A Qualitative Analysis of Email Interactions of Children who use Augmentative and Alternative Communication

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The aim of this study was to introduce email as a form of interaction for a group of six children who used augmentative and alternative communication. In a 12-week exploratory study, aspects of the email messages sent were analyzed. The content of the messages was analyzed by an inductive qualitative method, and seven descriptive categories emerged. The most frequently occurring categories were Social Etiquette, Personal/Family Statistics and Personal Common Ground. The children utilized different email strategies that included use of most of the above-mentioned categories. Through the email writing practice, the children developed new social skills and increased their social participation. Email practice may be a good strategy to increase children's social networks.

Keywords: Blissymbols; Internet; Email; Computer; Interaction; Social relationships; Augmentative and alternative communication

INTRODUCTION

Humans are social creatures, interested in making and keeping bonds of friendship with other people. Being included in different social spheres enables us to develop and maintain social relationships (Light, Arnold, & Clark, 2003). The Internet is an increasingly important social sphere for children today, who use this medium to send messages to each other, meet new friends, and maintain the friendships they have (Grinter & Palen, 2002; Merchant, 2005). The present study introduces email as a form of interaction for a group of children who use augmentative and alternative communication (AAC).

Letter-writing strategies of young children without disabilities have been described in studies examining children's writing to other children or adults (Hall, Robinson, & Crawford, 2000; Linnér & Linnér, 1992). In these studies, the first letters often contain questions and/or narratives about the writer's or recipient's family and/or pets; while second letters usually refer to something the correspondents had learned about each other. In Linnér and Linnér's study, the children showed an increased closeness and friendship as time passed. After the first reference frame was established, the letters displayed an increasing individualistic touch. A growth in what Clark (1996) calls "personal common ground" took place (p. 121). The reported content of children’s writing when establishing new relationships is similar across studies (Fitzgerald, 1932; Linnér & Linnér, 1992; van der Meij & Boersma, 2002).

For many children today, writing email messages (and otherwise communicating over the Internet) is taking the place of hand-written letters, and has become an important social venue. Studies aimed at examining children’s use of email to develop new relationships have demonstrated many similarities between ordinary letter writing and email message writing (Jarvis, Hargreaves, & Comber, 1997; Mavers, 2007; Merchant, 2003; Shpigelman, Weiss, & Reiter, 2009; van der Meij & Boersma, 2002). During any interaction, common ground is essential because it helps to organize the communication in relation to presupposed aspects the interlocutors may or may not have in common (e.g., age, gender, or interests). Common ground can be viewed as consisting of two components – communal and personal. Communal common ground refers to...
the norms of email writing as well as cultural and social characteristics of the communication partners; personal common ground is based on information acquired through social contact (Clark, 1996) and develops as strangers become friends and acquire a joint history of experiences. Both types of common ground are important to being perceived as a competent communicator.

As with traditional writing, emailing must also conform to social norms of the genre. Accordingly, email messages typically contain a greeting and a closing (van der Meij & Boersma, 2002) – although in close friendships this is not always necessary (Shpigelman et al., 2009); and statements, questions, and responses to a previous message. In addition, a message may contain emoticons (e.g., 😊); make use of abbreviated words (e.g., 4 U = for you); include slang phrases (e.g., that’s cool!); and use increasingly informal language to display personal closeness (Shpigelman et al., 2009). A growing understanding of the other person is demonstrated through empathy, by asking questions about him or her, and by relating the other person’s endeavors to oneself (Merchant, 2003; van der Meij & Boersma, 2002).

The Internet provides new participatory communication opportunities for individuals with disabilities. This is especially important for children with disabilities, who often experience limited social networks and participation in social activities (Skärb & Tamm, 2002). Meltzoff, Kuhl, Movellan, and Sjenowski (2009) described social interaction as a powerful medium for learning that may, in turn, lead to positive development in the understanding of vocabulary and language. Interaction in diverse situations with different people leads to a greater understanding of other people as more or less “like me” (Meltzoff et al., 2009). This, in turn, can lead to a better understanding of feelings and emotions in oneself and others, sometimes referred to as Theory of Mind (Sundqvist & Rönberg, 2010).

Computer interaction leads to more experience and participation in social exchanges as it facilitates, enhances, and supports social communication (Anderberg, 2006). The computer can thus be considered a vehicle for achieving self-determination and control over ordinary situations and its use may consequently result in a growth of self-esteem (Jönsson, 1996). Individuals who use AAC are often viewed as passive communicators who do not take initiative in interaction (Ferm, 2006). A conversation between an individual who uses AAC and a speaking person is often characterized by unequal turn-taking and by the natural speaker dominating the interaction (Light, 1988). When writing an email message the pressure to respond quickly is absent, enabling a child who uses AAC to take the time needed to get his or her message across (Gandell & Sutton, 1998).

