The Iconicity and Learnability of Blissymbols
A Study of the Interpretations of Blissymbols by Kenyan Children
with diverse Language Backgrounds

Simona Krstic
Elin Littorin

Supervisor:
Janna Aanstoot
The Iconicity and Learnability of Blissymbols
A Study of the Interpretations of Blissymbols by Kenyan Children with diverse Language Backgrounds

Abstract
There have been few studies conducted on how children from other than Western populations perceive and learn different graphic symbol sets or systems, especially on how children from poverty contexts learn graphic alternative and augmentative communication (AAC) symbols. Multicultural research is necessary in order to advance and to ensure the quality of the service of AAC for culturally and linguistically diverse AAC users. In the present study the authors strive to describe the learnability of the Blissymbol system in a non-western culture using a semiotic theoretical framework. The purpose of this study was to evaluate the iconicity and learnability of the Blissymbol system for Kenyan children with two different language backgrounds, Swahili and English. This was done in an attempt to investigate potential cultural and linguistic influences of the interpretation and learnability of the Blissymbol. The design and test material was adopted from a previous study (Jennische & Zetterlund, 2012). In the present study, 127 typically developed children in the age six to seven in class one or two in primary school, both from private and public schools, participated. The children had never before encountered Bliss. The children were asked to interpret single Bliss-words and compound Bliss-words, first spontaneously through giving free proposals and then after being given an instructive explanation. The test results were analyzed on a group level and compared between the different groups (age, class and language background). The results show that there was a significant improvement between the pretest and the posttest for all children in the different groups. This indicates that the Blissymbols used in this study had a generally low transparency but a generally high translucency. The results also indicate a generally high learnability and that the children were aided by the instructive explanation. Furthermore, there were significant differences between the different groups, where the children from class two performed better than children from class one and where the English-speaking children performed better than the Swahili-speaking children overall. Age was not significant. The results also indicate that there were differences in how the children interpreted the symbols, but that there were similarities within the specific groups. Further, this indicates that the symbols were interpreted in a similar way by children that belonged to the same age, language and socioeconomic background.

Key words: Bliss, AAC, non-western culture, Kenya, children, semiotics, iconicity, learnability, transparency, translucency.
Upphovsrätt
Detta dokument hålls tillgängligt på Internet – eller dess framtida ersättare – från publiceringsdatum under förutsättning att inga extraordinära omständigheter uppstår.

Tillgång till dokumentet innebär tillstånd för var och en att läsa, ladda ner, skriva ut enstaka kopior för enskilt bruk och att använda det oförändrat för ickekommersiell forskning och för undervisning. Överföring av upphovsrätten vid en senare tidpunkt kan inte upphäva detta tillstånd. All annan användning av dokumentet kräver upphovsmannens medgivande. För att garantera äktheten, säkerheten och tillgängligheten finns lösningar av teknisk och administrativ art.

Upphovsmannens ideella rätt innefattar rätt att bli nämnd som upphovsman i den omfattning som god sed kräver vid användning av dokumentet på ovan beskrivna sätt samt skydd mot att dokumentet ändras eller presenteras i sådan form eller i sådant sammanhang som är kränkande för upphovsmannens litterära eller konstnärliga anseende eller egenart. För ytterligare information om Linköping University Electronic Press se förlagets hemsida http://www.ep.liu.se/.

Copyright
The publishers will keep this document online on the Internet – or its possible replacement – from the date of publication barring exceptional circumstances.

The online availability of the document implies permanent permission for anyone to read, to download, or to print out single copies for his/hers own use and to use it unchanged for non-commercial research and educational purpose. Subsequent transfers of copyright cannot revoke this permission. All other uses of the document are conditional upon the consent of the copyright owner. The publisher has taken technical and administrative measures to assure authenticity, security and accessibility.

According to intellectual property law the author has the right to be mentioned when his/her work is accessed as described above and to be protected against infringement.

For additional information about the Linköping University Electronic Press and its procedures for publication and for assurance of document integrity, please refer to its www home page: http://www.ep.liu.se/.

© [Simona Krstic & Elin Littorin]
Acknowledgements

First, we would like to thank our supervisor, sounding board and Guru Janna Aanstoot for guidance, constructive criticism, lodging and pep talks when nothing seemed doable.

A great thanks to all of you working at the concerned Primary schools in Kenya; principals, head teachers and contact persons!

An even greater thanks to all children who participated and to their parents for letting them!

Thanks to our two interpreters for translating and giving us important information about differences between the two languages.

Thanks to Margareta Jennische, Uppsala University and Marianne Zetterlund, Stockholm, for letting us use your design and materials.

Thanks to Örjan Dahlström for guiding us through the statistics and to Fredrik Turesson for helping us to avoid a mental breakdown by helping us with Excel.

Thanks to Take Aanstoot for helping us becoming street smart in Kenya, to Alvin for being the most fabulous neighbor and to Chebet and Vincent for your kindness and help around the house.

Last, but definitely not least, we would like to thank ourselves and each other. Without us, this would definitely not been possible!

Over and out.

Simona Krstic & Elin Littorin

May 2014, Linköping
# Table of contents

1. Introduction......................................................................................................................... 1

2. Background.......................................................................................................................... 1

    2.1. Semiotics......................................................................................................................... 1

        2.1.1. The Saussurean model............................................................................................. 1

        2.1.2. The Peircean model............................................................................................... 2

        2.1.3. Semiotic concepts related to graphic AAC............................................................... 3

    2.2. Symbolic and conceptual development in children..................................................... 3

        2.2.1. Scaffolding in symbolic development......................................................................... 4

    2.3. Language and culture....................................................................................................... 4

        2.3.1. Word formation and language structure................................................................. 5

        2.3.2. Challenges in cross-cultural research....................................................................... 6

    2.4. Blissymbolics.................................................................................................................. 6

        2.4.1. The construction and use of the Blissymbol-system.................................................. 6

        2.4.2. Symbol variables that affect the learnability of Blissymbols.................................... 8

        2.4.3. Methods in teaching Bliss....................................................................................... 9

        2.4.4. Cultural aspects of iconicity and learnability of Blissymbols.................................... 9

3. Purpose.................................................................................................................................. 11

    3.1. Research questions.......................................................................................................... 11

4. Method.................................................................................................................................. 11

    4.1. Participants....................................................................................................................... 11

    4.2. Design and test procedure............................................................................................. 13

        4.2.1. Part I - Single symbols............................................................................................. 13

        4.2.2. Part II - Compound symbols.................................................................................... 14

        4.2.3. Part III - Self-generated compound words............................................................. 15

    4.3. Materials.......................................................................................................................... 15

        4.3.1. Translation of material............................................................................................. 15

    4.4. Methods of analysis......................................................................................................... 16

        4.4.1. Scoring number of correct answers.......................................................................... 16

        4.4.2. Analysis of error types............................................................................................. 16

        4.4.3. Reliability of test scoring........................................................................................ 17

        4.4.4. Statistical analysis.................................................................................................... 17

    4.5. Ethical considerations...................................................................................................... 18

5. Results................................................................................................................................... 18

    5.1. Overall average scores and comparisons...................................................................... 19

    5.2. Correlations..................................................................................................................... 22
5.3. Descriptive statistics of individual symbols……………………………………22
  5.3.1 Analysis of percentage correct answers of individual symbols………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………
1. Introduction

Interaction is characterized by the use of symbolic communication, which is most efficiently achieved through speech. However, there are some children and adults that never acquire functional speech. During the last few decades there has been an increased use of alternative and augmentative communication (AAC) for this group of individuals (Bloomberg, Karlan & Lloyd, 1990). The use of AAC-aided symbol systems with individuals exhibiting severe communication and motoric difficulties has continued to expand and grow, however empirical research to the efficacy and efficiency of various aided AAC symbols has lagged behind in clinical application (Bloomberg et al., 1990; Pennington, Marshall & Goldbart, 2007). In the current study, typically developed children participated. Since several studies support the generalization of data collected from cognitively normal individuals to other populations (Bloomberg et al., 1990; Fuller, 1988) studying typically developed participants is considered valid in AAC-research, which is done in this present study. Soto and Olmstead (1992) advocate that semiotics can be used as a methodological and/or theoretical framework for AAC research. Instead of inventing or redefining existing terminology they urge the AAC researchers to collaborate with researchers and use the relevant terms within the fields of semiotics (Soto & Olmstead, 1992). In the present study the authors strive to describe the learnability of the Blissymbol system in a non-western culture. To do so the authors have undertaken a semiotic theoretical framework in a way of describing the elements of the Blissymbol.

2. Background

2.1 Semiotics

Semiotics has a broad array of definitions depending on which tradition is followed. The most basic definition is “the study of signs”. The study of signs is to be found throughout the history of philosophy. There are two main contemporary models of what constitutes a sign, one that is developed by the Swiss linguist Ferdinand de Saussure (1857-1913) and the other developed by the American philosopher Charles Sanders Peirce (1839-1914). Traditionally, the term semiology was used to refer to the Saussurean tradition while semiotics was used for the Peircean tradition. Nowadays, the term semiotics is used as an umbrella term for the whole field (Chandler, 2007a; Nöth, 1990).

2.1.1 The Saussurean model

The Saussurean model focuses on linguistic signs (i.e. words) and belongs to a dyadic tradition where a sign consists of two parts, in this model called signifier and signified. The signifier is
the form in which the sign is presented (sound pattern) while the *signified* is the concept to which it refers to (thought). The two parts are dependent variables, which mean that there would be no sign if only one existed; also there is no self-evident connection between the sound of the word and the concept to which it refers. The *value* of a sign is depended upon its relation to other signs within the system as a whole, which means that no sign makes sense on its own. There is arbitrariness between the signifier and the signified and according to Saussure; the arbitrary nature is the first principle of language. The arbitrariness also makes room for interpretation. Observations across languages show that each language has different distinctions between one signifier and another (e.g. bed and red) and between one signified and another (e.g. bed and chair) and that the reality is divided into arbitrary categories and concepts, which are different across languages. Language plays a crucial role in construction of reality. Within a language one signifier (word) may refer to many signified (concepts) as well as one signified (concept) may be referred to through many signifiers (words) such as synonyms. This means that a sign does not have a one-to-one relation between the signifier and the signified. The context in which the sign is presented is of great importance. Every sign has a certain history and associations that are known by the members of that particular culture. The Saussurean thoughts of the arbitrariness of signs have lead semioticians to emphasize the conventional relationship between the signifier and the signified which makes signs dependent of social and cultural conventions that have to be learned (Chandler, 2007b; Silverman, 1983).

**2.1.2 The Peircean model**

Peirce’s model is a triadic model that consists of three essential elements; the *representamen*, an *interpretant* and an *object*. The representamen is how the sign is represented, an interpretant is how the sign is interpreted and the object is what is being represented (the referent) (Chandler, 2007b; Nöth, 1990; Silverman, 1983). In the Peircean model there are three different modes of signs. *Symbol/symbolic mode*, is when there is no resemblance between the signifier and the signified which means that this mode is fundamentally arbitrary and conventional e.g. language in general and in language specific (words, letters). *Icon/iconic mode* is when the signifier possesses some of the signified qualities through resemblance or imitation for example a portrait. *Index/indexical mode* is when the signifier has a direct connection to the signified for example a photograph and foot prints (Chandler, 2007b; Silverman, 1983).
2.1.3 Semiotic concepts related to graphic AAC

Fuller (1997) described variables that can influence acquisition and retention of Blissymbols. The variables can be divided into two groups: either referent variables or symbol variables. Referent variables include whether a symbol is concrete or abstract (Fuller, 1997). The symbol variable called *complexity* can be defined as the number of strokes that a Blissymbol consists of i.e. how many strokes it takes to draw the symbol (Carmeli & Shen, 1998; Fuller, 1997; Fuller & Lloyd, 1987; Hetzroni, Quist & Lloyd, 2002; Shepherd & Haaf, 1995). Graphic AAC symbol variables also include the concept *iconicity* (Fuller & Lloyd, 1987). *Iconicity* in Blissymbols involves the relationship between the symbol and its referent (i.e. the thing or event the symbol refers to) and involves three other terms that are placed along a continuum (Bornman, Alant & du Preez, 2009; Fuller, 1997; Fuller & Lloyd, 1991; Nöth, 2000; Shepherd & Haaf, 1995). *Transparency* is when a symbol is easily determined in the absence of the referent, which implies guessability (Hetzroni et. al., 2002; Shepherd & Haaf, 1995). The opposite of transparency is called *opaqueness*. If a symbol is opaque, the reason for the association between the symbol and its referent cannot be determined even though both the meaning and the symbol appear together. These symbols can also be called arbitrary in their meaning. If a symbol is opaque that means that it has low transparency (Carmeli & Shen, 1998; Fuller 1997; Fuller & Lloyd, 1991; Shepherd & Haaf, 2005). In between transparency and opaqueness is the concept called *translucency*, which to some extent overlaps the other two concepts. Translucency is defined as the guessability of the symbol when the referent is known (Carmeli & Shen, 1998; Fuller, 1997; Fuller & Stratton, 1991; Hetzroni et. al., 2002).

