Offline Factors Contributing to Online Engagement

In Technology, Pedagogy and Education, Vol 13 (1), 2004, 83-95

Contact information:

Clare Brett, Asst. Professor, Dept of Curriculum Teaching and Learning.
11-272, OISE/UT
252 Bloor St. W.
Toronto, Ontario M5S 1V6
email: cbrett@oise.utoronto.ca

Abstract

Online discourse environments are increasingly popular both in distance education contexts and as adjuncts to face-to-face learning. For many participants such contexts are experienced as positive, community supported learning opportunities, but this is not the case for everyone. Understanding more about the online and offline factors that contribute to the online experience is important in order to support equitable online learning. This study has analysed patterns of engagement and disengagement in one particular learning context; that of preservice, math-anxious elementary candidates enrolled in a two-year preservice program. Program supports for the self-declared math-anxious participants (N = 20 from a
total cohort of 57) included small group math investigations and participation in an online learning environment. Results show tremendous variability in levels of contribution and that the online context provided most learning support for participants who had had successful social and subject-related experiences in the program. Those with fewer successful face-to-face experiences, who espoused an ability-based notion of subject matter, and who felt less able to contribute substantively, participated less online. As well, patterns of participation were established rapidly and were hard to change.

**Background and Rationale**

Online discourse environments are increasingly popular both in distance education contexts (Hiltz & Wellman, 1997; Rovai, 2001) and as adjuncts to face-to-face learning (Duffy, Dueber & Hawley, 1998). For many participants such contexts are experienced as positive, community supported learning opportunities, but this is not the case for everyone (e.g. Dixon, 2001; Visser & Woolford, 2002). Understanding more about the online and offline factors that contribute to the online experience are important in order to support effective online learning experiences for a broader range of learners. This study looked at preservice teacher candidates' use of online conferencing technology as an adjunct support in their 2 year baccalaureate program in Toronto, Canada. From analyses of participation patterns it appeared there were four groups that varied considerably in their levels of engagement. Two particularly interesting findings were first, that among half of the group studied (10, from an N= 20 out of a cohort of 57), participation patterns emerged early and remained consistent across the two years. The second interesting finding was the particular
group of factors that influenced these patterns of engagement. This paper will describe these factors and their importance in understanding variation in online engagement.

**Design of the Study**

To facilitate the creation of a community to support math-anxious preservice teachers in productive engagement around core dimensions of math teaching, an online environment was used, in addition to small group discussion of open-ended mathematics investigation problems. The goal of the online community was to provide extended, multi-year, time and place independent access to teacher and peer networks of support. The dialogue offered the opportunity to create a new community and a new discourse around mathematics that might be less daunting than the traditional discourse from which they already felt alienated. It was envisioned that the experience of defining a new community would allow the participants to develop greater comfort and a more flexible perspective on what mathematics involved, enabling these teacher candidates to develop new ways to talk about math and to conceive of mathematics pedagogy. Indeed, collaborative electronic learning environments have been identified as potentially democratizing contexts that allow for multiple “voices” to have opportunity to contribute and define the discourses (DiMauro & Jacobs, 1995; Harasim, Hiltz, Teles & Turoff, 1995; Henri, 1992; Sproull & Kiesler, 1991; Selje & Meyer 1991; Turoff, 1999). Additionally, the online context offers a venue to examine different interpretations of ideas that can be used in the process of constructing personal knowledge (Jonassen, Carr & Yuen, 1998). Findings like these suggest that a collaborative learning environment would provide a particularly useful support for math-anxious preservice
teachers, because the users themselves could define the function and disposition of the math inquiry conference in order to meet their needs.

**Method**

This research involved a two-year observational study. Temporal analyses of conference activity, categorical ratings of portfolio and conference content as well as of interview responses were used to support interpretation. Some of the analyses take a sociocultural perspective, where the focus of understanding is on participation itself and learning is evidenced as contributions to the practice of one’s communities. Other analyses take a more psychological perspective, including attitudes and beliefs about mathematics and about participant’s views of learning, ability and teaching. Together, these perspectives allow a more complete understanding of the issues affecting engagement in online community because cultural, interpersonal and individual factors can be considered together.