Few studies have focused on email interaction and email message writing as pathways for individuals with disabilities to establish new relationships (Bradley & Poppen, 2003; Cohen & Light, 2000; Stanford & Siders, 2001; Shpigelman et al., 2009). Bradley and Poppen (2003) studied older adults with disabilities who were introduced to email as a way to get to know one another. The participants felt isolated and lonesome; however, when the email communication intervention commenced, it enabled them to establish virtual friendships with others in similar circumstances. Mentorship programs where youths with disabilities were paired with peers with or without disabilities have also been successful (Shpigelman et al., 2009; Cohen & Light, 2000). In these studies, email message writing appeared to motivate the participants to create text, develop personal relationships, and practice social skills. Cohen and Light described different topics that were of interest to the teen and young adult dyads communicating, including social conversation, school, work, technical assistance, and personal care attendants.

To date, there have not been any studies focusing on making friends over the Internet that included young children with complex communication needs; thus, it is difficult to know what topics these young children might want to write about. It is likely, however, that topics would coincide with important communication goals described by Light (1988): to communicate needs and wants, to transfer information to another person, to achieve social closeness, and to express social etiquette. Studies of letter or email message writing for children who use AAC are, therefore, ecologically important investigations. Using the Internet is one way to increase social contacts and participation in daily living activities because it supplements an individual’s existing social networks by extending and enhancing social connections (Wellman, Quan Haase, Witte, & Hampton, 2001).

The aim of the current study was to introduce a symbol-based email client in order to investigate if and how email communication increased participation of children who use AAC in social interactions. The following research questions were asked: DO the children make use of email? DO the children use the appropriate social codes associated with email message writing? What do the children write about? What strategies do the children use when writing email messages? What do the participants report regarding their experiences emailing?
METHOD

Participants

The participants were six Swedish children with complex communication needs who used AAC as their primary mode of communication (see Table 1). They were recruited by their teachers at school or by the speech and language pathologist, and met the following inclusion criteria: (a) used Blissymbolics via a computer, (b) were aged between 6 and 12 years, (c) attended regular compulsory schools, and (d) had knowledge of and access to computers and the Internet at school. The teachers reported that they themselves were interested in participating in this study.

Twelve children were originally recruited, six of whom were excluded from the analysis for the following reasons: (a) only a few messages were sent over the course of the study (less than 12 during the 12 weeks of intervention); and (b) computer staff at one of the schools denied permission for the researchers to install the email client.

The participants attended regular schools; had a dedicated teacher assistant; and received, when necessary, special education intervention. The children were between 6;10 and 13 years of age at the time of inclusion in the study, with a median age of 10;8. All of the children had a diagnosis of cerebral palsy. There were two girls and four boys. All of the children had been introduced to AAC in preschool or earlier. Some of the children knew each other before the project started, and interacted about four times a year (Cecil, Jon, and Laura; pseudonyms). Helen had, some years before, belonged to this group. Gavin and Ferris did not know any of the other children prior to the study.

Before the study commenced, the children’s general nonverbal cognitive levels, receptive language levels, and understanding of theory of mind (ToM) were assessed. General nonverbal cognitive levels were assessed using Raven’s Colored Progressive Matrices (Raven, 1965).

The test consists of three sets of visual problems of increasing difficulty (A, AB, and B). Each set contains 12 problems designed to test the ability to solve increasingly complex visuo-spatial problems. This test is commonly used in international studies for assessing cognition in individuals with complex communication needs because it does not require any verbal responses (Sabbadini, Bonanni, Carlesimo, & Caltogirone, 2001).

General receptive language comprehension levels were evaluated using the Test of Reception of Grammar (TROG) (Bishop, 1989) in a Swedish translation (Holmberg & Lundälv, 1998). Given a choice of four pictures, the child must point to the best match to the sentence spoken by the test leader. The TROG is composed of 20 blocks of 4 items, and each block tests different grammatical constructions.

Six stories with accompanying questions were designed to test social-emotional theory of mind after an adaptation of the stories described by Baron-Cohen, O’Ridordan, Stone, Jones, and Plaisted (1999), and Happé (1994). The adaptations were designed to make it possible to display an understanding of the questions by answering with either a single emoticon or by pointing to a single Blissymbol. The aim was to test the ability to attribute mental and emotional states to others and understand social faux pas and irony (Sundqvist & Rönngberg, 2010). The maximum score on this test was 30.

Each of the test scores was reported as standardized value with a mean of 100 and a standard deviation of 15. A full description of each test and test procedure is given in Sundqvist and Rönngberg (2010). The first author administered the tests to each participant individually, in a separate room at his or her school. The participants’ characteristics and assessment results are described in Table 1. What follows are short descriptions of each child.

Cecil attended first grade in a regular school. He was included in all regular classroom activities and had many social contacts and friends. He was mobile and walked with a wheeled walking frame.

