Speech pathology students enrolled in a lecture-based gross human anatomy program completed two out of nine topics in self-directed mode. Student performance in quizzes was compared for the two modes, and students completed questionnaires on their perceptions of the self-directed mode of delivery. Students performed as well in the first self-directed topic as they did in lecture-based material, but performance declined significantly on the second self-directed topic. Correlations showed that students who performed well in lecture-based topics also performed well on self-directed topics. The major issues that arose in the student questionnaires were primarily related to the amount of content of the topics, and the length of time required for completion. We conclude that there is a strong need for appropriate design of distance education materials to reflect student perceptions of length, content and time investment, and more importantly that there is a need to ensure extensive communication and support of students studying in distance education/self-directed modes for the first time.

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Self-directed learning in gross human anatomy: Assessment outcomes and student perceptions

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Abstract

Speech pathology students enrolled in a lecture-based gross human anatomy program completed two out of nine topics in self-directed mode. Student performance in quizzes was compared for the two modes, and students completed questionnaires on their perceptions of the self-directed mode of delivery. Students performed as well in the first self-directed topic as they did in lecture-based material, but performance declined significantly on the second self-directed topic. Correlations showed that students who performed well in lecture-based topics also performed well on self-directed topics. The major issues that arose in the student questionnaires were primarily related to the amount of content of the topics, and the length of time required for completion. We conclude that there is a strong need for appropriate design of distance education materials to reflect student perceptions of length, content and time investment, and more importantly that there is a need to ensure extensive communication and support of students studying in distance education/self-directed modes for the first time.

Key words: distance education, self-directed, assessment, satisfaction, perception, anatomy, speech pathology
Introduction

Many universities and colleges are increasingly relying on distance education as a mode of curriculum delivery. The underlying premise for distance education can be varied and may include student and/or instructor convenience and flexibility, financial benefits and, increasingly, pedagogical benefits (Ham and Davey, 2005; Gotthardt et al, 2006). However, there is significant debate about whether this mode of subject and course delivery is an appropriate substitute for internal, face-to-face learning in terms of the student experience and the quality of instruction (reviewed in Richardson, 2005; Richardson, 2006; Bray et al, 2007). There is evidence that students can perform as well in distance education courses as in traditional on-campus courses regardless of a range of demographic factors (Spooner et al, 1999; Johnson et al, 2000; Gagne and Shepherd, 2001; Lu et al, 2003). Furthermore, it has been reported that the major determinant of overall student satisfaction with distance education courses is the perceived quality of the instructor, and that students adapt well to a range of learning environments provided pedagogy is strong (DeBourgh, 2003). An extensive meta-analysis reported that despite a slight student preference for on-campus versus distance education learning, there was no overall data to support differences in student satisfaction levels between the two modes (Allen et al, 2002). Thus it appears that students can perform as well in a distance education environment, and that the major determinant of student satisfaction with the distance education experience is the perceived quality of instruction and pedagogy (DeBourgh, 2003; Allen et al, 2002).

While distance education is highly amenable to learning in a range of courses, this is more difficult in the biomedical sciences where visualisation and an understanding of
structure and function in three dimensions are essential. The potential for high quality
distance education subject design has significantly improved with the advent of the
internet and newly developed software that enables highly visual and interactive
resource development (Talay-Ongan, 2004; Ertmer and Nour, 2007). There are now
many examples of highly developed materials to support the biomedical sciences in
distance education (Huang and Huang, 2003; Ertmer and Nour, 2007), although it is
essential that these tools are used appropriately to avoid student frustration (Ertmer
and Nour, 2007) and anxiety with using computers, email and other online resources
(Fuller et al, 2006). A major issue in developing new distance education subjects and
courses is that designing new online resources can be time-consuming, and
subscription to previously developed online programs can be expensive. In many
cases newly designed distance education subjects are initially delivered using printed
materials, supplemented by an increasing use of online and interactive tools as they
become available.

The present study was conducted preliminary to conversion of an on-campus subject
in head and neck gross anatomy into distance education mode. The study was
designed to determine whether gross human anatomy could be communicated and
learned effectively in self-directed mode, and how students perceived the learning
value of self-directed material. We hypothesised that assessment outcomes (indicating
understanding and retention of the material) would be similar for self-directed and
lecture-based topics, but that students would perceive that more time investment was
required for the self-directed materials.
Materials and Methods

