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To accept or decline academic remediation: What difference does it make?

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ABSTRACT

Introduction: Academic remediation offered after failure in a knowledge-based progress-test assessment is voluntary and involves student-centered individualized support that helps students to learn most effectively for themselves. This paper explores whether accepting or declining the offer of academic remediation given to struggling students impacts their outcomes both short-term and longitudinally.

Method: Data was collated from 2015–16, 2016–17, and 2017–18 and included all students offered academic remediation in the third, fourth, and fifth years of a five-year Dentistry program. Z-scores for each stage and test were calculated and centered on a triggering point; the point at which the offer of remediation was made. These students' average performance post-trigger test and longitudinal performance were analyzed.

Results: While performance for both groups significantly improved for the immediate post-trigger test after academic remediation, those that accepted remediation sustained longitudinal improvements across subsequent tests compared to those that declined remediation.

Discussion: Through the academic remediation support process students appear to increase their mastery of "learning to learn" and are able to implement sustainable effective learning strategies to carry with them throughout their program.

Conclusion: Students who accept academic remediation maintain a more successful academic profile compared to those that do not take advantage of this.

Introduction

Most, if not all, students enrolled on a university degree program would quite rightly feel that they have mastered the ability to study having achieved the necessary entry qualifications. Most students will have grasped what "learning to learn" means for them. However, a proportion of students may find the transition to university education challenging, or at a later point find themselves struggling or performing poorly (Paul et al. 2009). To prevent underperforming students from becoming underperforming clinicians it is essential that early intervention and academic remediation is provided (Cleland et al. 2013). Remedial interventions in medical education have primarily focused on helping a student pass a single re-sit assessment Cleland et al. 2013; Audétat et al. 2013). Previous research on medical students and postgraduate doctors (Guerrasio et al. 2013) has shown that remediation can be used successfully to achieve improvements in learners' medical knowledge; clinical skills; clinical reasoning; time management and organization; interpersonal skills; communication skills; professionalism; and mental well-being. Further clarity is required to gauge the long-term impact of remediation by following up learners longitudinally during an educational program to explore the differences in performance of students who accept or decline an offer of remediation.

Peninsula Dental School is one of the first schools based in a community setting in the United Kingdom. Established in 2007, the Bachelor of Dental Surgery (BDS) program follows a problem-based, student-led, patient-centered curriculum (McHarg and Kay 2008). The educational philosophy of the BDS program is informed by the theory of *situated learning* (Lave and Wenger 1991) which asserts that learning is a transformative process intricately tied to its context and to the social relations and practices therein. It emphasizes the social nature of cognition, and the importance of authentic situations and activities to facilitate learning.

Knowledge acquisition and growth at our institution is monitored longitudinally through progress testing, which is designed to test knowledge at regular intervals over the duration of an educational program (Ali et al. 2016).

Practice points

- The average performance of students in knowledge-based assessments improves whether they accept or decline academic remediation, although targeted academic remediation appears to have a stronger impact in the short-term for those students who accept remediation.
- Accepting academic remediation has more of a lasting effect on the long-term performance of students in knowledge-based assessments compared to those who decline remediation. Students accepting academic remediation maintain a higher level of performance for longer than those who decline remediation.
- "Learning to learn" by utilizing strategies discussed during academic remediation to manage cognitive load has longitudinal positive impacts on student outcomes.

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Progress testing was first used to assess the knowledge of undergraduate medical students (Blake et al. 1996; Vleuten et al. 1996). It is now firmly established as a recognized form of assessment in undergraduate medical curricula (Tomic et al. 2005; Aarts et al. 2010; Freeman and Ricketts 2010; Nouns and Georg 2010; Schuwirth et al. 2010; Al Alwan et al. 2011). Peninsula Dental School was the first to use progress testing in its Bachelor of Dental Surgery (BDS) program (Bennett et al. 2010; Ali et al. 2016). The frequency of testing allows early recognition of student learning needs and provides structured and individualized feedback that can be discussed with academic tutors. Therefore, progress testing is predicated on a frequent-look, rapid-remediation philosophy.

