been reported, for example, in the areas of biology [2], environmental science [3], chemistry [4], general science [5], engineering [6] and nursing [7]. The Quantitative Skills in Science Project is an outcome of the coinciding of this decrease in mathematical skills in high school graduates with the increasing requirements of quantitative skills in science graduates [8]. Quantitative Skills (QS) is used as a broad term to include all numeracy, data handling, mathematics and statistics, and their application to a given context. To date, research has focussed around the quantitative needs and abilities of students in what might be classified as 'traditional' sciences: physical, biological and medical. Case studies in the QS project reported on ten Australian universities with regard to specific areas of science, consisting of one course in each of marine, biomedical, chemical and general science, with the other courses all being biological science. One area that has hitherto escaped investigation is that of exercise science. Generally delivered within a faculty of health, exercise science courses involve aspects of physical, life and health sciences and hence have as much dependence on QS as other science courses.

This paper considers the QS of students in exercise science courses at the Queensland University of Technology (QUT). It has been motivated by the author's experience over three years of providing learning support to students, and of discussions with educators in this discipline. As has been stated of educators at another Australian university:

> "Nursing staff complain that students are unable to calculate drug doses, engineers complain that students are coping badly with engineering mathematics and some cannot do even basic algebra, the scientists complain about the lack of algebra and poor performance in statistics of their students;" [9]

at QUT it can be added that, exercise science educators complain that students cannot use year nine trigonometry (taught to 14-year-olds), rearrange simple equations or use a calculator correctly.

As schools of exercise science react to and debate how to respond to their own QS dilemma, it is important that they are aware of the progress being made in other sciences. While the discipline has its own context, educators would benefit from situating their students in the broader QS issue. This paper seeks to begin such a discussion.

2. Context of this study

The undergraduate bachelor courses referred to in this paper are offered by the School of Exercise and Nutrition Sciences within the Faculty of Health at QUT. They include the four-year Bachelor of Clinical Exercise Physiology (HM44) and the three-year Bachelor of Exercise and Movement Science (HM43) as well as a number of four-year double degree courses which incorporate the Bachelor of Exercise Science with other courses in Health, Education and Business. There is also one five-year double degree with Nutrition which has a substantially higher entry requirement than the other courses. The list of three- and four-year courses is given in Table 1 along with the Overall Position (OP) score required for entry in 2012. The OP score is the tertiary entrance score obtained by Queensland year 12 students. It ranges from 1 to 25 with 1 being the highest score. In any year, the cut score for a course varies depending on student demand. (Year 12 is the final year of high school, generally completed by 17 year-olds.)

QUT does not require prerequisite study in specific subject areas for any of its undergraduate courses. The university website advises students that:

> "... we do assume you have a minimum level of knowledge in certain subject areas before you start your course. We call this 'assumed knowledge'.
>
> If you don't have the assumed knowledge for your course you can still apply, but you may want to do some extra study to help you catch up."

Table 1: Courses involving exercise science with OP[1] cut-offs for 2012 student intake

Course Name	Code	Length (years full-time)	OP cut-off
Clinical Exercise Physiology	HM44	4	8
Exercise and Movement Science	HM43	3	11
Exercise and Movement Science/ Business	IX17	4	9
Exercise and Movement Science/ Education (Secondary)	IX18	4	11
Nursing/ Exercise and Movement Science	HL23	4	11

[1]OP (Overall position) is the tertiary entrance score used in Queensland. The highest score is 1 and the lowest, 25.

The level of mathematical knowledge prescribed as prerequisite or assumed has been in a state of flux within these courses for some years and therefore a point of discussion amongst exercise science educators at QUT. Since 2011, for all of the courses listed in Table 1, assumed knowledge has been: year 12 Maths B and English, and one of Chemistry, Physics and Biology, with additional recommended study of Health Education or Physical Education. Maths B can be classified as an intermediate mathematics course, i.e. one that is "suitable for students who wish to proceed to tertiary studies that require significant but not extensive mathematical preparation, such as science, medicine, economics/ commerce, dentistry and agricultural science." [10]

Prior to the 2011 intake of students, assumed knowledge for these courses was the elementary [10] year 12 subject Maths A which does not include any algebra or calculus. In earlier years, Maths B had been prerequisite knowledge but this requirement was removed to increase student intake. Many academic staff considered the lack of mathematical prerequisite to be unsatisfactory, resulting, after much negotiation with the university, in its reinstatement under the new 'assumed knowledge' model for the 2011 intake.