**Participants**

The 20 participants in this research study (19 female, 1 male) were selected from a cohort of preservice teachers (N = 57) enrolled in an experimental two-year certification course at OISE/University of Toronto. The large proportion of female participants in the study reflected the gender proportions of the whole cohort, and was consistent with most of the cohorts of elementary beginning teachers at OISE/UT, the gender balance being greater at the secondary level. At the beginning of the program everyone was assigned to small groups (of about 5 people) for the math investigations. Two of these groups were all-female
groups in which all the members had indicated mathematics was an area of concern for them in teaching. The two other groups were chosen randomly from the remaining groups in the cohort. All the participants but two were Caucasian and the two were Asian females. All were native speakers of English, and were predominantly Canadian of British or Italian descent. Participants ranged in age from mid 20s to mid 40s. There were four women in their late 30s-early 40s that were also mothers and had worked for some time before entering the program.

The Program

In the first term of Year 1, participants were involved in small group mathematical investigations with open ended math problems, and were introduced to the online environment. Participation in the conference was not part of their formal evaluation but they were expected to participate in the same way they were required to attend class. The Math conference yielded about 550 notes (varying from a few lines to multiple pages) over the 2 years (they also had opportunity to contribute to as many as 24 other program related conferences on the First Class system). In the second term of Year 1 they had whole class math sessions and continued their online participation.

In Year 2, Preservice teachers in the primary/junior division who had chosen the Math/Science and Technology option, attended lecture/tutorials divided among math, science and technology issues. A major component of this term was a six-week block classroom placement, and conference discussion during this term was largely focussed on issues related to preparation for the placement and issues brought up during the mathematics classes. Nine out of the thirteen participants in the Primary/Junior/Intermediate option from
the Focus group chose the Math/Science/Technology (referred to as MST) specialization in Year 2. Another seven of the focus group of twenty were part of the Junior/Intermediate division and required to take as their teaching subject their background degree specialization, and were therefore ineligible to select MST as a specialization. These were mostly English/Language Arts majors. In the final term of Year 2 those in the MST option had Math Science and Technology classes which at this point in the program emphasized science and technology. The other members of the cohort had no formal math instruction, although many were doing some math teaching in their placements. All members of the cohort were encouraged to continue their reading and written contributions to the other mathematical conferences on the shared electronic conference, as it provided an opportunity to continue their mathematics work. Interestingly, the second year online contributors were not simply defined by whether they did or did not receive formal math instruction, as two of the most prolific contributors were in the non-MST group by virtue of their incoming specializations.

**Data Sources**

This paper will focus on how conference content and activity, with interpretations supported by evidence from portfolios and interview ratings, can inform participation patterns (see Table 1 below). More detailed descriptions of how the various analyses were conducted are available elsewhere (Brett, 2002; Brett, Woodruff, & Nason, 1999). For the purposes of this paper, particular findings will be highlighted that elucidate patterns characterizing the online activity.
Table 1 Structure of data sources and collection

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Time of Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference notes: reading &amp; writing patterns</td>
<td>Math inquiry conference: ongoing</td>
</tr>
<tr>
<td>Portfolios</td>
<td>Ongoing throughout program (an offline measure of engagement)</td>
</tr>
<tr>
<td>Interviews</td>
<td>End of year 1</td>
</tr>
<tr>
<td>Math content test</td>
<td>Term 1, Year 1</td>
</tr>
<tr>
<td></td>
<td>Year 2</td>
</tr>
<tr>
<td></td>
<td>Math inquiry plus other program conferences: ongoing</td>
</tr>
</tbody>
</table>

**Participation Patterns**

Activity in the shared conference was summarized through looking at (a) the number of entries contributed to the conference and (b) the proportion of the conference read. This summary revealed a general trend during the four terms towards greater participation both in terms of number of entries to the conference and the proportion of the conference read. For example, the proportion of the computer-mediated math conference read by the focus group (as compared to the whole cohort of 57) increased from 29.9% in Year 1 to 40.5% in Year 2. However, there was much variance among individuals in the focus group. When the participants are ordered according to how much they participated through reading and writing in the conference, four approximate sub-groupings emerge. These are defined below:
Table 2 Participation patterns in online reading and writing

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Participation Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaged</td>
<td>5</td>
<td>Higher levels of writing and reading in both years (&gt;10 entries pa) (&gt;60% dbase read)</td>
</tr>
<tr>
<td>Emergent</td>
<td>6</td>
<td>Reading and writing increase in Yr. 2</td>
</tr>
<tr>
<td>Withdrawing</td>
<td>6</td>
<td>Reading and writing decrease in Yr. 2</td>
</tr>
<tr>
<td>Disengaged</td>
<td>3</td>
<td>Low writing and reading rates in both years. (1-2 notes) (&lt;1% dbase read)</td>
</tr>
</tbody>
</table>