Learning is complex and is influenced by an interplay of cognitive, motivational, emotional, social, environmental and meta-cognitive factors (Schunk 2012). In its simplistic form, learning can be said to have occurred when schema construction (understandable cognitive representations) and automation (practice or recall of schema) occurs. The conceptual framework of the remediation program at Peninsula Dental School draws upon the cognitive load theory (Sweller et al. 1998; van Merriënboer and Sweller 2010) and follows a student-centered approach that facilitates learning through self-direction and reflection. By considering the understanding of memory, it is advocated that learning comes about through a process where information is organized in working memory into schema, these schema are moved to and stored in the long-term memory and when needed, the relevant schema is retrieved from long-term memory into the working memory for use and manipulation by the learner. Learning deepens when the schema, already established in long-term memory and reconstructed as needed in working memory, are expanded by drawing together prior and new information gathered. This process requires the smooth transfer of knowledge between working and long-term memory. Working memory is a limited capacity system and cognitive load reduces the capacity of the working memory to construct, manipulate, store knowledge in and retrieve knowledge from the long-term memory. Cognitive load theory highlights the impact caused by the limited capacity of working memory and the numerous factors that impact this "bottleneck" can have on effective learning (Sweller et al. 1998; Young et al. 2014). Managing cognitive load is a valuable metacognitive skill which the authors hypothesize remediation can support.

The remediation program at Peninsula further informed by existing literature (Ricketts and Bligh 2011; Audétat et al. 2013; Sandars et al. 2014; Vogan et al. 2014), and culminated in the identification of six targeted areas:

- A robust process for identifying poorly performing students
- Design and implementation of a School-wide formalized academic remediation process encompassing students, faculty and administrative support (See Figure 1)
- Faculty development involving initial training on the academic remediation process and then on-going faculty support and training for delivering academic remediation
- Design of a learning tool used in academic remediation meetings

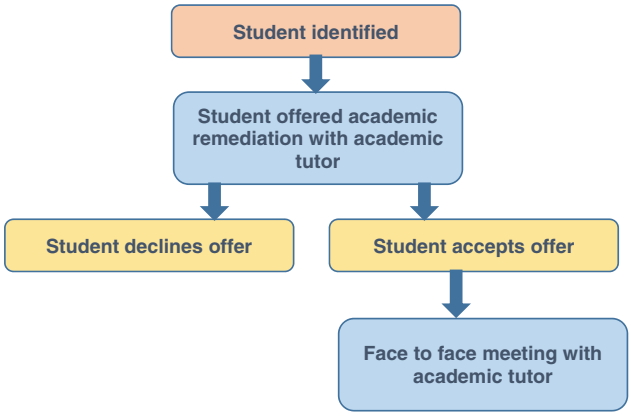

Figure 1. Outline of academic remediation process.

- Quality assurance of the academic remediation process
- Monitoring the impact of the academic remediation process on student outcomes in knowledge-based assessments

Academic remediation is offered immediately after failure in a knowledge-based progress test assessment. It is voluntary, as we want our students to be adult learners and take responsibility for their own learning (McHarg and Kay 2009). Remediation involves face-to-face sessions with an academic tutor for individualized support that helps students understand how to learn most effectively for themselves and focuses on learning strategies, understanding of memory, contextualization of knowledge, active recall of learning, self-organization, professional learning and time management. Cognitive load theory focuses on the management of the working memory during learning, whether that be intrinsic (relevant to the task), extraneous (not relevant to the task) or germane (individual way of acquiring schemata for learning). Through discussions and use of the learning tool at the face-to-face remediation meetings, students are encouraged to identify intrinsic, extraneous and/or germane cognitive loads that are impacting on the efficacy of their studies and explore strategies to manage these.

