
The Digital Playground: Kindergarten Children Learning Sign Language Through Multimedia

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The article discusses a study of 4-5 year old children’s use of technology to assist and enhance the acquisition of a play lexicon within a formal educational setting. The new language system to be learned was Auslan, a signed/nonverbal language. A purpose specific software program was developed by the authors, “Auslan Kids,” in order to test and evaluate the efficacy of multimedia in learning language particularized by visual representation. Of particular interest to the authors was the influence of characters and interaction styles on learning outcomes. Kindergarten children managed to learn Australian Sign Language vocabulary from the multimedia software package. Children that interacted with the software either by making the signs or by making selections with the mouse learned more signs that those who were passive and only watched. Children showed a slight preference for learning from a female over a superhero or puppet.

This research project examines the design and development of multimedia software for teaching kindergarten children Australian Sign Language. The design of the software was then tested on the target children to establish if
the design of the software was appropriate for the age group and to establish the children’s preferences for characters and learning activities. Results were collected on the children’s sign vocabulary acquisition to identify links between the design of the software, the behavior of the children, and their learning outcomes.

Australian Sign Language (Auslan) is a complete language system, comprising more than simplistic gestures or mime, and more than capable of conveying complex communicative requirements and exchanges and highly sophisticated concepts. As Schein and Mark (1984) contended, “a Sign is a hand motion configuration that conveys meaning” (p. 9). In contrast to spoken English, which is widely understood and used despite differences in accent and localised vocabulary within a number of countries, every country has its own unique sign language even within those countries that share a common language such as English. The sign system selected for this study is Australian Sign Language as the research was conducted in Australia. There are approximately 15,000 users of Auslan in Australia (Smith, 1996). While the study focuses on Auslan, there is clear applicability to other sign systems.

Each sign consists of a number of parts: hand configuration, place of articulation, orientation, path of movement, and non sign components (Bornstein & King, 1984; Capirci, Iverson, Montanari, & Volterra, 2002; Cheek, Cormier, Repp, & Meier, 2001; Drasgow, 1998; Hudson, 2000; Lederberg, Prezbindowski, & Spencer, 2000; Schein & Mark, 1984; Smith, 1996)

Many people erroneously assume that sign language is simple to learn because the signs resemble their referent. This is accurate in some instances such as the sign for aeroplane, an iconic sign where the characteristics of the sign are representative of its signification. However, only a small percentage of the Auslan lexicon consists of such iconic signifiers. Other signs include index signs where the sign, for example “bread,” is metonymically associated with its signification “using a knife to cut the bread.” However, other signs are purely symbolic and premised on entirely arbitrary signification. Such signs must be learned as conjecture is ineffective, for example “father” where no relation between the object/the signified and the sign exists (Hudson, 2000).
SIGN LANGUAGE FOR HEARING CHILDREN

Daniels (1994) found that the use of sign language with hearing children within a kindergarten setting resulted in increased use of language and development of vocabulary. Good, Feekes, and Shawd (1993) similarly reported a number of benefits for hearing children of kindergarten and lower primary age who were exposed to sign language on a regular basis. Such benefits include both social and developmental improvements:

Children love multisensory learning that involves seeing, hearing, speaking and doing. Sign language can enhance language experience by engaging all of these modalities. Teaching sign is a developmentally appropriate practice that promotes acceptance of differences and allows for hands-on language learning in the earlier years (p. 81).

Good et al. (1993) found that teaching sign language promoted language development and Daniels (2001) similarly found that the simultaneous use of sign language with speech increased kindergarten children’s vocabulary.

In addition, Daniels found that younger children used language more frequently when exposed to sign language as a part of the linguistic program in kindergarten, “learning languages in two different modalities does not interfere with semantic development; quite the contrary, it appears to enhance it” (Daniels, 1997, p. 28).

