Gender differences in engagement with creative technologies in the Early Years of schooling.

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Abstract

The use of creative digital technologies in the Early Years has the potential to provide rich, hands-on learning opportunities which foster the development of social competency. This paper describes a new framework for mapping collaborative development in the Early Years of schooling: the Social Processing Framework (SPF). This framework was used to code and analyse video-recordings and classroom observations in a Prep-1 classroom with 16 students (aged between 5 years and 6 months to 7 years) from diverse ethnic and cultural backgrounds as they engaged with unfamiliar creative digital technology in small groups. More than 1200 separate actions were categorised from 330 hours of video-recordings. While the initial focus of this pilot study was on analysing the development of social competency amongst students in the Early Years of formal schooling, it became evident that there were issues pertaining to the composition of the small groups in terms of gender. This paper analyses the relationship between single-sex groups and the frequency of each of the codes, and summarises findings as gender-specific. The data showed that: (1) single-sex boys groups demonstrated high proportions of negative, aggressive behaviour; (2) the single-sex girl groups evidenced high proportions of negative, non-aggressive behaviour; and (3) mixed groups demonstrated high proportions of positive behaviours. While there has been much research into gender differences and interaction with technology, little has been documented about these differences in young children. This initial study provides a basis for further research which could inform Early Years’ pedagogies as the use of learning technologies expands further through the phases of schooling. Suggestions for explicit teaching practices are provided as well as directions for further research and use of the Social Processing Framework.

Introduction

ICTs and the Early Years

Technology has an increasing influence in modern life and people constantly need to assimilate and accommodate new forms of technology. Young children’s access to digital technologies is dependent upon access to and experiences with an array of technologies prior to the commencement of the formal years of schooling. As the Early Years of schooling is a time in which the basis for authentic and enduring learning is formed, it is becoming an increasingly important topic of research and discussion in many countries (Fthenakis & Oberhuemer, 2004, as cited in Turja, Endepohls-Ulpe, & Chatoney, 2009). Computers and associated technologies help Early Years learners to develop fine motor skills, alphabet recognition, pre-mathematical skills, concept learning, cognitive development, self-esteem, social skills, and school-readiness skills (Brooker, 2003; Chantel, 2003, 2005; Judge, Puckett & Bell, 2006; Kankaanranta & Kangassalo, 2003; Leung, 2003; Sheridan & Pramling Samuelsson, 2003). It is clear that the use of technologies for the Early Years is beneficial; however what is surprising is the infrequent use of these technologies by teachers in this phase of learning. The role of technology seems to be limited to that of a teaching tool, such as the use of an Interactive Whiteboard operated by the teacher, rather than a collaborative learning tool used by the students.
Gender and ICTs

The development of self-image and attitudes towards gender roles commences before children reach school age (Krause, Bochner, Duchesne, & McMaugh, 2010). Technology is a field which is strongly connected to males (Turja et al., 2009; Upitis, 2001), and by age two or three, children show preferences for toys that are gender-specific designed (Cherney & Ryalls, 1999; Martin, Eisenbud, & Rose, 1995). Although Papert (1993) considered technology as potentially ‘genderless’ and that the opportunities for learning were the same for both boys and girls. Turja and her colleagues (2009) claim that there are two impacting paradigms upon gender: (1) early gender-typed attitudes and behaviours resulting from positive reinforcement by significant others (e.g., parents, siblings, educators), and (2) these attitudes and behaviours also appear to be a consequence of the child’s own cognitive activity. Other studies have reported that gender differences in young children’s access and use of computers may be attributed to environmental factors such as exposure to gender-specific roles, expectations, attitudes, and the influence of media and educational materials (Kalyanpur & Kirmani, 2005; Kirmani, Davis, & Kalyanpur, 2009; Volman & Eck, 2001).

There appears to be some gender differences with respect to achievement-related personality traits that may also affect ready uptake and use of technology. Generally girls are less self-confident, and attribute failure to a lack of ability and success to luck; while boys attribute success to ability and failure to luck (Hannover, 2007, as cited in Turja et al., 2009). Furthermore boys place importance upon competition, dominance, and power; whereas girls prefer to cooperate in small groups in which member status is equal (Turja et al., 2009). The question arises: Should students in the Early Years be placed in mixed or single-sex groups? Research is divided with support for both mixing genders (Pryor, 1995; Turja et al., 2009) and separating genders (Bers et al., 2002; Caleb, 2000). An approach that engages learners, regardless of gender is the design and construction of real-world solutions to problems, which potentially may combine traditional subject areas such as science, technology, engineering and mathematics, for example LOGO, LEGO Mindstorms and LEGO WeDo (Bers et al., 2002; Caleb, 2000; Howell & McDonald, 2011a; Papert, 1993).

