INTERNATIONALISING THE MANAGEMENT INFORMATION SYSTEMS MODULE

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Abstract: The work described here draws on the emergent need to internationalise the curriculum in higher education. The paper in particular focuses on the internationalisation of the Management Information Systems (MIS) module and the identification of learning differences among the two dominant cultural groups in higher education in the UK: Asian and European students. The identification of differences among knowledge patterns of these cultural groups is achieved through the application of a concept mapping technique. The research question addressed is: How can we internationalise the MIS module's content and teaching methods to provide for students from different cultural backgrounds?

1 INTRODUCTION

The increased diversity of students from different cultural backgrounds is pushing universities to internationalise their curriculum to better reflect a global perspective of students' experience (UUK, 2005). This process helps students develop the skills and knowledge to operate effectively in the global workplace environment. By definition, internationalisation of the curriculum is the process of integrating an international dimension into the teaching, research and service functions of an institution of higher education, with the aim of strengthening international education (Teekens, 2002). To that end, the teaching material and methods in higher education should integrate aspects from a range of different cultures and ethnic backgrounds to promote cross-cultural awareness. With regards to the MIS module at our university, there are two dominant communities in the student population: European, of which the majority is of British origin and Asian of which the majority is of Chinese origin. In particular, for the academic years 2005 to 2008 the average percentage of Asian and European students in the MIS module was 17% and 82%, respectively. Hence, the need to study the learning styles of the two cultural groups was of essence.

The focal point of this research aims to evaluate the level of learning among students of these two groups and subsequently, infer their causal factors using domain knowledge. Results from this process are used in redesigning the MIS module to better serve the needs of modern university classes.

A factor contributing towards the increasing need to internationalise curriculum in higher education stems from the fact that the learning styles among Asian and European students differ. According to Marton et al. (1993) Chinese students' leaning style is greatly based on memorising concepts which constitute rote learning. Moreover, Marton et al. identified two types of memorising in which Chinese participants engage: mechanical memorising and memorising with understanding. Moreover, the passive learning through memorisation in Asian cultures can be linked to their complex writing systems, composed of large sets of linguistic units. These systems require the memorisation of a large number of symbols and their mapping to natural language units (William, 2003). Having to memorise these symbols as part of their language, possibly affects their learning style. On the other hand, Western students tend to employ a reflective approach to learning with less passive memorisation. Considering the difference in learning styles among Western and Asian students it is imperative that for the successful internationalisation of the curriculum, these issues are addressed adequately. The literature varies in terms of evidence that supports the differences/similarities among Asian and European students (Holsinger, 2003; Nisbett, 2004). Some

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authors argue that Asian students are less creative than Western students, while others provide evidence of no difference (e.g. Kwang, 2004). This study aims to identify possible differences/similarities among the two groups with regards to the MIS module and accordingly tailor the current teaching methods to best address the needs of both groups.

The paper is organised as follows. Firstly an overview of the method is provided. A description of concept mapping as the main research instrument supporting this study comes next. Subsequently, the concept map assessment method used is explained and its application is demonstrated for the evaluation of the level of learning in the two groups. Results from the evaluation are presented and explained and their implications on the MIS module internationalisation are presented.

2 THE METHOD

The methodology used to assess the level of learning in the MIS module is composed of four steps. Firstly, students were introduced during class sessions to the theory of concept mapping and its practical applications through several examples. Subsequently a question-answer session followed to verify that the technique was understood. Next, the students were asked to prepare a concept map of their understanding of MIS module. To assist them with the task, students were asked to use questions such as: What is a MIS? Where are they used? How they are developed? Why are they important? The students were given 30 minutes to construct their models on paper. Along with their maps students also specified their country of origin and prior IT experience. The constructed concept maps were then collected and categorised according to students' origin and level of prior IS/IT experience. The exercise was conducted on the last lecture of the module and four lectures after the students completed a multiple choice test on all aspects of the module. Results from the test were used as a preliminary record of students' performance in the module. The study was performed with Second Year (i.e. level 2 in British terms) students of similar academic performance. This was achieved by analyzing the students' 1st year academic results. The screening process was performed based on three criteria: their 1st year academic performance, their score on the multiple choice test, their origin and their prior knowledge in IT/IS.