2.2 Symbolic development

DeLoache, Peralta de Mendoza and Anderson (1999) describe the understanding, use and creation of symbols as a hallmark of human cognition. Becoming symbol-minded is an important aspect of human development and allows children to participate fully within the society they are born (DeLoache, 2004; DeLoache et al., 1999). DeLoache (2004) defined a symbol as “something that someone intends to represent something other than itself”. In the following citation the difficulty in knowing whether a child’s statement is truly symbolic is described (DeLoache, 2004).

Consider a young child who looks at a picture of a dog and says ‘dog’. He or she could very well understand that both the word and the picture represent a general class of entities in the world. Alternatively, the child could simply have learned an association from repeatedly experiencing the word ‘dog’ paired with that particular picture (DeLoache, 2004, p. 67).
A symbolic artifact such as a picture or a model is both a concrete object and a representation of something other than itself; therefore it has a dual representation, which children have to learn to use. This means that they need to perceive the symbol and interpret its relation to its referent. This can be challenging for young children. The ability of dual representation of symbolic objects develops gradually over several years and increasing experience with different symbols plays a prominent role in this development (DeLoache, 2004; DeLoache et al., 1999). Furthermore, young children start the process of acquiring symbolic competence with a general symbolic ability (Campbell & Namy, 2003; DeLoache, 2004). It may seem obvious that symbols represent something other than itself; this is however knowledge you have to acquire. Infants only gradually appreciate how symbols differ from their referents. They have to experience that a symbol does not have the same quality as the something it refers to (e.g. you cannot drink milk from a picture of a glass of milk) (DeLoache, 2004).

2.2.1 Scaffolding in symbolic development
For young children’s acquisition of the comprehension and use of symbolic objects, scaffolding in form of adult instruction is of great importance (DeLoache et al., 1999; Peralta, Salsa, del Rosario Maita & Mareovich, 2013). The experience with symbolic objects and the informational support provided comes from the social context. Instruction is described as the amount and type of informational support given by a more skilled partner that scaffolds children’s comprehension and use of a symbolic object (Peralta et al., 2013). Additionally, adults often do not realize to which extent children, and novices in any symbolic medium, need explicit tuition (DeLoache et al., 1999; Peralta et al., 2013). Once a given symbol-referent connection is made the symbol seems fully transparent. This means that the mental representation of the meaning of the symbols referent is automatically activated and this is the reason to why it is difficult for experienced symbol users to realize that a given relation is not automatically apprehended by others (DeLoache et al., 1999).

2.3 Language and culture
In a study conducted by Huer (2000) it appears that the perceptions of the meanings of symbols are likely to vary as a function of culture/ethnicity. This leads to that individuals with different language and culture perceive graphic symbols differently. Language and cultural background is therefore an important factor to take into consideration when selecting and implementing AAC symbols. Since the present study was conducted in Kenya, a short description of the two languages, English and Swahili, used in the study are described below.
2.3.1 Language structure and word formation

English belongs to the Indo-European language family (Beekes, 2011) and is spoken as a lingua franca (Alptekin, 2013). Swahili is a Bantu language, which is spoken as a lingua franca in large parts of Eastern Africa (Polomé, 1967; Safari, 2012). A lingua franca is a language systematically used to make communication possible between people not sharing a first language (Columbia Electronic Encyclopedia, 2014; Encyclopaedia Britannica, 2014). The most common English word order is subject, verb and object (SVO) (Nakamura, Newell, Alm & Waller, 1998) and this is also true for Swahili (Deen, 2005; Polomé, 1967). One of the characteristics of the Bantu languages (such as Swahili) is the division of nouns into classes, and not into masculine, feminine and neuter genders. The noun classes are distinguished by their nominal prefixes. Swahili nouns, therefore, consist of a root of the word and a prefix (Safari, 2012). Each of the noun classes is roughly associated with a certain semantic characteristic (Deen, 2005; Petzell, 2005). Furthermore in Swahili the adjectives most commonly occur in post-nominal position, which means that the adjective is placed after the noun (Polomé, 1967; Safari, 2012). Overall, adjectives are quite uncommon within the Swahili language, and one of the most common substitutes for them is the use of the connective particle with a substantive, e.g. ‘kiti cha mti’ literally ‘chair of wood’ for ‘wooden chair’ (Polomé, 1967). In contrast, English is a prenominal language, which means that the adjectives generally precede the nouns (Mata, Percy & Sherman, 2014). Noun-noun compounds are the most common type in English (Plag, 2003). To be considered a compound two existing free lexical morphemes must be combined into a new free lexical morpheme. It is not enough to simply combine two words; the elements of the combined words need to carry new information into the compound. In linguistics one differentiates between the head and the non-head. The head carries the grammatical information and most semantic meaning of the newly formed word (Liese, 2009). English compounds are right-headed and inherit their major properties from the head such as syntactic information (e.g. oak tree = a kind of tree) (Plag, 2003). The non-head, also called modifier, is usually the left-hand element. The left-hand member modifies the right-hand member, but major semantic properties are left in the head (Liese, 2009; Plag, 2003). In Swahili, compounds commonly consist of a deverbative noun (i.e. a noun formed from a verb) plus the relevant objective modifier. An example of this is the word ‘kujua’ which means ‘knowledge’. The compound consists of the affix ‘ku’ and the stem ‘jua’, with the literal translation ‘to know’ (Petzell, 2005). This syntactic grouping of
a deverbative is formed by adding the class-prefix (i.e. ‘ku’) to the verbal stem plus the direct object of the verb (i.e. ‘jua’) (Polomé, 1967).

2.3.2 Challenges in cross-cultural research

In order to advance and ensure the quality of the AAC-services for culturally and linguistically diverse AAC users, multicultural research is necessary (Bridges, 2004). Matsumoto (1994, referred in Bridges, 2004) gives certain guidelines in how to engage in culturally relevant and valid research to avoid the potential hazards of cross-cultural research. One of the guidelines stresses the importance of *item equivalence*, which means that the researched items (e.g. words) need to have the same meaning across culture. Otherwise, it would be difficult to know what is being measured in cases where there is a disagreement (Bridges, 2004). Another guideline concerns the importance of adequate translation in order to ensure that the translated material has the equivalent meaning as the original language (Bridges, 2004; Peña, 2007). There are also challenges in cross-cultural research when it comes to interpretation and analysis of data and to ascribing certain behaviors to certain cultures, since the culture of the researchers and interpreters will influence the perception and interpretation. Not being cautious when interpreting data can lead to *ethnocentrism* which means viewing other cultures through one's cultural glasses, *images* which are representations built on own expectations and *stereotypes* that are fixed attitudes about other cultures (Bridges, 2004). When conducting studies across cultural or linguistic groups there are some features that need to be considered when translating instruments and instructions to other languages and one of them is *linguistic equivalence*, which strives to make certain that the words and linguistic meaning are the same in both versions. This can be made through two different types of translating techniques. In translation and back-translation one translator first translates from the original language to the target language. Then an independent translator translates the translated target version back to the source language in order to detect and to resolve any differences. The translation can also be reviewed by a native speaker to ensure the accuracy (Peña, 2007).

2.4 Blissymbolics

2.4.1 The construction and use of the Blissymbol-system

Graphic symbol systems have been invented and/or modified to realize the clinical needs of nonspeaking clients. However, research that examines perceptual and conceptual factors of the systems is needed as one means to make certain that they have continued effectiveness as communication enhancement techniques (Bloomberg et al. 1990).
Bliss created the Blissymbol system in hope that it would be used as a universal communication system and therefore would promote world peace by eliminating misunderstandings between people who speak different languages (McNaughton, 1985). Today Blissymbolics is a graphic symbol system used by individuals that cannot use speech for communication (Carmeli & Shen, 1998; Musselwhite & Ruscello, 1984; Schlosser & Lloyd, 1993). These individuals are either not able to or prefer not to use written words for communication, because it is too energy consuming. A board and/or an electronic aid are generally used on which the Blissymbols are displayed. The Bliss user then communicates via the board by for example pointing to indicate the target symbol. The message is possible to understand for people who do not know the symbols, since the written word is displayed above the symbols (Carmeli & Shen, 1998).

Blissymbolics is a semantic based and nonphonetic symbol system. A Bliss-character is an individual symbol and comprises the building block of the system. A Bliss-word represents a concept using one or more Bliss-characters. This means that a Bliss-character can also be a Bliss-word (Blissymbolics Communication international [BCI], 2013). These Bliss-characters can through the logic of the system then be combined to form an infinite number of new Bliss-words and compound symbols (Carmeli & Shen, 1998; Hetzroni et al., 2002; Musselwhite & Ruscello, 1984; Schlosser & Lloyd, 1993; Shepherd & Haaf, 1995). When two or more Bliss-characters are combined in a sequence, they are called compound Bliss-words. When two or more Bliss-characters are drawn together, not in sequence, they are called composite symbols (Blissymbolics Communication international [BCI], 2013). The Blissymbols system is also the only symbol system that has the advantage of having a specific syntax (Nakamura et al., 1998).

Furthermore, Blissymbols have a rule system for correct sequencing in combinations and placement in space. Once the system is learned, most of the language can be represented (Clark, 1981). Schlosser & Lloyd (1993) give the following description of the generative quality of the Blissymbol system:

Examples of elements are ‘cloth’, ‘legs and feet’ and ‘protection’. These elements can be combined to form compounds that represent new meanings. For example, the symbols ‘cloth’ and ‘protection’ can be combined to represent ‘clothes’ (i.e. the cloth that protects people) (Schlosser & Lloyd, 1993, p. 980).

Note that in today’s terminology “elements” are called Bliss-characters. The procreating essence of the Blissymbolics system is what allows it to constitute concepts that cannot be adequately represented in pictures (Carmeli & Shen, 1998; Clark, 1981). Furthermore, there are three different classes of symbols within the Blissymbol system. The first class is pictographs that are symbols that depict the outline or shape of the object they represent. The second class is called ideographs, which are symbols that depict an idea of the referent, but not what the
referent looks like (Musselwhite & Ruscello, 1984). The third class is called arbitrary symbols, which have no pictorial or ideographic relationship to its referent (McNaughton, 1985). These classes can be compared to the Peircean’s iconic, indexical and symbolic modes of a sign (Chandler, 2007b) described above.

2.4.2 Symbol variables that affect the learnability of Blissymbols

Musselwhite and Ruscello (1984) concluded that Blissymbols were the least transparent compared to Picsyms, and Rebus. The subjective impression of the participants indicated that the least transparent system was also judged to be the most difficult (Musselwhite & Ruscello, 1984). The reason for the lower transparency within the Blissymbols system may be due to several different factors. Firstly, Blissymbols has a larger proportion of ideographs than the two other systems. Secondly, Blissymbols incorporate less graphic details and can therefore be drawn with fewer strokes. Thirdly, Blissymbols are formed by combining few elements in various ways to create a large number of symbols. This makes the symbols easy in detail and very similar which reduces the discriminability between different symbols (Musselwhite & Ruscello, 1984). Bloomberg et al., (1990) concluded that Blissymbols were the least translucent of Blissymbols, Picsyms, PIC, PCS and Rebus. This result is supported by Huer (2000) whom also found Bliss to be the least translucent when comparing three symbols sets (Blissymbols, DynaSym and PCS) from a cultural perspective. Additionally, Bloomberg et al. (1990) contend that perceptual features (shape, size, depth) of individual symbols within a system contribute to their translucency. A simple illustration of an object and associated attributes can lead to a direct perceptual association with the referent. Symbols can also make reference to conceptual features of the referent that contribute to their translucency. Conceptual features include ideas generalized from experienced. It may be necessary to make a specific connection between the perceptual features of the symbol and the conceptual features of the referent (Bloomberg et al., 1990).

The results of Fuller (1997) indicates translucency to be a potent variable in learning Blissymbols. Additionally, complexity also seems to be a factor in facilitating the learning of Blissymbols by children when the visual association between symbols and referents is small, hence when the translucency is low. For low translucency symbols, children rely on a high complexity to help them acquire the symbol. Fuller (1997) defined low complexity symbols as having one to five strokes, while symbols with eight or more strokes had high complexity (Fuller, 1997). Furthermore, Hetzroni et al. (2002) concluded that high translucency
Blissymbols were learned faster than low translucency Blissymbols. Although, unlike Fuller (1997) these results also showed that high complexity assisted learning when translucency was high and low complexity assisted when translucency was low. This suggests that when a referent is known, the symbol will be easier to understand and identify (Hetzroni et al., 2002).