### TABLE 1 Participant Characteristics.

<table>
<thead>
<tr>
<th>Major modes of communication</th>
<th>Access to computer</th>
<th>Age</th>
<th>Years of Bliss educ.</th>
<th># of symbols</th>
<th>Raven score</th>
<th>TROG&lt;sup&gt;b&lt;/sup&gt; score</th>
<th>ToM&lt;sup&gt;c&lt;/sup&gt; score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecil Bliss, body language, letters, PCS&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Points</td>
<td>6;10</td>
<td>5</td>
<td>600</td>
<td>102</td>
<td>125</td>
<td>109</td>
</tr>
<tr>
<td>Ferris Bliss, PCS, body language</td>
<td>Joy stick</td>
<td>12;4</td>
<td>6</td>
<td>210</td>
<td>72</td>
<td>&lt;65</td>
<td>71</td>
</tr>
<tr>
<td>Gavin Bliss, sign</td>
<td>Points</td>
<td>9;2</td>
<td>2.5</td>
<td>500</td>
<td>95</td>
<td>80</td>
<td>109</td>
</tr>
<tr>
<td>Helen Bliss, body language, letters</td>
<td>Head mouse</td>
<td>10;5</td>
<td>8</td>
<td>600</td>
<td>90</td>
<td>110</td>
<td>106</td>
</tr>
<tr>
<td>Jon Bliss, body language</td>
<td>Head mouse</td>
<td>11;10</td>
<td>9</td>
<td>290</td>
<td>77</td>
<td>75</td>
<td>109</td>
</tr>
<tr>
<td>Laura Bliss, voice, body language</td>
<td>Head mouse</td>
<td>13;4</td>
<td>10</td>
<td>650</td>
<td>83</td>
<td>100</td>
<td>127</td>
</tr>
</tbody>
</table>

<sup>a</sup>PCS = Picture Communication Symbols; <sup>b</sup>TROG = Test of Reception of Grammar; <sup>c</sup>ToM = Theory of Mind.
He had an assistant who was with him all day at school. Cecil was very communicative and frequently used body language to communicate with his friends. He had recently learned to spell short words on the computer and used Clicker\(^1\) to write in Bliss. His nonverbal IQ, receptive language score, and the ToM score were within normal ranges.

Ferris attended a regular Grade 6 class for children with mobility issues. He had all his lessons in the “mobility-class.” He was able to move independently with his powered wheelchair. He had an assistant with him all day at school who helped him with daily living activities, communication, and schoolwork. He was not able to read and write with graphemes. He used his computer to write in Bliss (MindExpress)\(^2\). His nonverbal IQ was considered at the low end of the normal range. His receptive language score was below what was expected for his age. His ToM score was low and suggested difficulties.

Gavin attended a regular school and was in Grade 3. He was integrated in a regular class, but was withdrawn for most of his lessons. He was able to move independently indoors and outdoors. He had an assistant with him all day at school who helped him with some daily living activities, communication, and schoolwork. Gavin had previously used sign language and was introduced to Blissymbolics in Grade 2. He used Blissymbols and sometimes signs during interactions. He was considered a beginning writer. He used his computer to write in Bliss (MindExpress). His nonverbal IQ, receptive language, and ToM scores were within normal range.

Helen was in Grade 4 at a regular school, but one day per week, at a different school, she attended a special class for children with mobility issues. Some of her lessons at the regular school were given in a separate room. Her assistant drove her motor-powered wheelchair. The assistant was with her all day at school, and helped Helen with all of her daily living activities, communication, and schoolwork. She was beginning to be able to recognize and perceive some graphemes. She used her computer to write in Bliss (Clicker). Her nonverbal IQ, receptive language, and ToM scores were within normal range.

Jon attended a regular school and was in Grade 4. He was integrated in a regular class, but was withdrawn for most of his lessons. He was able to move independently outdoors in his walker. He wheeled around in his wheelchair indoors. He had an assistant with him all day at school who helped him with all his daily living activities, communication, and schoolwork. He was not able to read or write with graphemes. He used his computer to write in Bliss (Clicker). His nonverbal IQ and receptive language scores were within normal range, but considered low. His ToM score was within normal range.

Laura attended Grade 7 in a regular school. She was integrated in a regular class, but was withdrawn for most of her lessons. Her assistant drove her wheelchair, and was with her all day at school to help with all her daily living activities, communication, and schoolwork. She was not able to read or write with graphemes. She used her computer to write in Bliss (Clicker). Her nonverbal IQ, receptive language, and ToM scores were within normal range.

All of the children operated their own computers, but none had any prior independent emailing experience. The children had access to the Internet but did not have adapted programs that enabled them to independently access the Internet at school (or at home).