In 2010 a survey of students in the core first year introductory exercise science unit discussed in Section 3.1 indicated that only 23% of students had studied Maths B or a higher level mathematics subject in year 12. In 2012, official university entry data of students who had graduated from school in 2010 or 2011 indicated that 64% of students enrolled in HM43 and HM44 had studied Maths B. The 2012 online survey of students in exercise science discussed in Section 4 (not restricted to first year students) indicated that 56% of students had studied Maths B. For students who had no more than a one year gap between completing year 12 and starting their current course, the figure was 60%. These data certainly indicate that listing Maths B as assumed knowledge has increased the proportion of students with an intermediate mathematics background but that there is still a substantial number of students without it. This is likely to remain the case under the widening participation agenda.

Until the timing of this study, students enrolled in the four-year Clinical Exercise Physiology course had the opportunity to enrol in a make-up unit for Maths B. The enrolment advice given to students in this course was that if they did not have Maths B, they should undertake this make-up unit, if they had studied Maths B but not chemistry, they should take an introductory chemistry unit, otherwise they should enrol in a technology unit. The anomaly with this process was that students in the three-year course did not have space for this unit and they were often the students with lower tertiary entrance scores and therefore more likely to struggle with the skills required for later quantitative units which were core to both courses.

Regardless of the prior level of maths studied by students, educators are not always aware of changes in school mathematics curricula [11] nor are they fully appreciative of the level of skill demonstrated by a student who has passed but not necessarily excelled at a particular level of maths. In fact it is posited here that the further a discipline is both physically and ideologically from a school of mathematics, the less up to date its educators are likely to be in this regard.

3. QS in two Exercise Science units

3.1. Introduction to Exercise and Movement Science

At the beginning of 2010, the QUT Maths Access Centre (QUTMAC) which had provided learning support services at the main QUT campus since 2004, extended its student drop-in facility to the nearby satellite campus, attended by exercise science students. At the same time, the QUTMAC was approached by the coordinator of Introduction to Exercise and Movement Science (HMB110) to provide maths learning support to students in this unit. These events provided the author with her own introduction to QS in exercise science. The unit included an introduction to a number of areas including academic writing, researching, referencing, scientific method, Excel and, independent and paired t-tests. As educators in the school felt that students were having increasing difficulty with some of the more quantitative units throughout the course, an attempt was being made to use this unit to motivate students to improve their QS. It was agreed that the learning support provided would consist of: a diagnostic test to help students self-identify their need for support, weekly classes to improve basic mathematical skills (informed by the results of the diagnostic test) and encouragement to students to use the drop-in service which was available on campus two days per week.

A mathematics diagnostic quiz was added to week 1 of the unit. The test consisted of 18 multiple choice questions which required students to understand and work with decimals, powers of ten and percentages; convert between metric units; evaluate an algebraic expression; solve a linear equation; work with positive and negative powers; interpret a speed v. distance graph; use Cartesian coordinates; calculate the gradient of a line; recall trigonometric ratios in a triangle; and understand mean, median and standard deviation. None of the items required calculus or pre-calculus skills but all skills were considered relevant to the exercise science courses on which the students were embarking. 152 students sat the test; scores ranged from 2 to 17 (out of 18) with a mean of 10.6 and standard deviation (SD) of 2.8.

Students were required to attempt this quiz and recommended to access the QUTMAC services if they achieved poorly. Although the unit coordinator wanted to assign marks for accessing these services, this was seen to be contradictory to the policies of the learning support centre, consequently attendance was encouraged and monitored but entirely optional. Over the duration of the semester, fourteen students came to one or more classes, with one of those students attending eleven classes and the next highest attendance being four classes. For privacy concerns, the records kept at the drop-in centre meant that only the number of help-seeking incidences for a particular unit were recorded, with no indication of how many different students this involved. Over the thirteen weeks of semester, only eleven occurrences of assistance were sought for this unit, although of 152 students who did the test, 46 scored 9 or less out of 18.