The program in this study covers the compulsory head and neck gross anatomy material for students in the Bachelor of Health Science (Speech Pathology) degree at Charles Sturt University (Australia). This study was conducted with the last cohort of Speech Pathology students to complete the program in on-campus mode. The subject comprised 9 weekly topics given over a 13-week university semester. Eight of these topics were assessed in short weekly quizzes worth a total of 10 marks given in the week following the topic (Table 1). Topic 9 was not assessed with a quiz because it was covered in the last week of semester and students sat their examinations in the following week. Topics were covered in weeks 1-6 and 10-12 of the teaching semester, with weeks 7-9 and 13 being used for revision, the mid-semester examination, and student clinical placement. Topics 6 (Anatomy of Phonation, Articulation and Swallowing), and 8 (Cranial Nerves) were given in self-directed mode in weeks 6 and 11 of the semester (Table 1). All other topics were based on a live (face-to-face) weekly lecture that ran for 2 hours, and was given 2 days before the scheduled weekly practical class. Lectures consisted of a slide (PowerPoint) presentation outlining key anatomical structures and their functions relevant to speech pathology. For all topics students were allocated to a non-compulsory 2-hour cadaver-based practical class that reinforced the material covered in the lecture or self-directed topic. These classes were still scheduled in the weeks that lectures were replaced with self-directed topics to ensure students had contact with the lecturer and received support in their learning. This is consistent with the delivery of distance education programs in biomedical sciences at our university in which compulsory on-campus practical sessions supplement self-directed materials.
All students were required to learn the material regardless of the delivery mode, and to complete the weekly quizzes, while completion of the questionnaires about perceptions of the self-directed topics, and the inclusion of quiz scores in this research project, were entirely voluntary. Inclusion of all student data (questionnaire responses and quiz scores) was with informed consent received by participating students in accordance with the approval and guidelines of the Ethics in Human Research Committee at Charles Sturt University (protocol #: 2006/097).

The self-directed materials comprised a printed document containing background information and instructions for completing the topic, followed by several reading sections, each of which contained activities such as reading and summarising a section of the text (Seikel AJ et al, Anatomy and Physiology for Speech, Language and Hearing, Singular Publishing Group, 2005), answering questions, describing concepts in lay terms, labelling diagrams, and carrying out internet searches. Students were asked to search for web pages relevant to the topic and share the information with other students via the online subject forum. In the lecture class preceding each self-directed topic, students were provided with information about how to access the material, and approaches to studying in this mode were suggested.

At the completion of the topic (in the subsequent scheduled class time), students were asked to complete a pre-assessment questionnaire, followed by completion of a quiz-style assessment on the material covered in the self-directed topic. Students then completed a post-assessment questionnaire on the efficacy of the topic format after receiving their marks for the quiz. The pre- and post-assessment questionnaires were compared to determine if student responses were affected by their performance on the
assessment items. The items covered on the pre- and post-assessment questionnaires are summarised in Table 2.

Data analysis

Quiz scores.
Student quiz scores were compared as an overall mean +/- standard deviation with other topics that had been delivered in lecture format. Differences between mean quiz scores over a range of topics were tested for statistical significance by one-way analysis of variance (ANOVA) followed by post-hoc analysis using the least significant difference (LSD) model. For individual students, the quiz score obtained on each self-directed topic was correlated with the mean score obtained in all lecture-based topics. This was performed using the standard calculation for Pearson’s correlation coefficient in a Microsoft Excel.

Questionnaires.
Questionnaires were based predominantly on students choosing a quantifiable answer to a question (e.g. yes/no, better/worse/same/uncertain). These responses were quantified as a percentage of the total number of responses received to each question.

The questionnaires also had a section in which students were asked to offer comments about the self-directed topics. These were classified according to general themes (e.g. whether the comment related to length of the topics, or the level of confusion or difficulty of the material and instructions, etc).
Results

Comparison of quiz performance on material given in lectures compared with the two self-directed topics

Twenty-seven students consented to having their quiz scores included in this study. A total of 8 quizzes were given throughout the subject, 6 of these were on lecture-based material, and one quiz was given on each of the self-directed topics (see Table 1). Firstly, overall class means were compared for each quiz (Fig. 1A). For lecture-based material the class means ranged from 7.5 ± 1.9 (out of 10) in the first quiz (see Fig. 1A, L1) to 5.7 ± 2.3 (out of 10) in the fifth quiz (see Fig. 1A, L5). Overall class performance for the quiz given on the first self-directed topic did not differ significantly to any of the lecture-based quizzes (Fig. 1A, compare SD1 with L4 and L5), while performance on the second self-directed quiz was the lowest overall (Fig. 1A, SD2). The scores for all lecture-based quizzes were next pooled to obtain a measure of overall performance in this style of learning and compared with the two self-directed topics. Performance on the first self-directed topic was similar to lecture-based material, but performance on the second self-directed topic was significantly lower than both the lecture-based material and the first self-directed topic (Fig. 1B).