2.4.3 Methods in teaching Bliss
In addition to providing a symbol system that is appropriate to the child’s sensory and cognitive abilities is giving systematic instruction in how to use the symbol system (Rowland & Schweigert, 2000). Schlosser and Lloyd (1993) aimed to ascertain the effects of initial teaching of Bliss-characters on acquisition, retention and generalization of compound Bliss-words. The results showed that introducing Bliss-characters first did not enhance the learning of the compound Bliss-words (Schlosser & Lloyd, 1993). However, there were still advantages with initial teaching of Bliss-characters, since it eased generalization to untrained compound Bliss-words (Schlosser & Lloyd, 1993; Shepherd & Haaf, 1995). Furthermore, the results of Shepherd and Haaf (1995) revealed that participants learned composite symbols faster when Bliss-characters were included in training. Their results also showed that the twelve year olds in the study learned and generalized the symbols easier than the six year olds. This indicates that older participants were able to better use the abstract semantic concepts needed for the learning of Blissymbolics (Shepherd and Haaf, 1995).

The aim of Jennische & Zetterlund (2012) study, from which the design of the current study was adopted, was to investigate how Swedish children between the ages three and seven interpret and construct the meanings of Bliss-words. They found that, regardless of age, the meaning of the single Bliss-words was not obvious or transparent in the pretest when the children gave free proposals. After explanation of the meaning, using memory recall, they were easy to retain. Furthermore, it was apparent that the ability to correctly interpret the compound Bliss-words increased with age. They found that the children benefited from instruction and successively discovered the logic of the system. Additionally some single Bliss-words and compound Bliss-words seemed easier to interpret initially and/or retain than others (Jennische & Zetterlund, 2012).

2.4.4 Cultural aspects of iconicity and learnability of Blissymbols
There have been few studies conducted on learnability of graphic symbol systems in populations other than Western populations (Alant, Life & Harty, 2005). In addition, Bornman
et al. (2009) state that importance of the variable iconicity has been widely acknowledged, but there have been too few investigations of the impact of culture on this variable (Alant et al., 2005; Bornmann et al. 2009). Bornman et al. (2009) conducted a study where the aim firstly was to determine the translucency of specific Blissymbols as rated by six to seven year-old Setswana-speaking children (an official language in South Africa) and secondly to determine the learnability of these symbols. The results indicated that the majority of Blissymbols were rated as having high translucency like the findings in Quist et al. (1998), from which the design was taken. However, the distribution of symbols across ratings was different between the two studies (Bornman, et al. 2009).

There have also been few studies conducted on how children from different cultural contexts perceive different graphic symbols sets or systems, especially on how children from poverty contexts learn graphic AAC symbols (Alant et al., 2005). Alant et al. (2005) referred to Hart & Risley (1995) when discussing the need for such research. They stated that since there are evidence that poverty is associated with certain life experiences that can have a significant impact on vocabulary development, in both children with and without disabilities, it is important with further research in this areas (Alant et al., 2005). Alant et al. (2005) conducted a study in order to make a comparison of the learnability and retention between Blissymbols and CyberGlyphs for regular school children from South Africa. This was done to contribute to the understanding of the impact of cultural variations and poverty on learnability of graphic symbols. The results indicated that CyberGlyphs-symbols were easier to learn and to retain than Blissymbols. This could be due to that CyberGlyphs are more visually accessible for children who come from poor literacy with limited experience in dealing with geometrical shapes (Alant et al., 2005). Huer (2000) also conducted a study to determine the impact of culture and ethnicity on the perception of graphic symbols. The aim of this study was to investigate how three different aided symbol sets’ (Blissymbols, Dynasyms and Picture Communication System) iconicity were rated by adults living in the US from four different cultural backgrounds: European-American, African-American, Chinese and Mexican. The results suggest that individuals from different cultural/ethnical backgrounds perceive graphic symbols differently, since the results showed differences in translucency ratings between groups (Huer, 2000). Nakamura et al. (1998) investigated how graphic-based communication aids that were developed in English-speaking countries were used by people with a non-English-speaking culture (Japan). This was done with a thesis that the picture-based communication aids were not widely spread since the system was based on a different sentence formation. Since the word
order in English determines the meaning of the sentence unlike Japanese where it’s determined by attaching particles, the Japanese speakers might therefore found it difficult to interpret graphically represented sentences. The results showed that the symbol order and the syntax markers (i.e. particles) had an important role on the sentence production for the Japanese-speaking participants (Nakamura, et al., 1998). Alant et al. (2005) interpreted the results of Nakamura et al. (1998) as clearly indicating that language background has an impact in how symbols are combined in communicative purposes. Alant et al. (2005) also stressed the importance of comparing symbol systems to determine strengths and weaknesses of different systems that might influence the learnability and the implementation of the system within different cultural and economic contexts.

3. Purpose

The aim of the present study was to evaluate the iconicity and learnability of the Blissymbol system for Kenyan children with different language backgrounds, through analysis of their interpretations of single Bliss-words and compound Bliss-words. Then thereby investigate potential cultural and linguistic influences of the interpretation and learnability of the Blissymbol.

3.1 Research questions

- How do typically developed children in the ages six and seven (in classes one and two) from Kenya spontaneously interpret single Bliss-words and compound Bliss-words and how do they then retain the interpretations after explanation?
- How do typically developed children in the ages six and seven (in classes one and two) from Kenya generate given meanings by combining two single Bliss-words into a compound Bliss-word?
- Are there any differences in the correct and incorrect interpretations of the single Bliss-words and Bliss-words for Kenyan children that are primarily English-speaking compared to the children that are primarily Swahili-speaking?

4. Method

4.1 Participants

The participants in this study were typically developed children in the ages six to seven years old that attended class one or two in primary school, further group specifications are specified
below (Table 1 & Table 2). The collection of data was made at six different schools in the western part of Kenya, three public and three private schools, selected through a convenience sample. The teaching language in the public schools was mainly Swahili, while it was English in the private schools. Consent was given from the principal at each school and a contact person was provided to assist the test leaders with practical and administrative concerns.

Table 1.
List of participants, presented by language background, class and overall total.

<table>
<thead>
<tr>
<th></th>
<th>Swahili-speaking participants</th>
<th>English-speaking participants</th>
<th>All participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>33</td>
<td>30</td>
<td>63</td>
</tr>
<tr>
<td>Class 2</td>
<td>27</td>
<td>37</td>
<td>64</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>67</td>
<td>127</td>
</tr>
</tbody>
</table>

Table 2.
List of participants, presented by language background, age group and overall total.

<table>
<thead>
<tr>
<th></th>
<th>Swahili-speaking participants</th>
<th>English-speaking participants</th>
<th>All participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 6</td>
<td>30</td>
<td>37</td>
<td>67</td>
</tr>
<tr>
<td>Age 7</td>
<td>30</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>67</td>
<td>127</td>
</tr>
</tbody>
</table>

In order to get the aspired number of participants consent forms (see Appendix 1 & Appendix 2) were given to 343 children of which 166 were returned. Of the returned consent letters there were 127 children that met the criteria and 39 which were excluded due to not fulfilling the criteria. The criteria were established through information given from the parents in the consent forms. The inclusion criteria were that all participants were to be six or seven years old from class one or two in primary school, with normal vision, hearing, language and communicative development. There was a difference in criteria for participation in the study between the children that spoke English and the children that spoke Swahili. In the private schools the children had to be fluent in both Swahili and English and in the public schools the children only had to be fluent in Swahili. The division of children into Swahili-speaking and English-speaking is made in accordance with which teaching language was used at the schools. This entails that the Swahili-speaking children are all from public schools, while all of the English-speaking children are from private schools. Furthermore, most of the children were bilingual. In general, most of the English-speaking children could speak English, Swahili and in some cases a tribe language that was their mother tongue. Most of the Swahili-speaking children could speak Swahili and often a tribe language that was there mother tongue; some could also speak a little English. In Kenya both English and Swahili are official languages. Because of the age criteria
children in the class division only included children that were six and seven years old. Note that in Table 1 all 127 children are divided by class and in Table 2 the same 127 children are divided by age. In class one there were 43 six-year olds and 20 seven-year olds, while in class two there were 24 six-year olds and 40 seven-year olds.

4.2 Design and test procedure
The design and test material was adopted from a previous study (Jennische & Zetterlund, 2012) conducted at Uppsala University and translated into English, with exception of the last test part (called IIIB, which was excluded in the current study. The testing consisted of three parts,. In part one and two consists of a pretest answer and a posttest answer for each symbol. The pretest occurs first and the posttest directly subsequent to the pretest. The children were told that they were to look at some pictures and that they were required to guess what they meant. They were assured that it was not a school test or exam and that it was important to guess even if they did not know what the symbol meant, not whether they answered correct or incorrect. The test leader also assured the children that it was not expected of them to give the right answer since they had never encountered the system before and when wrong answers were given, the test leader would explain the correct answer. In the first test part 15 symbols were included and in the second test part 12 symbols (Appendix 3) were included. Finally, in the third test part the 15 symbols from part one were used again, except this time the children combined them into compounds. The English-speaking children from the private schools were tested in a separate room with one of the test leaders. Each testing took approximately 35-50 minutes and was conducted in English. The children responded in English. For the Swahili-speaking children from public schools each testing took approximately 30-80 minutes. With the Swahili-speaking children, an interpreter translated the test leader’s instructions into Swahili and the children’s responses in Swahili to English. The children answered in both Swahili and English. The testings were recorded on an mp3-player in case of any misunderstandings with the translation. The results were translated and noted in both English and Swahili when given in Swahili. When answers were given in English no translation to Swahili was made in the test protocol.

4.2.1 Part I. Single Bliss-words
In the pretest of the first test part (see figure 1) the children were asked to interpret the single Bliss-words spontaneously by giving free proposals. If they answered correctly they were told that they were indeed correct. If they answered incorrectly, they were given the correct answer with an instructive explanation about the symbol. At the end of the pretest the children were
asked which symbols were difficult and the test leader then explained them once more. In the posttest the children were asked to interpret the single Bliss-words again, using memory recall, to see whether they had retained the meaning of the symbols.

<table>
<thead>
<tr>
<th></th>
<th>![Symbol 1]</th>
<th>![Symbol 2]</th>
<th>![Symbol 3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest answer:</td>
<td>Free proposals</td>
<td>Free proposals</td>
<td>Free proposals</td>
</tr>
<tr>
<td>Posttest answer:</td>
<td>Memory recall</td>
<td>Memory recall</td>
<td>Memory recall</td>
</tr>
</tbody>
</table>

*Figure 1. Part I. Single Bliss-words. The figure shows a set of three Bliss-words (i.e. house, car and boat respectively) from the protocol of the first test part. In the pretest the children gave free proposals and in the posttest they used memory recall.*

4.2.2 Part II. Compound Bliss-words

In the second part (see figure 2 below) the children were introduced to the compound Bliss-words. Initially, the test leader placed the single Bliss-words for ‘house’ and ‘boat’ next to each other. Then the test leader explained to the children that the two symbols together created a new meaning that included the meanings of the separate symbols. The children were asked to give a free proposal for the subsequent compound Bliss-words, before being given the correct answer with an instructive explanation. The compound Bliss-words consisted of combinations of the previously tested single Bliss-words. At the end of the pretest the children were asked which symbols were difficult and the test leader then explained them again. In the posttest the children were asked to interpret the compound Bliss-words using memory recall.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest answers:</td>
<td>Free proposals</td>
<td>Free proposals</td>
<td>Free proposals</td>
</tr>
<tr>
<td>Posttest answers:</td>
<td>Memory recall</td>
<td>Memory recall</td>
<td>Memory recall</td>
</tr>
</tbody>
</table>

*Figure 2. Part II. Compound Bliss-words. The figure shows a set of three compound Bliss-words (i.e. boathouse, garage and castle respectively) from the protocol of the second test part. In the pretest the children gave free proposals and in the posttest they used memory recall.*

The 12 symbols that were displayed in this part of the testing consisted of four groups with three compounds in each group. The first group consisted of compounds made with the single Bliss-word for ‘house’ indicating that the compound Bliss-words were different types of houses (i.e. boathouse, garage and castle). The second group was compounds made with the single Bliss-word for ‘person’ indicating that the Bliss-words to be different kinds of people. In the third group the compounds were made with the single Bliss-word for ‘protection’ indicating the
Bliss-words to be different types of protections. In the fourth and final group the compounds consisted of the single Bliss-word for ‘cloth’ in order to make three different compounds about types of cloths.

4.2.3 Part III. Self-generated compound Bliss-words

In part III of the test the children were asked to compound the same single Bliss-words that were introduced in the first part into six new requested compound Bliss-words. This was done in order to see whether they had understood the inherent logic of the Blissymbol system. For this part all the symbols from part I of the test were placed in rows of threes on the table. The children were then given six words (e.g. ‘library’) and instructed to make that word using the symbols on the table (see Figure 3). They were also instructed to use at least two pictures to make the given word (e.g. ‘house’ and ‘book’ when combined becomes ‘library’). To combine the correct pictures they had to consider what a library is and use the knowledge they acquired of the Bliss-system in the previous parts.