In keeping with the general understanding that students value what is assessed, students were told that similar questions to those on the diagnostic quiz would be included in the final exam. Despite many opportunities to improve their skills, performance on the end of semester questions was on average poorer than on the diagnostic test. In part this may have been due to the fact that the stress of performing in the more formal situation of an end of semester exam including other components of the unit may have lowered the performance on these particular questions. Another likely explanation is that, as the mathematical questions were only worth 10% of the final assessment and the assistance available was outside the regular curriculum, students did not consider it an area truly valued by academics in their field and therefore not worthy of their investment [11,12]. In fact, it is possible that the diagnostic test may have inadvertently contributed to this outcome. A student who performed very badly on the diagnostic test may have been made aware of the size of their QS deficit and therefore realised the time that would need to be invested to address their problem. A reward of 10% would conceivably not be considered sufficient by time poor students in this position.

A restructure of the introductory exercise science units meant that this unit was discontinued after 2010. It was generally felt that it contained too many disparate topics and was not sufficiently context-based for students beginning a course in exercise science.

3.2. Biomechanics

Following from the involvement of the QUTMAC with HMB110, these learning support services were strongly promoted to the students enrolled in the unit Biomechanics 1 (HMB272) in 2010 and thereafter. This unit is compulsory for all Exercise Science courses as well as Podiatry, generally being taken in the second semester of second year. The unit is notoriously difficult for students and at this time regularly had a failure rate of approximately 40%. The unit is taught from a pre-calculus approach, the main QS required for success being: calculator competence; dealing with and converting between metric units; rearranging equations; using trigonometric relationships in triangles; and systematic problem solving. Students are required to apply these skills in a variety of biomechanical contexts, particularly kinematic and kinetic analyses of motion.

Unlike in the unit HMB110, students in HMB272 cannot ignore any lack of QS if they are to engage with the unit. With an enrolment of 200 students, there were 88 requests for assistance from biomechanics students at the drop-in centre in 2010. It should be noted that a single ‘request for assistance’ frequently consisted of a student working on problems for several hours, seeking help as often as required.

All of the specific skills described above are taught in high school mathematics prior to year 12, however, especially for those students who have not completed or who have struggled with Maths B, or for whom there has been a significant time lapse since completing school, the skills are not sufficiently consolidated to facilitate their confident and fast access. As demonstrated in [5], students who appear to have mastered a skill, often regress when they need to apply that skill in a more complex problem. In addition to that, transferability of QS is an issue that requires further research [13], with evidence published to support the view that the real problem for students is their lack of QS not lack of transfer [14], as well as the opposing view that lack of transfer is the real problem [15]. Experts in fields, such as exercise science, who repeatedly use specific QS themselves, sometimes fail to recognise how much they are expecting of students to consolidate, transfer and apply QS in a context which is new to them.

In 2011, the QUTMAC increased its involvement with HMB272. A diagnostic test was developed for students to self-assess their need for support and to increase their awareness of the need to address their skills deficit early in the semester. This test was informed by experience with the difficulties presented by students at the drop-in centre during the previous year. It was made available online via the unit Blackboard site but difficulties with timing meant it was only attempted by 35% of the class of 200 students. Scores ranged from 1 to 10 out of 10 with a mean of 6.5 and SD of 2.0. Fortnightly support sessions were conducted where exercises from the unit were worked through as slowly and in as much detail as students required with emphasis on the fundamental QS required. Attendance at these sessions was relatively low in comparison to the enrolment and demonstrated difficulty of the unit, however it was more consistent than for the introductory unit the previous year. When asked for feedback on these sessions, students said they valued the supportive environment and the slow pace; the most commonly suggested improvement was that sessions be held weekly rather than fortnightly. Requests for assistance at the drop-in centre increased from the previous year to 150. However, despite the provision of this assistance there was no improvement in the pass rate of the unit in 2011 over previous years.

