



A large scale evaluation of the effectiveness of computer based resources: A research methodology

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Abstract: The perceived effectiveness of computer based resources on the learning opportunities of a large group of first year students within the context of a single biology course was investigated. The resources included tutorial and self-assessment modules, on-line materials and communications technologies. The research model considered the views of the students and teaching staff, in order to investigate the alignment/non-alignment of staff-student perceptions of the resources. An action research methodology was adopted to explore stakeholders' perceptions as they participated in the teaching and learning process from the commencement of the course to its completion. Data of expected and realised use and usefulness of the various resources in student learning were collected using surveys and focus groups. Data show that 75% of students made use of the computer based tutorials provided to support their learning, with the majority (91%) of students who used the materials finding them useful. Student use of email was high, with 97% of all students surveyed indicating some use (mostly non-course related), however approximately 10% of the entire cohort found email useful in supporting student learning in this course. There was a misalignment between staff expectations of use of computer based resources and students' actual use, which needs to be addressed. The paper presents the research model, discusses why it was chosen and shows some of the current results.

Background

At The University of Sydney, the cohort of first year biology students is large (1300 students) and exhibits diversity with respect to cultural, educational and biological background, incoming entry grades and motivation. The current study examined one of the first year courses, Human Biology, which is designed to cater for a variety of learning styles by integrating a range of computer based resources (tutorial and self-assessment modules, on-line materials and communication strategies) with more traditional learning resources (lectures and practical sessions). To provide a flexibility which caters for the lifestyles of students in the 21st century an on-line virtual learning environment (<http://fybio.bio.usyd.edu.au/vle/L1/>) has been developed, which enables students to access the course educational resources anywhere/anytime (Peat, 2000).

This paper presents part of a large scale study which looked at the effectiveness of **all** learning resources in the first year Human Biology course, both traditional and computer based, from the perspective of both the students and the teaching staff. The aim of the **entire** project was to determine how **all** of the learning resources provided influence the overall teaching and learning process, rather than the effectiveness of individual resources. However this paper focuses specifically on student and staff perceptions of the computer based resources (learning modules, self-assessment modules, on-line materials and communication strategies, e.g. email) embedded within the curriculum. More specifically this paper examines the alignment/misalignment between student and staff perceptions of the use and usefulness of the computer based resources provided.

The computer based resources in question are being sustained within the curriculum and have been used by more than 800 students each year for several years. The tutorial and self-assessment modules in particular have been individually evaluated upon their introduction into the curriculum and have been demonstrated as effective (Peat, 1999; 2000; Peat et al., 1997). As within instructional technology the research agenda has gone beyond that of comparing resources to one of making them work better (Reeves, 1999). The project focused on the impact of the computer based resources on the overall learning process. The results presented in this paper will concentrate on the computer based learning modules (tutorial and self-assessment), and communication strategies (email). To determine how the resources influence the learning process and outcome, the action research model chosen was that of Bain-Alexander-Hedberg (Alexander and Hedberg, 1994; Bain, 1999).

Research methodology

In the preparatory phase of the project the curriculum was analysed to document the computer based and traditional resources used and to determine when and where the resources were to be introduced.

The research model involved a mixed approach to data production and analysis, with both quantitative and qualitative information obtained in the evaluation process (Alexander and Hedberg, 1994). Students were surveyed four times (DC₁ – DC₄) throughout the 13 week semester (Table 1). At DC₁ all students (n=800) were surveyed using a paper-based instrument. A subset of all students was used for the three subsequent surveys, with each instrument surveying 400 students (half the total number) chosen at random. In addition there were two focus groups of randomly selected students. Laboratory teaching staff (n=20) were surveyed at the commencement and completion of the course using a paper-based instrument.