A beneficial corollary to teaching hearing children sign language is that it maintains visual attention and promotes focus as the children are compelled to watch the teacher when they are signing. (Cooper, 2002). Daniels (1994, 1997, 2001) also noted that using sign language increases a child’s ability to focus attention as they are compelled to concentrate on the teacher’s complete range of communication techniques in order to understand. Children watch because of their natural curiosity and become active participants in the learning processes. The visual movement of sign language promotes eye movement, focus, tracking and concentration thereby enhancing brain development (Daniels, 2001). Sign language is an effective environmental stimulus thus enhancing brain development, promoting brain growth, and increasing brain activity particularly in the visual cortex. Increased language activity in two modes, such as verbal and sign, increases the connections (synapses) in the brain (Daniels, 2001).
As Daniels (2001) suggested, teaching sign language to all children leads to a more inclusive society.

If the present trend continues, and more and more children who are deaf receive their education in inclusive mainstream settings, it will become increasingly important for a larger number of their hearing classmates to know how to communicate with them in … some form of sign language (p. 104).

Teaching sign language to children may also influence and modify social attitudes to the deaf within society. As Daniels suggested, when sign language is taught within an integrated classroom setting it is imperative that students understand the importance of this form of communication as a language system used by the deaf community, that it functions as an alternative to verbal communication and that hearing people can communicate with the deaf using signs (Daniels). The introduction of members of the deaf community, both adults and children to the classroom plays an important role in children’s understanding of the function of sign language.

MULTIMEDIA’S POTENTIAL FOR TEACHING SIGN LANGUAGE

The visual and kinetic nature of sign language renders it difficult, if not impossible, to learn from a book, as written text precludes the transference of movement, emphasis and facial expression. (Drasgow, 1998). Traditionally, sign language has been taught from person to person, either from a deaf or hearing parent to a deaf child, or in an educational setting. Current advances in technology have led to the development of mediums that are appropriate for teaching sign language, such as videos, DVDs, computer programs, and interactive multimedia.

This research explores the possibilities of the development of a multimedia resource to assist hearing children at preschool level to learn sign language. Initial investigations have focused on the most appropriate attributes for inclusion in software to increase the engagement opportunities for children and enhance their learning.

This is the first of a series of iterative research projects designed to refine each aspect of the software. Several iterations are necessary as there are so
many unknown variables in using a computer to learn sign language. In addition, the unique requirements of the particular age-group add further complexity. Learning Auslan has similarities with other language learning for which there is existing computer software. However, as a manual, nonverbal language Auslan adds an additional level of complexity which poses a unique problem as it requires the fusion of several cognitive and physical domains. The process of transposing physical gestures from the computer screen to the gross and fine motor coordination of a child user warrants specialised investigation. Initial research focused on the ways in which children might interact with a computer to learn a physical skill with a complex cognitive component.

As no similar previous research existed, a number of assumptions were made in lieu of available indices. For the initial project, the timeframe of 10 minutes for each interaction was adopted. The children were already accustomed to completing other computer activities within the same time constraints and thus integrated comfortably into the established structure of the kindergarten session. As learning a new language is a cognitively intense activity, children could rapidly experience cognitive overload while learning Auslan, thus it was crucial to limit the children’s interaction to short intervals. In addition to attempting to acquire new language skills, the children were also compelled to contend with a computer and technology that was relatively new to them.

The next consideration was the number of words to introduce in each 10 minute session. In the initial stages of the project, 12 words were used in each session with the intention of further refining the most appropriate number premised on the results of the first iteration. Another issue confronting the researchers was the appropriate number of repetitions for each word and whether or not it was feasible to introduce the possibility of child-controlled repetition and variation. The difficulties arising with a variable system included how to communicate the variability to the children and, if such a feature could be incorporated, how the children would discern the most appropriate number of repetitions for learning.