2.1 The Research Instrument

Concept mapping is a technique used for representing knowledge in the form of graphs, composed of nodes and arcs/links. Nodes represent concepts and arcs represent the relations between these concepts. Concepts are labelled depending on the idea/notion that they represent. Links can be non-directional, uni-directional or bi-directional. The direction indicates cause-effect or specialisation -generalisation relationships. Accordingly, concepts may be categorical, or simply associative. The concept mapping technique was developed by Novak (1977) whose work was based on the theories of David Ausubel (1968). Ausubel stressed the importance of prior knowledge in the process of learning new concepts and stated that "meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures". In education, concept maps have been used as a way to represent knowledge of a learner and as a method of assessing learner progress and understanding (Novak, 1998).

Concept maps are effective tools for making the structure of knowledge explicit. The usefulness of concept mapping for assessment is linked to the complexity of the information they can encapsulate. This distinguishes them from more conventional evaluation techniques such as multiple-choice tests that could be described as linear. Markham et al. (1994) suggest that these traditional uni-dimensional assessment measures represent a failure to recognize that knowledge is based on an understanding of the interrelationships among concepts. Researchers have found concept map-based evaluations to yield equally comprehensive and accurate overviews of knowledge as compared to well-planned structured personal interviews (Edwards et al., 1983) and assessment through writing (Osmundson et al., 1999). However, concept mapping allows for more efficient data collection than interviews, and presents an advantage over writing-based assessments in that it is inherently non-linear. Even though there are still a number of important unanswered questions about the role of concept maps in measuring knowledge, there is substantial evidence supporting the reliability and validity of concept maps for assessment (McClure et al., 1999; Ruiz-Primo, 2001). Therefore, concept maps are ideal for measuring the growth of students' learning (Hay, 2007). Plus, they enable students to reiterate ideas using their own words, and as a result inaccuracies or misunderstandings can come to the surface. When it comes to developing concept maps, there is a range of directedness spanning from highly-directed to low-directed. In this study low-directed concept mapping was used and students were free to decide which and how many concepts to include in their maps. This was necessary in order to identify differences and similarities among students groups.

2.2 Concept Map Assessment

For the assessment of students' models a master concept map (Figure 1) was firstly developed to be used as a point of reference based on which all students' concepts maps were compared to.

The master concept map models all the concepts and their interrelationships as they were covered in the module. Concepts in the master were categorised into three groups depending on their level of importance with regards to the module's learning outcomes. Highlighted concepts in the master, as depicted in Figure 1, indicate strong link to the learning outcomes of the module and, therefore, are assigned higher weightings during the assessment. Each of the 51 concept maps was scored based on three scoring methods: (a) holistic, (b) relational and (c) existential with master.

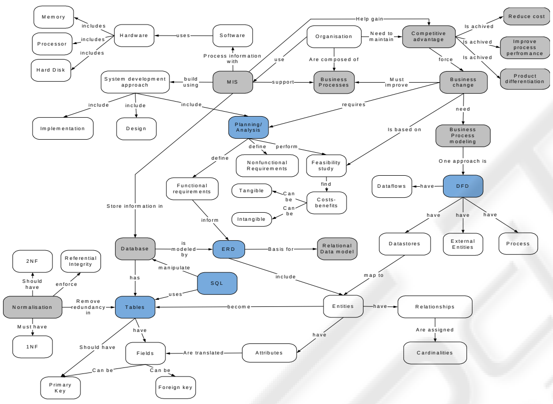

Figure 1: Master concept map.