Semester commences **HUMAN BIOLOGY SEMESTER 2, 2000** *Semester ends*

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TIME →

	Data Collection Points			
	DC ₁	DC ₂	DC ₃	DC ₄
Stakeholders				
Students	S	S	S FG	S FG
Laboratory teaching staff	S	-	-	S

(DC = Data collection point; S = Paper-based survey; FG = Focus Group)

Table 1. Data collection for evaluation of effectiveness of computer based resources in the first year course Human Biology

The first data collection point (DC₁) was at the commencement of the course in order to provide a benchmark of understanding and perceptions prior to any teaching and learning influences. Although a separate instrument was designed for the students and staff, the questions focused on similar course delivery issues and all stakeholder perceptions of learning resources and how they would be used. This enabled the alignment of responses and the derivation of common themes in terms of the understanding, potential and use of learning resources within the program and asked all stakeholders for their expectations of the use and usefulness of different learning resources. Data collection at DC₂ and DC₃ coincided with the introduction of specific resources into the course. Students were sampled with questions focusing on specific aspects of the resources provided. Focus groups were implemented at DC₃ and DC₄ in order to investigate further student perceptions of the usefulness of email and the self-assessment modules to their learning. Both students and staff were sampled at DC₄, at the completion of the course, in order to gather information about both the students' actual teaching and learning experiences after exposure to the computer based learning modules, on-line materials and the communication technologies and the staff's actual perceptions of student usage of the resources. The DC₄ survey data from students and teaching staff was used as a comparison with data collected at DC₁. Staff and student responses at DC₄ enabled alignment to be investigated.

Results

Benchmark data from DC₁ indicated that, of the students studying Human Biology, 99.5% had access to a computer, 98.5% to the Internet and 86% used email. Of the students using email, DC₂ data showed that 90% used it for social communication, while only 30% used it to contact fellow Human Biology students.



	Students		
	Expectation of access	Expectation of access (S ₁)	Actual access (S ₄)
Access computer			
- never/rarely	0%	13%	16%
- weekly	74%	54%	71%
- daily	26%	33%	13%
Access Internet			
- never/rarely	0%	11%	20%
- weekly	90%	55%	64%
- daily	10%	34%	16%

(S₁ = initial survey at start of course; S₄ = final survey at completion of course)

Table 2. Access to computers and Internet: comparison of staff perception of student access and percentage of students who expected to access and actually accessed resources

With regard to the use by students of technology to assist learning in the course, the teaching staff expected all students to be accessing the Internet at least weekly and thought that the students would find the computer based materials useful/extremely useful to their learning (Tables 2 and 4). However this study indicated that only 76% of students used the Internet, and 75% of students made use of the computer based tutorials provided to support their learning (Table 3), with the majority (91%) of those students who did use the materials finding them useful/extremely useful (Table 4). With regard to the usefulness of computer based resources in supporting learning, the students' expectations did not line up with the perceptions of the teaching staff (Table 4). Overall staff perceived the resources to be more useful to students in their learning in Human Biology than the students found them to be. At DC₂ in response to the question 'please add any comments you may have about your access to computer based learning (CBL) at home' there were both positive and negative responses:

I like using CBL, find them useful.

Usually no problems – I find them helpful, although I have no access to the Internet at home, only at work.

I like them. I really like the whole VLE. The design is really great!!! I use it all the time.

Hard to access and need to download stuff, and even then it doesn't work.

Never used them, never will.

Again at DC₂ in response to the question 'Do you have any other comments to make about the use of CBL resources in Human Biology?' there were both positive and negative comments:

CBL is unnecessary and a waste of time. One is able to learn more from reading books in the time it takes to do a CBL module.

It puts you at a disadvantage if you don't have the devices to view them.

It is a huge help with personal study that can be conducted at home.

Beneficial – another source of info; reinforces; in some cases clarifies.

Yes, it allows me to further understand the topic, but sometimes it involves you spending a lot of time for it.

It is a very effective method of independent study and is very helpful in being another complement to lectures and the text.

The overall student use of email as a form of asynchronous communication was high (DC₁), with 86% of all students surveyed indicating some use. Interestingly the student expectation of use of email (53%) was greater than actual use (22%). Similarly there was a misalignment between student use of email and staff expectation, with staff assuming a much higher percentage of students (81%) would use email (Table 3). Of the 22% of students that used email for course related purposes only half (57%) found it to be useful/extremely useful i.e. approximately 10% of the cohort (Table 4). At DC₂ students responded to the open-ended question 'please add any comments you may have about your use of email with respect to Human Biology':

Need more help with email/net; just was suddenly thrown into the technology; don't use it much because don't know much.

Email has been a social device. I find it unreliable ...

Notices sent via email are really helpful.

I do feel comfortable with the knowledge that if I need it, it is available.