There were several factors considered during the design of “Auslan Kids” including; the age of the children, the most appropriate lexicon to promote play, the delivery rate and number of words presented, the appropriateness of the presenter, the activities utilised and the interaction style of the children.
The target audience consisted of kindergarten children aged approximately four to five years old. This particular age group is likely to be in a transitional stage of development where they are learning to widen their social world from home to a more structured learning environment. Children within this age group are unlikely to be skilled in reading and writing and may be moving to an awareness of the composition of words through an alphabet. This project was conducted within a mainstream kindergarten with hearing preschoolers. Hearing children within a mainstream kindergarten setting were selected to ensure the integrity of the data was not diminished by the children learning sign language from other sources. All of the children in the kindergarten were not exposed to Auslan from any other source. Neither the kindergarten teacher nor assistant teacher had used sign language in their teaching.

**Figure 1.** Elements influencing the development of Auslan Kids

**METHODOLOGY**

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language previously, however both were keen to participate in the project. The project was conducted during the last term or final quarter of the kindergarten year, prior to all the children moving on to school. The children at the selected kindergarten had all been exposed to and used a computer once a week for 10 minutes for the previous three terms of the year giving them approximately 35 opportunities to use the computer prior to the experiment. A variety of children’s software was used to build familiarity with the computer and to develop computing skills. The computer is located in an open area in the kindergarten and therefore, the other children in the session could observe if they felt inclined. It was imperative that the ability of the children to learn Auslan, was the focus of evaluation rather than the ability to use a computer, thus participants were expected to be familiar with a computer and the skill set required for simple interaction.

The subjects who all live in a southeastern suburb of Melbourne, Australia, are aged between four and five years of age, and attending kindergarten three days a week. Each kindergarten session was four hours in duration, with most sessions run in the morning and only one afternoon session. The physical environment of the kindergarten is constructed with both indoor and outdoor play areas and on most days the session time is split evenly between the two areas. The sessions were loosely structured with the children eating snacks and lunch together interspersed with various group activities such as show and tell, singing, and story time. The remainder of each session consisted of free activities in either the indoor or outdoor areas.

Once approval had been confirmed by both the Ethics Committee of the University and the Kindergarten Committee, all 43 parents of the kindergarten children were invited to participate in the project. Sixteen (16) parents (of 11 girls and 5 boys) returned the consent forms for their children to participate. The initial schedule for the use of the program “Auslan for Kinder” was for 10 minutes per week for nine weeks. The computer was located in a corner of the main area at a low table with child-sized chairs for both the participant and the researcher. During the “inside” session, the children were invited to use the software on a rotational basis to complete all activities at the rate of one activity per week. During the first and second weeks of the project, a researcher was present to observe the children’s interactions and to record data in addition to the data collected by the software.

The children had their photograph taken with a digital camera. This photograph was then integrated into the software to enable the children to login.
independently. The photograph was supported by written text of their name in the corner of the screen, however the visual cue of the photograph was considered to be the most accurate form of login as many children may not be competent in selecting their own name from a list. The login procedure enabled collection of data on each child’s interactions and the setting of the correct activity each time a child logged in to ensure that each child’s individual interactions progressed steadily through the activities.

The final session was used to assess the each child’s progress in learning the Auslan play vocabulary in terms of both expressive and receptive skills. The computer program was designed to facilitate the collection of the children’s vocabulary, assessment data was gathered by the software and additional data was observed by the researcher. During this final session the researcher also asked the children to identify their favourite character from the female, hero, or puppet.

**DESCRIPTION OF AUSLAN FOR KINDER**

“Auslan for Kinder” includes a variety of drill and practice style activities and creative activities such as vocabulary instruction, an interactive story-book, a signed song, and a game. The variety of activities was designed to cater for different learning styles and to reinforce the target vocabulary by using it within a variety of settings. The schedule of activities was: three weeks of vocabulary instruction, the first week presented by a woman to provide an interpersonal relationship; one week by a super hero to provide a positive role model; and one week by a puppet to develop engagement. In the fourth week the children were provided with the opportunity to select the presenter of their choice. The activities were a story, song, and game, and the children had the opportunity to select which of these three activities they wished to repeat. The final week focused on assessment. A specifically developed “play lexicon” was used. Such a vocabulary differs significantly from that traditionally taught in sign language classes as the emphasis was on words appropriate for interaction in the play environment rather than on functional communication.
VOCABULARY INSTRUCTION

