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The assignment that triggered change:

Assessment and the relational learning model for generic capabilities.

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ABSTRACT

In a context where changes in conceptions or experiences associated with learning generic skills is a desirable learning outcome, how can assessment instruments be designed to bring about the desired changes? In this paper we show how understanding the variation in students' experience of learning a specific generic capability represents the first step in designing assessment instruments for bringing about desirable learning outcomes. Our research has revealed that from a student's perspective two major elements produce changes in conception or experience. From a teacher's perspective, these changes should lead the student into desirable learning outcomes. The two elements identified by students are assignments designed to encourage reflection and the characteristics of the teaching staff. On the basis of students' perceptions, therefore, we are further challenged to carefully construct assessment to bring about change.

Introduction

In a context where changes in conceptions or experiences associated with learning generic skills is a desirable learning outcome, can assessment instruments be designed to bring about the desired changes? Over the past few years, observing and researching Information Technology (IT) students learning to search the Internet has been enlightening. In research interviews with the students, individuals have commented on the importance of planning a search and having the ability to use different information searching tools. They mention also the importance of being able to use the searching options available to filter their Internet or library database results into a small but highly relevant set. Words like Boolean and wildcards (or logical operators and truncation) have rolled off students' tongues during interviews, and the teacher has been impressed by the students' abilities to "talk the talk". Unfortunately, later, while seated at computer

terminals, some of these same students have not "walked the walk". Seated at the computer during the research interview, or observing them later in classes, some individuals used none of the tools they had cited; they ignored or failed to notice typing errors, and then expressed frustration about the tool's poor design. Some students then promptly switched to another search engine, while simultaneously switching search terms. This polarity between students' words and actions was concerning, suggesting that their experience needed closer investigation. This led to an ongoing research project investigating students' varying experiences of searching for web-based information.

This paper reports on aspects of an ongoing investigation into how students experience Internet searching. The first stage included a set of interviews, which provided base material for a model comprising four categories of information searching. In a second interview, students' comments on the completed semester of learning clarified the initial category development. The second round of interviews was also used to uncover students' views of influences on their learning.

In this paper we summarize the empirical work and then show how the results were applied to analysing and trying to improve the unit's assessment in order to improve learning outcomes. What has not yet been done is to test whether changing the assessment has led to improved learning. The results have been used to analyse the curriculum material to reveal assessment weaknesses and areas for improvement.

The intention of this paper is to show how understanding the variation in students' experience of learning a specific generic capability, in this case, the student's information searching ability, can represent the first step in analysing assessment instruments for bringing about desirable learning outcomes.

Ample research suggests that learning activities may be designed to improve learning outcomes (Marton & Booth, 1997; Marton, Hounsell, & Entwistle, 1997). Marton (Marton & Tsui, In press) further proposes that the learning study is a powerful tool in developing learning activities that bring about desirable learning outcomes, and Biggs (Biggs, 1996) reminds us of the principle of constructive alignment. We agree with Biggs and Marton that learning activities, including assignments, should be crafted to bring about desirable learning outcomes.

In our application of the relational approach to teaching and learning (Bowden & Marton, 1998; Marton & Booth, 1997) to the generic capability agenda, an attempt has been made to design formative assessment instruments to construct the student's experience of learning. Students during interviews suggested that it was assignments that triggered a change in their experience of information searching. We determined, therefore, to pursue the use of assessment as a mechanism for opening up the space of variation associated with learning to search the web. This means that we are suggesting that assessment can be constructed to enable the students to move from a position of seeing the world in one, or a limited number of ways, to appreciating and using the various lenses available through which to view the world.

How do students experience Internet searching?

Most contemporary research into web-based searching behaviour currently falls into two broad categories. The first of these could be described as classic information retrieval research. The second is research into internet searching or internet use. In both areas attempts have been made to understand both information search patterns and searching behaviour, and in some cases attempts have also been made to understand the experience of the end user.

Growing out of information retrieval or information management roots, classic information retrieval research traditionally considers database, online catalogue, and other information retrieval system searching. The primary focus is often related to the design of the retrieval system (Robertson & Hancock-Beaulieu, 1992) or the likely relevance of the final results (Jansen & Pooch, 2000). Studies have commonly considered what have become known as recall or precision ratios, which look at the number of relevant and non-relevant documents retrieved, compared with the number of relevant documents actually available (Sparck-Jones & Willett, 1997). While it is possible from this research to identify trends in typical interactions between searchers and the system (Silverstein, Henzinger, Marais, & Moricz, 1999), they quantify rather than explain search behaviour.

