The Microworld of *Phoenix Quest*: Social and Cognitive Considerations.

Zaeem Maqsood

Research and Development in ICT in Education (ICT.02C2)
31 August 2001
Word length: 3746

Introduction

The paper under discussion attempts to “explore social and cognitive considerations in the context of a computer game microworld or learning culture environment”. A computer game called *Phoenix Quest* (PQ) is employed as a representative microworld and its impact is studied in the context of a school environment.

My aim is to critically reflect upon the methodology used in this paper. I will attempt, as much as possible, to engage with the paper (as opposed to providing a summary). To that end I intend to present an argument regarding what the paper intended, what it actually achieved and why it may be (or may not be) considered academically useful.

My analysis will interrogate the research with respect to its attempt to theoretically specialize, empirically localize and inferentially generalize. I will then provide recommendations for the paper and present the structure for my argument in syllogistic form. Briefly, I will argue that the paper’s (mis)use of foreground experimental methods weakens the author’s inferences, while the understated use of background ethnographic techniques serve, ultimately, to provide a use for the research.

The Theoretical & Professional Field

The issues raised by Young and Upitis in this paper emerge from an environment that highlights concern for the importance of children's play and social interaction. They refer to the U.N Convention on Children's Rights (1989) which regards play as an important educational process and a birthright of every child. Similarly, Hawkins (1965) and Papert (1993) are recruited to underpin this notion of play as both a legitimate and valuable way of learning and Vygotsky (1978) points to a requirement for a specific social nature for human learning to take place

The authors indicate that both Papert and Vygotsky are talking about the same thing, i.e. social play, but this is far from clear. Papert's notion of play does not require social interaction, whilst Vygotsky's social learning does not entail play. Still, cognitive psychology and legislated human rights form the theoretical and practical background to the research.

The Problematic

Social interaction is essential according to Bearison (1982) and Clements and Nastasi (1988). Cognitive growth involves the conflict of ideas resulting from these social exchanges and the resolution of these conflicts.

The authors refer to Papert's notion of the microworld, as an appropriate concept to describe dynamic learning environments. Not only does Papert's microworld description include 'objects to think with', but, claim the authors, it also includes a "social environment that allowed learners to construct their own understanding…". Again, the authors seem to be stretching Papert's ideas. Papert was referring to LOGO and it is not clear that LOGO inherently supports, or was intended to support social interaction. However, this new notion of microworlds is useful and is, in fact, an interesting move for the authors on it's own, without any forced re-definitions.

The authors point to the need to investigate the nature or quality of social interactions in knowledge construction, given that, according to Cobb (1994), learners construct their ways of knowing regardless of whether the construct their own knowledge or the knowledge is transmitted to them. Ryba and Anderson (1990) go further and claim that interpersonal skills are “at least as important as academic learning”.

The authors are not only interested in how computers can provide a platform for social interaction. They are also concerned with the reasons why some children do not use computers. They point to Sutton (1991) as suggesting that race, gender and class play a role here. The authors are particularly interested in the impact of gender on access. Again, there are some children who either use computers reluctantly or avoid them altogether, according to Turkle (1995) and Upitis (1998).

So, the authors establish motivation for their research in the arguments that social interaction is essential for learning, is inherent in the idea of microworlds and is an area of personal development the stands along side learning. While computer learning environments can support social interaction and development, some children avoid, or have limited access to computers altogether. Thus, the authors perceive a need to investigate computer supported social interaction and (given that computer supported interaction is possible and useful) computer usage limitations.

The Research Problem

The perceived need for the research, as stated above, is almost as close as the authors get when stating their research problem. The problem could also have been presented as a hypothesis, a question or a proposition, but it is never clearly expounded in any of these forms. Instead, we find a number of

references to the authors concerns, from which we must draw out the research question and related concept variables.

On page 393 the authors aim is to study a group of student's "learning and social interactions while…playing…*Phoenix Quest*". Here, the authors do not elaborate on what is meant by learning and social interactions. Later, on page 396, the authors are interested in the students "affective responses, cognitive development and social behavior", again unelaborated. The authors present a model of social behavior, which allows us to clarify the research focus a little. Also, the authors describe the *PQ* game in terms of its mathematical content and 'conversation nets' and point to its design goal of increasing achievement in maths and science. Later they ask, "how carefully designed computer games can contribute to the creation of rich and effective learning cultures or microworlds".