The first sessions comprised of a multimedia enhanced drill and practice sign language instruction activity that incorporated text, images, audio, and video. The written text of the target word is in the top left corner to promote word recognition, however, it is not assumed that kindergarten/preschool children are literate. Three pictures on the left hand side of the screen illustrate the hand shape, side view, and movement of the sign. In the centre of the screen is a video of a presenter making the sign for the target word three times. The video is as large as is feasible as it is the most important tool for learning each sign. The video illustrates the sign, including the hand shape, location, movement, and the appropriate facial expression. The video also shows the sign within the appropriate signing space. As signs are dependent upon where they are produced, failure to correctly place the sign in relation to the body will render some signs unintelligible where other signs are robust in hand space. On the right hand side of the screen is the list of 12 target words. While the children are not expected to be able to read the words, the list is provided to orient the children within the activity so that they remain aware of the number of words they have seen and how many new words remain.

A voice-over of the word is provided and a description of the hand shape, location, and movement for each word. When these descriptions are combined they provide a detailed explanation of the sign. For example, “good”: the word is announced followed by the hand shape: “Put your thumb up”; the location: “in the centre of your body”; and the required movement: “Push your hand forward, away from your body.”

Each word is displayed in the video three times then the next word in the list is automatically highlighted unless the child selects another course of action. Following the last word in the list, the program automatically moves back to the first word. “Auslan for Kinder” is designed with this automatic movement as well as with the option of manual control. This strategy was implemented as signing involves the extensive use of both hands thus interaction with either the mouse or keyboard may interfere with the sign learning process. The manual controls available include using the next word and previous word buttons or selecting any word from the list.
In the design of multimedia to teach sign language to four and five year old children, consideration was given to the use of characters to facilitate higher levels of engagement. Children may be more absorbed and attracted to a character than a person (Ellis, Blashki, & Quigley, 2004; Kelly, 2003). Further research in this field is required to assess children’s preferences.

<table>
<thead>
<tr>
<th>WORD TITLE</th>
<th>HAND SHAPE</th>
<th>SIDE VIEW</th>
<th>MOVEMENT</th>
<th>LOG OUT</th>
<th>PREVIOUS WORD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>List of Words</td>
<td>Childs Name</td>
<td>Next word</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2.** Vocabulary instruction

**CHARACTERS**

In the design of multimedia to teach sign language to four and five year old children, consideration was given to the use of characters to facilitate higher levels of engagement. Children may be more absorbed and attracted to a character than a person (Ellis, Blashki, & Quigley, 2004; Kelly, 2003). Further research in this field is required to assess children’s preferences.

**Figure 3.** The Characters—the female presenter, the super hero and the puppet
Two characters were chosen as presenters in “Auslan for Kinder” vocabulary instruction in addition to a female presenter. The first character, a gender-neutral superhero, was selected to appeal to both boys and girls and to function as a positive deaf role model for children. Such a character requires careful selection to ensure that it reflects a positive image of sign language users. Thus a clown or monkey would be inappropriate as both could be considered objects of fun, whereas a super hero or a fireman could present a positive role model (Ellis & Blashki, 2004). The super hero has “special power” to communicate without speaking which could be incorporated into a story that promotes the use of sign language. The second character selected for inclusion was a likeable puppet as it is engaging, appealing, and familiar (and often used in television for children). The puppet, “Alfy” was custom-made of polyurethane foam with fake fur material coverings. A customised puppet was required to meet the specifications of the project. Whereas most puppets are only made with three fingers and a thumb, Alfy has custom gloves to fit on the signer’s hands and in particular to provide clear signs. Alfy proved complex to film, as the puppet requires two people to operate: one person provides the hands and the other operates the face and mouth.

