The Interaction Effect of Medium and Pedagogy on Semantic Knowledge Structure

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1. Background

Enthusiastic educators digitize different sorts of learning materials in the hope of enhancing learning outcome. The learning outcomes from this trend, however, remain inconclusive because detailed evaluation is often lacking.

One difference between the traditional printed medium and the digital medium is the arrangement of presentation of the concepts to be learnt. Digital medium allows the concepts to be arranged in a networked structure with the aid of hyperlinks which is not possible in traditional printed medium. The advantage of networked structures lies in encouraging the active exploration of information in the absence of any predefined structure. This encourages an active knowledge construction process, which is crucial in learning. A concomitant disadvantage is that learners may get easily lost in the network (Dix, Finlay, Abowd & Beale, 1998).

The digital medium may therefore complement the strengths of problem-based learning pedagogy, as they share the same objective in encouraging the learners to explore. The disadvantage of the digital medium may on the other hand be overcome through providing learners with browsing objectives, such as instructions to solve particular structured problems within a PBL learning framework.

2. Method and Results

To assess the interaction effects of problem-based learning and digital medium, techniques in learning outcomes assessment were further explored. These evaluated the learners' semantic differentiation with the help of multidimensional scaling. Chi, Feltovich and Glaser (1981) argued that experience level determines the differentiation of a problem. A number of other researchers have also suggested that expertise affects concept differentiation, experts tending to differentiate concepts more finely and more systematically (*c.f.* Fisher, 2000).

2.1 Construction of Expert Model

A group of research postgraduate students with biological psychology background was asked to make pair-wise difference comparisons on some biological psychology terms, which constitute the dissimilarity matrices. ALSCAL (Alternating Least squares SCALing) solutions of them was constructed, and regarded as the experts' model.

2.2 Pedagogy and medium interaction effect

A 2x2, medium (digital, printed) x pedagogy (directed learning, problem-based learning), research design was run in an authentic biological psychology learning environment. Dissimilarity matrices data were collected after the learning sessions. Preliminary data analysis suggested that multidimensional scaling solutions were problematical in terms of the groups, because of the large variance within group. Individual ALSCAL solutions were, therefore, constructed, from which parameters were derived for further analysis.

2.2.1 Tuncker's Congruence Coefficient

Tuncker's congruence coefficients between individuals' and the experts' dissimilarity matrices were calculated based on the first stage results. A 2x2 ANOVA (pedagogy x medium) showed that there is a significant pedagogy main effect ($F = 17.414$, $p < 0.01$). The knowledge differentiation criteria by the individual in the directed learning group are more similar to the experts' group model than to the problem-based learning group.

2.2.2 Further analysis

Further analyses using parameters from a cluster analysis and property vector fitting revealed no significant difference between groups.

3. Discussion

The results indicated that the effect of medium shift is not as dramatic as the effect of pedagogy application. Educators should consider putting more effort into implementing useful pedagogy rather than digitizing learning materials alone.

The pedagogies investigated in this study, through directed learning, which mimics the nature of traditional teaching, and problem-based learning, yield different semantic knowledge structures. This mirrors the objective of problem-based learning, in that it leads the learners to construct their own understanding. The individual semantic models that are derived as outcomes from this process are, therefore, less congruent with those of the experts. Whether this is beneficial or not depends on the teaching objective.

Finally, this research only explores one area of digital medium based instruction. The effects of more sophisticated digital functions, for example animation, intelligent tutor and online-collaboration, should be further explored.

4. References

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