From this we can draw out the research focus, which can be articulated as:
'What cognitive and social interaction issues arise from the use of microworlds and what is the impact of gender on these learning environments?'

The authors do not seem interested in measuring the effectiveness of the learning environment in either absolute or relative terms, but rather whether the *PQ* microworld can foster learning.

The concept variables will include cognitive development, social adaptation, cultural practices and gender impact. Only social adaptation has been explicitly ordinally scaled between adaptive and maladaptive peer-related adjustment.

The Empirical Field

The general empirical field within which the authors are operating includes microworlds in a traditional school setting involving girls and boys. Microworlds are seen as computer based learning environments with embedded interactive objects and social interaction with the intention to encourage cognitive and social development. So the field encompasses software developers, junior schoolteachers and edutainment developers.

The Empirical Setting

Indicator Variables

The indicators for cognitive development include use of the math's and language puzzles, collaboration with other learners and reaction to the mail female character, Julie. The authors rely on justification by proxy for these indicators, as they refer to (the developers of the game) the E-GEMS group at the University of British Columbia. The indicators for social adaptation were taken from Walker *et al* (1992). Adaptive peer-related adjustment includes cooperation, support, leading, complimenting and affiliating with peers. Maladaptive adjustment indicators include disruption, snobbishness, aggression, bragging and requiring help constantly. Gender impact indicators given included time spent on the game, advice shared about the game, progression within the game and acquisition of chapters and puzzles. No justification was given. For the cultural practice/complexity concept variable, strategies, exchanges, valuations and exclusivity were the indicators. No justification was given.

Sampling

The researchers have adopted a theoretical sampling strategy. The setting involved "41 boys and 57 girls, aged 8 to 12 years, from four junior school classes…over a five month period in a middle income suburban school, located in a mid-sized Ontario city". They do not describe anything particularly special about the sample – it is not in transition from one state to another for example. So the sample is supposed to be a representative case. But this point is not justified in any way, and in fact it is not clear exactly what is being represented here. The authors may be trying to represent all children of the given age range, or maybe just suburban children, or suburban children from North America only. The reader does not know if the setting is also supposed to represent inner city schools, or single sex schools as well or even home computing/internetworking and the authors do not help us with this. Indeed, it was mentioned by the authors that most of the children had home computers, but this interesting feature of the setting was not followed up. Also, the PQ game itself was selected as representative of educational microworlds, but this was not justified by the authors.

Research Design

The research was designed to he highly experimental. Computers were provided to classrooms that did not have computers before and were given for a set period only – four weeks at a time. The teachers were required to ensure each child in the experiment had an opportunity to play *PQ* for at least 30 minutes a week and each devised a schedule for this purpose. So we can see the experiment intervened in the school environment to a high degree. Yet for some reason the teachers were allowed to arrange the students pairing/non-pairing by themselves without justification, even though it was not clear that this would not have a great impact on social interaction. The teachers were eager and valued the software even before the experiment and were allowed to use the computers for non-experimental purposes. None of

this was discussed by the researchers to any interesting degree, even though it may have had an impact on the students' performance during the experiment. Generally the Hawthorne Effect was not touched upon.

First-hand Data Collection

Three different researchers actually carried out the sampling, but the authors do not tell us who they were. If the researchers mentioned did not include the authors, then it makes it more difficult for them to argue for the reliability for the data collected. No measure of reliability was provided and there is no mention of a pilot study, so we do not know to what extent the researchers findings correlated.

There was no use of a control group or a pre-test – post-test in the intervention. This is only a problem if Young and Upitis intend to make inferences from their findings, regarding the impact of the intervention, (such as cognitive or social skills development), but not if they are intent on only describing the culture that emerged as a result of the intervention.

The stated data collection methodology is experimental/interventionist, yet it is interesting to note that the researchers also employ ethnographic techniques as well. The experimental is very much in the foreground, while the ethnographic is in the background and not even included as part of their methodology. The researchers intervene yet they also stand back and observe the results. In this sense it is more ethnomethodological than experimental or ethnographic. The failure of the Young and Upitis to recognize this weakens their research. One of the reasons it is weakened is because the authors fail to acknowledge and address ethnographic issues such as recontextualisation.

The authors made use of a highly structured observation schedule in their first hand data collection. This schedule had a mixture of interval and event sampling, with an emphasis on interval sampling every two minutes. The

schedule only sampled non-mathematical features of the PQ game. It included all socially interactive features as well as non-game classroom based social interaction. These were left unexplained and unjustified by the researchers, as were differences in sampling times across subject (30 minutes versus 12 minutes).