Holistic concept map scoring examined each model and assessed the students' overall understanding of the module. Based on this judgment, each map was assigned a subjective score on a scale between 1 and 10. The relational scoring method was adapted from a technique developed by McClure et al. (1990) and assesses student maps based on the quality and number of propositions specified in the model. A proposition is defined when two concepts are connected by a labeled arrow indicating the relationship between the two concepts. Each proposition was assigned a correctness value between zero and three. The highest score designates that the proposition is specified in the exact or very similar way to the master. Specifically, for each proposition in each concept map, three properties were evaluated: the relationship, the link label and the direction of the link (if specified). The first examines the correctness of the association among the two linked concepts. The second examined the description of the link and the third its direction. For the assessment of the association, each proposition is assigned a score of 1 if the relationship between the two concepts is valid and 0 otherwise. Subsequently, if the relationship between the two concepts is valid, the description of the link is given the score of 1 if the naming is correct and 0 otherwise. Finally, if both of the previous conditions hold and the link's direction is correct an additional point is given to the proposition. The maximum score assigned for each proposition is 3. However, since some propositions are considered as more important than others the above scores are adjusted by a weighting factor. The 3 levels of importance that were used in the relational assessment of the maps are: low, medium and high and each is assigned a value of 1, 2 and 3 respectively. Specifically, the shaded concepts in the master map (Figure 1) were assigned a higher level of importance than the non shaded ones. Hence, propositions are multiplied by their corresponding weighting factor and subsequently summed before reaching the final relational score of each map. Therefore, the relational assessment of each concept map is calculated using the following formula:

$$\mathrm{Relational} = \sum_{c=1}^{n} [(R+D+T)\cdot R\ ]\cdot W \qquad (1)$$

where R=concepts relationship, D= link description, T=link direction, W=weighting.

Based on this formula, if R=0 then relational score=0. This means that, if the two concepts that are linked are irrelevant the proposition gets zero score.

Using the formula, the maximum relational score for the master concept map is 282. This is calculated by multiplying the total number of relationships (56) that exist in the model by the corresponding correctness and importance factor. Among the total number of propositions, 12 are assigned a weighting factor of 3, due to their high importance to the module's learning outcome and 14 the weighting factor of 2 due to medium importance. The rest were assigned a weighting factor of 1. Therefore, the maximum score for the relational assessment of the master model is calculated as follows:

Master Concept Map Relational score
= (56-12-14)*3*1 +12*3*3+14*3*2 = 282.

Finally, the existential concept map assessment examined the existence of concepts in the map with regards to the master model. Therefore, the inclusion of a correct concept in the map was assigned the score of 1 and zero otherwise. Concept names that were not specified exactly as in the master model but were referring to the same notion were given full marks. For instance, the acronym SDLC that refers to system development life cycle, is highly related to the “System Development Approach” concept in the master map and hence received full marks if specified in either way. In addition, concepts were assigned a weighting score between 1 to 3 depending on their level of importance. The formula for the assessment of the existential score is shown below:

$$Existential = \sum_{c=1}^{n} C \cdot W \qquad (2)$$

where c= a correct concept from the master map, C= concept importance {High, Med, Low } and W its corresponding weighting factor =[1-3]. According to this formula, the maximum score for the existential assessment is equal to the total number of high importance concepts*weighting+ total number of medium importance concepts*weighting +total number of low importance concepts*weighting. In the master map of Figure 1, there are 28 concepts of low importance, 5 of medium and 7 of high importance. This gives a total score for the existential assessment of 59 i.e. 28*1+5*2+7*3=59.

The concept map of each student was assessed based on the above three measures and subsequently transformed to a score in the rage of 0-10. This was achieved by dividing the product of each map’s assessment*10 by the maximum score of that assessment. A similar procedure was followed for the relational assessment where the maximum score is 282. The average value from all three assessment types defined the overall concept map’s score.