**Ethics**

Consent to be included in the project was obtained from the participants and their parents. The email messages were forwarded to the researcher, but the children had the option of not forwarding certain messages. The names and places of residence were changed in order to ensure participants’ anonymity. The email messages included in this article have been translated (from Blissymbols to Swedish to English) and altered (e.g., names of places and people were changed) in order to preserve anonymity, but in such a way as to not alter the meaning or the grammar of the sentences used.

**Material**

**Software and Email Client**

The email client used in this study was developed by the EU-project – World Wide Augmentative and Alternative Communication (WWAAC) (Paulson & Nicolle, 2004). WWAAC was developed as an additional module for the program, Symbols for Windows\(^3\). The key feature in choosing the email client was its capacity to translate the email message into written language. Another important consideration was the ability to configure and adjust the system to fit individual needs. The chosen email client had speech output on control buttons, could send and receive messages independently (multiple-access options), and had an address book with photos linked to friends’ email addresses.

The standard Blissymbol display (600 Blissymbols) was added to the program, along with
phrases and the child’s own family members’ and friends’ names, which made emailing fast and easy (see Figure 1). A phrase was represented as a sequence of symbols that could be selected as a single unit in one cell on the display. The phrases included message starters like, “My name is” and “How are you?” It was also important to allow for the participant to be able to use the same informal language that children with typical development use in their email messages. Therefore, informal comments like “Wow” and “Awesome,” and concluding remarks such as “Have a nice day,” “Take care,” and “Bye” were added to the program. A child was able to select letters of the alphabet to express something that was not available on the email client Bliss chart.

Speech output was available when writing messages and reading incoming mail. If the sender was a WWAAC-mail user, a picture of the sender was displayed in the “You got mail” window. The incoming mail was translated to the preferred symbol-language (in this case Blissymbolics). Outgoing email messages written in Blissymbolics were translated to written language if the receiver did not have WWAAC-mail. This enabled the user to write to anyone, without indicating that he or she was a person who used AAC. A communal Post Office Protocol (POP) server was required but because most schools did not have this type of server, a communal POP server was linked to the study, along with individual email addresses for the participants.

Procedure

Once the email client was installed, each teacher, assistant, and child received a short introduction to the program. The teachers were encouraged to include the subject of emailing in at least one lesson every week. Some email etiquette rules were explained. The children were expected to respond as quickly as possible to any mail they received from another child in the group. Every child was encouraged to initiate at least one email message a week. The instructions also stressed the importance of the children remembering facts they learned about the others in the group, some of whom they would not know.

After these initial instructions, each child and teacher was given a list of names, pictures, email addresses, and mail addresses of the other participants. This list, which was also added to the email address book, encompassed the children included in the study, but each child was free to email other friends or family as well.

As this was a heterogeneous group, the amount of writing and other assistance required varied among the children. During the 12 weeks of intervention, the teachers made sure that each child had the time he or she needed to write at least...
one message per week. In addition, they were instructed to support the children in the same ways as they would when supporting them to learn other kinds of communication skills. Writing email messages was new to the children, some of whom required strategic help to master the technique. The teachers asked general questions (e.g., “What can you write first?” or “Do you want to ask something else?”), as well as more specific questions aimed at formulating sentences (e.g., “How would you ask that?” or “What word do you need?”). Some children did not need any strategic help and were reportedly completely independent in their emailing. The teachers were also instructed to contact the first author if they had questions about the email client and/or Internet access.

A couple of backup mailing methods were available as needed. If the email client failed, the teachers were instructed to send PDF (Portable Document Format) documents. In contrast to the document format in the children’s communication programs, PDF-saved documents are platform-independent, which meant that the Blissymbol messages could be opened and read on any computer that had freely available software. The messages were constructed in the child’s usual computer communications program: Clicker or Mind-Express.

The email project lasted for 12 weeks. The teachers and children were encouraged to continue their email interactions, if they wished, after the end of the project. After the project, each child with his or her assistant sat down with the first author for a semi-structured interview (Kvale, 1996). The interview focused on the emailing experience and included questions such as “What do you think about this project,” “What was fun,” “What wasn’t fun,” “What worked,” and “What didn’t work?” The assistants were also questioned about each child’s independence in writing email messages. The answers to the questions were written down for subsequent analysis.

Measures and Data Analyses

Unless a participant chose to click the “Do not forward” button (none did so) all email messages sent by the participants in this study were automatically forwarded via email to the researcher. This was done to measure the frequency of communications, record the sender and receiver of email messages, and record the length and analyze the content of the messages. In some instances, the children used pre-stored phrases. These phrases were, however, within the child’s language capacities and could have been produced symbol-by-symbol by the child. Therefore, the words within the phrases were counted in the total word count. A phrase was considered to be a unit that represented a distinct concept.