The researchers also made use of field notes during the children's free time. Again, this was not deemed important enough for inclusion as part of the methodology presented. Yet, some of the most descriptive and interesting findings are reported on the basis of the field observations. Again, questions of recontextualisation emerge and remain unanswered by the authors. We are left wondering why the field notes describe what they do and what reliability should they be credited with.

Second-hand Data Collection

The researchers used questionnaires and interviews for their second hand data collection. The interviews were fairly interventionist – three girls and three boys were selected (by the teacher) and were asked ten questions. By far the most methodologically troublesome question was the first, were ten research findings were presented to the children and they were asked to comment. Not only was this question confusing, but the findings were not obviously related to one another. For example "on average the boys got 27 chapters and the girls got 15" and "most girls like the cave puzzles best" seem to be related only in that they raise gender issues. We are not told how exploratory the interviews were. Also, issues regarding the possible influence of the teacher on the selection of the interview candidates was not discussed.

The questionnaire used consisted of twenty-one highly structured questions. There was repetition and the questions did not seem obviously loaded or too difficult to answer, apart from perhaps the last one which asked what the learners favorite puzzle was and presented a list seventeen puzzles from which the child was expected to remember the name and pick one. A typical

question was “Did you like writing to Julie? a) yes b) no c) I didn’t write to Julie”.

Findings

Gender Impact

The time spent playing the game varied by gender, with boys spending more time on PQ than girls. The researchers observed that the boys had more of an interest in “completing or winning” the game. In half the classes the boys progressed further in terms of chapters and puzzles acquired, whilst in another class the girls progressed further. In the fourth class there was no gender difference. The game was generally seen as a ‘girls game’ by the boys and in fact the girls seemed to show the most active interest and this was seen to be due to Julie, the main character.

Cultural Patterns

Based on field notes, the boys were seen to develop more complex cultural patterns than girls, which included self-directed group discussions and strategy and information exchanges. The boys even developed a barter economy for the valuation and exchange of unequal gaming tips.

Social Adjustment

Whilst there were differing levels of social adjustment among the learners, none showed peer-related maladjustment. However, there was interaction and comparison between classes.

Cognitive Development

There was a difference in the use of the postcard writing feature, between girls and boys. More girls than boys liked writing to Julie and more boys than girls liked writing to Darien and the Keeper – both male characters. More girls than boys demonstrated a lack of awareness of the math content and in fact very few learners were able to articulate the math concepts encountered. The authors take this as indicative of a need for more teacher involvement whilst the learners played PQ.

Despite these findings, the important questions remain. We do not have any results relating to different age groups or to different pairing styles. It would have been interesting to compare these results to the home computer use of the same sample of children.

Qualitative Analysis

There was little description of the qualitative analysis methods used by the researchers. Young and Upitis mention the use of field notes and observations, but they do not reveal to us the principles by which they categorize learner behavior. Whilst presenting their findings, the authors mix in analysis, albeit low level analysis, without pointing this out to the reader. For example, the nature of the game, being open-ended, and flexibly timed was seen as an important explanation for the interest shown by the girls in the game. Also, the authors categorize one boy's behavior as 'Leads peers' – socially adaptive – when he orders a researcher to move from the computer with "Quick, quick, quick get off!". This is a worrying categorization, not only because the boy comes across as quite rude, but because we don't know why the researchers saw this as socially adaptive. They have not revealed their principles of analyzing the text. The analysis required an elaborated description, which perhaps the authors just didn't have space for.

Quantitative Analysis

The statistics were drawn from the observation schedule and questionnaire and provide limited insight into the results of the experiment. What they do show is that boys liked the male characters more than the girls and that the boys showed a greater awareness of the math content. It seems odd then, that Young and Upitis use these findings to support their enthusiasm for the appeal of this game to female learners. By far the most interesting findings were generated by the ethnographic/ethnomethodological methods, field notes and exploratory interviews, which is unfortunate for the authors since they foreground their use of experimental and quantitative techniques.

Generalizing

Validity

The authors rely on justification for cognitive development indicators by proxy, as they refer to (the developers of the game) the E-GEMS group at the University of British Columbia. This is the extent of the rationale given and we are expected to take it on good faith that if the UBC researchers say the software develops cognitive skills, then it does.