In 2012, a number of major changes were introduced to the assessment of HMB272 and extra online support in the form of videos of worked exercises was provided by the unit coordinator. The diagnostic test was once again given to students, but instead of being given online, was completed by students in the first lecture (n=166, mean = 5.6, SD = 2.0). Students were given immediate feedback from QUTMAC staff who worked through the solutions in that first class and provided information about the support that would be available during semester. Support sessions were increased from fortnightly to weekly and the drop-in centre continued to be available two days per week. These services were not accessed as frequently as the previous year, despite an increase in enrolment to 250; the drop-in centre had only 72 instances of assistance for HMB272. As previously most assistance had been focussed on the unit exercises, it is assumed that the provision of on-line video solutions met the students' need and was hence largely responsible for this decrease in attendance. At the end of the semester, the failure rate for the unit dropped to 18.5%. As significant changes were made to the assessment of the unit as well as to the quantity and quality of support provided, it is not possible to determine the impact of any individual change. While the Biomechanics unit has been a major stumbling block for many students, there are also other exercise science units where students' lack of QS is evident. It remains to be seen whether the improved pass rate in this unit reflects any lasting improvement in QS for these students over previous cohorts.

4. QS perception survey of students and academics

4.1. The survey

As lecturers increase the amount of support they provide to students they often remark that the effect on student results is to increase the number of top grades but not to decrease the number of failures. Statistically, the most obvious explanation of this phenomenon is that the student cohort can best be modelled by a mixture of at least two populations rather than a single, unimodal population. This is often understood in terms of ability but it also applies to the students' personal career goals and perceptions of what the course involves [16]. If the perceptions of students are not only diverse within the cohort but also disparate from those of the teaching staff, then engaging students in study may be a substantial problem.

In 2012, an online survey was conducted to investigate the perceptions of exercise science students and academics at QUT regarding the QS needed for exercise science courses. Students were asked for their school mathematical and post-school quantitative backgrounds, their perception of their own level of QS commencing their course and currently, and of the level of QS they believed was required for their course. Exercise Science academics were requested to complete a similar survey. This asked about their perception of students' mathematical backgrounds, levels of QS on commencement and graduation and level of QS required for successful completion of the course. QS was defined for survey participants in line with the QS in Science project.A request to complete the survey was sent to all students enrolled in 17 different courses associated with exercise science. These courses include the single and double degrees listed in Table 1 and a number of discontinued but essentially equivalent courses in which students were still enrolled. These courses can be classified as: three-year exercise science degree, four-year exercise science degree, double degrees in exercise science and health, double degrees in exercise science and education, double degrees in exercise science and business. Of approximately 1500 students involved in these courses, only 45 completed the survey at this time. As these numbers were small, the survey was reopened and students currently undertaking the core unit Research in Human Movement (HMB276) were asked to complete the survey during a computer lab class. In most courses, HMB276 is completed in first year, although in some double degree plans, it is scheduled for second year. The survey was adjusted slightly so that if students had previously completed the survey in response to the original email they were directed immediately to the end without completing it a second time. An extra 209 students completed the survey in this way. This did significantly influence the representation of different year levels and courses completing the survey. In the initial 45 students, first, second and third year students were approximately equally represented, while of those students who completed the survey in class, 72% were first years and 16% were second years. Also, no double degree students completed the survey initially but were represented in the combined responses. Eight of the students who completed the survey in class were enrolled in the five year double degree with Nutrition. As students need to be very high achieving in order to be accepted into this course, these students were removed from any analyses of the survey as they were likely to be a very different population of students in many ways. It is most likely that the small number of students who responded initially to the survey had a special interest in QS and therefore the pooled data are likely to have improved the representativeness of the results. However, as HMB276 is a quantitative unit, it is likely that those students who were undertaking it in their second year or above included a high proportion of students who had failed the unit or avoided it in their first year.

The academic survey was sent to 17 staff members, with only 5 responses being obtained. Although a few interesting comments can be drawn from these responses, the numbers are too small to allow any valuable comparisons between student and academic perceptions.