A qualitative analysis of the content of the email messages was performed, in order to identify and categorize phenomena found in the messages (Dahlgren & Fallsberg, 1991; Strauss & Corbin, 1990). Through an inductive approach, relevant codes were developed for words or sentences that formed meaningful units. This involved naming codes and constantly comparing the different codes with each other to determine which ones belonged together. Each new unit that was coded was compared to every other unit until, eventually, discrete topics were developed. The different discrete topics were linked together in categories. This was an iterative process where the researcher constantly questioned the validity of the results through a reorganization of the topics into different categories. The topics’ commonalities were reflected in these categories (Strauss & Corbin, 1990). The categories were then named.

Inter-observer agreement was calculated (Larsson, 1993). A second independent coder, a psychologist who was familiar with complex communication needs, was selected. In order to establish inter-observer reliability, 20% of the email messages sent were randomly selected. The distinct category descriptions were described to the second coder and the inclusion criteria for each category were explained (see Table 3). The second coder independently re-coded meaningful units in the email messages and placed them into the above-described categories. Mean inter-reliability (number of agreements divided by the number of agreements plus disagreements × 100) resulted in a 94% agreement rate, a high inter-rater reliability score.

Each participant’s dyadic interaction was also studied, in order to analyze strategies used in email writing and determine if there were any changes in strategies over time. This analysis focused primarily on content rather than form. The messages were transcribed using the conventional notational system for AAC (von Tetzchner & Jensen, 1996).

RESULTS AND ANALYSIS

Frequency and Length of Email Messages

During the 12-week test period, the children sent a total of 175 email messages. The children predominantly emailed the other participants of this study, most of whom were new acquaintances. A total of 26 email messages were sent to non-participants such as a family member or friend. The number of email messages sent by each participant ranged from 12–69 (mean = 29). The
average length of an email was 3.8 phrases (range = 1.1–6.4), and each message contained an average of 15.8 Blissymbols or words (range = 8.7–21.9; see Table 2). The frequency of symbols must be viewed with caution, however, as some phrases that were available in the program consisted of several symbols. Gavin, Helen, Laura, Cecil, and Jon continued to email each other and others after the 12-week test period. Ferris did not continue emailing.

**Topics Discussed**

By using an inductive, qualitative method, the content of all email messages was coded and seven descriptive and distinct categories emerged (see Table 3). The categories are complementary to the goals of communication described by Light (1988). The children in this study used social etiquette to a great degree. Since 50.8% of the coded units were placed in this category it was certainly an important factor of socially accepted interaction. Transferring personal information to another person was also important in writing email messages, as illustrated by the categories Personal and Family Characteristics (20.2%), Preferences (3.5%), Pastime Activities (5.0%) and School/Afternoon Care (3.6%). The children also expressed (specific) needs and wants when they tried to assess how the email program worked, by asking or by just testing the program (5.9%). Another important goal of communication was to achieve social closeness, which was, in some sense, achieved in all categories, but perhaps especially in the category of Personal Common Ground (10.9%). Each category that emerged from the data is described below.

The category Social Etiquette accounted for the largest number of email messages, most of which contained both a greeting, which in translation would be similar to “Hi” (“Hej” in Swedish), and closings comparable to “Good bye” (“Hej då”). Many of the messages also contained contributions considered to be part of the Social Etiquette category, similar to “How are you?” (“Hur mår du?”), “Thank you for the letter” (“Tack för brevet”), and season’s greetings such as Happy Easter (“Glad Påsk”). Many messages contained multiple closings. This is illustrated by an example from Laura, who finished one email message with four different closing formulations: “Lots of Love Hope to hear from you soon! X-X-O-O Bye Laura.”

The second largest category was Personal and Family Statistics. The children wrote about themselves – their ages, their school levels, their siblings, and their pets. They also posed the same questions to their “pen pals.” A typical instance of this was when Gavin wrote about himself and started to ask the same sort of questions to his pen pal. Gavin wrote: “I live in Littleton. My phone number is 48402. I have a dog. Do you have pets.” Cecil started out by telling the pen pal about himself. He wrote, “I am 7 years old”.

The third most frequently used category that emerged was Personal Common Ground. This category contained meaningful units that were related to a joint understanding of events or situations mentioned in earlier messages or that were occurring in real life. The topics/codes were about planning joint future events, jointly experienced events, and contributions to an ongoing conversation happening in real life (i.e., not online). For example, Helen wrote “brat” to her sister who sat at a computer next to her. An example of social interaction originating from a previous message could be observed as Jon

<table>
<thead>
<tr>
<th>TABLE 3 Categories and Topics/Codes Derived From the Email Messages.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td>Social Etiquette</td>
</tr>
<tr>
<td>Personal/Family Statistics</td>
</tr>
<tr>
<td>Personal Common Ground</td>
</tr>
<tr>
<td>Email-Client Queries and Testing</td>
</tr>
<tr>
<td>Pastime Activities</td>
</tr>
<tr>
<td>Preferences</td>
</tr>
<tr>
<td>School/Afternoon Care</td>
</tr>
</tbody>
</table>

