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Building Phonemic Awareness

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Abstract

Waag Society develops a tangible and intuitive tool for primary school children who just started learning to read. It provides pupils with an interactive system that invites them to unravel the mystery of word construction in a playful and explorative way. StoryBOX exists of a set of technologically enriched blocks, filled with different sounds (phonems). Every block contains a sound that can be listened to separately or in a series. If a series of phonems form a word, one doesn't hear the individual sounds, but the entire word.

Playing with StoryBOX, children will be able to distinguish and manipulate individual sounds and literally build or deconstruct words. Thus pupils will develop phonemic awareness in one of the most natural ways of learning – playing. Studies have shown that phonemic awareness has a direct correlation with students' ability to read as they get older. It improves children's word reading and reading comprehension, as well as helping children learn to spell.

Learning to read is mostly a serious and structured matter. StoryBOX offers children the possibility to discover language in an explorative way. Hence the exploration of the language is experienced as playing, rather than learning. Pupils build, change and combine out of their natural curiosity. This playful approach is meant to enrich existing educational formats, rather than to replace them.

The challenge in the developing process is to create a tool that satisfies the demands of language education, suits the practice of the teacher, and that offers pupils an exciting and effortless manner of learning. Therefore a key aspect of this project is to involve pupils and teachers in the design process to assure that the final product will suit their real needs.

1. Introduction

In this paper Waag Society's innovative pilot StoryBOX is introduced. One of Waag Society's core themes is Creative Learning. The interests and capacities of pupils are the focal point. In the context of learning, Waag Society attributes great importance to physical interaction in combination with novel digital possibilities.

Waag Society is an Amsterdam based media lab, researching and developing creative technology for innovative applications in the field of education, healthcare, culture and society, bridging virtual and real world experiences. The lab's aim is to make technology accessible for society, by creating pilots and prototypes. Its research agenda includes tangible interfaces, narrative structures, gaming principles, semantic web, mediated collaboration, locative media and design methodologies. One of the subjects that Waag Society has been experimenting with is play in education.

StoryBOX offers children the possibility to discover language in a playful and intuitive way. In StoryBOX tangible objects are used for language learning. Using auditive and tangible senses they can recognize characters, construct small words and experiment with language structures in a playful way. Waag Society aims on developing a tool within the context of the Dutch educational system which focuses on an important early step on learning to read: phonemic awareness.

In this paper language and education context and the specific features of StoryBOX will be presented.

2. Pre-reading skills

The target group of StoryBOX consists of pupils aged six/seven. StoryBOX focuses on language education for the youngest primary school pupils. At the age of six, children in the Netherlands leave nursery school and attend so called 'group 3'. In this first-grade of primary school they – amongst other things – start learning to read and write. Two important early steps in learning to read are phonemic awareness and letter-sound correspondence. In StoryBOX these principles of language can be discovered in a playful way.

2.1 Phonemic Awareness

Sensenbaugh [1] states that while most kindergarten children have mastered the complexities of speech. However they do not know that spoken language is made up of discrete words, being composed of syllables, which themselves are made up of the smallest units of sound, called "phonemes". This awareness that spoken language consists of discrete sounds appears to be a crucial factor in children learning to read.

Phonemic awareness is often confused with phonological awareness. Phonological awareness refers to an awareness that words consists of syllables, onsets and rimes, and phonemes, and therefore can be considered as a broader notion than phonemic awareness [1]. Phonological awareness includes phonemic awareness.

Phonemic awareness is a critical pre-reading skill [2]. Children must become aware that words are made up of sounds that get combined like interchangeable parts to form new words. Research shows that children who develop phonemic awareness and letter-sound knowledge early on are more likely to be strong, successful readers. Phonemic awareness has a direct correlation with students' ability to read as they get older. It builds a foundation for students to understand the rules of language. [3] Research indicates that phonemic awareness is the best predictor of the ease of early reading acquisition, better than IQ, vocabulary and listening comprehension. [4]

StoryBOX offers a playful environment for practicing common phonemic awareness skills, as listed below.

- Phoneme isolation: recognition of individual sounds in words.
- Phoneme identity: recognition of a common sound in different words.
- Phoneme substitution: turning a word into another by substituting one phoneme.
- Oral segmenting: analysing the individual sounds of a word.
- Oral blending: blending individual sounds into a word.

In most methods for practicing these skills, the interaction between pupil and teacher is required. With StoryBOX pupils are able to practice independently without direct input of the teacher.

2.2 Letter-sound correspondence

StoryBOX offers children the possibility to develop not only the phonemic, but also the letter-sound awareness. Research shows that understanding of how spoken words map to printed words in text is an important skill in close relationship with pupil's emerging phonemic awareness [5]. Although phonemic awareness is a necessary condition for learning to read, it is not a sufficient condition. It is critical for children to be able to link phonemic awareness to a knowledge of letters [1]. Once beginning readers have some awareness of phonemes and their corresponding graphic representations, research has indicated that further reading instruction heightens their awareness of

language [6]. Spector [7] recommends combining training in segmentation and blending with instruction in letter-sound relationships.