<table>
<thead>
<tr>
<th>Draw the child’s own proposals for:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Target referent and definition</td>
<td>Library</td>
<td>Barn/stables</td>
</tr>
<tr>
<td>Houses where you can borrow/buy books</td>
<td>Houses that are home to animals</td>
<td>Someone who works with animals</td>
</tr>
</tbody>
</table>

Figure 3. Part III. Self-generated compound Bliss-words. The figure shows three compound Bliss-words for the given target referent (i.e. library, barn and farmer) from the protocol of the third test part, combined using the correct single Bliss-words in the correct order.

4.3 Materials

The Blissymbols were displayed on cards in black, against a white background. The measurements of the single Bliss-words were 3x3 centimeters and for the compound Bliss-words 4x4 centimeters. Test protocols were used to note the children’s responses. The testing in the public schools were recorded on and saved as mp3-files.

4.3.1 Translation of the material and the use of interpreters

The material used in this study was adopted from a previous study (Jennische & Zetterlund, 2012). It was first translated from Swedish to English by the test leaders and then translated into Swahili through a native interpreter. There were two interpreters that translated when
answers were given in Swahili. The interpreters were switched between the two test leaders after half of the number of children was tested in order to minimize the possible influence of the interpreters. The interpreters were in advance educated and informed about the test procedure and their role during the testing. This information included that they translate only what the test leader said, in order to not give some unintended extra clue to the child. This was done to try to eliminate any misinterpretations or interference with the test procedure.

4.4 Methods of analysis
4.4.1 Scoring numbers of correct answers
First, scoring of correct or incorrect answer was conducted for all test parts. Criteria for what was a correct answer were made in order for coherent grading between the two test leaders. The criteria for correct answer included the target word or its synonyms. Jennische and Zetterlund (2012) also accepted a sequence of words that indicated the correct meaning of the symbol. In the current study, the answer had to be given in one word, which meant that no paraphrases were accepted even if indicating the right meaning of the target words. In part two, compounds, different criteria was made about the scoring for the English-speaking and the Swahili-speaking children, since the two different languages have different ways of compounding. In Swahili ‘Nyumba ya gari’ (i.e. ‘the house of the car’) was counted as an correct answer while in English the answer “house of the car” was not counted as an correct answer. The test leaders graded the protocols separately and then viewed and compared their gradings in order to make sure that there was a consensus about the scoring criteria.

4.4.2 Analysis of error types
For part I and II an analysis of the incorrect answers was made in order to identify possible patterns in which different error types were given. The categories for the error types were chosen through the authors first analyzing the material and then selecting prominent answers, which were given by many children. The incorrect answers were categorized into 12 different error types (see Table 3, in Appendix 4). Of these 12, different error types were used in part one and two and also in pretest and posttest due to the nature of the error types. Some of them required that the children had heard the explanations or seen previous symbols in order to assume that this had affected their interpretations of the subsequent symbols. The percentage of error types was calculated for each symbol in order to be able to distinguish which category of incorrect answer that was used the most for each symbol. This was conducted in order to make it possible to compare the answers of the selected participant groups (i.e. age and language
background) to see potential similarities and differences in which the error types were used. The symbols were rated separately by which error type was the most frequent for each symbol.

4.4.3 Inter- and intrarater reliability

A random sample of 12 participants (i.e. approximately 10 %) was selected from the total 127 participants to analyze the reliability of the test leaders’ different scorings on the test. Inter-rater reliability for scoring of incorrect and correct answers was calculated using Pearson’s r. The reliability between the test leaders was $r = .99 - 1.0$ for all test parts. The intra-rater reliability between the test leader’s first common scoring and their separate second respective scorings was also $r = .99 - 1.0$. Additionally, inter-rater reliability for error types was calculated with a random sample of four participants using Cohen’s Kappa. The test leaders then rescored the selected sample children according to the given criteria. The rescoring showed that 22 of the symbols in the chosen material were incorrectly answered. These symbols were then given an error type from each test leader respectively. The range of correlation for error types for the different symbols in part one was between .43 and 1.0. The average correlation between the test leaders was found to be .90. For part two of the test the correlation between the test leaders regarding error types was 1.0. Overall, the agreement between the test leaders was outstanding.

4.4.4 Statistical analysis

All statistical analyses were calculated using parametric tests in IBM SPSS Statistics 22.0 for Windows since data was normally distributed. Charts were constructed using Microsoft Excel 2010. Data was entered anonymized into IBM SPSS Statistics 22.0. Independent variables included age, class and language background; while, dependent variables included the scoring of the test part and the error types. Statistical comparisons between and within groups were made with t-tests (paired sample t-test and independent sample t-test). The size effects of the significant comparisons were calculated using Cohen’s $d$. In addition, correlations were calculated using Pearson’s $r$. Significance level was set at .05 for all analyses. For the incorrect responses an analysis of error types was conducted to determine pattern in these responses. The types of incorrect answers were then coded and inputted into SPSS. A frequency analysis was conducted for the different incorrect answer types for each individual symbol in all parts; this was presented in number and percentage.
4.5 Ethical considerations

Several ethical considerations were made in this study. Firstly, informed parental consent was practiced for all participants, given that they were all minors. The consent forms were sent home with the children from the respective schools and then returned with the children. The consent forms were written in English for the English-speaking families and translated to Swahili to the Swahili-speaking families in an attempt to make the information accessible to all parents. Considerations were made about the possibility of parents being illiterate and therefore not able to understand the written information in the consent form. Therefore, the teachers in the public schools informed the children that if the parents did not know how to read, they would need to help them or ask an older sibling to read to them in order to understand and to fill in the form. The teacher also informed the children that the parents could contact the school if they had any questions. Interpreters were used for the Swahili-speaking children from the public schools to give them the opportunity to perform at their best and not have the results affected by language difficulties. The interpreters were well informed about the test procedure and their requirements in an attempt to reduce any misunderstandings or interference in the testing. Due to the authoritative teaching style practiced in Kenya, sensitivity in eliciting the guesses were practiced in an attempt not to threaten the child’s face. Also, consideration for the different teaching style that is adopted in Kenya was taken through an emphasis in the initial introduction of the testing that guessing incorrectly was not of significance and that there was no test and the most important thing were to guess, even if the child did not know the correct answer. Considering the location for the data collection, the identity of the children was scarcely at risk. To protect the identity of the children however, the data were presented on a group level. In addition, the data will be kept anonymized at the Speech, Language and Pathology-program at Linköping University also to protect the identity of the participants and to possibly be included in future studies.

5. Results

In the results average scores for total test parts and statistical comparisons of them are reported overall and for all group divisions (i.e. ages six and seven, classes one and two, ages six and seven divided by language background and classes one and two divided by language background). Furthermore, correlation analyses for all test parts (for pretest and posttest separately when included) are disclosed for the variables age and class. Descriptive statistics, including number and percentage of correct answers, for individual symbols are presented for
all participants and when divided by age and language background. Lastly, descriptive statistics of error types are given for the incorrect answers in part one and two.

5.1 Overall average scores

The overall average score on the pretest for part one for all 127 children was 1,54 (SD; 1,33, Max; 15) in the pretest and 10,11 (SD; 2,55, Max; 15) for the posttest. For all children the average score for part two was 2,06 (SD; 2,12, Max; 12) in the pretest and 6,65 (SD; 3,78; Max; 12) in the posttest. Finally, the average score for all children in the third test part as 2,02 (SD; 1,63, Max; 6). There was a significant difference between pretest and posttest for all children in part one: t(126) = -37.582, p = .000, r = .99. This difference was then consistent in the age groups and the classes. This difference was also evident in part two of the test as well t(125) = -18.036, p = .000, r = .85. Like in part one this difference was consistent in the age groups and the classes. The children performed significantly better on the posttest than the pretest for both parts one and two of the test, with a large effect size, which indicates that they improved. Furthermore there was no difference found between part one and part two.

Table 4.

Part I-II. Single Bliss-words and compound Bliss-words. Average total score (M) and standard deviations (SD) before (pretest) and after (posttest) explanation presented by age group

<table>
<thead>
<tr>
<th>Groups (n = number)</th>
<th>Age 6 (n = 67)</th>
<th>Age 7 (n = 60)</th>
<th>t</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Part I. Pretest</td>
<td>1,61</td>
<td>1,37</td>
<td>1,45</td>
<td>1,30</td>
<td>.68</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part I. Posttest</td>
<td>10,24</td>
<td>2,40</td>
<td>9,97</td>
<td>2,70</td>
<td>.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part II. Pretest</td>
<td>1,96</td>
<td>2,0</td>
<td>2,17</td>
<td>1,2</td>
<td>-.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part II. Posttest</td>
<td>6,82</td>
<td>3,9</td>
<td>6,46*</td>
<td>3,6</td>
<td>.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part III</td>
<td>2,03</td>
<td>1,7</td>
<td>2,02</td>
<td>1,6</td>
<td>.50</td>
</tr>
</tbody>
</table>

Note: N = number of participants. n.s = non significant Maximum scores: Part I = 15, Part II = 12. *= Number of participants was 59.

As shown in Table 4 the average scores and standard deviations in part one and two of the test were similar for both pretest and posttest in the different age groups. In addition, there were no significant differences between the two age groups in either test part. However, a slight difference can be seen in Table 5 below, where class two performed slightly better on the second test part in both the pretest and posttest. Furthermore, class two performed significantly better on part two, however with a small size effect. There was also a significant difference that
indicated that class two performed significantly better on the posttest on part one of the test. Class two also performed significantly better than class one in part three.

Table 5.

**Part I-II. Single Bliss-words and compound Bliss-words. Average total score (M) and standard deviations (SD) before (pretest) and after (posttest) explanation presented by class**

<table>
<thead>
<tr>
<th>Groups (n = number)</th>
<th>Class 1 (n = 63)</th>
<th>Class 2 (n = 64)</th>
<th>t</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Part I. Pretest</td>
<td>1.54</td>
<td>1.3</td>
<td>1.53</td>
<td>1.4</td>
<td>.036</td>
</tr>
<tr>
<td>Part I. Posttest</td>
<td>9.35</td>
<td>2.2</td>
<td>10.9</td>
<td>2.6</td>
<td>-3.51</td>
</tr>
<tr>
<td>Part II. Pretest</td>
<td>1.67</td>
<td>2.0</td>
<td>2.44</td>
<td>2.1</td>
<td>.21</td>
</tr>
<tr>
<td>Part II. Posttest</td>
<td>5.82*</td>
<td>3.7</td>
<td>7.45</td>
<td>3.6</td>
<td>-2.50</td>
</tr>
<tr>
<td>Part III</td>
<td>1.44</td>
<td>1.5</td>
<td>2.59</td>
<td>1.6</td>
<td>-4.23</td>
</tr>
</tbody>
</table>

Note: N = number of participants. n.s = non significant Maximum scores: Part I = 15, Part II = 12. * = Number of participants was 62.

There was an significant difference between the two language backgrounds in the pretest t(125) = 5.137, p = .000 r = .42 of part one. In the posttest of part one the difference was almost significant t(125) = 1.959, p = .054. This difference was consistent in both the pretest t(112.05) = 4.127, p = .000 r = .36 and posttest t(124) = 5.451, p = .000 r = .44 of part two. The effect was small to medium large and indicates that the English-speaking children performed better than the Swahili-speaking children overall. This difference was analyzed further in Table 6 and Table 7. The English-speaking six-year olds performed significantly better on the pretest of part one and the posttest of part two. Furthermore the Swahili-speaking seven-year olds performed significantly better than the Swahili-speaking children overall. Though, it is important to note, that for some significant results there was a small size effect.

Table 6.

**Part I-III. Single Bliss-words, compound Bliss-words and correctly self-generated Bliss-words for given meanings. Average total scores (M) and standard deviations (SD) before (pretest) and after (posttest) explanation presented by language background for age group six**

<table>
<thead>
<tr>
<th>Groups (n = number)</th>
<th>Swahili (n = 30)</th>
<th>English (n =37)</th>
<th>t</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Part I. Pretest</td>
<td>0.87</td>
<td>1.11</td>
<td>2.22</td>
<td>1.27</td>
<td>4.57</td>
</tr>
<tr>
<td>Part I. Posttest</td>
<td>10.43</td>
<td>2.16</td>
<td>10.08</td>
<td>2.6</td>
<td>-5.9</td>
</tr>
<tr>
<td>Part II. Pretest</td>
<td>1.57</td>
<td>1.79</td>
<td>2.27</td>
<td>2.19</td>
<td>1.41</td>
</tr>
<tr>
<td>Part II. Posttest</td>
<td>5.17</td>
<td>3.35</td>
<td>8.16</td>
<td>3.79</td>
<td>3.39</td>
</tr>
<tr>
<td>Part III</td>
<td>1.83</td>
<td>1.88</td>
<td>2.19</td>
<td>1.54</td>
<td>.85</td>
</tr>
</tbody>
</table>

Note: N = number of participants. n.s = non significant. Maximum scores: Part I = 15, Part II = 12, Part III = 6.
Table 7.