The aims of this paper are to evaluate the academic remediation process for progress testing and explore whether the investment in terms of resources and staff time is merited by the, yet unknown, impact on student outcomes. It achieves this by exploring the impact, both short-term, i.e. immediately after the test with a poor performance, and long-term, i.e. longitudinally for subsequent tests over a period, of accepting or declining the offer of academic remediation.

Methods

Study setting

The progress tests are aimed at assessing Applied Dental Knowledge (ADK) and students in Stages 2, 3, 4 and 5 of the BDS program sit the test simultaneously three times per academic year. Different questions are included in each sitting of the progress test to ensure that the same questions are not repeated for a given cohort for the duration of the program. Each progress test is standard set to the level expected from a newly qualified dentist as outlined

by the General Dental Council (2012), and progress is indexed by a steady increase in scores achieved. The progress tests are formative in Stage 2 and summative in all subsequent stages. Therefore, each cohort sits three formative and nine summative progress tests during the BDS program.

Each test is based on 100 single best answer multiple-choice items and scored 1 for a correct response, 0 for a "don't know" response, and −0.25 for an incorrect response. Questions in each progress test Questions are written linked to an appropriate dental vignette setting the test item within a clinical context with the objective of testing the application, analysis, and synthesis of knowledge. The test places minimal emphasis on simple factual recall.

The grades for individual tests are "Unsatisfactory," "Borderline," "Satisfactory," and "Excellent." Poorly performing students are identified as those students receiving a "Borderline" or "Unsatisfactory" grade in any ADK assessment and these students are offered remediation.

Standard setting for ADK normally uses a combination of two procedures - Angoff and Hofstee - based on the judgments of an expert panel of assessors. The final standard for the assessment is set using the Hofstee standard setting procedure where the maximum pass mark is set to the Angoff estimate for Year 5. The standards for other year groups taking the test summatively are set at the same point relative to the data for each year as the Year 5 standard. This is achieved by calculating the number of standard deviations the Year 5 standard is away from the Year 5 mean score. This is then applied to the other year groups at the same number of standard deviations (calculated for each year independently) away from their respective mean scores. Grades for each year group are awarded as shown in Table 1.

Data collection and analysis

Ethics approval was gained from the Institutional Review Board (Application number 16/17-727). Data was collated from each ADK test for academic years 2015–16, 2016–17 and 2017–18. Each of the three tests in each year are sat summatively by students in years 3, 4, and 5 of our five-year BDS program, and performance data from students in these year groups who accepted or were offered but declined academic remediation ($N = 30$ see Table 1) was compiled for analysis, i.e. all those that accepted and those that declined academic remediation following a grade of borderline or unsatisfactory. For context, the numbers of students sitting each ADK exam across the academic years 2015–16 to 2017–18 are shown in Table 1. The demographic data for those students offered academic remediation is shown in Table 2. This data are fairly representative of the cohorts as a whole and there was no difference in the profile of those who accepted or declined academic remediation.

To mitigate assessment variability Z-scores were calculated within each stage and within each test over the three years. Data was collated in May 2018.

In order to assess the impact of remediation, student longitudinal ADK scores were centered on a triggering point; the point at which the offer of remediation was made. Student assessment scores were converted from percentages to Z-scores within each stage within each test to control for variation in test difficulty and performance across stages of study. Test occasions are numbers from −10 (ten tests before remediation) to +7 (seven tests after remediation), and the test in which students' performance triggered an offer of remediation being aligned with −1, such that Test 0 is the first test post-remediation.

Changes in percentage scores, mean Z-scores for pre- and post-trigger tests, along with *p*-values from repeated measures of t-tests of the difference between pre- and post-trigger test scores were calculated. In addition, it was decided *a priori* to conduct a 2 Remediation (Completed, Decline) × 2 (Pre, Post) analysis of variance was conducted in order to assess the effect of remediation versus its decline and change between pre- and post-trigger test performance.

Table 1. Student numbers sitting each ADK and those who triggered academic remediation following a borderline/unsatisfactory grade.