4.2. Student perceptions of QS

Students were asked to rate the level of QS they had at the beginning of their course on a scale from a low of 1 to a high of 7. From 229 respondents, the median score was 4 (mean = 4.1; SD = 1.3). As one would expect, this score depended on the level of maths completed at school, with a 95% confidence interval for the difference between students with and without Maths B of 0.60 to 1.30. The distribution of scores is shown in Figure 1 with students having studied Maths B clearly dominating the higher scores and students without Maths B the lower scores. Note that 31 of 229 students did not record the level of maths they had studied at school. These students did not appear to have belonged to any specific group with their responses to other questions being typical of the whole group on other variables including the numbers of years since they had completed schooling. To see whether post-school experiences had a clear effect on students' rating of their own QS, students were further classified as those who had completed Maths B (n=109), those who had not completed Maths B but had done some quantitative work or study since leaving school (n=26), and those who had neither (n=63). The one-way ANOVA gave a p-value < 0.0005 with pairwise comparisons indicating no significant difference between those without Maths B who had previous quantitative work or study experience and those who had neither. Those who had studied Maths B however were significantly higher than both the other groups.

It was also considered whether students' own perception of their QS on starting their course depended not only on their quantitative background but also on the year in which they were currently enrolled and the type of course they were studying. General Linear models were used to assess this. With possible interactions removed because of non-significance, p-values for whether or not Maths B had been studied, whether student was first year or above and the type of course being studied were <0.0005 ($F_{1,191}$), 0.105 ($F_{1,191}$) and 0.585 ($F_{4,191}$), respectively. If students who completed the survey out of class were removed from the analysis then the p-values changed to <0.0005 ($F_{1,149}$), 0.092 ($F_{1,149}$), and 0.365 ($F_{4,149}$) respectively. Note that for these students, the mean for those in first year was 4.2 (n=133) but 3.7 (n=51) for those in second year or above. Combined with the p-value, this suggests that even allowing for whether or not they had done Maths B, there is very slight evidence that the students beyond first year believed they had lower QS on commencing their course than did their first year counterparts. This is consistent with the observation in Section 4.1 that this group would have included a higher proportion of students who lacked either QS or QS confidence.