Part I-III. Single Bliss-words, compound Bliss-words and correctly self-generated Bliss-words for given meanings. Average total scores (M) and standard deviations (SD) before (pretest) and after (posttest) explanation presented by language background for age group seven

<table>
<thead>
<tr>
<th>Groups (n = number)</th>
<th>Swahili (n = 30)</th>
<th>English (n = 37)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Part I. Pretest.</td>
<td>1,03</td>
<td>1,19</td>
</tr>
<tr>
<td>Part I. Posttest.</td>
<td>8,87</td>
<td>2,65</td>
</tr>
<tr>
<td>Part II. Pretest.</td>
<td>1,03</td>
<td>1,03</td>
</tr>
<tr>
<td>Part II. Posttest.</td>
<td>4,62*</td>
<td>2,71</td>
</tr>
<tr>
<td>Part III.</td>
<td>1,53</td>
<td>1,59</td>
</tr>
</tbody>
</table>

Note: N = number of participants. n.s = non significant Maximum scores: Part I = 15, Part II = 12, Part III = 6.

* = Number of participants was 29.

Table 8 and Table 9 shows that the English-speaking children had a higher average score in all test parts for both classes. Here it is also apparent that class two had a higher average score for both the English- and the Swahili-speaking children. In class one the English-speaking children performed significantly better than the Swahili-speaking children in the pretest of part one, in the posttest of part two and in part three. For class two the English-speaking children performed significantly better than Swahili-speaking children in the pretest of part one and both pre- and posttest for part two. The size effect of these significances was medium large.

Table 8.

Part I-III. Single Bliss-words, compound Bliss-words and correctly self-generated Bliss-words for given meanings. Average total scores (M) and standard deviations (SD) before (pretest) and after (posttest) explanation presented by language background for class one

<table>
<thead>
<tr>
<th>Groups</th>
<th>Swahili (n = 33)</th>
<th>English (n = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Part I. Pretest.</td>
<td>1,03</td>
<td>1,19</td>
</tr>
<tr>
<td>Part I. Posttest.</td>
<td>9,18</td>
<td>2,28</td>
</tr>
<tr>
<td>Part II. Pretest.</td>
<td>1,21</td>
<td>1,39</td>
</tr>
<tr>
<td>Part II. Posttest.</td>
<td>4,41*</td>
<td>2,72</td>
</tr>
<tr>
<td>Part III.</td>
<td>1,0</td>
<td>1,28</td>
</tr>
</tbody>
</table>

Note: N = number of participants. n.s = non significant Maximum scores: Part I = 15, Part II = 12, Part III = 6.

* = Number of participants was 32.
There was non-significant negative correlation between age and number of correct answers for part one. This finding was then consistent in part two and three of the test. There was no correlation between age and number of correct answers. There was however a significant positive correlation between class and number of correct answers on the posttest ($r = .299$, $p = .01$) in part one, which suggests that number of school years improve the score on the pretest to a medium large effect. Additionally, there was a significant positive correlation between class and number of correct answers on both the pretest ($r = .183$, $p = .04$) and the posttest ($r = .218$, $p = .014$) of part two. The effect of the correlation was small to medium large, which further indicates that number of school years improve the score on the test. Lastly, there was also a significant positive correlation between class and number of correct answers in the third test part ($r = .354$, $p = .001$). This shows that number of school years improved the test score for all test parts.

5.3 Descriptive statistics of individual symbols

In Table 10, on the subsequent page, percentage and number of correct answer are presented for both pretest and posttest in part one. It shows an overall improvement between pretest and posttest. The table shows which single Bliss-words were the easiest to guess (in the pretest) and which showed the most and the least improvement (in the posttest).
Table 10.
Part I. Single Bliss-words. Percentage of correct answers of the total number of children \((N = 127)\), including which were easiest to guess, of each of the 15 given Bliss-words before (pretest) and after explanation (posttest)

<table>
<thead>
<tr>
<th>Target word</th>
<th>Single Bliss-word</th>
<th>Pretest Percentage % (N)</th>
<th>Pretest # 1-10</th>
<th>Posttest Percentage % (N)</th>
<th>Posttest # 1-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td><img src="image1" alt="House" /></td>
<td>44,1 % (56)</td>
<td>1</td>
<td>92,1 % (117)</td>
<td>2</td>
</tr>
<tr>
<td>Car</td>
<td><img src="image2" alt="Car" /></td>
<td>7,1 % (9)</td>
<td>7</td>
<td>90,6 % (115)</td>
<td>3</td>
</tr>
<tr>
<td>Boat</td>
<td><img src="image3" alt="Boat" /></td>
<td>10,4 % (13)</td>
<td>4</td>
<td>75,6 % (96)</td>
<td>6</td>
</tr>
<tr>
<td>Book</td>
<td><img src="image4" alt="Book" /></td>
<td>13,4 % (17)</td>
<td>3</td>
<td>89,8 % (114)</td>
<td>4</td>
</tr>
<tr>
<td>Crown</td>
<td><img src="image5" alt="Crown" /></td>
<td>40,2 % (51)</td>
<td>2</td>
<td>57,5 % (73)</td>
<td>10</td>
</tr>
<tr>
<td>Animal</td>
<td><img src="image6" alt="Animal" /></td>
<td>1,6 % (2)</td>
<td>9</td>
<td>66,9 % (85)</td>
<td>9</td>
</tr>
<tr>
<td>Person</td>
<td><img src="image7" alt="Person" /></td>
<td>1,6 % (2)</td>
<td>9</td>
<td>52,0 % (66)</td>
<td>11</td>
</tr>
<tr>
<td>Hand</td>
<td><img src="image8" alt="Hand" /></td>
<td>1,6 % (2)</td>
<td>9</td>
<td>68,5 % (87)</td>
<td>8</td>
</tr>
<tr>
<td>Foot</td>
<td><img src="image9" alt="Foot" /></td>
<td>3,9 % (5)</td>
<td>8</td>
<td>41,7 % (53)</td>
<td>13</td>
</tr>
<tr>
<td>Protection</td>
<td><img src="image10" alt="Protection" /></td>
<td>0,8 % (1)</td>
<td>10</td>
<td>28,3 % (36)</td>
<td>14</td>
</tr>
<tr>
<td>Head</td>
<td><img src="image11" alt="Head" /></td>
<td>7,9 % (10)</td>
<td>6</td>
<td>69,3 % (88)</td>
<td>7</td>
</tr>
<tr>
<td>Cloth</td>
<td><img src="image12" alt="Cloth" /></td>
<td>1,6 % (2)</td>
<td>9</td>
<td>66,9 % (85)</td>
<td>9</td>
</tr>
<tr>
<td>Table</td>
<td><img src="image13" alt="Table" /></td>
<td>10,2 % (13)</td>
<td>5</td>
<td>80,3 % (102)</td>
<td>5</td>
</tr>
<tr>
<td>Floor</td>
<td><img src="image14" alt="Floor" /></td>
<td>3,9 % (5)</td>
<td>8</td>
<td>45,7 % (58)</td>
<td>12</td>
</tr>
<tr>
<td>Bed</td>
<td><img src="image15" alt="Bed" /></td>
<td>13,4 % (17)</td>
<td>3</td>
<td>93,7 % (119)</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: In the table the Bliss-words are given in the same order as they were presented to the child. The # that is given for columns four and six are ordered from highest to lowest percentage of correct answers.

In Table 11, percentage and number of correct answer are presented for both pretest and posttest in part two. It shows an overall improvement between pretest and posttest. The table shows which compound Bliss-words were the easiest to guess (in the pretest) and which showed the most and the least improvement (in the posttest). For example, none of the children (0 %) could
guess the Bliss-words ‘glove’ in the pretest and approximately half of the children (54.3%) had learned the symbol in the posttest.

Table 11.

Part II. Compound Bliss-words. Percentage of correct answers of the total number of children (N = 127), including which were easiest to guess, of each of the 12 given Bliss-words before (pretest) and after the explanation (posttest)

<table>
<thead>
<tr>
<th>Target word</th>
<th>Bliss-word</th>
<th>Pretest Percentage % (N)</th>
<th>Pretest # 1-12</th>
<th>Posttest Percentage % (N)</th>
<th>Posttest # 1-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boathouse</td>
<td></td>
<td>4.7 % (6)</td>
<td>10</td>
<td>39.4 % (50)</td>
<td>9</td>
</tr>
<tr>
<td>Garage</td>
<td></td>
<td>30.7 % (39)</td>
<td>3</td>
<td>63.0 % (80)</td>
<td>4</td>
</tr>
<tr>
<td>Castle</td>
<td></td>
<td>8.7 % (11)</td>
<td>9</td>
<td>41.7 % (53)</td>
<td>7</td>
</tr>
<tr>
<td>Driver</td>
<td></td>
<td>1.6 % (2)</td>
<td>11</td>
<td>64.6 % (82)</td>
<td>3</td>
</tr>
<tr>
<td>King</td>
<td></td>
<td>34.6 % (44)</td>
<td>2</td>
<td>67.7 % (86)</td>
<td>1</td>
</tr>
<tr>
<td>Sailor</td>
<td></td>
<td>12.6 % (16)</td>
<td>7</td>
<td>40.9 % (52)</td>
<td>8</td>
</tr>
<tr>
<td>Glove</td>
<td></td>
<td>0 % (0)</td>
<td>12</td>
<td>54.3 % (69)</td>
<td>6</td>
</tr>
<tr>
<td>Shoe</td>
<td></td>
<td>18.9 % (24)</td>
<td>6</td>
<td>64.6 % (82)</td>
<td>3</td>
</tr>
<tr>
<td>Hat</td>
<td></td>
<td>22.8 (29)</td>
<td>4</td>
<td>64.6 % (82)</td>
<td>3</td>
</tr>
<tr>
<td>Tablecloth</td>
<td></td>
<td>9.4 % (12)</td>
<td>8</td>
<td>38.6 % (49)</td>
<td>10</td>
</tr>
<tr>
<td>Sheet</td>
<td></td>
<td>44.1 % (56)</td>
<td>1</td>
<td>66.1 % (84)</td>
<td>2</td>
</tr>
<tr>
<td>Carpet</td>
<td></td>
<td>20.5 % (26)</td>
<td>5</td>
<td>59.8 % (76)</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: In the table the Bliss-words are given in the same order as they were presented to the child. The # that is given for columns four and six are ordered from highest to lowest percentage of correct answers.

In Table 12, percentage and number of correct answer are presented for part three. The table shows that there was a difference in how easy the children found it to construct a target word using single Bliss-words. It also shows that the children were able to use the information they had retain about the Blissymbols in the previous parts when constructing the target word.
Furthermore, the compound Bliss-word that was the easiest for the children to construct was ‘farmer’. The compound Bliss-word that was the most difficult was ‘sail’.

Table 12.
Part III. Number and percentage for all of the children’s (N = 127), correctly generated Bliss-words (choice of single Bliss-words) for given meanings (items), including which were easiest to guess

<table>
<thead>
<tr>
<th># 1-6</th>
<th>Item</th>
<th>Correctly constructed compound Bliss-word</th>
<th>Percentage % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Library</td>
<td></td>
<td>42,5 % (54)</td>
</tr>
<tr>
<td>3</td>
<td>Barn</td>
<td></td>
<td>37,0 % (47)</td>
</tr>
<tr>
<td>1</td>
<td>Farmer</td>
<td></td>
<td>50,4 % (64)</td>
</tr>
<tr>
<td>6</td>
<td>Sail</td>
<td></td>
<td>10,2 % (13)</td>
</tr>
<tr>
<td>5</td>
<td>Towel</td>
<td></td>
<td>30,7 % (39)</td>
</tr>
<tr>
<td>4</td>
<td>The king’s car</td>
<td></td>
<td>33,9 % (43)</td>
</tr>
</tbody>
</table>

Note: In the table the items are given in the same order as they were given to the child.

5.3.1 Analysis of percentage correct answers of individual symbols

Figure 4. Part I. Percentage correct answers for each single Bliss-word in age group six presented by language background, pretest and posttest.

The results show that there was a high percentage of incorrect answers amongst the Swahili-speaking children in age group six for the pretest (see Figure 4). In this group there were two
symbols reaching over 10% of correct answers: house (33.3%) and book (23.3%). For the English-speaking children the scores were also low with nine symbols not reaching above 10%, where scores of the remaining six symbols had a range between 13.5-75.7%. Furthermore, the English-speaking children had a higher score at more symbols compared to the Swahili-speaking children overall. Though, there were some symbols in which the Swahili-speaking children had a higher percentage of correct answers comparing to the English-speaking children (book, animal, foot, head and cloth) even though the percentage difference were not that high. In posttest there was a large improvement for both the Swahili-speaking and the English-speaking children. In this part the majority of highest correct answers was reversed, i.e. produced by the Swahili-speaking children. The Swahili-speaking children performed better than the English-speaking children at the symbols for house, car, book, animal, person, hand, head, cloth and table. When comparing mean percentage it shows that the Swahili-speaking children had a lower score on the pretest (6.4%) comparing to the English-speaking group (23.4%). However, the Swahili-speaking group had a higher mean percentage in the posttest (76.2%) comparing to the other group (65.7%), which indicates a larger improvement between the mean score (69.8%) compared to the English group (42.3%).