		Student Numbers (B/U Grades)		
Academic Year	Test Occasion	Y3	Y4	Y5
2015–16	1 – ADK17	62 (7)	NA	NA
	2 – ADK18	62 (2)	NA	NA
	3 – ADK19	62 (9)	NA	NA
2016–17	1 – ADK20	56 (0)	55 (0)	NA
	2 – ADK21	56 (0)	55 (0)	NA
	3 – ADK22	56 (0)	54 (0)	NA
2017–18	1 – ADK23	56 (3)	56 (3)	55 (3)
	2 – ADK24	58 (0)	56 (1)	55 (2)
	3 – ADK25	58 (0)	56 (0)	55 (0)

Table 2. Demographic summary by remediation status.

Characteristic	Declined	Remediated
Gender		
Male	8	11
Female	4	8
Ethnicity		
Asian	8	14
Other	2	1
White	1	2
Disability		
No Known Disability	10	13
Specific Learning Disability	2	3
Other Disability	0	2

Results

Average performance

In terms of percentage scores, those who complete remediation show an average increase of 12.85% between the test that triggered the offer of remediation and the following test, compared to those who do not complete remediation, who show an average increase of 8.00%.

Mean Z-scores for pre- and post-trigger tests and p-values from repeated measures of t-tests are shown in Table 3. In addition, a 2 Remediation (Completed, Decline) × 2 (Pre, Post) analysis of variance was conducted to assess the effect of remediation versus its decline and change between pre- and post-trigger test performance. These results support the findings of the *t*-test whilst showing no statistically significant interaction between remediation status and the difference in pre- and post-trigger test scores.

From these results, it appears that students who complete remediation show larger improvements in their Z-scores (on average) than those who do not complete remediation. Both increases in the score are statistically significant.

Longitudinal performance

Taking each test in sequence centered on the point of remediation, Figures 2 and 3 show student performance prior to and following remediation (tests −10 to −1 and 0 to 7 respectively. Individual points are student Z-scores for individual tests, the lines show average performance within each test.

Students who accept remediation show improvement directly following remediation, and a continued trend to increasing performance across subsequent tests (Figure 2, solid line) towards the cohort average. Those who decline remediation show some immediate improvement, but do not sustain improvements across subsequent tests (Figure 3, solid line) towards the cohort average and to a lesser extent than those who accepted academic remediation.

It can be seen that both groups attain the same level at test occasion +7. This is accounted for in the discussion but is related to this being the final ADK test of the 5-year program, thus being a very high-stakes assessment.

Table 3. Mean ADK Z-scores and percentage score equivalents pre- and post-trigger by remediation status.

	Mean Z-Scores (SD)				
	Pre	Post	Difference	N	*p*
All student data					
Remediated	−1.90 (0.45)	−0.74 (0.88)	1.16	19	<0.001
Declined	−1.86 (0.53)	−1.06 (0.97)	0.80	12	0.022
	Mean % Score (SD)				
All student data					
Remediated	41.02 (7.68)	53.87 (8.93)	12.85	19	0.010
Declined	46.20 (8.43)	54.20 (8.16)	8.00	12	<0.001

Discussion

The results of this study show short-term improvement in performance was not dependent on whether the students