Other investigations have focused on web-based searching behaviour, ranging from pure database searching and likely information retrieval (Jansen & Pooch, 2000), to search strategies and information seeking in context approaches (Fidel et al., 1999; Klobas & Clyde, 2001; Wiley, 1998) . Typically some form of quantifying measure has again been used in most of these approaches leading to attempts to describe the "average web-based searching behaviour". We believe the challenge is to identify the variation in searching behaviour, rather than norms.

The literature of end user behaviour is more complex. Over the past four decades there have been numerous research studies into end-user characteristics. For this period, and indeed for the current research, the work of the most interest would be that of Kuhlthau (Kuhlthau, 1988), who looked at students working on assignments and their experiences when using information in the library. This work led her, over the next few years, to eventually describe information literacy in terms of a "way of learning" (Kuhlthau, 1993). Preliminary studies looking at information searching behaviours (Cole & Kuhlthau, 2000; Tibar, 2000), have suggested that users make an attempt to define what they deem to be information in each individual context. That is, what to one person seems highly relevant, to someone else would be utterly useless, as it does not suit their needs in their own work or study environment.

Information science research is showing an emerging interest in applying educational research into the variety of ways needed to understand the searching process (Kuhlthau, 1988; Limberg, 2000a, 2000b). Limberg and Kuhlthau's work is particularly relevant to this study, in that they show that the variation in the users' experience of searching can highlight areas where a gap exists between the search process and the learning outcomes.

Limberg's work goes further to suggest that information seeking is actually not content specific, but is a more general process. This process, however, cannot be described without relating it to the content of what is learnt. These latter studies confirm that human factors in web-based searching behaviour must not be ignored. We need to place the end user firmly in the picture.

Research Aims

The searching experience is not solely about recall and precision ratios, it is not solely about computer literacy skills, it is not about whether the interface or the system tool is well designed, and it is not solely about the cognitive abilities of the end user. The searching experience involves a combination of factors. We need to understand the variation in the experience of internet searchers, and we should be looking at their "way of learning" (Kuhlthau, 1993). In doing so, we may identify why particular search behaviour is evident, and in understanding the underlying reasons for the approach, we may be able to build a framework to help people move into more satisfying search experiences.

Based on these findings, and our teaching observations, our research project has a series of broad aims including:
1. To determine variation in the ways IT students approach information searching when using the Internet and library databases.
2. To determine variation in IT students' views of what helps them learn to search for information when using the Internet and library databases.
3. To recommend teaching and learning strategies for curriculum design that are based on managing students' experiences.

Eliciting Variation in Approaches to Information Searching

As the research aimed to uncover variation in students' experience, a phenomenographic approach was taken (Marton, 1986, 1994, 2000).

The majority of the students who participated were enrolled in a QUT (Queensland University of Technology) FIT (Faulty of Information Technology) subject ITB322 Information Resources. In this unit they learn to identify, retrieve and evaluate print and electronic business information resources that are relevant to a variety of problems; thereby applying their knowledge in Internet, Intranet, and virtual library environments. Primarily the unit is designed to encourage learning about a variety of information resources and their uses, independent of the format of those resources. The curriculum focuses on information retrieval techniques across a wide area of information resources which will be useful in the future careers of each student. A small number of 1st year IT students also participated.

Data gathering during 2000 – 2002 involved investigations of student diary work and a series of 35 interviews conducted over several semesters. Participants were mostly in their final year or postgraduate study. 13 students were interviewed in 2001, 10 students were interviewed in 2002.

Approximately half the students participated in both interviews; one at the start of semester, followed by a second round interview, with the same student, at the end of the semester. The final transcripts comprise 23 first round interviews and 12 second round interviews.

Both interviews were used to identify variation in experiences of searching. The second interview was analysed to reveal students' perceptions of influences on their learning.

Different cultures, ages and genders were represented. On completion of a small writing and/or drawing task students were asked to describe a recent search experience, and to describe how they learn to search for information using various web based tools. Careful attention was paid during interviews to asking students to explain their interpretation of key concepts in the area. Students were then videotaped whilst engaged in a search task, and they were encouraged to think aloud about their processes while they were searching.