**TABLE 2 Number of Email Messages and Mean Length of Phrases and Mean Number of Blissymbols/Words in Each Participant’s Messages.**

<table>
<thead>
<tr>
<th>Participants</th>
<th>Number of email messages</th>
<th>Length of email messages (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phrases</td>
<td>Blissymbols/words</td>
</tr>
<tr>
<td>Cecil</td>
<td>13</td>
<td>1.1</td>
</tr>
<tr>
<td>Ferris</td>
<td>13</td>
<td>3.5</td>
</tr>
<tr>
<td>Gavin</td>
<td>27</td>
<td>6.4</td>
</tr>
<tr>
<td>Helen</td>
<td>69</td>
<td>2.1</td>
</tr>
<tr>
<td>Jon</td>
<td>12</td>
<td>4.4</td>
</tr>
<tr>
<td>Laura</td>
<td>41</td>
<td>5.2</td>
</tr>
</tbody>
</table>
answered a question from Cecil about an upcoming meeting that both boys usually attended: “Jon going Skalman Yes, Wednesday May 17...”

Another category, Email Queries and Testing, contained questions about the program along with messages from the participants who were clearly testing out the program. Helen wrote, for example: “Yes Hi Thank you No great Welcome Sorry lousy Pastime present time many combination.”

Another category was Pastime Activities. Here, the children wrote about matters like going on a vacation, what they were going to do while on their school break, or what they had been doing on a break. Helen wrote, for example: “Today family is going to Arlanda.”

The category Preferences also emerged in the data. The children wrote about what they liked and did not like: favorite colors, favorite foods, favorite TV shows, favorite toys, etc. An example of this was a message from Gavin to Cecil:

My favorite food is potato and fish... What is your favorite color? My favorite color is black and brown and red and yellow and green and white.

The final category that emerged from the data was School/Afternoon Care, and it included topics/codes related to school activities (e.g., going on outings), or afternoon care activities (e.g., baking). John wrote: “Today is baking club” (afternoon care).

**Common and Individual Strategies in Email Writing**

The children used the categories in different instances and for different purposes in their email messages. When a child wrote to an unknown child, the first message often fell into the descriptive category, Personal and Family Statistics. The children composed the first message by either telling everything about themselves or attempting to find out more about the other person by asking questions (See Table 4). As the participants became acquainted, references to their Personal Common Ground occurred more frequently. A typical pattern for certain types of email messages also emerged, as can be seen in those messages with informal address and interactional features (See Table 4). This strategy was used when the sender of the message knew the other child well. Such email messages were often focused on the descriptive category of Personal Common Ground.

The children’s individual patterns of category specific codes could be observed by comparing the proportions of categories that were actually used by each child. The Social Etiquette category was excluded from our investigation of categories that could be considered optional or variable from participant to participant because it may be considered obligatory (Figure 2). Gavin and Ferris had the highest proportion of topics in the Personal/Family Statistics category. The boys did not know any of the other children before the study commenced, which meant it was essential for them to discover aspects that would eventually make up a personal common ground. Helen, however, who already knew many of the children, wrote mostly about Personal Common Ground. Jon wrote most often about School/ Afternoon Care and Pastime Activities, and was the only participant who wrote about the former category. For both Jon and Laura, who also knew many of the children in the study, Personal Common Ground was their second most utilized category. Helen, Jon, and Laura were the only children who wrote about Pastime Activities. Cecil had a large proportion of messages related to Email Client Queries and Testing.

A progression of the descriptive categories in messages sent and received was noticeable in some instances. As the email messages were exchanged, the children established a shared reference ground, and messages within the category of Personal Common Ground became more apparent. An example of Laura and Helen’s message exchange is presented in Table 5. They had met several years earlier and became reacquainted through the email project. Their initial email messages contain topics from the categories Social Etiquette, Preferences, Personal and Family Statistics, and Pastime Activities. The category of Personal Common Ground occurs for the first time in Helen’s third message. Of particular note is the increased use of the category Social Etiquette, as Helen finishes the message with several closings using informal language.

**TABLE 4 Email Strategies.**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Example of email</th>
</tr>
</thead>
<tbody>
<tr>
<td>First message:</td>
<td></td>
</tr>
<tr>
<td>Tell all</td>
<td>my name is Ferris O. I LIVE IN N-city GO TO SCHOOL IN U-city. I AM 12 YEARS OLD. How old are you? talk to you later good bye Ferris</td>
</tr>
<tr>
<td>Ask all</td>
<td>HELLO How are you??? WHERE DO YOU LIVE How old are you? Take care! Regards from Gavin</td>
</tr>
<tr>
<td>Increasing personal</td>
<td>HIT IT PASTIME IS FUNNY YOU WERE IN MY SCHOOL TODAY I SEE LETTER YOU HAVE 2 DOG take care! Good bye Ferris</td>
</tr>
<tr>
<td>common ground</td>
<td></td>
</tr>
<tr>
<td>Informal</td>
<td>Be-t-a-t</td>
</tr>
</tbody>
</table>
Helen’s third and Laura’s fourth message, the category Personal Common Ground is used frequently, as is the use of informal language retrieved from the pre-stored sentences.