An illustration of the method in assessing a concept maps is provided in Figure 2. The points obtained in each scoring technique are provided in circles on the students’ concept map. Therefore E1 corresponds to existential score that achieved the value 1. Values next to concept’s links represent relational scores. The overall score of each model is assessed by accumulating the existential, relational and holistic scores.

3 ANALYSIS AND RESULTS

Descriptive analysis of the results of the 43 participants (8 are Asian and 35 are European) indicates that the students’ overall learning is low. Particularly, the lowest score corresponds to the relational aspect of the concept maps. This is especially evident by the maximum score on this dimension that is only 4.72 out of a possible maximum 10. This result is attributed to the quality and number of propositions in the students’ models.

Low performance is related to the difficulty in identifying relevant relationships among concepts and specifying them with correct propositions, which is a first indication of surface learning (Biggs, 2003). Moreover, the analysis revealed that scores are

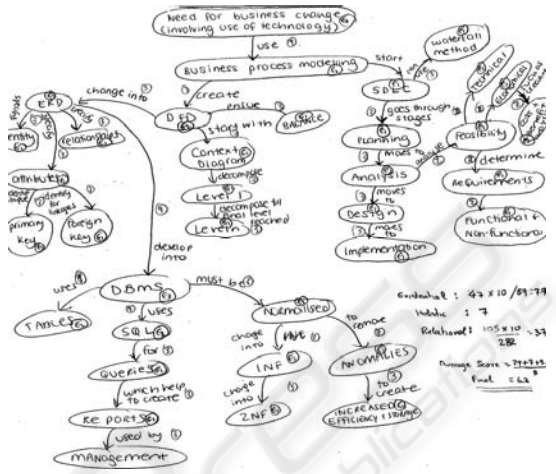

Figure 2: A concept map of a European student.

differentiated among the two groups of students. In particular, European students scored higher than the Asian students in the existential, holistic and aggregate assessments. On the other hand the Asian students performed slightly better on the relational dimension. However, the differences between the two groups’ scores were not found to be statistically significant, according to the results of independent sample t-test (Table 1).

Table 1: Collated view of the scores achieve in all assessment by the two student groups.

	Group	N	Mean	Standard Deviation	t	Sig.(p)
Existential	European	35	3.8111	1.88351	0.726	0.472
	Asian	8	3.3051	1.14239		
Relational	European	35	1.9696	.89994	0.267	0.791
	Asian	8	2.0638	.90468		
Holistic	European	35	3.6571	1.66173	0.436	0.665
	Asian	8	3.3750	1.59799		
Overall	European	35	3.1460	1.41251	0.43	0.669
	Asian	8	2.9146	1.15673		

Before getting to any conclusions with the above results a possible limitation should be acknowledged. That is the consideration of the starting ability of the students, which was captured in this occasion with a multiple choice test before the concept mapping activity. According to the results of this test, the mean overall score of the European group was higher than the mean of the Asian students, and the difference was statistically significant [$Mean_{European}$=16,25, $Mean_{Asian}$=13,7; t=3.683, p<0.01]. Therefore, for any comparison between different 'origin' groups to be meaningful we needed to 'control' at least this variable. In order to do so we decided to create an 'experimental' condition situation for this sample of students where each of the Asian student was matched randomly with a European student who gained an equal mark on the test before the activity. A paired samples t-test was then run to check for the difference between the scores in each dimension. Results from this test shown no significant statistical difference between the matched means in each dimension for the two groups of students. This may be due to the small sample size (in this case N=7). However, what should be noticed is that the pattern of the differences in the means is consistent. Hence we could claim that in this experiment/study European students performed better in the overall, existential and holistic aspects of their concept maps, and Asian students performed better at the relational dimension.

It should also be noted that for both groups of students, the performance in relational analysis was much poorer compared to the other two aspects. This result can be attributed to memorisation of the concepts and the low understanding of their meaning (Biggs, 2003). This could be due to the low level of student's practical experience with the module's material because of the sheer number of students that were registered in this module (around 250).