INTERACTIVE AUSLAN STORY

The second activity comprises a story presented in both English and Auslan. While the vocabulary section presents single signs to aid children in learning to understand and produce specific signs, the story was included to enable children to experience Auslan in the context of a language system. The story was written specifically for the research incorporating the target vocabulary. The Auslan video of the story illustrates that Australian sign language has special characteristics such as the ability to show multiple perspectives (Smith, 1996).

Each page of the story has the female presenter on the left hand side of the screen signing the text of the story with an illustration on the right hand side. Located in the lower centre is the text of the story with controls located either side for the child to move to the next and previous pages. Upon entering the page the story is read in English. Selecting a word from the text displays the individual sign for the word, and prompts the audio for the word.
Variable Speed Song

The song selected for “Auslan for Kinder” is the “ABC song” familiar to many children and sung to the tune of “Twinkle, Twinkle Little Star.” The song screen consists of a video of the female presenter on the left hand side of the screen to ensure that the receptive view of each sign is clearly visible to the child user. Located on the right hand side of the screen is a still image of each sign from the perspective of the person making the sign. This perspective was considered pivotal to assist the children to recognise and read finger spelling produced for them and to assist in knowing what the sign should look like as they make it. Located below the images is the alphabet synchronised with the audio of the song so that as each sign is produced the relevant corresponding letter is highlighted. The song automatically runs from start to finish until the user chooses to interrupt the flow by the selection of a particular letter or the next or previous buttons: the audio then continues to loop from this point.
The Farm Animal Game

The game developed for “Auslan for Kinder” is a modified version of a traditional matching game. A farmer and three animals appear on the screen, and the farmer makes a sign for one of the animals. The player is then required to take the bucket to the appropriate animal: if the player is correct, the animal says “thank you”; if the player is incorrect the animal says “no.” In each case, the animation and animals are reset with a new combination.

**Figure 6.** The game

RECEPTIVE AND EXPRESSIVE ASSESSMENT

The assessment activities were designed to address several of the research questions in particular the appropriate number of signs targeted for children of this age. Designing an assessment task for evaluation of the receptive vocabulary learned by the children was far less complex than designing an appropriate task for expressive vocabulary.
The receptive assessment activity displays a video on the left hand side of the screen. Located on the right hand side of the screen are three buttons with images to represent the meaning of the song. When the cursor is moved to a button, the word for the button is played. This was to ensure that the children understood the meaning of each button. The activity ran through a list of word 25 words with the other two buttons featuring words that were randomly inserted. As no text could used on the screen, due to the age group of the children, the words for the list were chosen to be easily illustrated. Collection of the data gathered from each child’s interaction was accomplished by way of the computer program for later analysis. Audio encouragement such as “good job” and “good try” were also inserted to encourage the children during the activity.

The design of the expressive vocabulary assessment activities was more complex as the aim was to encourage children to make the signs. A video of a signer was used to ensure consistency in both query and presentation of the signs. A sample script for the video might comprise the following;

Do you remember the sign for word, pause
Can you make the sign for word, pause
You’re really trying, pause
Let’s make the sign for word together pause
Presenter makes the sign Word

This format was adopted to allow the child time to remember the sign for the word and to encourage the child to make the appropriate sign on their own. To record data for this section an observer was required with an observation sheet.
Figure 9. Flowchart of activities
Results of the Research

The initial two sessions involving the children using the computer were observed by a researcher and some unforeseen results were immediately apparent. The children clicked on an image indicating either a boy or a girl and then their own photograph in order to login. Such a visually oriented procedure proved appropriate for kindergarten-aged children, however several of the children unintentionally clicked twice causing them to login to the incorrect name. While the researcher was able to reset the login to the correct child, the login system was immediately modified to check that the child had clicked on the correct image before starting a task. The original design assumed a higher level of competency in fine motor movement of the input device than the kindergarten children had acquired. This assumption was premised on the conjecture that as the children had already been using the computer for approximately 35 weeks for 10 minutes they would have the required skill set. Clearly competency in this skill may take longer to acquire or perhaps the software used may not have promoted the use of a single mouse click.