In posttest there was a large improvement for both the Swahili-speaking and the English-speaking children. In this part the majority of highest correct answers was reversed, i.e. produced by the Swahili-speaking children. The Swahili-speaking children performed better than the English-speaking children at the symbols for house, car, book, animal, person, hand, head, cloth and table. When comparing mean percentage it shows that the Swahili-speaking children had a lower score on the pretest (6.4%) comparing to the English-speaking group (23.4%). However, the Swahili-speaking group had a higher mean percentage in the posttest (76.2%) comparing to the other group (65.7%), which indicates a larger improvement between the mean score (69.8%) compared to the English group (42.3%).

**Figure 5.** Part I. Percentage correct answers for each single Bliss-word in age group seven presented by language background, pretest and posttest.

In part one, the Swahili-speaking children in age seven, the score exceeded 10% of correct answers in three symbols (house, book and head) (see Figure 5). Amongst the English-speaking
children this was evident for five symbols (house, boat, crown, table and bed). The symbol for house was the most transparent for both groups with a percentage of 66.7% for the Swahili-speaking children and 50% for the English-speaking children. When comparing mean percentage of the pretest score between the two language groups it shows that the English-speaking children had a higher percentage of correct answers (13.1%) than the Swahili-speaking group (9.1%). Similar results were showed in the posttest where the English-speaking had a mean score of 75.1% comparing to 59.6% for the Swahili-speaking children. It also indicates a bigger improvement for the English children (62%) than for the Swahili-speaking children (50.5%). Even though there was a higher mean score for the English-speaking children, there were some symbols that the Swahili-speaking children had a higher score than the English-speaking children. These were the symbols for house, book, hand, foot and head in the pretest and house, book, head and cloth in the posttest.

![Graph](image_url)

**Figure 6.** Part II. Percentage correct answers for each compound Bliss-word in age group six presented by language background, pretest and posttest.

In the pretest of part two for age group six, there were five symbols (garage, king, shoe, hat and bed sheet) in which the score exceeded 10% for the Swahili-speaking children and eight symbols (garage, castle, king, sailor, shoe, hat, bed sheet and carpet) for the English-speaking children (see Figure 6). In the posttest both language group exceeded the 10% score for all symbols. When comparing the percentage for correct answer for each separate symbol, the pretest scores shows that the English-speaking children have the highest score at five symbols
(castle, king, sailor, shoe, and carpet) while the Swahili-speaking children have the highest score at four symbols (garage, hat, tablecloth and bed sheet). In the posttest The English-speaking children had an overall higher score than the Swahili-speaking children. Also, when comparing the mean percentage score between the two language groups it shows that English-speaking children have a higher mean score both in pretest (26.8%) and the posttest (68%) comparing to the Swahili-speaking group (13%) and (31.2%).

![Compound Bliss-words for age group seven. N = 60](image)

Figure 7. Part II. Percentage correct answers for each compound Bliss-word in age group seven presented by language background, pretest and posttest.

In the pretest of part two, the symbols for which the seven year old Swahili-speaking children exceeding 10% of correct answers were the three following symbols: garage, hat and bed sheet. In the English-speaking group, the all of the symbols exceeded 10% except for boathouse, driver and glove. In the posttest both language groups exceeded 10% at all symbols (see Figure 7). When comparing the scores for each symbol the results shows that the English-speaking children had the highest scores for all of the symbols in the pretest and in the posttest. This is also evident in the mean percentage of the overall score for all symbols in the pretest (31.9%) and in the posttest (68.6%) comparing to the mean score in pretest for the Swahili-speaking children (8.6%) and in the posttest (37.8%). Thus, the mean score of improvement (difference between pre and posttest) between the two language groups were similar with 36.7% for the English-speaking children and 29.2% for the Swahili-speaking children.
5.4 Descriptive statistics of error types

5.4.1 Part I. Single Bliss-words

All children except the Swahili-speaking children from age group seven used the ‘Visual’ error type as the most common error type when given an incorrect answer in the pretest of part one (Figures 8-11, Appendix 8.5). Amongst the Swahili-speaking children in age group seven, the most common error type was ‘Letter’, which means that the Swahili-speaking children in age seven mostly associated the symbols to a letter. In the posttest the most common used error type for all children was ‘Visual’. The results indicate that even though the children performed much better in the posttest than in the pretest, the same types of incorrect answers (i.e. ‘Visual’) were the most commonly given in both pre- and posttest. Thus the ‘Visual’ error type was distributed differently on different symbols across the groups. This indicates that even though the children used the same kind of error type overall there was a difference in at which symbols this error type occurred. This further indicates that the children interpreted the different types of symbols differently. An example of this is that for the symbol for ‘foot’ the most commonly used error type for the Swahili-speaking children was ‘Paraphrasing or association’, while it was the ‘Visual’ error type for the English-speaking children.

5.4.2 Part II. Compound Bliss-words

In the pretest of part two the most commonly used error type for all children was ‘Paraphrasing or association’ (see figures 11-15 in Appendix 8.5). This indicates that the incorrect answers were given through paraphrasing or associating to previously shown symbols i.e. ‘The thing for the king’ for the symbol for crown or ‘umbrella’ instead of sailor where the child often associated the symbol for boat to an umbrella. In the posttest, there were differences between the groups. For the Swahili-speaking six-year olds the most commonly used error type was ‘Naming one single Bliss-word’ and for the English-speaking children in the same age the most used was ‘Other’. For the seven-year olds the most used error type was ‘Explanation, not with target word’ for both the Swahili-speaking children and the English-speaking children. The results indicate that the seven year olds, in both language groups, used the instructive explanation as a strategy when naming the compound symbols in the posttest (e.g. a ‘driver’ is a person that drives a car). The results also indicate, as in part one, that the children interpreted the different types of symbols differently even though they used somewhat the same error types overall. In part two there was a greater distribution between the different groups (age and language) in posttest than in pretest.
6. Discussion

6.1 Result discussion

There was a significant difference between pretest and posttest for all children in both part one and two. The children performed significantly better on the posttest than the pretest for both parts, which indicates that they improved after the instructive explanation of the symbols. This is in accordance with the fact that it is beneficial to include teaching of Bliss-characters before teaching compounds (Schlosser & Lloyd, 1993; Shepherd & Haaf, 1995). This shows that the Bliss-symbol system is learnable (Jennische & Zetterlund, 2012), despite its low transparency (Musselwhite & Ruscello, 1984) and translucency compared to other symbol systems or sets (Bloomberg et al., 1990). This also shows that the children were aided by scaffolding in form of adult instruction, which is in line with (DeLoache et al., 1999; Peralta et al., 2013).

In the present study there was a significant difference between the two classes, which indicates that number of school years enhanced performance on the test overall. However, this difference had small size effect. Therefore, it is worthy of consideration that there also was a significant positive correlation between class and number of correct answers in all test parts, except the pretest of part one. This further shows that number of school years increased the score on the test. Nevertheless, no difference was found between the two age groups, indicating that age did not affect the results. This could contradict the result of Shepherd and Haaf (1995) which showed that older participants were able to better use the abstract semantic concepts needed for the learning of Blissymbolics. A visual analysis of the percentage of correct answers (Figures 4-7) for both the single Bliss-words and the compound Bliss-words indicates that the score between the different ages had a similar distribution, which in part could account for the fact that no difference was found. Furthermore, Shepherd and Haaf (1995) had a larger gap between their age groups, examining six and twelve year olds. In the present study the test groups consisted of six- and seven year olds and these ages were distributed over both classes. The ability of dual representation of symbolic objects, needed to interpret symbols, develops gradually over several years and an increased experience with different symbols plays a part in this development (DeLoache, 2004; DeLoache et al., 1999). The reason why the two age groups performed similarly on the test could be that they have a similar amount of experience with symbols. Additionally, there was a difference between classes and in class two the seven year olds were overrepresented. This indicates that there could be an age difference after all.
Overall, it can be seen that the percentage correct answers for the symbols in the pretest of the first part were slightly lower than in the pretest of part two. This suggests that the children were aided from their knowledge from the first test part in the pretest of the second part. However, in the posttest this slight difference was reversed. This indicates that it was more difficult to learn compound Bliss-words than single Bliss-words. A reason for this could be that to understand the compound symbols a greater understanding of the generative quality of Bliss is needed, since it required the child to understand that when two single symbols are added together they make a new meaning or word. That is that two single Bliss-words put together can through the logic of the system then be combined to form an infinite number of new compound Bliss-words (Carmeli & Shen, 1998; Hetzroni et al. 2002; Musselwhite & Ruscello, 1984; Schlosser & Lloyd, 1993; Shepherd & Haaf, 1995).

The English-speaking children performed significantly better than the Swahili-speaking children overall in almost all parts, except for the posttest of part one. Hetzroni et al (2002) suggested that when a referent is known, the symbol will be easier to understand and identify (Hetzroni et al., 2002). The Swahili-speaking children in both age groups had a lower percentage of correct answers for more symbols than the English-speaking children in the pretest in part one and two. This might be due to the fact that some of the target words were unfamiliar to the Swahili-speaking children. Not knowing the referent would therefore make the symbol harder to interpret which could have been one reason for why the Swahili-speaking children had a lower score in the pretest before given the target word and instructive explanation. The results indicates that even though the Swahili-speaking had a high percentage of incorrect answers in the pretest and might not initially know all the target words, they still showed a great improvement in the scores for the posttest. This further indicates that there was a great learnability of most of the symbols presented in part one and two.

Fuller (1997) stated that complexity seems to be a factor in facilitating the learning of Bliss symbols for children when the visual association between symbols and referents is small (i.e. when translucency is low). While, Hetzroni et al. (2002) on the other hand concluded that high complexity assisted learning when translucency was high and low complexity assisted when translucency was low. The results of the current study seem to be in line with the result of Hetzroni et al. (2002) also indicating high translucency-symbols (e.g. car) had high complexity (i.e. nine strokes), while low translucency-symbols (e.g. protection) had low
complexity (i.e. two strokes). However the number of different symbols in this test material may be too few to draw any greater conclusions from this similarity.

The meaning of the single Bliss-words was not obvious to children in pretest of part one, much like they were not obvious for the Swedish children in (Jennische & Zetterlund, 2012). The symbols ‘house’ and ‘crown’ were the most transparent of the tested symbols, as above 40 percent of the answers in the pretest were correct. This is if you take in consideration that the children simply guessed the meaning of the symbols in the pretest and that transparency can be defined as how guessable a symbol is (Hetzroni et. al., 2002; Shepherd & Haaf, 1995). From these results the symbols that had a percentage of correct answers between 7,1-13,4 % (i.e. car, boat, book, head, table and bed) can be seen as somewhat transparent, but only if you take in consideration that the overall correct percentage for each symbol did not exceed 50 % for any of the symbols. The rest of the symbols (i.e. animal, person, hand, foot, protection, cloth, and floor) had below 5 % correct answers, indicating low transparency for these symbols in comparison with the others. Bloomberg et al. (1990) stated that a simple illustration of an object and associated attributes could lead to a direct perceptual association with the referent. That entails that the more pictographic symbol is, the easier it is to identify (Musselwhite & Ruscello, 1984), which is also evident in the results of the current study e.g. for the symbol for ‘house’ and ‘crown’. However, besides the generally low transparency of the symbols used in this study, the study indicates a generally high translucency of the symbols. This is shown by the results of the posttest, when the children had heard the explanation of the symbols, in part in which 12 of the maximum 15 symbols had a percentage of correct answers above 50 %. Additionally, five symbols exceeded 80 % correct answer (i.e. house, car, book, table, bed). The symbols that showed a considerable improvement from pretest (when the referent was unknown) and the posttest (when the referent was known) (i.e. car, book, table, bed) can be interpreted as being translucent (Carmeli & Shen, 1998; Fuller, 1997; Fuller & Stratton, 1991; Hetzroni et. al., 2002). For the symbol for ‘Crown’ there were 40,2 % correct answers in the pretest and the 57,5 % in the posttest, indicating that it was not translucent, considering that knowing the referent did not greatly improve the score. Lastly, three symbols (i.e. person, floor, protection) had low percentage scores on the posttest (28, 3-45, 7 %) indicating that these symbols could be opaque (Carmeli & Shen, 1998; Fuller 1997; Fuller & Lloyd, 1991; Shepherd & Haaf, 2005).