	Expectation of use	Students	
		Expectation of use (S ₁)	Actual use (S ₄)
Use of Internet	74%	81%	76%
Use of computer based tutorials	84%	73%	75%
Use of Email	81%	53%	22%

(S₁ = initial survey at start of course; S₄ = final survey at completion of course)

Table 3. Use of computer based learning resources for Human Biology: comparison of staff perception of use by students with students' expected and actual use

	Staff	Students
	Expectation of usefulness	Actual usefulness (S ₄)
Internet		
- not useful	5%	11%
- useful	83%	55%
- extremely useful	12%	34%
Computer based tutorials		
- not useful	0%	9%
- useful	66%	53%
- extremely useful	34%	38%
Email		
- not useful	22%	43%
- useful	61%	47%
- extremely useful	17%	10%

(S₁ = initial survey at start of course; S₄ = final survey at completion of course)

Table 4. Usefulness of computer based learning resources: staff perception of the usefulness compared to actual usefulness of resources to students who used them

Focus group discussions indicated that students expected information to be sent to them via email but they would rather talk face to face with staff as this gives immediate feedback and allows for follow-up questions. Responses included:

Not fast enough.

Information sent by the lecturer is useful, but would not ask questions this way as prefer to go and visit the lecturer or consultant.

Feel silly asking questions. (Would) rather go and see someone as can then follow through with second question.

Discussion

The results presented in this paper were only a part of a large scale study of the use and usefulness of all the learning resources provided to the students. It was found that, due to the methodology used, a number of problems were encountered during the data collection process. Due to the holistic and inclusive nature of the investigation, the quantity of data generated was huge and time became an issue, given that preceding data had to be analysed quickly in order to inform each subsequent survey instrument. Similarly we found there was too little time to reflect on the data before moving on to the next phase. This, with our inexperience in writing survey questions, led to some data being hard to interpret. Although the students were involved in the project and were provided with information as it came out of the data, there was a perception that students were being over surveyed in Human Biology and university courses generally. The use of an action research method exacerbated this problem, which was reflected in a difficulty in obtaining volunteers to participate in focus group discussions.

Initial analysis of the data indicates that we as teachers may have unrealistic expectations of the students' use of the new technologies in learning. There appears to be a mismatch between how we, as providers, think the resources will be used and how useful the students perceive them to be. It may be that the students, whilst expecting to use the technology, find they do not like using it, do not



know how to use it or have problems using it. These issues were not addressed in the current study, however the implication for universities considering putting more materials on-line would seem to be one of caution.

One of the more interesting aspects of this study is that there appears to be approximately 20% of the cohort who, whilst having access to computers and the Internet either at home or on campus, are resistant to the new technologies in teaching and learning. This resistance is not due to a lack of access, given that 98.5% students indicated having access to the Internet. It is possible that some of this resistance may be due to difficulties reported in accessing our materials due to the plug-ins required. In 2001, in an effort to overcome some of these problems, a CD-ROM containing all the First Year Biology learning resources and the appropriate plug-ins will be available for purchase by the students, and it is hoped that this will enhance the use of the tutorial and self-assessment modules. The data reinforces the idea that within the student cohort there is a variety of learning styles, which require the provision of a diverse range of learning resources, both on-line and off-line. Oliver and Omari (2001) reported a similar lack of uptake of web-based teaching with 20% of students not comfortable with using the Web as their learning environment. The reason for this lack of uptake needs to be investigated before putting a large proportion of teaching and learning resources on the Web.

The environment in which the resources are to be used is important – Human Biology is an on-campus course, whereas many providers are dealing with a mixed-mode or off-campus delivery. We need to be aware that providing resources on-line will not necessarily mean they will be used or accessed – just as other materials/texts are used or not used at the whim of the individual student.

Another issue is that the use of the computer based resources is not compulsory – optional resources may have less attraction or perceived use than those which are specifically linked to assessment or examination components. The students' perception may be that they could pass using the other (traditional) resources alone. This of itself may not be a bad outcome. It shows us the value of offering a diverse range of materials to provide students with a rich learning environment – one where different views of content and a selection of resources to suit all learning styles are available should they be required.

Although the course investigated is campus based, changes in student life styles (particularly the need for paid employment) necessitate addressing the problems of access and equity – we have tried to provide anytime/anyplace access to our resources to accommodate these shifts. As teachers we must continue to look for the optimal combination of teaching and learning resources that are aligned with the social, economic and knowledge environments of the students' world.

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