Social interaction in the Early Years

The value of social interactions for learning has been demonstrated by research (e.g., Bandura, 1977; Papert, 1993; Resnick, 2007; Vygotsky, 1978) and has been a commonly used strategy by teachers in their classrooms. The ability to facilitate social competence and provide learning opportunities for students to develop social skills is an important aspect of the Early Years’ curriculum. ‘Social competence’ implies an ability to demonstrate positive peer interactions such as turn-taking, sharing, and encouraging. In the context of this study, negative peer interactions were
considered in two ways: (1) aggressive, and (2) non-aggressive. Aggressive behaviours include relational, physical, and verbal forms, and consistently have the effect of isolation, antagonism, domination, or rejection. Typically these behaviours do not contribute to the success of the group in task completion. Non-aggressive negative behaviours are described in this paper as those which do not contribute to the success of the group in task completion yet do not adversely affect any members of the group. Examples of this behaviour include self-withdrawal and tokenistic role enactment.

Opportunities for learning social interaction norms or sharing behaviours need to be embedded in the teaching and learning of Early Years’ programs as the 6-8 years age span is considered to be a critical period for social development (McKay & Keyes, 2002). The motivation to learn social skills is often driven by the desire to ‘fit in’ at school and form their first friendships (Krause et al., 2010). This new school setting in which they are immersed requires several adjustments: their social environment has assumed an academic context, peer relationships suddenly play a greater role in their lives, and they observe and follow the behavioural models of their teachers and peers (Bandura, 1977; Vygotsky, 1978, 1986). This view of social interaction is largely skill-based, adopting a perspective that there are a set of skills or understandings that must be acquired by an individual before they could be regarded as being ‘socially competent’.

An alternative view has been proposed by the Reggio Emilia approach which views children as social actors in their own lives, and influence and are influenced by their social circumstances (Kim & Farr Darling, 2009). This approach perceives learning as an organic process of ‘doing’, engaging in social groups, co-constructing knowledge with peers and teachers, and learning from cognitive conflict and argument. The Reggio approach suggests that the explicit teaching of social competence is not required; rather teachers can act as guides, so that children develop an understanding of how to participate positively in social groups through experience. Hence in the field of Early Years learning, the process of becoming socially competent has two opposing fields of research: the Reggio approach that is an organic process of self-moderation or the approach that suggests it is the acquisition of a finite set of skills. Regardless of whether social competency is taught, acquired through experience or more commonly learnt via a combination of the two approaches, learning how to interact with others is a basic skill children in the Early Years of schooling learn.

METHODOLOGY

Research questions
The research presented in this paper constitutes part of a pilot project, and seeks to answer the questions: (1) Are there clear gender differences in young children’s engagement with creative,
digital technologies, and (2) If so, what are the implications for the use of creative, digital
technologies as a means of developing positive social interaction?

**A Social Processing Framework for Mapping Collaborative Development in the Early Years**

The data analysis framework used in this paper (Howell & McDonald, 2011b) builds on the work of Kumpulainen and Mutanen (1999) and arose after initially coding the video transcripts involved in the pilot study. Table 1 shows the Social Processing Framework (SPF) which focuses on identified instances of social processing, inclusive of verbal interactions. The shaded codes are those which the researchers designated as ‘negative’ (i.e., resulted in little or no contribution to group cohesion or task completion). Further classification of the negative codes into aggressive and non-aggressive actions resulted in the identification of 4 (INDI), 5 (DOMI), 6 (CNFL), 9 (CFLT), and 14 (FOAH) as denoting aggressive behaviours and 1 (OFFT), 7 (CNFU), 13 (NONP), and 17 (PASS) as denoting non-aggressive behaviours. In this study ‘aggressive’ was attributed to behaviours which resulted in physical contact (such as, snatching, hitting or pushing) or anti-social interaction (such as, dominating or self-isolating). The descriptor of ‘non-aggressive’ was used to categorise behaviours that were non-participatory.