Of course, any conclusions drawn from such small numbers have to be tentative, but the persistence and patterns of these groupings are still fascinating. Results of ratings from the offline engagement measure, the mathematics portfolios, were consistent with the online participation patterns at the higher levels. The portfolios (self-selected examples of significant learning episodes) were rated on a four point scale of reflective elaboration of important concepts. Interrater reliability was $r = .82$. Of the six participants receiving the highest rankings in the Portfolio measure four were also members of the Engaged group, and two from the Emergent group. However, the ratings were more variable for the other participants, suggesting that while many of the group were engaging deeply with the ideas in the offline context, some were more consistently doing so than others in both the offline and online environments.

Looking further at factors which might have influenced the emergence of these patterns; an analysis of the responses to the questionnaires and the interviews revealed five factors that appeared to influence the levels of participation in the online community, two more related to the technology: 1) home access to the network, 2) familiarity with a shared online environment, and three that influenced online behaviour indirectly: 3) the experiences in the small group mathematical investigation workshops, 4) how participants attributed their
negative feelings about mathematics, and 5) their overall sense of efficacy as substantive contributors to the discussion. Another factor that might have been expected to influence their online participation more heavily and yet seem not to was their level of incoming mathematics knowledge.

**Home Access to the Network**

Home access to the computer conferences was particularly critical during Term 1 when the participants without home access could not immediately participate in the development of the conference at the same level as those who did have home access. According to those participants who had home access to the conferences, this facility provided them with time to focus on and think about the topics and issues being discussed, thus facilitating the process of reflection. The engaged group participants all did have home access. The emergent and withdrawing group reported a pattern of regular reading in the conference followed by written e-mails to specific people for many of their responses. All three of the disengaged group participants mentioned problems with access as the main reason for their lack of participation.

While the problem of lack of home access was alleviated somewhat at the beginning of the second term when everyone was given a computer terminal and modems for home, some participants, especially those from the emergent and the withdrawing subgroups, reported technical difficulties such as terminals malfunctioning and slow access. They felt this negatively influenced the quantity and quality of their participation in the conferences. The emergent participants seemed better able to cope with these technical difficulties and more fully participated in the conferences than the withdrawing participants. The lack of
immediate entry for some people into the development of the online conference may have continued to make them feel more peripheral in shaping the directions of the online community.

**Familiarity with a Shared Online Environment**

For all of the participants, this was the first time they had used such an open computer communication system, they were used to one-to one means, such as email. Thus, there was some initial hesitation to contribute and thereby potentially be exposed to criticism. For some participants, especially in the withdrawing and disengaged subgroups, this feeling persisted, and using e-mail, or talking to one other person, was chosen as a more direct and preferred means of communication. Comments from these participants indicated that the larger, more anonymous content of the conference created a feeling of impersonality and anxiety that they avoided through interacting in one-on-one contexts.

Another concern, referred to occasionally by participants during the first term, was that the people who participated a lot online were doing this to impress the faculty, rather than through a genuine desire to get on top of the mathematical ideas and work through their mathematics anxiety. This suspicion seemed, however, to die out for many people by the end of Term 2. In part this may have been due to database conference participation not being used directly for grading purposes, making it appear to be a genuine resource for their own learning and development (which it was intended to be), and not a disguised form of evaluation.

As well, for some participants there was a concern about how they presented themselves online. According to Albrecht, Burleson and Goldsmith (1994), asking others for help can make one seem weak or incompetent. The extra costs associated with asking for
help may have influenced participants to choose contexts where the balance was more even (such as online discussions in subject areas with which they felt more confidence), and where they could contribute assistance to others as well as receive ideas and help. The mathematics topic certainly exacerbated this sense for some people, and this feeling of not being a valuable contributor to the discussion was mentioned in interview responses, particularly by participants in the withdrawing group (the group with reduced participation in Year 2). By contrast, participants in the engaged group discussed their feelings openly in the conference from the beginning, about mathematics, the small group math investigations, and their pedagogical concerns. They seemed the most at ease in the database, both for social purposes and as a context for content-related discussion.