When analyzing the children’s percentage of correct answers of the separate symbols in the pretest of part one (Figure 5 & Figure 6), there were some target words that appeared to have
prominently lower scores for the Swahili-speaking children. The two age groups found different types of symbols difficult. In age group six it was the symbol for ‘crown’ that had the prominent lower score comparing to the English-speaking children. In age seven this was applied for several symbols i.e. for ‘boat’ and ‘foot’. Almost all of the Swahili-speaking children in both age groups answered incorrectly when interpreting the symbol for ‘boat’ in the pretest. The majority of incorrect answers, 76.7% of the six year olds and 90% of the seven year olds, belonged to the ‘visual’ category. Boat as a concept might be unknown due to lack of experience of that concept, since the study were conducted in the hinterland of Kenya nowhere near a lake or sea, the children might not have seen a boat and therefore not been familiar to the concept. Since the connection between the perceptual features of the symbol and the features of the referent is necessary which are generalized from experience (Bloomberg et al., 1990; Huer, 2000), it would be difficult to make connection between the perceptual features of the symbol and the referent when the features of the referent is unknown. Furthermore, individuals with different languages and cultural backgrounds perceive graphic symbols differently (Huer, 2000). The Swahili-speaking children most likely knows the word for foot. Hence, in Swahili the word and concept for foot also includes the leg, which is a different classification of the concept apart from the English one for foot. Within a language one word may refer to many concepts and also, one's reality is divided into arbitrary categories and concepts which are different across languages (Chandler, 2007b). This might be why there were so many of the Swahili-speaking children that gave the wrong answer for foot, since most of the children were answering in English in the pretest after the instructive explanation of the target word were given. Many of the children therefore answered leg instead of foot, which in Swahili are the same things but would be considered an incorrect answer in English. This could therefore be a matter of linguistics. There were also a few symbols where the Swahili-speaking children had a prominent higher score than the English-speaking children. This was only evident in part one. These were somewhat the same in the both age groups, with ‘head’ and ‘cloth’ as the most prominent in both groups. These words might be more familiar to the Swahili-speaking children, for example one of the local interpreters explained that cloth is most likely a familiar concept for these children since it is common that mothers uses a cloth when carrying their children on their back, which would make cloth a word that is used in their everyday living.

For the second part of the test the compound symbols (i.e. garage, king, bed sheet) with the highest percentage of correct answers (40.7-44.1 %) in the pretest, incorporated single symbols that can be interpreted as either highly transparent (i.e. house and crown) or highly translucent
(i.e. car) in part one. However, the symbol for ‘king’ consists of the single symbols ‘person’ and ‘crown’, of which ‘person’ was indicated as being opaque in the first test part. This could indicate a learnability of the single symbol ‘person’ or that it perhaps was easier to learn in relation to another symbol, the ‘crown’. Additionally, the symbols that had the second highest percentage of correct answers (18, 9–22, 8 %) (i.e. shoe, hat, carpet) and the symbols with the highest percentage of correct answers both include symbols from the second or third of each group of symbols (e.g. boathouse, garage, castle) indicating a learning curve during the course of this test part. The children were aided by the instructive explanation from the first symbol in each symbol group in the second and third symbols. This is in accordance with Jennische and Zetterlund (2012) who found that the children in their study benefited from instruction and successively discovered the logic of the system.

Both the compound symbols with second lowest percentage correct answers (8, 7–12, 6 %) (i.e. castle, sailor, tablecloth) and the compound symbols with the lowest percentage correct answers (0–4, 7 %) (i.e. boathouse, driver, glove) included target words or concepts that the authors interpreted perhaps were unknown to the children. The symbols within this range of percentage correct answers are mostly symbols that make reference to conceptual features of their referents. Conceptual features include ideas generalized from experience (Bloomberg et al., 1990). This entails that if you have little experience of the referent itself (i.e. the target word) it would be difficult to connect the symbol to a concept within the referent. For the posttest of part two of the test, the symbols with the highest percentage of correct answers (63, 0–67, and 7 %) (i.e. garage, driver, king, shoe, hat, bed sheet) almost exclusively included symbols that had the highest or second highest percentage in the pretest. With the exception of the symbol ‘driver’ that had a low percentage of correct answers (1,6 %) in the pretest and a high percentage of correct answers (64,6 %) in the posttest. This indicates that this symbol had high translucency, similarly to the symbol ‘car’ in the first test part. Lastly, the symbols that had the lowest percentage of correct answers (38, 6–41, 7 %) (i.e. boathouse, castle, sailor) in the posttest also had low percentage correct answers in the pretest, suggesting these symbols had low transparency and translucency.

The main difference between the posttests of part two for the two language groups in both age groups was seen for ‘castle’, ‘king’ and ‘sailor’. These words might not be words that the Swahili-speaking children use in their everyday living and since signs needs to be learned and are dependent of social and cultural conventions (Chandler, 2007b) the Swahili-speaking
children might not have them in their vocabulary. The English-speaking children from private schools might have come in contact with these concepts through other media, since these children were brought up under wealthier conditions comparing to the Swahili-speaking children from the public schools. The results may therefore also been influenced by the different socioeconomic status presented in the different groups, since poverty is associated with certain life experience that can have a significant impact on vocabulary development (Alant et al., 2005).

When analyzing the error types, the most commonly used category in pretest of part one was the ‘visual’ in both language groups in age six. This means that the children associated to things that had the same visual characteristics of the symbol when interpreting the symbol i.e. answering umbrella when interpreting the symbol for boat. Even though the children had the same types of incorrect answers there were still differences in the distributions of the different categories for different types of symbols. In age group seven the Swahili-speaking children were more likely to associate the symbol to a ‘letter’ while the English-speaking children were more likely to associate the symbol to its ‘visual’ features. Associating a symbol to a letter is also a type of visual analysis since the child think that the symbol might look just like the letter. Hence, it seemed more likely that the current subject in school influenced the children, since many children associated a letter to the symbol even when there was no visual resemblance between the two. In the pretest of part two the most common type of incorrect answer was made through the category ‘Paraphrasing or association’ i.e. ‘the thing for the king’ for crown or associating to previous shown symbols. This was evident for both languages in both age groups. In the posttests there was more diversity of types of incorrect answers between the language groups in both part one and two. The results indicate that there was a difference in how the children interpreted the symbols between the different groups (age and language), but that there were similar types of interpretations within the groups. This would mean that the symbols were interpreted in the same way by children that belonged to the same groups of age, language and socioeconomic background, which previously stated could be a result from different life experience (Alant et al., 2005; Bloomberg et al., 1990; Huer, 2000), word knowledge and conceptual features of the referent (Chandler, 2007b; Hetzroni et al., 2002; Bloomberg et al., 1990), language (Huer, 2000) and of socioeconomic status (Alant et al., 2005).
6.2 Methodological discussion

6.2.1 Participants

An important notation in the light of the current study is that some children were uncertain as to when they were born, which could explain why age did not affect the results in this study. Furthermore, it is important to consider that an inclusion criteria in this study was that the children be aged six or seven years old. This criterion excluded children that were eight in class two. The reason for these criteria was to have as homogenous groups as possible. However, a homogenous division of groups was difficult achieving when considering language backgrounds. This is largely explained by the fact that in Kenya both English and Swahili are official languages. In addition to this a large variety of tribe languages is also common aside from the official languages. The division of Swahili and English-speaking children is still valid considering that they reflect the different teaching languages at the schools. It is interesting to note that this division also involves a socioeconomic aspect. Bearing in mind, that in the public schools the teaching language was Swahili, while it was English in the private schools.

Moreover, the children in the current study were typically developed as judged by their parents. It is valid to conduct a study about Bliss with typically developed children, even though Bliss is used by people with disabilities and generalization to people who have significant cognitive impairments may be restricted (Schlosser & Lloyd, 1993). It is valid, considering that several studies support the generalization of data collected from cognitively normal individuals to other populations (Bloomberg et al., 1990; Fuller 1988). This involves that if intellectually normal adult viewers have difficulty associating an item with its referent the young child or individual will also have difficulty making the connection. This in turn supports generalization of results from a population of children with normal intellectual ability to children with cognitive disabilities (Bloomberg et al., 1990). Furthermore, Schlosser and Lloyd (1993) contend that testing actual AAC-users who use Blissymbolics would also make it difficult to provide homogenous groups, which further emphasizes the benefits of using typically developed children in the current study.

6.2.2 Translation

The testing material from this study can be questioned, mainly when it comes to the selected symbols. Since the design and the test material were taken from a previous study conducted in Sweden with Swedish speaking children, the symbols might have been better suited for Swedish children. The authors found that some words appeared to be difficult, even after the instructive
explanation. This was especially true for the Swahili-speaking children. This could indicate that they did not have the target word in their vocabulary. Not knowing the meaning of the target word can affect the outcome when interpreting the symbols, since words can have different nuances and associations across cultures. Not knowing the meaning of the word can also be problematic when it comes to knowing what is being measured (Bridges, 2004). These children would probably have performed better if given a symbol representing a known referent and it can be discussed what is being measured since it is difficult to make the connection between the symbol and its referent when the referent is unknown. If possible, it would have been beneficial to be acquainted with the culture in advance and chose culturally appropriate symbols, as was done in Bornman et al. (2009). However, in this case the design and symbol selection were adopted from a previous study (Jennische & Zetterlund, 2012) and therefore there was little room for changes. The changes that were made consisted of different criteria for what were correct answers. In the current study only the target word or its synonyms was accepted as correct, while a sequence of words that indicated the correct meaning was also accepted in the other study. However, in Swahili ‘nyumba ya gari’ (the house of the car) was counted as an correct answer while in English the answer ‘house of the car’ was not counted as an correct answer, due to different compounding rules within the languages. This kind of compounding occurred quite frequently in the Swahili-speaking children 20 of 60 children called the compound for ‘garage’ ‘nyumba ya gari’. In conclusion, it seems that there were similarities in regards to which symbols the children found easy or difficult to interpret between the studies and this indicates that it is unlikely that the selection of symbols did not affect the results.

The translation of the material (i.e. translation of the target word/referents of the symbols) was first translated from Swedish to English by the test leaders. Since the translation to English was not made by an actual interpreter, there might have been some inaccuracy in the translations of the different target words/concepts. Additionally, translation from English to Swahili was made through one of the interpreters who is a native speaker (i.e. the translator spoke both Swahili and English fluently). This was done in an attempt to achieve linguistic equivalence, to ensure that the translated material would have the equivalent meaning as the original language (Bridges, 2004; Peña, 2007). However, using translation/back-translation described in Peña (2007) might have achieved even further accuracy, since it would have ensured that the translated material examines the same constructions.
For the Swahili-speaking children interpreters were used to translate answers given in Swahili to English for the test leaders. In an attempt to reduce any misunderstandings or interference with the testing, the interpreters were informed about the test procedure and their requirements. Even though this precaution was taken, the test leaders still had to occasionally remind one of the interpreters to only translate what the test leader said. This could have affected the results of the symbols that were given an instructive explanation that revealed something other than what the test leader was saying. However, since the test leaders were somewhat familiar with the Swahili language and knew the target words in Swahili they could detect if the interpreter gave too much information in the instructions and correct them.

6.2.3 Methods of analysis

In the scoring of correct answers synonyms to the target word were included, but not a sequence of words that indicated the intended meaning. This was the only alteration that was made in the design from Jennische and Zetterlund (2012). The reason for this more stringent correction was because it gave the possibility to further analyze the incorrect answers. Moreover, the purpose of analyzing the error types in part I and II was to identify patterns in the incorrect answers. For instance which type of error was the most frequent for each symbol. The selection of prominent answers that were then divided into different categories was conducted qualitative. This means that the selected error types are firstly connected to the authors’ opinions of the answers. However, the selected categories are secondly connected to how frequent they were in the material. This indicates a validity of the chosen error types. Still, the possibility persists that some categories (e.g. ‘other’) could have been divided into the other categories or perhaps been found to be an new category had the authors had more information about the answer. Furthermore, the reliability between the test leaders’ scoring of incorrect and correct answer was between .90 and 1.0. This shows that the scoring of the test leaders were in correspondence with each other. This indicates that the scoring was valid.

6.3 Conclusions

The results of the present study indicate that the Blissymbols had low transparency, which is in line with findings in other studies. Additionally, the results indicate a generally high translucency of the symbols since there was a significant improvement in the posttest of all parts for all children. The results also indicate a general high learnability and that the children were aided by the given instructive explanation.
There was a significant difference between the classes and the score on the test was increased by number of school years. Even though there was no difference between age groups, since the seven year olds were overrepresented in class two, age could still be a factor influencing the learnability of Bliss.

The English-speaking children performed significantly better than the Swahili-speaking children overall. However, the Swahili-speaking children showed a great improvement in the posttest, which suggests a learnability of most of the symbols. The results also indicate that there were differences in how the children interpreted the symbols, but that there were similarities within the specific groups. Further, this indicates that the symbols were interpreted similarly by children that belonged to the same age, language and socioeconomic background.