The second notable observation was that three participation styles were adopted by the children for the vocabulary instruction. The first group consisted of the Active Participants group who responded to the software as expected and intended by the designers, by watching the signs and trying to make them for themselves. The second group were the Watchers, those who intently observed the screen but made no attempt to make the signs and did not interact with the software in any way. The third group were the Continuous Clickers: this group continuously clicked on the elements of the screen. Of the sixteen children that participated in the study, seven were active participants, six children watched and three were continuous clickers.

It is worth noting the possible variability in the reaction and responses of the children, dependent upon the presence or absence of an observer. As signing is such a visible skill, children may be reluctant to make signs for several reasons as noted by McLaughlin (1992). These include shyness and the fact that physical gestures may be perceived as culturally inappropriate in a culture which uses speech for communication with little gesticulation or fear of getting the sign wrong and consequent embarrassment may be impeding the child’s participation in the activity.
The study was designed to be offered within the confines of a 10 week kindergarten term. Due to the usual array of absences and excursions that comprise part of a normal kindergarten program, many of the children only completed five or six activities. In the last weeks of the term it was apparent to the researcher that simply continuing to work through the activities was of less significance than whether children had acquired the vocabulary in long-term memory. To ensure that children were given the opportunity to complete the assessment task in the last week, the schedule was adjusted accordingly. Consequently, the data collected on the number of words learned has been affected.

**Average Correct by Interaction Style**

The seven children who were active participants achieved an average total of sixteen correct signs. A smaller group of three children clicked continuously while using the program, and these children achieved an average of 17
correct signs. Six children observed, and this group achieved an average of 13 correct signs.

![Chart showing average number of words correct by interaction style](chart.png)

**Figure 11.** Average number of words correct by interaction style

**Total Vocabulary Acquired**

The group achieved an average correct score of 15 signs, with the most signs any child learned being 24 and the minimum learned, 7.

**Receptive vocabulary.** Children were able to correctly select an average receptive vocabulary of 12.25 words from 25 tested. The maximum correct selection was 18 and the lowest 5. The receptive vocabulary assessment was multiple choice with three possible selection thus children who were guessing could potentially score eight correct.
Expressive vocabulary. Children were able to correctly express an average of 2.75 signs from a list of 22 asked. This figure was skewed by six children who did not attempt any signs. The average for the 10 children that attempted the expressive vocabulary was 4.4 signs correct. The maximum number of signs that a child made correctly was 12. Four children made over seven signs correctly and four children made between zero and three signs correctly, two children attempted signs but made none correctly. The majority of expressive signs that were attempted were correct; of 71 attempted 44 were correct or 62% correct.

Influence of Activities Completed

The average number of activities completed was six out of eight. To have been exposed to the entire target vocabulary children would need to complete the first four activities. Twelve words are introduced per activity for the first four activities. The receptive vocabulary tested 25 words and the expressive vocabulary tested 22 words.
Children generally scored well on the iconically represented animals such as *chicken*, *dog*, and *cat*. They also scored well on activities that are iconically represented such as *run*, *pencil*, and *paint*.

On the expressive list, *think*, and *me* were correctly signed by more children than any other word on this list possibly due to the similarities to common gestures. A similar argument could be made for the children’s success with signing *you* and *I*.

*Play doh* rated well on this list possibly as the sign bore gestural similarities to the action of playing with play doh. Of particular interest was the high scoring on *jump* as, unlike the signs for *run* and *swing*, which require the imitation of the action, requires learning without recourse to action triggers. Similarly, four children were able to sign *mummy* correctly. This is an arbitrary sign which must be learned. Clearly, the children attached importance to some words and thus learned them regardless of the ease with which they could be learned.
As might be expected, several children confused *no* and *Know*, substituting one for the other, which is problematic in testing words that are homonymous.