To determine how individual students performed using these two styles of material delivery, more detailed analyses were carried out for each student. Firstly, a correlation between mean performance on lecture-based material and each of the two self-directed topics was determined. For both self-directed topics, a positive correlation with performance on lecture-based material occurred, indicating that individual students who performed well in one style of learning also performed well in the other. This correlation was particularly high (0.87) for the first self-directed
topic (Fig. 2A), and slightly lower (0.61) for the second (Fig. 2B). Secondly, raw quiz scores for individual students were compared to determine whether students performed better, worse or the same on quizzes on the self-directed topics versus quizzes on lecture-based material. For both self-directed topics, the majority of students performed worse than on lecture-based material, but this was strikingly so for the second self-directed topic where only 2 of the 27 students obtained a better score than their average for lecture-based material (Fig. 3). Furthermore, students who performed worse on the self-directed topics generally did so by a greater magnitude than those who performed better. For the first self-directed topic, students who performed worse did so by an average of 1.6 ± 0.9 (range of 0.5-2.9) marks, while those who performed better only did so by 0.6 ± 0.4 (range of 0.25-1.1) marks. Again, this difference was more striking for the second self-directed topic, where students who performed worse did so by 2.9 ± 1.5 (range of 0.5-5.2) marks.

*Analysis of student perception of self-directed topics*

The pre-assessment questionnaire asked students to note how much time they spent on the topic, the level of difficulty and any confusion involved, and access and types of resources that they used for the topic. Students spent an average of 3.3 ± 1.9 hours on the first self-directed topic, with a range of 1.5-10 hours. Students generally spent more time on the second self-directed topic although the variation was much larger, taking an average of 5.6 ± 4.3 hours, with a range of 0.25-20 hours. The data for times reported by individual students are presented in the histogram in Figure 4, which demonstrates that most students spent up to about 4 hours on the first self-directed topic, while the time spent by students on the second self-directed topic was highly variable, with 10 students reporting that they spent over 5 hours on the topic.
The data for access to material and level of difficulty are summarised in Table 3. For both topics, the majority of students reported that they had access to the materials they required to complete the topic, and that the topic was easy to follow. However, while the majority (85.7%) of students reported that there was something confusing about the first self-directed topic, only 23.1% reported this for the second topic. When asked to supply comments about what specific things were confusing or difficult about the topic, those who responded for the first topic reported that specific information and directions contained within the topic was ambiguous, while for the second topic all comments related to the amount of information contained within the topic and that the topic was given at a “bad time of year” and coincided with many assignments for other subjects.

The resources students used to complete the topic are listed in Table 4. Most students relied on the prescribed text book for the subject, but most used at least one other resource. It should be noted that some of the activities involved in the topic referred specifically to reading sections of the text book and searching the internet for relevant websites. For the first self-directed topic, the majority (42.9%) of students used 2 resources, but for the second topic, the majority (57.7%) used only 1 resource.

Students were asked in both the pre- and post-assessment questionnaires if their understanding of the self-directed material was better, worse or the same as material delivered in lectures in previous weeks (Table 5). For the first self-directed topic, similar numbers of students reported a better or a worse understanding of the material compared with lecture-based material both pre- and post-assessment. However, while
32.1% reported a similar level of understanding pre-assessment, this increased to 52.4% post-assessment. This corresponded to a decrease in the number of students who were uncertain, which decreased from 28.7% pre-assessment to 9.5% post-assessment. For the second self-directed topic, no students reported either pre- or post-assessment that they had a better understanding compared with lecture-based material. In direct contrast with the first topic, 61.5% reported that they had a worse understanding pre-assessment, and this increased to 70.6% post-assessment.

Students were asked both pre- and post-assessment if they had a preference for self-directed or lecture-based delivery of subject material (Table 6). In all cases the majority of students preferred lecture-based material. While 28.6% of students reported a preference for self-directed material after the first topic, this decreased to only 5.9% after the second topic. Furthermore, for both topics there was a decrease in preference for a combination of lecture-based and self-directed material between the pre- and post-assessment questionnaires.

Themes for suggested changes from students

Two key themes emerged when students were asked in the pre-assessment questionnaire for their recommended changes to the material included in the first self-directed topic. The first of these related to the content of the material provided for students to complete the topic. Ten of 28 respondents recommended changes to the topic design, focussing on content such as images, written material, and length of time required to complete the topic. The majority thought the topic was too long and there were too many activities, but several requested that more activities, more images and references to alternative resources, and more challenging material be included.
The second theme to emerge related to support provided for students during the first self-directed topic. Nine of the 28 respondents to the pre-assessment questionnaire requested answers to the questions and activities, and/or a follow up tutorial session with the lecturer in support of the self-directed topic.