A phenomenographic approach was taken to analysis of the interview transcripts revealing categories of description structurally linked in an outcomes space (Marton, 2000). The following section will firstly outline the basic categories, and then explain the essential differences between the four categories.

Describing different ways of Internet searching

Based on the analysis of the experiences of upper undergraduate and post-graduate IT students, four categories have been identified that capture students' different ways of searching for information. These categories can be shown in the outcome space provided in Figure 1. The outcome space reveals a logical path for Categories 2 through to 4 and a major gap in conceptions between Categories 1 and 2. The research findings suggest that assessment design as well as reflective opportunities for students may assist in bridging this gap. In the following section, the four categories are outlined. Further information on the categories can be found in Edwards and Bruce (Edwards & Bruce, 2002).

Each of these categories is associated with different meanings being assigned to the search experience. Each is also associated with different awareness structures, different approaches to learning and different search outcomes. The brief descriptions provided here were developed to answer the following questions: What was the focus for students in the experience? Were they aware of the information environment and its structure? Was there any evidence of planning or any ongoing reflection used in their approach?

These questions emerged as keys to describing this phenomenon during the course of the analysis.

Category 1: Information searching is seen as looking for a needle in a haystack.
In this category students see information searching as similar to looking for a needle in a haystack. A significant amount of attention is directed towards the search topic. They appear to see it as imperative to understand the topic or they will "never find it out there." Although they are aware of the information environment they have no appreciation of the importance of the structure of that environment, the wide variety of information resource tools available, nor that the structure of these search tools will enable them to find the information they require. More importantly in this category there is little evidence of approaching the search process in a reasoned or a reflective manner. There is usually an assumption that the information required is not available at this source, or the search tool in use is of poor quality and does not index the required information.

Category 2: Information searching is seen as finding a way through a maze.
In this category students see information searching as the process, or the planning, of a search. While they still focus on the topic, there is a strong emphasis appearing on the choice of terms and synonyms, databases, and retrieving results into a useable format for later work. The process or the planning of the search has become more important, with students beginning to use advanced search features, and talk about some aspects of the quality of the information found. In this category they are more likely to persist, consider alternatives, and persevere to find results. They have a growing awareness of the rich variety of search tools available, however, again there is still a tendency to blame the tool rather than question their own abilities.

Category 3: Information searching is seen as using the tools as a filter.
In this category students see information searching as using the searching tools as a filter to find information. They tend to use the tools to help them understand the topic as well as to find the required information. They are much more aware of the structure of each of these tools and show an ability to adapt their searching based on the tool they are currently using. In this category students take the necessary steps to correct mistakes as required and planning is evident. This planning often includes an analysis of the terms and a more pronounced attempt to identify synonyms before proceeding. There are also attempts throughout the search process to identify and change strategies based on the results of the first attempts.

Category 4: Information searching is seen as panning for gold.
This category could also be described as using the search tools as a filter, but this time the intention is to limit results to high quality information. In this category students see information searching as a process of using the tools during the search to limit the final set of results to include only the highest quality resources. The intention is to use the appropriate tools to find only primary information resources. As the awareness of primary and secondary information is heightened, the tools and their structure are used to refine both the topic and the search, to help filter out poor quality items. Strong planning and reflection are evident and the searching process includes changing strategies based on the results of first attempts.

Students' views of influences on their experience of learning to search the Net

It can be seen from the four categories defined that students have different experiences when searching for information. Secondly, and more importantly, at the second research interview, conducted after the study and assessment of the subject was completed, students reflected upon their evolving searching experience for the semester. Each student perceived that they had changed their experience of searching compared with their experiences prior to the subject unit commencing. Each student believed that their searching experience had improved in both speed and the end quality of the information search results found. More importantly, most students stated an ability to both transfer the knowledge gained to other units of study, and to help their peers when they searched for information. The students identified two reasons for change

1. Assignments designed to encourage reflection, and
2. The characteristics of the teaching staff.

Assignments Designed to Encourage Reflection

There are three items of assessment designed for the unit. The three items and their relative assessment weight for the unit are:

1. Reflective Journal (20%)
   Each week students are asked to complete a journal entry as a means of encouraging interaction with the unit's material. The students are asked to critically reflect upon and summarize the content of lectures, tutorials, set readings, and field visits. They are asked to consider their information searching experiences using a reflective approach (Edwards & Bruce, 2002). In this reflective process the student is asked to identify the activity and then evaluate and consider the material they covered to determine for themselves its validity. This could also be described (Brookfield, 1995) as *the process of hunting out our assumptions and critically examining them.*

2. Information Consultants' Search (30%)
   For this assignment the students are given a choice of four topics. They are to complete an information search on the topic selected assuming that they are working for a client. The final product is expected to present 10 to 25 highly relevant items that will provide resources to resolve the information search request, selected from the wide variety of information resources they have been exposed to during their semester of study. They are expected to produce the selection of items with a brief summary of their contents to their assumed client. As well as this list, they are expected to complete a report of their process reflecting on the way they approached the search and stating the reasons for their information resource selection process.

3. Information Resource Guide (50%)
   This assignment, which is a team project, asks students to produce a Resource Guide to a subject area. The teams are encouraged to select an area that they may like to work in on completion of their Degree. The team is to list only the best of

the major resources that would be required to solve most questions encountered when working in the selected subject area. The guide is to be arranged for ease of use, and provide abstracts of the listed resources with brief bibliographic details. From the final set of resources, five resources are to be selected and nominated as the "Top 5 Resources" and a justification for that selection is to be provided. Group presentations of the "Top 5 Resources" found are required.

Students attributing changes in their information searching experience to assessment items identified the reflective element of the first two assignments as important.

The first assignment identified as important by students was the weekly reflective journal. Some of the students attributed changes in their information searching method to the reflective journaling which was undertaken weekly. In general students stated that the effort of having to reflect upon the content each week had caused them to change their experience.

> *… if I wasn't doing the journals this semester I don't think I would have rethought a lot of the things that I'd learned straight away, and I think that a lot of the good things that I'd learned may not have, you know, may have just disappeared.*
> Male student, UG 21-25 yrs (Int 2001:2.2 p.8)
> **Please Note: (Int 2001: 2.2 p.8) = 2001 Interview: Interview Number 2: Participant 2 (p.8 of transcript).**

The second assignment highlighted by the students was the Information Consultants Search. Various students attributed their information searching experience change to this assignment where they were required to produce a search report of their search process. The students reported that being forced to reflect and report on assumptions, keyword selection, or other aspects of the search process, made them realise that they should change the way they approached searching.

> *What if I just blame it on assignment two … That – big time change for me. Well you see it had to be comprised of all these different components. Like ok, your client …synopsis, your assumptions, your keywords and synonyms, your … there were so many different areas. …. So you had to make sure you that you know all these in order to put down in your report if you really wanted to do well in this report. … So I came up with all these assumptions and was like, oh ok I've never thought about these before.*
> Female student, UG 21-25 yrs **(Int 2001:2.3 p.11)**

Characteristics of the Teaching Staff

Approximately half of the students attributed the changes in their searching experience to the characteristics of the great teachers who made the unit fun. They stated that if the lectures were not fun and interesting, and the staff not caring and approachable, then they would not have learnt anything. In their opinions, these great teachers each had a fun approach to classes, as well as being eager to help and simply were approachable people. In their view this was the reason they changed. They each said that either the lecturer, or the tutor, was the best teacher that they had ever had. Put simply, the teaching staff made the unit interesting and enjoyable, as evidenced by the following quotation.

Male student, UG Under 20 yrs **(Int 2001:2.4 p.8)**

While this is an area which requires further investigation, it is not the purpose of this paper to expand on this aspect further.

Using assessment to craft students' experiences of learning to search the Net

The students' views about the role of assessment reinforced for us the potential role of assessment in crafting students learning experiences. We subsequently analysed the early assignments in the unit the students were undertaking in relation to the categories of description found. We wanted to identify the ways of experiencing Internet searching that each item of assessment was designed, at least from the teacher's perspective, to encourage. Further, we wanted to determine how the assessment could be further developed to craft student experiences.

Analysing the existing assessment in relation to different ways of seeing

Based on the research findings, we have mapped the assessment items against the categories of description to identify how well the assignments have been designed to encourage learning. The results of the analysis and the students' perceptions are shown in Table 2.