**DISCUSSION**

**Styles of Interaction**

The children exhibited three distinct styles of interaction when using the software, these were active participation, continuous clicking, and watching. The identification of three styles of interactions that children exhibited raises questions about the reasons children respond in different ways to the same software. For many children, their mode of interaction is determined by the perceptions formed in their observation of others and their own emerging computer skill set. Thus, a child’s mode of interaction may be a reflection of their schema of the purpose of a computer and the appropriate way to interact according to this schema.

The expectations of “computer work” formed by the children in this study, was apparent in a number of ways. As an example, the instruction in vocabulary was specifically designed to be semi-automatic thus permitting the operator’s hands to make the signs unhampered by the need to use their hands for computer interaction. This caused a conflict for those children for whom their schemata of the computer is that of a device requiring constant interactions and the semi automated nature of Auslan Kids did not meet some of these expectations. Different types of activities may be required to cater for the children that clicked continuously, such as presenting the vocabulary as a picture with hot spots. The children could then actively seek
the hotspots on an object in order to discover the sign for that particular object. This method could also be usefully applied to items that can be visually represented with clarity, however, other methods may be required to convey conceptual data.

The active engagement of the child in the learning process, lead to a greater number of signs being learned. It did not matter which participatory strategy was adopted, either active or clicking. The continuous clickers appeared to be randomly selecting elements on the screen, yet they scored an average slightly higher than that of the active participants and much better than the children that adopted a watching behaviour. The continuous clickers may have been behaving in a very strategic manner that was not evident to the observer. It may be that continuous clickers are taking an active role in using consciousness raising strategies for noticing each aspect of the new language as advocated by Schmidt’s (1990) noticing hypothesis.

**Receptive Versus Expressive**

A number of children performed well on the receptive vocabulary activity, with most children learning a significant number of signs by using the computer, with children averaging 12.25 words correct. Only two children achieved eight or below, a score that is statistically possible by guessing.

Conversely, the children did not score as well in the expressive vocabulary task. One child managed to express 12 signs correctly and another child made 10 signs correctly, an indication that it is possible to learn expressive vocabulary through multimedia. Those children who attempted expressive signs only did so when they were certain of making the sign correctly. The majority of the children only attempted a small selection of expressive signs from the list. Six of the children did not attempt any expressive signs. While there may be many reasons for this, including that they failed to remember any of the signs, it is more likely that the children were reticent and hesitant to make the signs when under the scrutiny of the researcher. In the future, the use of video recording may ameliorate this obstacle to the children’s confidence. The assessment for expressive signs proved more difficult than that for receptive signs in which the children were prompted by the pictures. Another format of assessment may need to be devised to gain a full understanding of children’s capabilities, examples of which may include an
individual or group interview. The words contained in the expressive list may have been more difficult to remember as their selection was premised on the fact that they were difficult to illustrate and were often more conceptual in nature. The authors accept that this may have biased the results.

Characters

The preference for presenter was not well defined with each of the characters selected by similar numbers of children. The boys indicated a preference for the hero however the girls were more evenly divided between the female and the puppet. The small sample size rendered this result invalid for assuming any general interpretation, however the lack of clear preference for any particular character was an unexpected result. The boys were observed to be more engaged by the superhero and the girls vocalised and pointed when the puppet was presenting. Interestingly, however, the novelty factor of these characters did not lead to their selection as the preferred character, as the children selected the human as their preferred character. The reason for this is unclear. One could speculate about the children being comfortable with a person, that the female presenter made the signs more clearly or the children expected to communicate with a human rather than a hero or puppet. Further research is necessary to clarify this preference. While the development of the super hero costume and the puppet took a considerable amount of time and resources, once developed these can be used repeatedly. In terms of the complexity of filming, the female and the super hero are relatively simple, however the puppet proved very difficult to film and does not appear to secure higher levels of engagement to warrant the extra effort.