**Participants’ and Assistants’ Views on Emailing**

After the completion of the email project, interviews were conducted to collect information regarding the assistants’ and participants’ thoughts and feelings about the project and its presumptive impact for the participants. Positive statements from Laura’s, Cecil’s, Gavin’s, and Helen’s assistants about emailing indicated that the children enjoyed and were interested in the email communication. For example, they requested more words/other words/social words; “quick sentences” (to be able to ask common questions); and more addresses for their address books. Helen’s, Cecil’s, Laura’s, and Gavin’s assistants estimated that the children almost always wrote their email messages independently. A majority of the children stated that they liked writing and receiving email messages; they thought it was fun to get to know and write to new children.

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**TABLE 5 Progression of Email Messages Between Helen and Laura.**

<table>
<thead>
<tr>
<th>Order</th>
<th>Writer</th>
<th>Message</th>
<th>Categories used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Helen</td>
<td>HI Laura How are you? Regards from Helen</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td>1st</td>
<td>Laura</td>
<td>HI Helen I AM FINE! How are you? MY FAVORITE COLOR IS PINK! WHAT IS YOURS? Good-bye Laura</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Preferences</td>
</tr>
<tr>
<td>2nd</td>
<td>Helen</td>
<td>HI Laura I a-m FNE. I LIKE PINK AND BROWN. Regards from Helen</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Preferences</td>
</tr>
<tr>
<td>2nd</td>
<td>Laura</td>
<td>HI Helen HAVE I ASK YOU WHEN YOU HAVE BIRTHDAY? WHAT YOUR BROTHER NAME? WHAT FUTURE YOU DOING ON BREAK? Hugs Laura</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Personal and Family Statistics, Pastime Activities</td>
</tr>
<tr>
<td>3rd</td>
<td>Helen</td>
<td>HI Laura I HAVE BIRTHDAY IN JUNE. MY BROTHERS NAME IS MIKE. I AM GOING TO MY GRANDMOTHER IN X-l-a-n-d FOR 6 WEEK. Cool! ARE YOU GOING TO B-i-g-v-i-l-l-e TO BLISS MEETING? See you soon! Write soon pretty please Many regards from Helen</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Personal Common Ground</td>
</tr>
<tr>
<td>3rd</td>
<td>Laura</td>
<td>HI Helen YES I AM GOING TO THE BLISS MEETING IN B-i-g-v-i-l-l-e. I HOPE YOU WILL BE THERE TOO... I AM GOING TO G-r-ô-n-a L-u-n-d ON SATURDAY. IT IS GOING TO BE A LOT OF FUN. Regards from Laura</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Personal Common Ground, Pastime Activities</td>
</tr>
<tr>
<td>4th</td>
<td>Helen</td>
<td>HI How are you? That’s cool! t-o go to G-r-ô-n-a L-u-n-d Good bye hugs Helen</td>
<td>Social Etiquette</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Personal Common Ground</td>
</tr>
</tbody>
</table>
Most of the negative statements from the children and their assistants concerned the email client (i.e., lack of proper grammatical structure and inability to incorporate attachments). Jon’s and Ferris’s assistants reported that the boys sometimes needed strategic help to formulate the email messages. Jon generally enjoyed the emailing experience although he did not request any new Blissymbols or addresses. He wanted to send pictures, and that was not possible with the email client used. Ferris infrequently wanted to write email messages, although he enjoyed receiving them.

**DISCUSSION**

The results supported our hypotheses that emailing is an appropriate way of supporting and enhancing social contacts for children who use AAC. Since letter writing, or in this case email message writing, is a “socially negotiated practice” (Hall et al., 2000, p. 131), the children participating in this study needed to develop new social email skills in order to interact with others, because writing email messages was a new experience that demanded an exact formulation of the topics delivered in order to avoid misunderstandings. Most of the children almost always wrote their email messages independently. The adults, however, also played an important role as bearers of knowledge about social email writing. As each child learned the social codes of emailing, he or she had the opportunity to become a more active participant and achieve a greater degree of autonomy in emailing situations.