All students who supplied recommended changes about the second self-directed topic reported that the topic contained too much information and took too long to complete. Several students also recommended that more learning activities be included in the topic, although no specific activities were suggested. Several students also commented that the second topic coincided with a large workload (e.g. assignments) in other subjects. These factors are likely to be major contributors to the significant decline in student preference for self-directed learning that occurred between the first (28.6%) and second (5.9%) self-directed topics.
Discussion

This study demonstrates that students are able to perform as well in self-directed topics, but that they may perceive that self-directed topics require a greater time commitment, compared with topics delivered in a traditional lecture-based mode. In this case, the second self-directed topic coincided with a large workload for other subjects, and this correlated with lower performance, an extremely variable amount of time spent on the topic, and use of fewer resources. It also correlated with an increase in the number of students reporting that the topic was too long, and contained too much information, although between the first and second topics there was a three-fold decrease in the number of students reporting that the topic was confusing. Therefore, in our experience, student satisfaction levels with self-directed learning are low, and this is attributable primarily to design of the materials and support/instructions given to students, the perceived amount of time required to complete the topics, and to student workloads in other subjects. These findings are currently being used to make significant design changes to the conversion of this subject to full distance education mode.

It should be considered that the level of difficulty of the topic material contributed to the decline in quiz performance for the second self-directed topic. This possibility could only have been excluded by having half the students do each topic in self-directed mode, and the other half in lecture-based mode. However, it was considered that this could disadvantage some students should our hypotheses be proven wrong (i.e. that students perform as well in each mode of delivery), and the study was thus designed with ethics, pedagogy, and student equity in mind. Despite a potential contribution of this factor to student performance and perceptions of the self-directed
topics, this does not significantly impact on the other issues that were raised by students in their pre- and post-assessment questionnaires.

A major issue in this study was the amount of time students felt was required to complete the self-directed topics. This occurred despite the students being informed that the self-directed topics should take no longer to complete than the combined total of normal lecture time and presumed weekly study time. This may be due in part to the design of the topics and communication between the lecturer and students about expectations and study approaches, but may also reflect student time management skills. The phenomenon of student procrastination, whereby weekly study habits are avoided and substituted for last minute study for examinations, has been widely reported and reviewed (reviewed in Schouwenbourg, 2006). Self-directed learning puts a strong emphasis on the learner taking responsibility for their own time management and the learning experience (reviewed in Lee et al, 2003). This is detrimental to using distance education or flexible learning tools for some student groups (Lee et al, 2003), and there is evidence that distance education is more suited to students who can work at their own pace and avoid procrastination (Leasure et al, 2000). Certainly for distance education to work well, students must be committed to take responsibility for their learning, and show dedication to completing required learning tasks (Ladyshewsky, 2004). Therefore, the student perception that the distance education topics consumed too much time may be associated with the general practice of not studying extensively on a weekly basis outside lecture times.

A range of factors contribute to a successful distance education experience. Student personality types can affect perception of the distance education experience whereby
extroverts who like the social contact and to study in groups with other students can find the isolation of distance learning difficult (Meisgeier and Richardson, 1996), although in the case of the present study this is unlikely to be a major contributing factor since all students were enrolled in other on-campus subjects and had adequate opportunity to study in groups on the self-directed topics. Different learning styles can also affect performance and perception of distance education (Allen et al, 2002), although our results show that most students who performed well by distance education also performed well on lecture-based topics, and this likely reflects a general commitment of those students to regular study habits and a stronger academic ability. Certain demographic issues may contribute to how students approach distance learning. Adult learners, particularly those aged over 46 years (Inglis, 1987), are more likely to succeed at distance education than younger students, and there is evidence that younger students in the 16-19 year age range require a highly supported learning environment (Guthrie and Krzemionka, 1987). In the present study, the majority of students were aged 22 years or less and in their second year of university study after coming straight from high school. This further supports the requirement for a high level of instructor support for distance education, and it is important that demographic information, such as age, be taken into account in the design of distance education materials, and/or the application of self-directed materials for on-campus subjects.

Conclusions

In summary, this study has shown that self-directed learning can be as effective as standard lecture-based learning, but that students perceive that completing material in self-directed mode is more time-consuming and laborious. Importantly, this research has provided key information that will be used to develop new distance education
materials in the future, with a specific focus on the design of the distance education materials, the structure of the materials in relation to workloads in other subjects in the course, and the level of guidance provided to students in study skills specific to distance education.
References