Words Correct

There were several factors that influence whether a child remembers a particular sign; iconicity; significance of the word to the children; and exposure to the word in multiple activities. The children scored well on some of the words that were iconic in nature, for example: 12 children were able to correctly identify the word chicken, which is a hand movement that looks like a bird cheeping. They scored less well on words that were arbitrary such as night as the sign does not have any clues to their meaning.
Words of high significance to children such as *Mummy* were remembered by children as the meaning of the word was important enough for children to notice. The sign for *mummy* is not iconic and was not used repeatedly in activities however four children were able to express the sign. This was significant in the context of the expressive assessment.

The word *cake* was selected correctly by a high frequency of children with 12 children getting it right, this cannot be explained by the iconicity of the sign as it is arbitrary in nature. It is also not a word of particularly high significance to children although it would be known to them. One could speculate that the children remembered this word because it was repeatedly used in the story activity which was the book of “Toby and the Me Cake.” The significance of this suggests that children can learn sign by repeated exposure to signs in the context of stories.

**LIMITATIONS AND FURTHER RESEARCH**

**Time Constraints**

One of the major difficulties that confronted the researchers was the imposition of rigid time constraints. The sequence of activities was thus designed for a nine-week term. The research was conducted in the fourth and final term of kindergarten to ensure that the children were comfortable in their environment and were already familiar with using a computer in the kindergarten setting. The majority of children only completed five or six activities in a ten week term. There were a number of contributing factors including absences, a schedule of excursions and end of year activities at the kindergarten. Initiating the research activities in term three to enable further research in term four if required for completion, may be a solution. Fewer activities for completion may be an alternative resolution to the difficulties faced by the researchers.
Small Sample

Undeniably the sample used for this project was relatively small, yet the sample still enabled valuable insights regarding children’s interactions while using a computer to learn sign language. These insights will be incorporated into future research projects. A project such as this generates many more variables than can be usefully explored in one such study, thus several areas remain that require further research, including (but by no means limited to); an exploration of the most appropriate activities for inclusion; the number of times words need to be repeated to ensure that they remain in long term memory; and perhaps of greatest interest to the authors, whether or not children who successfully learn sign language from the computer are capable of transferring such learning processes to other play and educational situations.

Activity and Word Selection

This was a deliberately small study using a small sample size and a limited vocabulary. The selection of the words was carefully considered however there were difficulties, such as using the words know and no caused problems as they sound the same but have different meanings and signs. The word deaf was used in the vocabulary and most of the children clearly did not know the meaning of the word. In future variations of the program, a video that introduces deafness would be useful to help the children understand the context for learning sign language.

For future versions of the program a more appropriate song should be used. The alphabet song had too many signs and was too advanced for children that are not yet familiar with the alphabet. Therefore the song will be replaced with “Sing a rainbow” by Arthur Hamilton. This song is familiar to the children but has far fewer signs to make. Seven (7) colours are introduced in the song together with six other signs compared with 26 letters and 12 other signs in the Alphabet song. A more extensive version of the program is being considered that has a much larger vocabulary with other activities such as hide and seek style activities to introduce words and a more interactive introduction to the vocabulary.
CONCLUSION

As this study amply demonstrates, purpose-specific multimedia has the potential to teach Australian Sign Language to kindergarten children, however, the design of appropriate software needs extensive research and refinement. The further development of teaching resources for learning Auslan is self evidently beneficial, in particular for those staff and children at integrated kindergartens. To engage children in the learning process, special consideration has been given to the design of “Auslan for Kinder” and it incorporates several devices such as appealing and positive characters and a story, song, and game to reinforce the target vocabulary and to provide for children’s different learning styles and competency. Despite the small sample size, this study suggests that multimedia has the potential to assist in the acquisition of signing language skills in four and five year old hearing children (and, not inconceivably, to other children of different ages and abilities) as it conveys the kinetic nature of sign language very effectively, can be readily used at the child’s own pace and negates any difficulties posed with a preliterate audience by using audio support. Nonetheless, further research is required if such potential is to be fully developed and thereby used to facilitate integration and engagement in the learning of language skills for all children.

References


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