We would agree with Limberg that students must have rich opportunities for active investigation, analysis, and reflection (Limberg, 2000a, p.193). We also believe that the principles upon which we chose to analyse, and later to redesign, the assessment for the subject, include the assumption that learning a generic capability means coming to experience that capability differently. Assessing a generic capability, therefore, means discerning the character of the learning outcomes achieved by the student; assignments need to make it possible for the assessor to discern them. Assessing a generic capability also provides the opportunity of designing the assessment instrument in order to influence the character of the desired learning outcome.

INSERT Table 2: Current Assessment mapped against Categories of Description

From the initial analysis, in Table 2, it appears that Category 3 is built into the assignments very clearly. It can be seen that both Assignment 1 and 2 mapped with Category 3, in that both assignments require the students to reflect upon the searching process. This built in reflection requires the students to experience searching using a reflective approach. Assignment 2, in particular, asks students to refine their topics,

devise alternative search terms, and adapt their searching based on the tool in use. These are the experiences of Category 3 searching.

In Table 3 each assignment is analysed to consider how the assignment requirements encouraged the experience of each of the categories. It can be seen both tables that in both Assignment 2 and 3, there was a requirement for the students to limit to high quality resources, or to engage in the experience of Category 4 searching. Unfortunately, there was only a limited requirement in either assignment for students to reflect on this process. This lack of reflection does not deeply encourage the Category 4 experience, which is an obvious area needing attention. That is the existing assignments were
1. Designed to encourage Category 3 searching
2. Not designed strongly enough to encourage Category 4 searching.

Recommending changes to the assessment

Based on the analysis, it can be seen that Assignment 2, which required students to limit to high quality resources only, and Assignment 3 which asked for the "Top 5 Resources", need to be further enhanced in order to encourage the students into a deeper experience of learning to search for information. The simplest step here would be to increase the relative weighting of marks to encourage the student to both understand the necessity of searching for quality resources, and to encourage the student to reflect upon this process in a search report. Therefore the following table shows, based on our analysis, the changes which are recommended.

INSERT Table 3: Current Assessment requirements and suggestions for improvement

In Table 3 we have provided simple examples for both Assignment 2 and 3 designed to encourage reflection equivalent to the experiences of Category 4 searching. In this way, as with the existing Assignment 2 Search Report, the reflection element can be built into the Report Criteria, and the students can be encouraged towards a Category 4 experience.

It would appear that while there is a need to design the assessment to make the assignments work harder, to lead students into the structure of the experience that is considered desirable, the existing assessment does encourage the students to move into a higher level of information searching experience. While these elements should be maintained, the assessment now needs to be crafted to work harder. On the basis of students' perceptions, we now need to carefully re-construct assessment to bring about desired learning outcomes to encourage reflection to Category 4.

What we have tried to achieve in modifying these assignments is the simultaneous attention of students to relevant dimensions or elements of the searching experience. That is, we are trying to allow the student to be aware of what is happening in many areas of the experience. The description of each category reveals the elements that need to be attended to in designing the assessment. In other words, assessment can be designed to encourage students to attend to the different aspects they need to be aware off. In the

example reported here, reflection to high quality information resources needs to be further enhanced to allow the students to experience that particular aspect of Category 4.

Conclusion

Our findings suggest that from a student's perspective two major elements help them learn: assignments designed to encourage reflection and the characteristics of the teaching staff. On the basis of students' perceptions, therefore, we are challenged to carefully construct assessment to bring about change. This paper has described our attempts to analyse assignments based on prior research in learning outcomes. We have begun to make our changes based on these findings and the unit is now being taught with improved assignments specifications. It is too soon yet to determine whether we have been successful in our attempt to get the students to "walk the walk", not just "talk the talk".

We suggest that the process of understanding how students learn to search the internet, and crafting assessment so as to construct appropriate experiences, may be applicable to the teaching and learning of other generic skills.

Finally, while embedding generic capabilities into assessment is vital to trigger changes in conceptions or experiences, and to deepen the learning experience, the ability and quality of the teaching staff should not be ignored. Their ability, to arouse curiosity and make the learning environment both stimulating and enjoyable, helps promote interest in the topic, which may also lead to changes in learning outcomes.

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