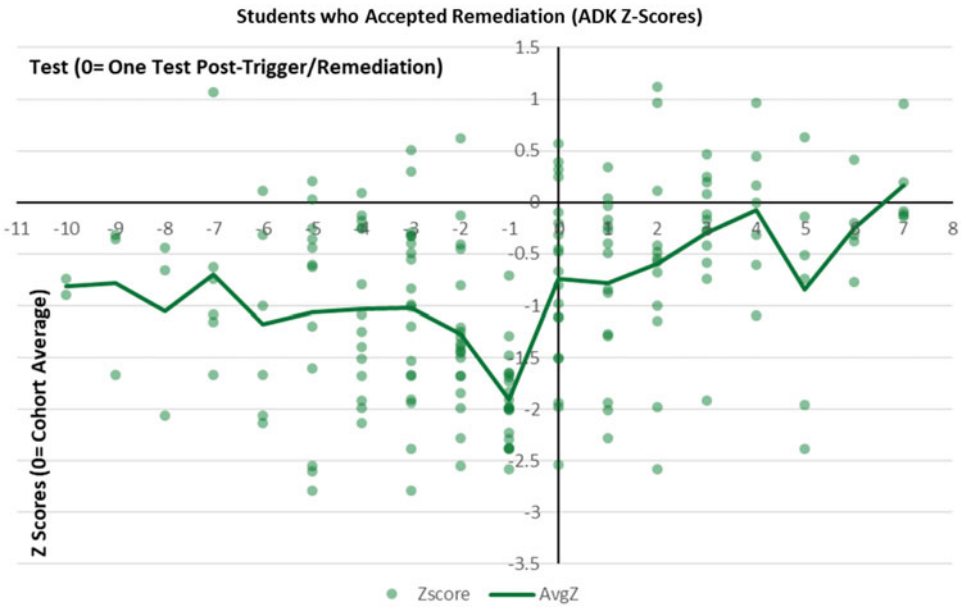

Figure 2. Longitudinal performance of students who accepted remediation.

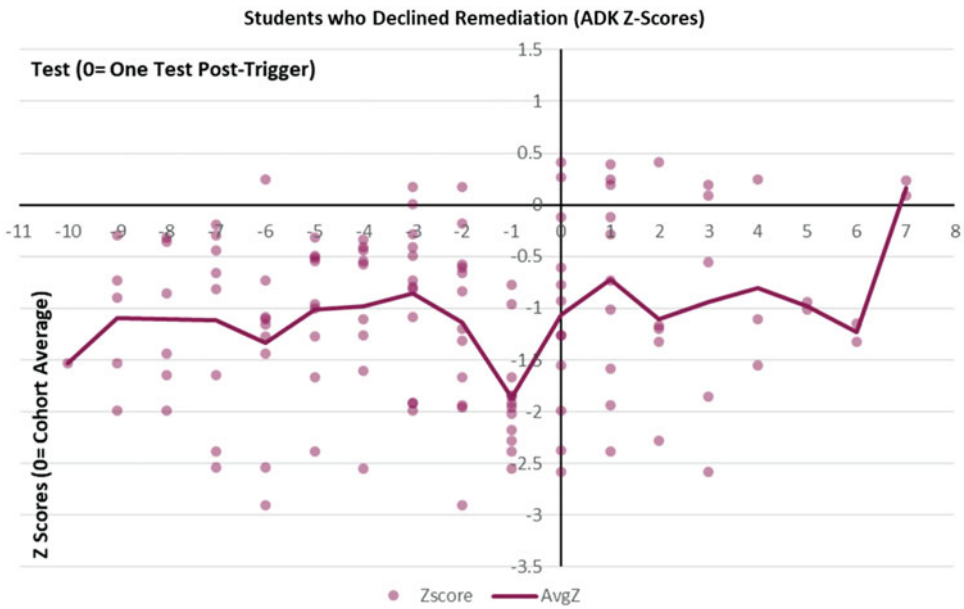

Figure 3. Longitudinal performance of students who declined remediation.

accept or decline an offer of academic remediation as the data shows average performance improves without any intervention. This may be from a multitude of reasons that need further exploration: maybe the actual act of being identified as struggling student may spur some students to study harder, maybe some students are capable of identifying their learning deficiencies on their own and making an attempt to overcome them following a failed assessment. Often students conclude that a significant life event or illness immediately preceding the failed assessment has been the cause of the failure and predict that this can be overcome by a renewed effort to study.