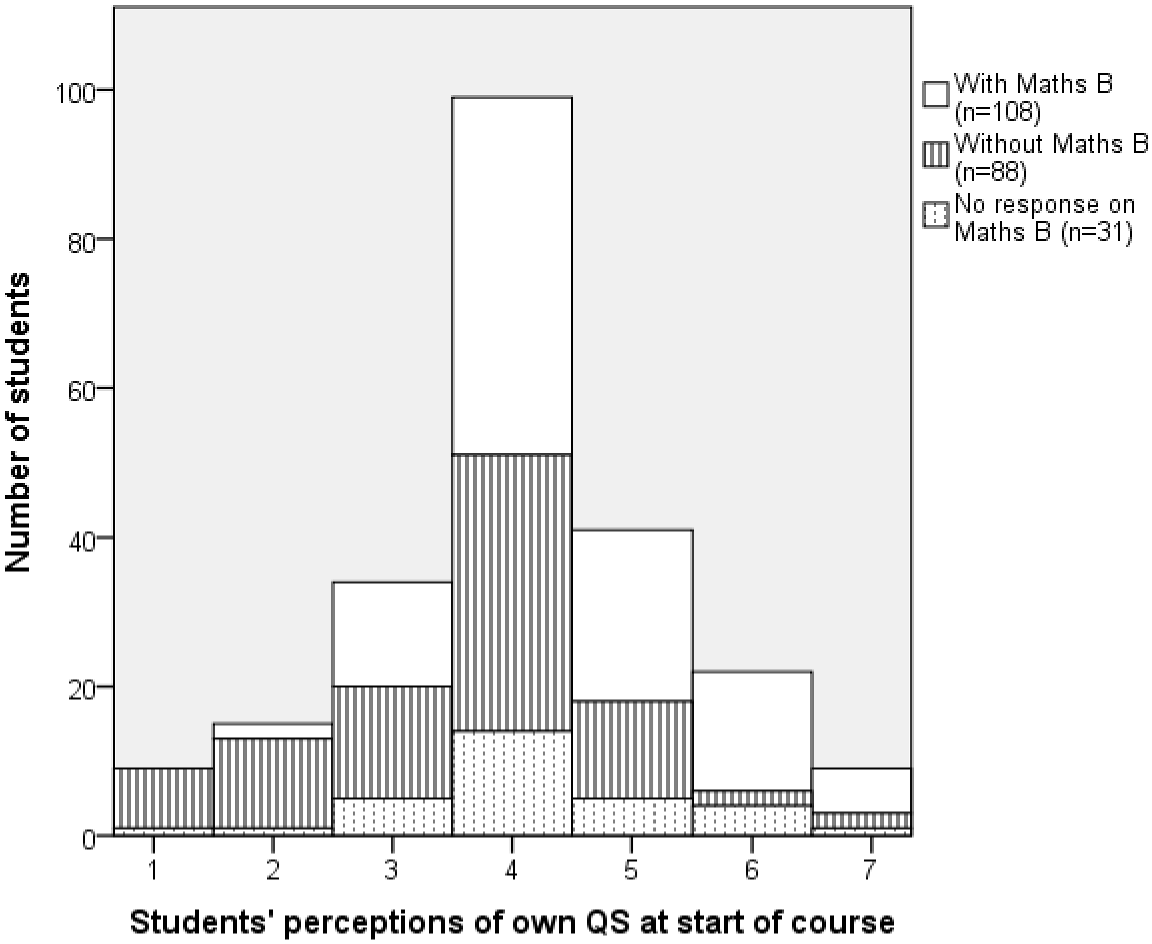

Figure 1: Students' perception of their own QS looking back to the beginning of their course for those with and without Maths B and nonresponses. Students were asked to rate their own QS on a scale of 1 to 7 as they were at the beginning of their course.

Students were also asked to rank their current level of QS and the level which they believed was required to succeed at their course. Perceived QS at three stages, starting, current and required, were combined in a repeated measures analysis allowing for course type and first year or above, as well as whether or not Maths B had been studied. Sphericity could not be assumed and a lower bound analysis was then applied. Neither of the factors year nor course type had a significant impact on QS level and were removed from the analysis to simplify the interpretation. The resulting analysis showed that the effect of having studied Maths B, impacted the perceived QS differently depending on the stage. For students who had studied Maths B there were no significant differences ($p=0.111$) between their perceived starting QS level, current QS level and required QS level, while for students who had not studied Maths B there were significant increases ($p<0.0005$) between both the perceived starting and current QS levels and between the current and required QS levels.

Figure 2 gives a striking illustration of the phrase that is often used by the QUTMAC staff: "Students without Maths B are on a very steep learning curve." Of course the levels of QS illustrated here are the levels as students perceive them, rather than any absolute measure. An absolute measure of required QS would be equal regardless of previous study. This