The messages the children wrote were fairly short; the mean number of words per message was 15.8. AAC, however, is often cumbersome and slow, so this rate still represented a strong effort. Most importantly, the length of email messages does not tell the whole story. A short message may contain a high degree of complexity and represent a process of advanced thinking. For instance, Helen’s use of email to tease her sister by writing “brat,” displayed much more knowledge of the social world than a lengthy reply might have done. The categories that emerged in the data are complementary to the goals of face-to-face interaction involving children who use AAC (Light, 1988). The same topics seem to be important both in email exchanges and during real-time conversations. There were common chronological aspects regarding what goals were predominant at specific times during the “getting to know you” process, and there were individual differences in what categories and topics the children chose to write about. Some of the differences seemed to be connected to each child’s preexisting social network and to the need for development of personal common ground. The content and the form of all of the children’s email messages were, nonetheless, similar to letter writing by similarly aged children without disabilities (Linnér & Linnér, 1992).

An important aspect when writing email messages is that, unlike during real-time AAC conversations, there is unlimited time to produce each message. The children could take as much time as necessary to find the right Blissymbols or think of the best questions, and so were active participants, indeed as they initiated interactions, asked questions and actively participated in communication opportunities. This was an interesting finding because AAC use is often characterized by little participation in communicative interactions (Light, Collier, & Parnes, 1985). Interestingly, all but one of the children was within normal range for receptive language understanding and nonverbal intelligence, which presumably enabled them to understand and participate on equal grounds. Most of the children had also used Blissymbolics when they were in preschool, and each, therefore, had a good knowledge of the language and the Blissymbols available.

Email messages to familiar individuals were often of a different character than those to unknown individuals. At first, the children wrote about themselves and asked questions of their email recipients. Subsequent messages illustrate how the children were finding common ground with each other — a process that is essential to making friends (Clark, 1996). As time passed, the children’s email message-writing practices changed in other ways as well. For initial email messages, the children used single openings and closings; they subsequently extended the messages with multiple contributions from the Social Etiquette category. With respect to sustained friendships, the children eventually dispensed with topics/codes from the Social Etiquette category and instead wrote messages that were shorter and more formal in nature. The children displayed a strong capacity to adapt to the context and let each unique context guide the formation of the individual messages. An understanding that other children may or may not be “like me” may be an important consideration when writing to different communication recipients, just as it is during in-person communications with different individuals (Meltzoff et al., 2009). The initial testing also revealed that all but one of the participants had a good understanding of social situations (i.e., theory of mind).

Given that participation in daily social activities is often limited for children who use AAC, the
ability to develop personal common ground is particularly vital to making and sustaining friendships. The ability to explore personal common ground with other individuals may also provide insights that will be helpful during other types of interactions.

Validity/Reliability Issues

The focus of this study was limited to emailing in school situations. Teacher illness and reported problems with computers resulted in a low number of email messages sent during some periods. One school district denied access to the remote POP3 server, which was needed for the email client used. Thus, the children affected by these problems were eventually excluded from the analysis. Another limitation of the study might be that the strategic help from assistants provided to two of the participants may have influenced what the children wrote. On the other hand, some children in this study were sometimes in need of strategy help to formulate email messages. Thus, it is possible that their assistants influenced what the children wrote. However, providing the assistance may have been as a way of scaffolding the writing skills of the children, leading to greater independence in writing.

Future Research

This study describes how children who used AAC learned to interact with and get to know each other. Future research could investigate characteristics of emails written to other children (including those with typical development), such as known classmates or pen pals. In addition, study of the use of instant messaging may permit indentifying the characteristics of digital interaction and its impact for these children. The effect of email interventions on the understanding of theory of mind would be another important area of study. It is interesting to note that the only child in this study who did not enjoy or care to continue emailing also had the lowest theory of mind and language scores. A longer, formalized emailing may lead to a greater understanding of others and increased language and social skills.

CONCLUSION

Emailing enhanced and supplemented the social networks of the children in this study and provided a new social arena that most enjoyed exploring. Emailing also gave the children time and opportunities to practice semantic and syntactic complexity in the sentences they produced and, more importantly, chose to produce, in order to interact. The children in this study made use of similar strategies and discussed similar topics in the email messages, just as children without disabilities do when they write traditional letters. The children wrote about themselves and their families and their school situations, and they asked their pen pals questions about the same matters. As they started to learn about their pen pals, relationships developed and the category of Personal Common Ground became increasingly important. As friendships became closer, the messages became more informal and sometimes contained only one word or one Blissymbol. Emailing gave the children opportunities to explore how to make friends, how email messages are produced, and how to change their interaction to match each unique context involving the sending and receiving of email messages. Most importantly, it gave the children a chance to actively participate in interactions on their own terms.

Declaration of interest: The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

Notes

1. Clicker is a registered trademark of Crick Software Ltd, Crick House, Boarden Close, Moulton Park, Northampton NN3 6LF, UK.
2. Mind Express is a registered trademark of Jabbla, Victoriastraat 52, B-9000 Gent, Belgium.
3. Symbols for Windows is a registered trademark of Handicom, Oranjelaan 29, 3843 AA Harderwijk, Holland.

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