Of note is the same level z-scores at test occasion +7. As this was the final ADK test of the 5-year program (ADK25), it was a very high stakes assessment and involved two final-year students identified in ADK24 who had previously declined all offers of remediation up to ADK24 but took up the offer prior to ADK25. The authors postulate that this finding detracts from the main precept of the results which shows students who decline remediation plateau at their pre-trigger level and additionally fall short in longitudinal performance compared to those students who accept academic remediation.

It is encouraging to note that the average improvement in performance when academic remediation is accepted is above that seen when academic remediation is declined. Accepting academic remediation appears to predicate a sustained and persistent improvement in performance compared to those that decline it. It can be hypothesized that individualized targeted support that is delivered by trained faculty offers a richer and more pertinent analysis of the landscape and learning situation surrounding each individual student than they can discern on their own. Through the academic remediation support process of personalized exploration, identification and management of intrinsic, extraneous and germane cognitive loads, these students appear to have increased their mastery of "learning to learn" and are able to implement sustainable effective learning strategies to carry with them throughout their undergraduate program.

The academic remediation program at our institution provided timely, supplemental, individualized instruction after identification of a deficit, as proposed by Custer (2018). The authors postulate that academic remediation helps learners in several ways above and beyond that which learners are able to ascertain for themselves, and which are sustainable and long-lasting:

- Academic remediation relieves the bottleneck between working and long-term memory by helping students develop meta-cognitive strategies for handling the cognitive load. Learners are shown how to identify and focus on the gaps in their learning, break their learning into manageable chunks and use their study time efficiently (managing intrinsic cognitive load). They are encouraged to address their current environment, whether that be physical, emotional, social, medical or related to specific learning difficulties (managing extraneous cognitive load). They are shown meta-cognitive and self-regulated learning strategies to augment their learning. They are encouraged to focus on the learning process rather than the outcome.
- Academic remediation expands the schema through active recall. Learners are shown how to actively recall their knowledge in a meaningful and consistent way, and thus manipulating schema repeatedly reinforces their cognitive representations over and above simple recall (managing germane cognitive load).
- Academic remediation facilitates learning which makes information in long-term memory more accessible as well as building associations between different schema and contextual cues. Attention is given to the way in which schema are retained in long-term memory and learners are encouraged to consolidate their learning (managing germane cognitive load).
- Student strategies in assessments are discussed in academic remediation meetings, with emphasis on how anxiety and task-irrelevant thoughts (managing extraneous cognitive load) can be managed in order to maximize the cognitive resources available to working memory.

Meshing together these different strands substantiates the learner's proficiency with learning to learn and gives them an edge when shifting from poorly performing to successful, above and beyond those that do not take advantage of what is offered to them in terms of support. The authors have considered why some students decline the offer of academic remediation and further study is needed in this area. They are cognizant that the term "remediation" may be off-putting due to potential associations with terminologies resembling "remedial" classes at school and are considering renaming the process, framing it as "study skills support."

It is acknowledged that the sample size is small, and the data reported is from a single undergraduate dental program, which may raise questions around the generalizability of the findings. However, this is the first study exploring the impact of academic remediation for dental undergraduates. It would be helpful to explore the usefulness of remediation programs to improve students' performance on progress tests in other medical and dental programs. This will be particularly useful in overcoming sample-size issues, allowing additional analyses to any trends due to gender, race or learning disabilities.

Conclusion

In summary, the average performance of students in this study, improved whether they accept or decline academic remediation, although targeted academic remediation appears to have a stronger impact in the short-term for those students who accept remediation. More interestingly, however, accepting academic remediation has more of a lasting effect on the long-term performance of students compared to those who decline remediation. Students accepting academic remediation maintain a higher level of performance for longer than those who decline remediation. The resource implications of running an academic remediation strategy are seen in this study to be worth the effort and through the publication of this paper, learners will be encouraged to engage in support when it is offered to them. Students who accept academic remediation

maintain a more successful profile compared to those that do not take advantage of this opportunity.

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Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

Glossary

Academic remediation: A support process that aims to shift poorly performing or struggling students to become successful in academic assessments

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