Table 1

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OFFT</td>
</tr>
<tr>
<td>2</td>
<td>COLL</td>
</tr>
<tr>
<td>3</td>
<td>TUTO</td>
</tr>
<tr>
<td>4</td>
<td>INDI</td>
</tr>
<tr>
<td>5</td>
<td>DOMI</td>
</tr>
<tr>
<td>6</td>
<td>CNFL</td>
</tr>
<tr>
<td>7</td>
<td>CNFU</td>
</tr>
<tr>
<td>8</td>
<td>QABE</td>
</tr>
<tr>
<td>9</td>
<td>CFLT</td>
</tr>
<tr>
<td>10</td>
<td>SCGM</td>
</tr>
<tr>
<td>11</td>
<td>REDI</td>
</tr>
<tr>
<td>12</td>
<td>INST</td>
</tr>
<tr>
<td>13</td>
<td>NONP</td>
</tr>
<tr>
<td>14</td>
<td>FOAH</td>
</tr>
</tbody>
</table>

*SPF - a Social Processing Framework for Mapping Collaborative Development in the Early Years*
Participants

The participants in this study were students enrolled in a Preparatory – Year 1 class in a small, urban Australian primary school with students drawn from varied ethnic and cultural backgrounds. The 16 students participating in the project were aged between 5 years 6 months and 7 years, and were being taught in a multi-age setting. The students were participating in a pilot project that was exploring the use of LEGO robotics in the Early Years as a conduit for emerging literacy and numeracy. All of these students had had no prior experience with: LEGO, robotics or using laptop computers. Furthermore, none of the students had access to computers at home.

Method

The pilot was conducted over a 6-week period, one group was video-recorded during the first visit, and all groups were videoed during visits 2, 3 and 5. The class teacher assigned the students to groups of four with the intention of matching like abilities and temperaments. Each group was video-recorded separately and their interactions were then analysed. The unit of analysis was broadly defined by a single act of collective interaction by the group members. The data (n = 1207 individual interactions) were then coded for analysis using the Social Processing Framework (SPF). The pilot was undertaken in three phases: (1) modelling, (2) exploring, and (3) evaluating (refer Table 2). As the nature of the evaluating phase was different to the other phases (the students did not construct a robot in groups), the video-recordings made during that visit were not included in the coding using the SPF. Visit 4 was not videoed at all due to the researchers’ inability to source a research assistant on that day.

Table 2

<table>
<thead>
<tr>
<th>Phase</th>
<th>Duration</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Modelling</td>
<td>2 x 60 minutes</td>
<td>Construction of two different simple robots; initially with researcher direction.</td>
</tr>
<tr>
<td>2. Exploring</td>
<td>3 x 60 minutes</td>
<td>Construction and demonstration of individual group selected robots: little or no researcher intervention.</td>
</tr>
</tbody>
</table>
3. 1 x 90 minutes Prediction of novel robot movement based on acquired knowledge. Data collection and evaluation.

Modelling phase

The modelling phase took place over two sessions, each of one hour duration, in two successive weeks in Semester 2, 2010. During this phase, the researchers guided the students through the construction stages of a pre-selected robot. For the first of these two sessions, the class teacher organised the students into heterogeneous ability groups composed of boys or girls (the decision to have single-sex groups came from observing dominating behaviour of the boys in the mixed groups and passive acceptance of this behaviour by the girls). The students were arranged into groups of 4 students, making a total of 4 groups to be video recorded. At the end of this session, the class teacher and the researchers were in agreement that some adjustment of the group composition was warranted based upon the observation of dysfunctional group dynamics. For the second session of the modelling phase, the students were organised into alternative groups and instructed to make sure that everyone took turns in the construction and programming of the new robot. By the end of the modelling phase, the students were able to follow the steps on the group laptop, moving forwards and backwards as required by the group, without having to wait for the researchers to lead the process. Students were also modifying aspects of the programming in order to change motor speed, direction, or sound.