To categorise students' learning level we employed the taxonomy of Bloom (1956). According to this taxonomy, learning is categorized into six distinct levels that span from surface to deep learning. These levels include: (1) Knowledge of facts, terminology, (2) Comprehension of meaning (3) Application of previously learned information (4) Analysis that includes the skill to make inferences (5) Synthesis that includes creative skills (6) Evaluation which includes the ability to critique, defend, and reframe. An updated model of "Bloom's Taxomony", described by Lorin et al. (2001) organises knowledge into four levels: factual, conceptual, procedural and metacognitive. The assessment method employed here is highly related to this taxonomy. Specifically, existential assessment aims at factual knowledge, while relational assessment is linked to conceptual knowledge. Procedural and metacognitive levels are approximately assessed by the holistic assessment. Therefore, depending on the scores obtained from the assessment, students are classified in one of the four categories. The classification rules based on which this categorisation is performed are as follows: Factual level of knowledge is assigned to students with concept map score between 1 and 2.5. The minimum value for this is 1, since the range between 0 and 1 does not provide sufficient evidence of factual learning. Conceptual level of learning is assigned to students with concept map score between 2.5 and 5. Similarly, the range between 5 to 7.5 and 7.5 to 10 corresponds to the remaining two categories of learning, namely, procedural and metacognitive. Results from this study shown that both groups of students did not manage to achieve an adequate level of deep learning. This is attributed to the low level of hands-on experience in the laboratory caused by the sheer number of students (250).

4 DISCUSSION AND CONCLUSIONS

The main contribution of this study is the identification of learning differences among Asian and European students with emphasis to Chinese and British nationalities. The research helped to identify misconceptions between and within the two groups and propose appropriate course of action for the internationalization of the MIS module. The underlying principle of our approach is concept mapping and assessment. The literature reached a consensus regarding the usefulness of concept mapping for student evaluation (Hay 2007). Other methods for identifying students' misconceptions and understanding exist (e.g. Winer & Vazquez-Abad, 1995), however, these, did not establish the same validity and utility (Nakhleh 1994). Similar work by Freeman and Urbaczewski (2001) demonstrated the use of concept maps for assessing students' knowledge in an Information Systems module. However, unlike the research reported here, this study did not examine differences among cultural groups.

One limitation of our study is that it draws from dissimilar sample size among the two groups. Specifically, the number of Asian students (8) was considerably smaller than the European (35). As a result, the conclusions that can be made have a limited (if any) statistical significance. However, the results identified common problems in both groups that helped the redesigning of the MIS module and as such contributed towards improving the level of learning.

The main implications of our work point to the need to increase the exposure of the students to the theory through hands-on sessions. This became apparent from the analysis of the results that indicated reduced understanding of the practical aspects of the module in both groups. As a remedy to this we propose that MIS students engage in group case-studies drawn from the international scene (Lynn, 1999). Hands-on sessions like these will facilitate students to construct their understanding by practicing the material, while group work will help students to learn from each other. Moreover, the groups must be composed of students with different cultural background. Both approaches could act as a catalyst to improve the engagement of international students in the learning process.

Concluding, since the MIS module necessitates the use of information modelling, the instructional methods and consequently the MIS module design should be based on modality learning styles to help students with a single dominant learning style strengthen weaker learning styles. This is a common characteristic in multicultural classes and an issue that needs to be addresses effectively for a successful internationalisation of the curriculum. Moreover, since the results indicate that the learning level of both groups is low, teaching approaches, such as: research-led teaching through injection of research output in the teaching process, increased reflective discussion through problem based learning, and increased student motivation through applied activities of basic research skills will lead to improved student learning by supporting their different learning styles.

Part of our immediate future directions includes the investigation of possible variations in the pace of learning among different cultural groups. This in return, will help us refine the module delivery pace to further improve the learning experience in multicultural classes.

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