3. Physical & Playful Learning

Waag Society attributes great importance to physical interaction in combination with novel digital possibilities. Physical play can enhance the learning experience, as is for instance shown in research on embodiment and gestures in mathematics education and on embodied media learning environments [8]. Especially playing with blocks can stimulate language education. Children learn to place the blocks on a line. They learn to play with structures, which stimulate the brain for language learning [9].

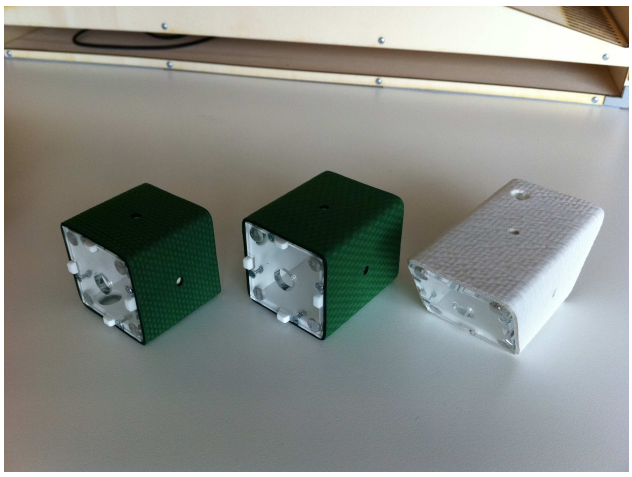
Russ [8] states that gaming environments provide us a safe and relaxed place to experiment and explore the world. By playing games, cognitive and affective processes are practiced such as problem solving, vocabulary, social skills and empathy.

Up to the age of six children are allowed to play inside and outside the classroom, but that suddenly changes in group three, which can create difficulties for some children. Playfulness, multisensory stimulation and affective and social activities become less free and less prominent within school. Learning through playing becomes learning by being taught. Young children like to play, but formal education, from approximately the age of six and upwards, focuses for a large portion on cognitive development.

StoryBOX creates an accessible and intuitive method for exploring language and for developing phonemic awareness in particular. This suits recommendations for phonemic awareness activities not only to keep a sense of playfulness and fun, and avoid drill and rote memorization, but also to encourage children's curiosity to experiment with language [6]. Yopp also recommends to make sure the tone of the activity is not evaluative but rather fun and informal. Because of the audio and the tangible quality of the interactive blocks, the exploration of the language is experienced as playing, rather than learning. Pupils build, change and combine out of their curiosity, using various senses.

4. StoryBOX

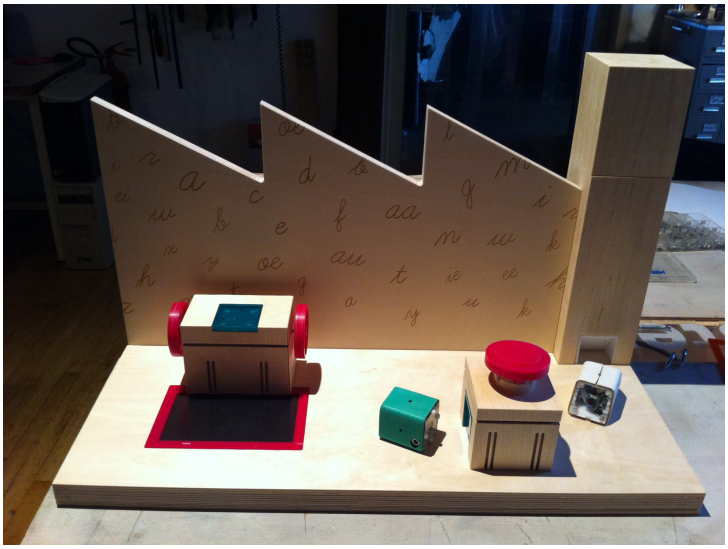
StoryBOX consists of various parts: a number of tangible, technologically enriched blocks, a factory-shaped box and a couple of headphones functioning as stethoscopes for listening to the sounds in the blocks.



The square blocks contain 'short sounds': consonants and short vowels. The rectangle blocks contain long vowels. This differentiation between short and long vowels is made because in Dutch the letter a can be pronounced as the short /a/ or as the long /a/. Pronouncing /man/ (Dutch word for 'man') with the short 'a' is a different word then pronounced /man/ (Dutch word for 'moon'). Hence the long or short pronunciation of a vowel is semantically differentiating in Dutch. This principle counts for all vowels in Dutch.

Apart from the square and rectangle blocks, there are also trapeze shaped word blocks.

Every block contains sounds that can be listened to individually or in a series, using a 'stethoscope'. Pupils are challenged to form words out of the sounds. For example, when the 'v'-sound is linked to the 'i'- and 's'-sounds, one hears 'vis', Dutch for 'fish'. When the combined sounds do not form a word, the user hears nothing but the separate sounds.