Exploring phase

The exploring phase took place over three weeks, one day per week for sixty minutes. In each session, the students worked in the same groups, constructing and programming a robot of their choice. This worked most effectively when group roles were assigned to the students by the researchers such as LEGO piece finder, assembler, and laptop operator. The researchers and class teacher encouraged and questioned the students but did not explicitly contribute to the construction of the robots. At the completion of each session, the students demonstrated their robots to the other groups, and spoke a little about how they made it and what were some of the challenges.

Evaluating phase

The final phase occurred over an extended session of ninety minutes. In this phase students were shown a robot which they had not seen or made previously. They were questioned as to the components of the robot and asked to predict the kind of movement and sound it might make. The robot was then activated and the students were able to self-check their predictions. In this phase, the students were also invited to fill out a simple survey and to do a “What do we know?”
assessment. While the students were doing this with the supervision of the teacher assistant, the researchers interviewed the class teacher.

RESULTS

As the research questions for this paper focus upon possible gender differences between girls and boys and the nature of these differences, the codes were categorised as positive or negative in terms of contribution towards task completion. The negative actions were further categorised as aggressive (adversely affecting group members) or non-aggressive (not affecting group members). Table 3 summarises behaviours noted during the initial visit (visit 1) during which one group (two boys and two girls) was video-recorded in order to test the framework for coding. In visits 2 and 3, two girl groups and two boy groups were videoed, and in visit 5 one girl, one boy and one mixed group were videoed. In order to determine trends in social interactions, codes from the three visits during which all students were video-recorded with frequency differences of five points or greater were used.

Table 3

Summary of positive and negative behaviours

<table>
<thead>
<tr>
<th>Visit 1</th>
<th>Positive behaviours</th>
<th>Negative behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>1 (N = 93)</td>
<td>Nil</td>
<td>8</td>
</tr>
<tr>
<td>2 (N = 409)</td>
<td>11, 12, 16</td>
<td>2, 3, 8, 15</td>
</tr>
<tr>
<td>3 (N = 529)</td>
<td>10, 11, 12</td>
<td>2, 3, 8, 15, 16</td>
</tr>
<tr>
<td>5 (N = 176)</td>
<td>Nil</td>
<td>2, 8</td>
</tr>
</tbody>
</table>

Number codes that are bolded indicate negative, aggressive behaviours. N represents the number of distinguishable behaviours.

DISCUSSION

Visit 1

As this was the first school visit and the first session of the modelling phase, the activity in the classroom was controlled by the researchers; the students did not have access to laptops until the programming stage. The coding from the first visit (one mixed group of two girls and two boys) showed negative behaviours 5 (DOMI), 9 (CFLT), and 14 (FOAH) demonstrated by the boys only, and 17 (PASS) was demonstrated by one of the girls only. The three negative behaviours exhibited
by the boys were all denoted as being aggressive, whilst the negative behaviour exhibited by the girl was non-aggressive.

Visit 2

The second school visit which resulted in video-recording of two girl groups and two boys groups indicated that the boys showed more negative behaviour than the girls and that three of the four negative behaviours were aggressive, that is 5 (DOMI), 9 (CFLT), and 14 (FOAH). The two negative behaviours exhibited by the girls, that is, 7 (CNFU) and 13 (NONP), were both non-aggressive.

Positive behaviours exhibited by the girls were 11 (REDI), 12 (INST), and 16 (ENCRA). Code 12 (Instruction advice sought from the teacher) was the highest frequency (N = 72) in this visit, and although considered by the researchers as ‘positive’ the action clearly indicates uncertainty, lack of confidence or perhaps even a desire to maintain connection to a More Knowledgeable Other (in this case the class teacher) during their engagement with unfamiliar materials. Positive behaviours exhibited by the boys were 2 (COLL), 3 (TUTO), 8 (QABE), and 15 (DGAC). It appears that whilst the boys exhibited the majority of negative behaviours this was balanced by a high frequency of positive behaviours. As both boy groups successfully completed their robots well in advance of the girl groups, it could be surmised that this balance is integral to task completion.

Visit 3

The third school visit again video-recorded the actions of two girl groups and two boy groups. Positive behaviours exhibited by the girls were again three of the codes with one change. Interestingly the positive boy behaviours were the same codes as for the previous visit with one addition, perhaps indicating a positive growth in social interactions. Negative behaviours exhibited by the girls were 7 (CNFU), 9 (CFLT), 13 (NONP), and 17 (PASS), and of these only 9 (Conflict between students in a group; resolved by the teacher) was regarded as aggressive. Negative behaviours exhibited by the boys were 5 (DOMI) and 14 (FOAH) a reduction by half from the previous visit. The actions denoted by 5 (DOMI) are regarded as aggressive whereas 14 (FOAH) is non-aggressive and appears to be more of a competitive behaviour.