The social adaptation indicators have a more solid footing, being based on Walker's *et al* (1992) model. No justification was given for the gender impact indicators and the authors did not tell us what they regarded as culturally interesting phenomenon and why.

Relationships between Indicators

The units of analysis were individuals, the experimental subjects as a whole, individual classes and genders.

The authors made a number of inferences. They claimed that the use of a female protagonist did not discourage boys and that the communicative aspect of the game was particularly appealing to the girls, as they 'tend to emphasis creating and maintaining strong friendships and interpersonal relationships in their everyday lives'. But these inferences seem to be contradicted by their findings. When asked about the game, several boys sighed and said 'This game is for girls!' and the game was regarded as a 'girl's game'. Yet the boys tended to progress further and acquire more chapters and puzzles and this, it seems, shows that the boys were not discouraged by the 'girl's game'. This could have been explained by the use, by the boys, of complex interpersonal information exchanges. These exchanges also seem to contradict the notion that, according to McDonnell

(1994), the girls emphasize interpersonal relationships. One has to ask why, if the girls were so socially adaptive, did they not share and exchange information. One reason that the authors seem to contradict themselves, is that they seem to place much greater emphasis on their quantitative findings than on their qualitative findings. It is the latter that highlights the boys perception of the game as a 'girl's game' and which explores the information sharing mechanisms developed by the boys. It is the former which points to the importance of the female character for the girls.

The authors also inferred that because of a 25% failure to recognize the math content by the learners, the teachers should have had greater involvement. But the authors also point out that the students did not make use of the paper-and-pencil exercises that were provided precisely for the purpose of highlighting the math content. They also made not recommendations for the game design, which surely must have played a part in assisting the students to recognize the math and language content.

In terms of the control of variables, the researchers were able to control the math and language content and communicative tools. The independent variables were social adaptation and cultural patterns.

Relationship between Concepts

There was an implication of social adaptation from the use of the game. This was based on a previously defined model (Walker *et al*, 1992), but was problematic due to the authors failure to reveal the principles by which they used this model. The authors also implied cognitive development. This was stronger, as the software was based on research undertaken by the University of British Columbia. Bearison (1962) was also recruited to demonstrate this. The authors claimed that the impact on gender, of Julie the female protagonist was positive for girls and not-negative for boys and this was not clear from the findings at all. Finally, there was an implication that microworlds can create

dynamic and complex learning cultures. There was clear evidence for this, but due mostly to ethnographic techniques and almost ignored by the authors.

Conclusion

As I said in the introduction, the paper seeks to be something it isn't and as a result ignores much of what is valuable in the research and highlights what is either unreliable evidence or invalid inferences. Yet, upon reading, we forgive the authors, and we do this because of an intuitive sense of what they were trying to achieve and what was finally valuable in their research.

The research positions itself as experimental and highly structured and the authors either ignore or downplay the ethnography and semi-structured aspects of the research. The flawed experimental setting weakened any inferences based upon the findings. In fact, the ethnographic research was stronger than the experimental. The failure to acknowledge the ethnographic aspect of the research greatly reduces the power of the findings. Ultimately, the usefulness of this research lays in its ethnographic exposition of microworld learning cultures. The extrapolation of the microworld notion from Papert (to include a social environment was glossed over, but needn't have been, and in fact should have provided the main motivation for this research.

My main recommendation for the theoretical exposition would be to make the research question more explicit. It is this haziness that ultimately undermines any statistical inference by the authors. I would also recommend relegating the lengthy description of the game features to the appendix, to at least make room for a (almost non-existent) description of their analytical technique at a later stage. I would have paid greater attention to clarifying my concept variables, as well.

For the empirical setting and the findings, I would recommend that experimental issues need to be addressed properly. There was no control group and no pre-test – post-test and no explanation for the lack of either. The authors could have answered a lot more questions with the data than they did, such as questions about age differences and home computer use. The

authors also need to justify why certain findings were selected and presented, in both the experimental and field based settings.

I would not recommend linking the value of the research to other idea of fundamental importance, like social development, or to its acceptance and use of a family magazine. I would have advised the authors to better point out the shortcomings of their research and opportunities for further research.

Bibliography

Young, J. and Upitis, R. (1999). 'The microworld of Phoenix Quest: social and cognitive considerations'. *Education and Information Technologies.* 4 (4). 391-408

Brown, A. and Dowling, P. (1998). Doing Research/Reading Research: A Mode of Interrogation for Education.