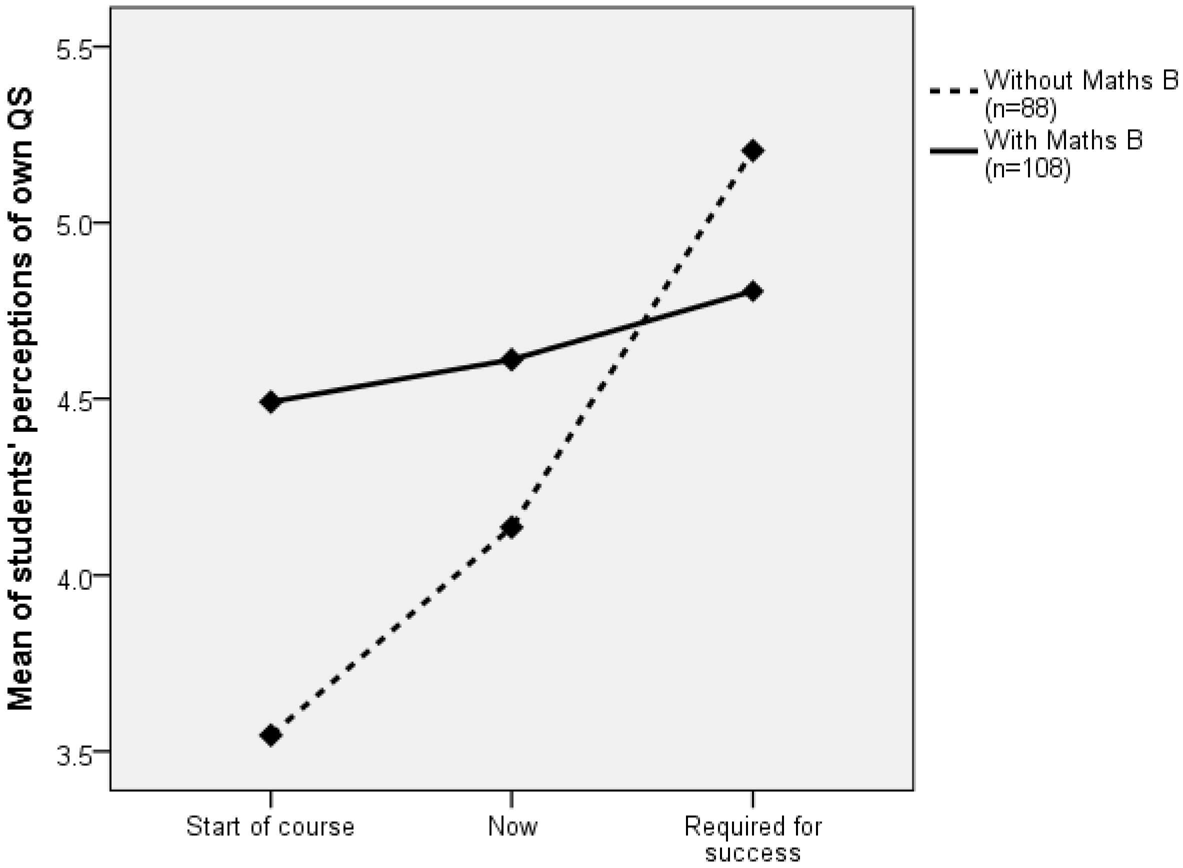

Figure 2: Mean perceived QS levels for students with and without Maths B. Students were asked to rate their own QS on a scale of 1 to 7 as they were at the beginning of their course, now and as they considered necessary for successful completion.

analysis emphasises the fact that students with limited background perceive the task to be very difficult, possibly even more difficult than it really is.

4.3. Educators' perceptions of students' QS

Academics were specifically asked about the QS of students enrolled in the two main exercise science courses HM43 and HM44. They were given the opportunity to state that the QS levels were different for the two courses and to record separate results or to indicate no difference between courses. Of the five responses received, two indicated a difference between the courses. However, as the differences between the courses were not significant at any stage, the HMB43 and HMB44 were considered as one course and average scores used for the two responses which differentiated between them.

Academics were asked the three questions regarding the QS of students:

(1) What level of quantitative skills do you believe students require to succeed at HM43/HM44?

(2) How would you rank the quantitative skills of the majority of students commencing HM43/HM44?

Table 2: Academics' perceptions of students' QS during course.

Stage	N	Mean	Standard error
Start	5	3.000	0.418
End	5	4.600	0.292
Required	5	5.700	0.624

Academics were asked to rate their students' QS on a scale of 1 to 7 at the start and end of their course, as well as the level they perceived as required for successful completion of the course.

Table 3: Pairwise comparisons of academics' perceptions of students' QS during course

Comparing stages	Mean Difference	Standard error	p-value Bonferroni adjusted
Required-start	2.700	0.860	0.105
Required-end	1.100	0.872	0.827
End-start	1.600	0.510	0.105

Academics were asked to rate their students' QS on a scale of 1 to 7 at the start and end of their course, as well as the level they perceived as required for successful completion of the course.

(3) How would you rank the quantitative skills of the majority of students when they graduate from HM43/44?

The means and standard errors for these QS levels are given in Table 2. A one-way repeated measures analysis with the answers to these questions given as three different stages (commencing, completing and required), showed a significant difference between the stages (p=0.023). However, using the Bonferroni adjustment for multiple comparison, there were no significant differences between pairs. These results are shown in Table 3.