Of interest to this research are the conditions of the project during the third visit that may account for these differences in frequency of positive and negative behaviours. During the second visit the construction of the robots and the programming using the software was still very much led by the researchers, and cohesion was maintained by waiting for each group to perform a task before allowing all groups to move on. This apparently frustrated the boys as indicated by their negative behaviours, in particular 1 (Off-task) and 14 (Forging ahead). The third visit allowed the groups to self-manage and self-pace the construction of the robots by providing a laptop pre-loaded with the software to each group. Perhaps this change in locus of control resulted in the reduction in negative behaviours in the boy groups.
Also of note is the high frequency of three positive behaviours: 2 (Collaborative behaviour, N = 41), 8 (Quality assurance behaviour, N = 26), and 16 (Encourager, N = 10), indicating that collaboration, quality assurance, and encouragement were key attributes of these boy groups who both completed the task more fluently and quicker than both of the girl groups. The marked increase in negative behaviours in the girl groups during visit 3 may indicate that girls work ‘better’ when directed and hence paced by the teacher (as in the case of the second visit). The spike in frequency for code 12 (Instruction advice sought from the teacher) for the girl groups from 72 in the second visit to 111 in the third visit may indicate a lack of confidence or risk-taking behaviour. Furthermore the increases in the frequencies of 1 (OFFT) from 5 to 16 and 17 (PASS) from 1 to 11 perhaps indicate a coping strategy for the girls who were feeling very uncomfortable in the situation required of them. The boys appeared more willing to work things out for themselves, whereas the girls sought assistance after short periods of time and frequently.

Visit 5

The fifth school visit during which the groups chose and constructed their own robot with minimal input from the researchers or the class teacher resulted in no positive or negative behaviours on the part of the girls which were five or more points higher in frequency than the boys. However, the boy group evidenced one more negative behaviour than they had in visit 3 and in fact the three behaviours were not evidenced in the third visit. Of interest is the maintenance of positive behaviours 2 (COLL) and 8 (QABE) across all three visits.

In summary, the following insights can be made from the coding of the video data: (i) over the weeks of the project, the boys exhibited more negative behaviours than the girls, (ii) the majority of negative behaviours exhibited by the boys were aggressive, (iii) the boys exhibited more positive behaviours than the girls, (iv) the mixed groups exhibited fewer negative behaviours than with the girl or boy groups, and (v) the girl groups exhibited more negative, non-aggressive behaviours than the boy group.

CONCLUSION

In terms of the two research questions initially posed in this paper, these propositions can be made. First, there do appear to be clear gender differences in young children’s engagement with creative, digital technologies. This was evidenced by the more frequent negative and in particular aggressive, negative behaviour of the boy groups (shown in Table 3). In contrast is the high frequency of collaborative behaviours demonstrated by the boy groups. In essence, even though the boys in the single-sex groups antagonised each other there was still a sufficiently high degree of collaboration resulting in task completion ahead of the girl groups. This seems to support the findings of Turja et al. (2009) in terms of the behaviour of the boys, but not so much in terms of the behaviour of the girls. Although the girls showed just as much enthusiasm for working with the
LEGO and the laptops, and indeed maintained this between visits (as indicated by the class teacher), their degree of initiative and perseverance was demonstrably less than that of the boys. Second, the use of the creative, digital technology in this pilot project clearly proved to be a means of developing positive social interaction; successful task completion required collaboration, turn-taking, and quality assurance. These were behaviours which the boys demonstrated more than the girls. Finally, the group which demonstrated the highest levels of positive behaviours and lowest levels of negative behaviours and which was also successful in task completion was the mixed group. Perhaps this is a case for mixed gender grouping as the negative behaviours of the boys seem to be tempered by the girls, and the girls are more engaged due to the vicarious experience of the boys’ facility with the materials. As the use of creative, digital technologies continues to permeate the Early Years of schooling, more research will be needed to discern effective digital pedagogies.

REFERENCES