6.4 Clinical implications and future studies

Multicultural research is necessary in order to advance and to ensure the quality of the service of AAC for culturally and linguistically diverse AAC users. The clinical implications of the findings of the present study imply the use of instructive explanation when teaching Bliss to children. It also suggests that cultural and linguistic background of the patient should be taken into consideration when designing the actual intervention. For future studies it would be interesting to conduct a study with the same design as the present study that has a larger time span between pretest and posttest. This could reveal if the children learned and retained the Blissymbols over time. The authors would like to encourage further studies in this field, since there are few studies conducted on how children from other than Western populations perceive and learn different graphic symbols sets or systems. Also, in today’s multicultural society, it is important to investigate potential cultural and linguistic influences of the interpretation and learnability of the Blissymbol.
7. References


We are two last year students from the Speech, Language and Pathology Program at Linköping University in Sweden. We wonder if you allow your child to participate in a project about understanding Bliss-words. Bliss is a symbolic communication system for people who cannot communicate using speech or sign language. Bliss-words consist of a number of symbols, each of which describes a concept.

We want to study how typically developed children understand how combinations of simple Blissymbols can have different meanings.

We are looking for children who are 6-7 years old, who wish to participate in the project. We were wondering if you would consent to letting your child participate. The child may at any time interrupt participation in the study; however the information which is gathered up to that point may still be used in the results.

The investigation is expected to take no more than 30 minutes and can be done in a quiet corner of the classroom or a separate room. The child will be asked to name different Blissymbols and to make up their own Bliss-words.

The material will be kept de-identified at the Department of Speech and Language Pathology, IKE, at Linköping University in Sweden. The results of the study will be presented in a four year master essay at a seminar and then published online.

If you agree to your child’s participation in the study at the school, we would be grateful if you confirm this by signing the enclosed form and send/return it to the school.

Sincerely

Simona Krstic
Speech-Language-Pathology Program, IKE
Linköping University
XXXX@student.liu.se

Elin Littorin
Speech-Language-Pathology Program, IKE
Linköping University
XXXX@student.liu.se

Supervisor: Janna Aanstoot
Senior lecturer in Speech- and Language Pathology
Speech-Language-Pathology Program, IKE
Linköping University
XXXX@liu.se
I/We, as this child’s parent/guardian have read the information about the project and agree that my/our child may participate in the survey. I also agree that the information I state below can be used in the study.

Date ___________________________  Signature/s ___________________________

Child’s name: _____________________________________________________________

Child’s Date of Birth: ______________________________________________________

Language/s spoken at home: ________________________________________________

Language/s your child speaks fluently: _________________________________________

Answer the following questions to the best of your ability and knowledge. Please check one of the boxes.

- Does your child have a known hearing impairment? YES □      NO □
- Does your child have a known visual impairment? YES □      NO □
- Has your child’s language development been normal compared to children in the same age? YES □      NO □
- Has your child’s communicative development been normal compared to children in the same age? YES □      NO □

Comment:__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
8.2 Appendix 2 - Consent form to Swahili-speaking parents

Kwa mzazi/mtunzi!

Sisi ni wanafunzi wawili kutoka chuo kikuu cha lincoping nchini Sweden. Tunauliza kama utamkubalia mwanao kushiriki katika hafla ya kujaribu kuelewa maneno ya (bliss). Bliss ni aina ya mawasiliano mbadala za ki ishara. Tunataka kujua urahisi wa kujifundisha huu mtindo wa mawasiliano kwa watoto wanaokua vizuri.

Tunatafuta watoto walio na umri wa miaka 6 hadi 7 kushiriki katika mradi huu. Uchunguzi unatarajivwa kutochukua zaidi ya dakika 40 na utafanywa katika chumba tafauti shuleni. Mtoto ataulizwa kutaja majina za ishara tafauti za Bliss na kuunda maneno zao wenyeza za Bliss. Majaribio hayo yataweza kwenye ukanda kwa sababu za kikalimani. Mtoto yuko huru kukatiza ushiriki wake wakati wowote, lakini habari ambazo zitakuwa zimekusanywa mpaka wakati hu bado zitatumika.


Kama utakubalia mwanao kushiriki katika mradi huu shuleni, dhibitisha haya kwa kutia sahihi fomu iliopo ndani na uirudishe shuleni.

*Mimi wako*

<table>
<thead>
<tr>
<th>Simona Krstic</th>
<th>Elin Littorin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mradi wa usemi na lugha</td>
<td>Mradi wa usemi na lugha</td>
</tr>
<tr>
<td>Chuo kikuu cha Linköping</td>
<td>Chuo kikuu cha Linköping</td>
</tr>
<tr>
<td><a href="mailto:XXXX@student.liu.se">XXXX@student.liu.se</a></td>
<td><a href="mailto:XXXX@student.liu.se">XXXX@student.liu.se</a></td>
</tr>
</tbody>
</table>

*Mnyapara: Janna Aanstoot*

Mkufunzi mkongwe katika fani ya usemi na lugha

Chuo kikuu cha Linköping

XXXX@liu.se
Mimi kama mzazi/mtunzi wa mtoto huyu nimeshasoma habari kuhusu mradi huu na ninakubalia mtoto wangu kushirikishwa katika utafiti huu. Pia nina kubali ya kwamba habari nitakayo peana hapa chini inawezatumika katika utafiti.

Tarehe: ____________________________________________________________

Sahihi: ____________________________________________________________

Andika majina yote ya mtoto: _________________________________________

Tarehe yake ya kuzaliwa? Tarehe:_______ Mwezi: ________ Mwaka: ____________

Ni lugha gani mtoto huongea nyumbani? __________________________________

Ni lugha gani mtoto huongea vizuri sana? __________________________________

Soma maswali yafwatayo na uyajibu kulingana na uwezo wako na ujuzi, tafadhali weka NDIO au LA.

• Je mwanao anasikia kawaida? NDIO □ LA □

• Je mwanao anaona kawaida? NDIO □ LA □

• Je mtoto wako amekuwa kilugha sawa sawa na wengine wa umri yake? NDIO □ LA □

• Je mawasiliano ya mwanao imekua kawaida ikilinganishwa na wengine? NDIO □ LA □

Pendekezo: __________________________________________________________

________________________________________________________

________________________________________________________

___________
## 8.3 Appendix 3 - Symbol word list

### Part I. Single Bliss-words

<table>
<thead>
<tr>
<th>Target word</th>
<th>Bliss-word</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td><img src="image" alt="House" /></td>
</tr>
<tr>
<td>Car</td>
<td><img src="image" alt="Car" /></td>
</tr>
<tr>
<td>Boat</td>
<td><img src="image" alt="Boat" /></td>
</tr>
<tr>
<td>Book</td>
<td><img src="image" alt="Book" /></td>
</tr>
<tr>
<td>Crown</td>
<td><img src="image" alt="Crown" /></td>
</tr>
<tr>
<td>Animal</td>
<td><img src="image" alt="Animal" /></td>
</tr>
<tr>
<td>Person</td>
<td><img src="image" alt="Person" /></td>
</tr>
<tr>
<td>Hand</td>
<td><img src="image" alt="Hand" /></td>
</tr>
<tr>
<td>Foot</td>
<td><img src="image" alt="Foot" /></td>
</tr>
<tr>
<td>Protection</td>
<td><img src="image" alt="Protection" /></td>
</tr>
<tr>
<td>Head</td>
<td><img src="image" alt="Head" /></td>
</tr>
<tr>
<td>Cloth</td>
<td><img src="image" alt="Cloth" /></td>
</tr>
<tr>
<td>Table</td>
<td><img src="image" alt="Table" /></td>
</tr>
<tr>
<td>Floor</td>
<td><img src="image" alt="Floor" /></td>
</tr>
<tr>
<td>Bed</td>
<td><img src="image" alt="Bed" /></td>
</tr>
</tbody>
</table>

### Part II. Compound Bliss-words

<table>
<thead>
<tr>
<th>Target word</th>
<th>Bliss-word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boathouse</td>
<td><img src="image" alt="Boathouse" /></td>
</tr>
<tr>
<td>Garage</td>
<td><img src="image" alt="Garage" /></td>
</tr>
<tr>
<td>Castle</td>
<td><img src="image" alt="Castle" /></td>
</tr>
<tr>
<td>Driver</td>
<td><img src="image" alt="Driver" /></td>
</tr>
<tr>
<td>King</td>
<td><img src="image" alt="King" /></td>
</tr>
<tr>
<td>Sailor</td>
<td><img src="image" alt="Sailor" /></td>
</tr>
<tr>
<td>Glove</td>
<td><img src="image" alt="Glove" /></td>
</tr>
<tr>
<td>Shoe</td>
<td><img src="image" alt="Shoe" /></td>
</tr>
<tr>
<td>Hat</td>
<td><img src="image" alt="Hat" /></td>
</tr>
<tr>
<td>Tablecloth</td>
<td><img src="image" alt="Tablecloth" /></td>
</tr>
<tr>
<td>Sheet</td>
<td><img src="image" alt="Sheet" /></td>
</tr>
<tr>
<td>Carpet</td>
<td><img src="image" alt="Carpet" /></td>
</tr>
</tbody>
</table>
### 8.4 Appendix 4 - Error types for incorrect answers

Table 3. Error types for incorrect answers for part I (single Bliss-words) and part II (Compound Bliss-words). Error type, with definition and an example.

<table>
<thead>
<tr>
<th>Category</th>
<th>Definitions and examples of answer types</th>
</tr>
</thead>
<tbody>
<tr>
<td>No answer</td>
<td>When the answer is due to the child omitting a response or stating that they had forgot or did not known. E.g. “I don’t know”.</td>
</tr>
<tr>
<td>Visual</td>
<td>When the incorrect answer is due to symbols physical likeness to something other than its referent. E.g. “It looks like a window” for book.</td>
</tr>
<tr>
<td>Paraphrasing or association</td>
<td>When using more than one word when describing the target word or when associating to previously displayed symbols. E.g. “The thing for the king” for crown.</td>
</tr>
<tr>
<td>Letter</td>
<td>When the incorrect answer is a a letter. E.g. “Letter ‘i’” instead of person.</td>
</tr>
<tr>
<td>1Explanation, not with target word</td>
<td>When the answer clearly is associated to the given explanation without inclusion of the target word. E.g. “This is a person driving a car” for driver.</td>
</tr>
<tr>
<td>1Explanation, with target word</td>
<td>When the answer clearly is associated to the given explanation with inclusion of the target word. E.g. “This is the carpet that you put on the floor” for floor.</td>
</tr>
<tr>
<td>2Naming one single Bliss-word</td>
<td>When the compound Bliss-word was denominated with one of the two included single Bliss-words. E.g. “House” for castle.</td>
</tr>
<tr>
<td>2Naming both single Bliss-words</td>
<td>When the compound Bliss-word was denominated with the two included single Bliss-words, but not compounded. E.g. “House and boat” for boathouse.</td>
</tr>
<tr>
<td>2Incorrectly compounded</td>
<td>Incorrectly compounding Bliss-words that are related to the target word or single Bliss-words that are included in the compound. E.g. “Floorcarpet” for carpet.</td>
</tr>
<tr>
<td>2Wrong order</td>
<td>When compounding the included single Bliss-words literally. When the answer would have been correct if the order of the single Bliss-words was reversed. E.g. “Houseboat” for boathouse.</td>
</tr>
<tr>
<td>2Code switching</td>
<td>When code switching occurs within the given answer, with inclusion of the single Bliss-words that the compound Bliss-word consist of. “e.g. “Nyumba ya car” for garage.</td>
</tr>
<tr>
<td>Other</td>
<td>When the incorrect answer cannot be included in any of the other categories. E.g. “Stairs” for bed.</td>
</tr>
</tbody>
</table>

1 = Error types that only were included in the posttest.
2 = Error types that only were included in part II.
8.5 Appendix 5 – Percentage of error types for incorrect answers

**Figure 8.** Part I. Age six, Swahili-speaking children. Percentage of error types for (number of incorrect answers)

**Figure 9.** Part I. Age six. English-speaking children. Percentage of error types for (number of incorrect answers)
8.5 Appendix 5 – Percentage of error types for incorrect answers

Figure 10. Part I. Age seven. Swahili-speaking children. Percentage of error types for (number of incorrect answers)

Figure 11. Part I. Age seven. English-speaking children. Percentage of error types for (number of incorrect answers)
8.5 Appendix 5 – Percentage of error types for incorrect answers

Figure 12. Part II. Age six. Swahili-speaking children. Percentage of error types for (number of incorrect answers)

Figure 13. Part II. Age six. English-speaking children. Percentage of error types for (number of incorrect answers)
8.5 Appendix 5 – Percentage of error types for incorrect answers

**Figure 14.** Part II. Age seven. Swahili-speaking children. Percentage of error types for (number of incorrect answers)

**Figure 15.** Part II. Age seven. English-speaking children. Percentage of error types for (number of incorrect answers)