Internet access is increasingly pervasive and levels of computer literacy and home access to computers continue to develop. However, it is important to keep in mind that for many people computer interaction is not immediately a comfortable or obvious context for communication or reflection, particularly for preservice candidates with full timetables and a desire to stay with the familiar (Visser & Woolford, 2002; Dixon, 2001; Visovic, 2000). Time is still needed to orient and support newcomers in these practices.

**Experiences in the Small Group Mathematical Investigation Workshops**

As described in the Program section, all participants were assigned to small groups to work through a series of mathematical investigations during the first term of the program. The small group experiences were important for three reasons. First, this was the only experience for many of these participants with “talking” math. Second, they provided some of the first collaborative academic experiences for many of these participants. None of the
group had previously experienced, either their own educational backgrounds or in work-related contexts, true collaborative learning situations that emphasized the sharing of ideas through discussion. Third, the problems discussed in the groups offered substantive content to use in the online discussion environment. This meant that at least some of the ideas were familiar, even for those people who felt less confident in discussing mathematical ideas in such a public environment.

However, negative experiences in these small groups might have influenced participants’ interpretations of other program activities, such as the shared database. So, at the end of the first year, participants were asked to describe their reactions to these interactions, and specifically, their comfort level with the small group experience. The results are shown in Table 3. While there was variability among the emergent and withdrawing groups, there was consistency in the positive reactions among the engaged group and in the mixed reactions among the disengaged group. While no one reported entirely negative experiences, the main problem reported by those who found the experience less satisfying was feeling diffident about their own ability to contribute substantively within the small group discussions, although they found the situation a very useful one for their own learning.

Table 3

Ratings of Small Group Experiences

<table>
<thead>
<tr>
<th>Group</th>
<th>Average*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaged</td>
<td>3.0</td>
</tr>
<tr>
<td>Withdrawing</td>
<td>2.2</td>
</tr>
<tr>
<td>Emergent</td>
<td>2.2</td>
</tr>
<tr>
<td>Disengaged</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Note. These were categorized as follows: 1 = the group did not help their learning or confidence; 2 = the group did not help right away, but they came to feel more confident gradually, and 3 = the group provided confidence building and/or help with learning from the outset.

**Attribution for mathematical difficulties**

It was expected that if participants were successfully reframing their understanding of mathematics as being a more accessible and learnable subject, they would also reconsider the reasons behind their early negative experiences with mathematics. Specifically, if they found they could now learn math, they might see their early experiences being the result of poor teaching or some other external factor rather than their own lack of mathematical ability. With this perspective, participation in the online community is more likely because learning and development become possible, making the interaction potentially more worthwhile.

Generally, most participants expressed negativity toward their school experiences, and many participants mentioned a common attitude among their teachers that reflected an entity view of intelligence (Cain & Dweck, 1995; Dweck & Elliot, 1983) in which intelligence is a fixed capacity that does not increase or decrease over time. Such a perspective in a teacher makes it less likely they would focus on developing understanding among students they saw as less competent. It is also a belief about learning that many students applied to themselves.

In an interview at the end of the first year, the participants were asked the question: “How do you account for your feelings about yourself as a math learner based on your
experiences as a child and as an adult?” These responses were categorised into three groups.

Table 4 shows a similar pattern to earlier analyses in terms of the ordering of the groups.

Table 4  Location of Attributions of Origins of Mathematical Anxiety

<table>
<thead>
<tr>
<th>Name/Group</th>
<th>Group Average*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaged</td>
<td>2.8</td>
</tr>
<tr>
<td>Emergent</td>
<td>2.2</td>
</tr>
<tr>
<td>Withdrawing</td>
<td>2.0</td>
</tr>
<tr>
<td>Disengaged</td>
<td>1.3</td>
</tr>
</tbody>
</table>

*Note. 3=External = causes were external to the person, (e.g., a teacher); 2=mixed = included some internal factors (e.g. lack of ability) and some external (e.g. a teaching process); 1=internal (e.g. ability, competence).