The 'Factory' provides a tool for the pupils to change the sounds in the blocks. By connecting a sound-block to the radio-tool, one can search for a different sound by tuning the radio. Once the sound one was looking for is heard through the stethoscope the corresponding letter has to be written on the touch-screen. If this is successfully done, the sound-block is loaded with that particular sound.

The 'Factory' also provides a 'machine' for loading word-blocks. At the left side of this tool one puts in the connected sound blocks, on the other side one puts a word block. By pushing a big button the word will be loaded in the wordblock.

The third feature of the 'Factory' is the chimney. The chimney prints out the words that are manufactured once a word block is connected to the 'fire place'.

The stethoscope is made out of two 'half' headphones. With StoryBOX pupils will be working together in pairs. To make sure a pair is still able to communicate, each headphone only covers one ear. Because the headphones are connected to the same stethoscope both players get the same auditive feedback.

Pupils not only get auditive feedback by listening to the sound- and wordblocks, but also are challenged to write down the corresponding letter of a sound on a touchscreen in the 'Factory'. With StoryBOX after all we also aim to address the important link between phonemes and their graphic representation: letters. In case pupils have difficulty writing a certain letter, the touchscreen provides a presentation which can be traced. In addition there is a little screen on the stethoscope on which the sound (consonant, vowel or word) that is listened to appears in text. To complete their word construction it's possible for children to print the word at the chimney.

5. Prototyping with users as designers

StoryBOX is being developed through the method of *users as designers*. *Users as designers* is the main design philosophy of Waag Society, in which creative research is put into practice. It holds that design requirements should be defined by real users and not by organizations, panels or marketers. *Users as designers* is a combination of existing and customized participatory and empathic design methods that help to facilitate the dialogue needed to illicit personal and contextual information that helps define the user's needs and wants. [10]

This paper gives an overview of the functionalities of StoryBOX up until now, halfway the development of the third and last prototype. In earlier stages of the development process two other prototypes of StoryBOX have been tested with pupils. Prototypes are tested and evaluated with users to make sure it meets their needs. The aim is to investigate whether a product or service can be successful for a (larger) user group.

At every stage in the design process of StoryBOX several tests with children are carried out and based on their reactions the design was adapted. In addition, a group of experts provided feedback. The experts were teachers, researchers of language education and special needs teachers.

The first prototype started out with soundblocks and a stethoscope. In the first test series in spring 2011, four tests with four pupils were carried out. For the second prototype results of the first testing phase have been used. This resulted in the factory design to challenge pupils to be producers and creators of language [11]. Another series of tests has been performed with four other kids. This resulted in several functional adaptations of the 'factory', to make the flow of building words out of sounds more intuitive.

The third and last prototype of the StoryBOX-project, as described in this paper, will be tested in autumn of 2011. In these user evaluation sessions the development team will focus on game and educational logic, tactility and materials and logistics of the factory metaphor.

6. Reflection

After the testing of the prototype a team of researchers will examine the effects of StoryBOX on language learning. The physical interaction in combination with novel digital possibilities is an important focus in every of Waag Society's projects. For the StoryBOX-project in particular we are particularly keen on the value of this innovative tool on children's writing- and reading-skills. We expect that pupils may benefit from new forms of learning that address more senses. Language learning based on sounds enable children to activate their brain in a different way. We hope results will show that children learn to read easier after having discovered phonemes and their corresponding letters by playing with StoryBOX than the children who only learn from pure textbook methods.

7. Acknowledgements

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References

[1] Sensenbaugh, R. (1996). *Phonemic Awareness: An important early step in learning to read*.

[2] Burns, M.S., Griffin , P. & Snow, C. E. (eds.). (1999). *Starting Out Right: A Guide to Promoting Children's Reading Success*. Bloomington, IN: ERIC Digest

[3] Snider, V.E. (1997). *The relationship between phonemic awareness and later reading achievement*. Washington, DC: National Academy Press

[4] Stanovich, K.E. (1993-94). *Romance and Reality (Distinguished Educator Series)*. Reading Teacher, 47(4), 280-91

[5] Morris, D. (1993). *The relationship between children's concept of word in text and phoneme awareness in learning to read: a longitudinal study*. Research in the Teaching of English, 27 (2), 133-154.

[6] Yopp, H.K. (1992). *Developing phonemic awareness in young children*. Reading Teacher, (45 (9), 696-703.

[7] Spector, J.E. (1995). *Phonemic awareness training: application of principles of direct instruction*.

[8] Russ, S. (2004). *Play in child development and psychotherapy: toward empirically supported practice*. Reading and Writing Quarterly: Overcoming Learning Difficulties, 11(1), 37-52.

[9] Nieuwstadt, M. van (2010). *Brabbelen met blokken* newspaper article NRC (December 24th - 2010)

[10] Dijk, D. van, Kresin, F., Reitenbach, M., Rennen, E. & Wildevuur, S. (2011). *Users as Designers. A hands-on approach to Creative Research*. Amsterdam: Waag Society.

[11] Reitenbach, M., Dijk, M. van, Resink, E. (2011). *Exploring playful language education through co-creation with children*. Paper presented at the 19th International Conference on Computers in Education - ICCE 2011