[Tables 2 and 3 near here]

Although no statistical significance exists between perspectives of academics (n=5) and students (n=229) it appears that the academics are even more pessimistic about the majority of students than the students without Maths B are about themselves. In particular, only one academic thought the QS of the majority of graduating students was higher than that needed to succeed in the course! Several factors are likely to be influencing this result. Firstly it is highly likely that only educators who teach in units which are highly QS dependent and in which students experience difficulties considered the survey important enough to take time to complete it. Secondly, these educators do not base their judgement on accurately recalled data but on a representativeness heuristic [17] where struggling students are more representative of their own experiences. Thirdly, perhaps the academics' interpretation of 'succeed' is not merely to pass the course but to master all the material within it.

5. Discussion

To date, exercise science has been excluded from the QS literature despite the fact that it is a science which combines physical, biological and health sciences and hence depends on QS as much as other scientific disciplines. As evidenced in this study by both students' and educators' perceptions of the gap between students' demonstrated and required QS, this lack of published research should not be taken to imply that exercise science is not experiencing the same QS dilemma as other disciplines nor that it has gone unnoticed by educators in the field. The paucity of responses to the online survey described in this paper from exercise science educators and from students (until required to participate in class) is possibly an indication of the lack of value assigned to QS by those in the discipline and hence of how difficult it may continue to be to engage them in productive change.

Observation of exercise science students in this study, suggests that despite their substantial QS deficit, it is difficult to motivate students to access freely available, extra-curricular assistance in building their skills and confidence. Lack of engagement however, does not imply that these students are unaware of their problems.

In this study, students' perceptions of their QS deficits have been shown to depend heavily on their school mathematics backgrounds. This is consistent with a University of Western Sydney study which concluded that success in units including physics (to which biomechanics is closely related) depended heavily on the level of mathematics undertaken at school with year 12 elementary level not being sufficient [9].

In particular, students in this study who have studied less than an intermediate level of mathematics in their final school year perceive themselves to be disadvantaged. Of particular note is the degree to which these students not only perceive themselves as starting their course with a lower level of QS than do their peers with a greater background, but also have a higher perception of the level of QS which they need to achieve for success, than do their peers.

It is generally accepted that students are more likely to learn if they are engaged in the content and therefore that context-based approaches are essential for teaching QS in science [15,17]. However, a warning should be taken from the experience of Matthews et al. in an interdisciplinary course for biology:

> "students with weak mathematical skills derived little benefit from an interdisciplinary approach and are likely to disengage from learning, in comparison with students who enter university with a solid foundation in mathematics." [18]

Especially in courses where prior knowledge is assumed rather than prerequisite, extra support is necessary for less well prepared students. The value of QS to the discipline needs to be clearly demonstrated in the curriculum and assessment processes to motivate these students to tackle their QS deficit.

6. Moving forward

One aspect which has not been investigated in this study is the experience of students who undertook the Maths B make-up unit. Although they have not been documented, conversations with students have indicated that undertaking this unit does not provide the background required for units such as Biomechanics. One reason for this is often given to students making choices for year 12 subjects: one semester of study at university cannot effectively make up for two years at school. Another reason however is more course specific. The university Maths B make-up unit focuses heavily on the calculus component of the Maths B curriculum in order to prepare students for higher level mathematics. However these are the very skills and concepts which are not relied on in exercise science courses. (This is not to say that they are not used by exercise science researchers or are not useful to students who do understand them.) It is skills such as algebraic manipulation, functional thinking and problem solving, that students with Maths B background have developed over time, that are depended upon in quantitative exercise science units.

In an attempt to help exercise science students at QUT develop the QS they require, from 2013, all students, regardless of background, will undertake a specialised mathematics unit in the second semester of their first year. This unit will be delivered by the School of Mathematical Sciences after being developed in collaboration with the School of Exercise Science and Nutrition. Considerable effort will be made to ensure that contexts are relevant, with examples and data being obtained from other exercise science units. Exercises and assessment are being designed with the intent of engaging students from a diversity of mathematical backgrounds. Such diversity will continue to be present in such a course as universities embrace the widening participation mandate.

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