A correlation between group and origins of math anxiety was $r = 0.60$, but with the Bonferroni correction for small groups, this failed to reach significance. Nevertheless, the pattern is interesting, in that those who were most able to engage with the ideas in the database (the engaged group) tend to be those attributing most blame for their mathematical difficulties to outside influences, allowing them the possibility of developing agency with respect to mathematics. By contrast, none of the disengaged group or the withdrawing group solely identified outside sources, such as teachers or pedagogical methods as responsible for their mathematical fears.
Sense of efficacy

However, the variability among responses suggested that there were other issues influencing computer use, not just ease of access. Since the technology was supplied for this program and getting connected was a function of student interest, a general sense of efficacy (particularly around technical and mathematical areas) was an important underlying factor influencing engagement. An important difference between the emergent and withdrawing groups was the number of members who chose the math, science and technology (MST) as their specialization in Year 2. The four members who chose MST all mentioned their continuing anxiety about all three areas: as well as their determination to take responsibility and agency for overcoming these anxieties through increasing their experience and knowledge in these areas. Making this decision to specialize in math, science and technology was the most likely reason for their online participation rates to have increased in Year 2. However, technology, like mathematics and science has been a traditionally male domain and like mathematics, technology was not a previously familiar area for many of the participants, and not a challenge some felt able to take up.

Influence of incoming knowledge

One potential explanation for the robustness of these patterns of participation is that the engaged and emergent group members have higher levels of incoming math knowledge, making them more comfortable in the online environment. However, the correlation between the number of contributions written in the math conference and the score on the incoming math test is not significant in either Year 1 (r = 0.28) or in Year 2 (r = 0.30 n.s). This suggests that incoming knowledge level does not predict the level of database
engagement through written contributions. Neither are the correlations significant either year, when looking at engagement in terms of amount read in the shared conference. In Year 1, the correlation between percentage of the conference read with the average math score is \( r = .28 \) (n.s) and in Year 2, \( r = .30 \) (n.s). Together these results suggest that engagement may have more to do with participants sense of agency as substantive contributors and how they were able to identify themselves (or not) as math learners given the strong influence of sociocultural factors. Thus the results point to the importance of beliefs rather than knowledge alone, as critical in determining the level of community engagement.

**Conclusions and Implications**

While the numbers of participants within the sub groups were small, thus limiting the generalizability of these findings, the main conclusions emerging from these data with respect to patterns of engagement are first, they are established quickly, particularly at the extremes of engagement (the engaged and the disengaged groups). Secondly, these patterns are persistent. Those who show most change over time (the emergent and withdrawing) still do not reach the beginning levels of engagement or disengagement for the groups at the extreme. Patterns are also persistent in that they last over time—in this case for two years. Third, patterns show stability and robustness. Quantitative patterns of online participation and contributions, as well as reflective elaboration scores from ratings of portfolio (offline) data, indicated similar levels of engagement or disengagement.

Particular factors have been identified in this paper as contributing to the emergence of these patterns. First, technology related factors, such as consistent online access from the
beginning of the program, and a comfort with the shared online environment are important. However, underlying beliefs and attitudes towards themselves as learners of technology and of mathematics may be as important as actual content knowledge levels in terms of whether one participates or not. In this case, participants who attributed the origins of their math anxiety to external causes seemed to have developed a less ability based notion of math that allowed the possibility of change, and the sense of this capacity to learn mathematics seemed to influence participation more than incoming level of mathematics knowledge.

Successful face to face small group experiences provided a measure of confidence that extended for those participants into their online interactions, and allowed them to feel they could make substantive contributions to the community.

The attitude of the disengaged group participants toward the technology and their resistance to being drawn into the community discourse, even over time, is significant. It demonstrates that simply including an online component, even with some face to face preparation may not be enough to “create” community broadly across a group that allows everyone to take advantage of the reflective context offered by the online environment. Others have noted the reluctance of some learners to leave the familiar and try new aspects of technology (Visser & Woolford, 2002; Visovic, 2001). The online environment appeared in this study to work best for the verbal, confident and determined who, through early involvement in the online activity, created an identity and a sense of their own value and efficacy. For others, positive experiences in the face-to-face small group context supported them in entering the online conference. This confidence allowed them to explore their understanding online and take advantage of that resource.
Finally, both the Engaged and the Disengaged groups’ patterns of engagement were very consistent across the two years, suggesting that early intervention and extra support needs to be made available early in the program in order to change the engagement trajectory for those less willing to participate. The challenge for online learning environments used both as adjunct and distance contexts will be to identify and provide appropriate scaffolding and support for individuals with varying knowledge, skills and epistemologies.
References


Duffy, T. M., Dueber, B., & Hawley, C. L. (1998). Critical thinking in a distributed environment: A pedagogical base for the design of conferencing systems (Center for


