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Diagnosis of Literacy through the Application of Digital Technologies

1. Introduction

At least a decade ago in Slovakia, the need for innovative approaches to the development of pre literacy as well as digital literacy in kindergarten was declared. There are a number of publications on this issue (Kalaš 2011, p. 28–29; Kostrub, Tothová, Severiny, Kikušová 2014). But we found (Petrová 2005, p. 176, Valášková 2008, p. 177–182) that in educational practice, the innovative approaches are applied by the teachers to a modest degree. Teachers have superficial knowledge of them and do not know how to apply them in kindergartens. They prefer using the behavioral method of education (see the results of the studies, for example (Gašparová 2011, p. 74). The purpose of this article is not to search for and analyze the causes of the absence of high-quality, scientific and professional literacy stimulation (see example Zápotočná, Petrová 2010, p. 91). Rather, it is our goal to find a starting point. We have decided, therefore, to present one possible method for the development of literacy, which in both research and in practice was proved to be functional (see Section 3). Of the total quantity of options available to stimulate literacy through digital technologies, we decided to focus on those that can positively affect the kindergarten preparation of conventional reading in first year of elementary school. Specifically, we created the first pilot version of activities aimed at the development of phonemic awareness. We have created a stimulative computer program called "Phonemes – our friends", with one part used for the diagnosis of the player's level of phonematic

Journal of Preschool and Elementary School Education 2/2014 (6)

awareness. We thereafter conducted a stimulus program in a study (see Section 3). There were three basic reasons to develop this program, which we present in the following chapter.

2. Justification

2.1. Phonemic awareness and its position in the context of a complex development of literacy as the first reason.

It is a well- known fact (Adams 1995, p. 494; Stanovich 2000) that the phonological skills of children are a prerequisite for successfully learning conventional reading. Phonemic awareness is the most important aspect of phonological awareness. They both present a kind of developing sequence, which has its own patterns (Adams 1995). While lower levels of phonological awareness may develop in children spontaneously (creation of rhyming words , differentiation of words to sounds which are not carriers of meaning, i.e. the differentiation of words to syllables), the higher levels of phonemic awareness (differentiation of words to phonemes and manipulation of them) need to be regularly and systematically developed. This kind of development should be ensured and actively supported, especially in kindergarten. But the reality is different in many kindergartens in Slovakia. On the basis of research findings (Valášková 2008, p. 177–182) it can be stated that the activities aimed at developing phonological skills are done unsystematically and these are also limited to trivial "distinction" or even "the perception of sound" activities. Already on the basis of the terminology, it is evident that in such cases the educational activities occur only in the context of behavioral approaches. In this type of education there is no space for an individual and cooperative approach which applies techniques and strategies that would lead the child to learn not by drill or memorization, but with understanding. In developing phonemic awareness it is basically unrealistic to stick to the frontal teaching method only. There should instead be a systematic complex of educational activities developed with regard to the developing sequence of this awareness, with a view to the development and formation of cognition of the child,

as well as with regard to his social and cultural environment. The bottom line is that the child begins to be consciously oriented in the sound structure of language, to understand the structure of language (see example: Mikulajová, Dujčíková 2001, p. 83; Petrová, Valášková 2007, p. 65). And this can be achieved not only through he use of natural language, but also by conscious, explicit teaching. Phonemic awareness alone is a prerequisite for the understanding of the abstract of grapheme and phoneme correspondence (Adams 1995), which is necessary for teaching reading and writing techniques (decoding) in the first year of elementary school. In Slovakia this is (unfortunately) used only with an analytic-synthetic method. But for children (especially preschool) it is very hard to understand this abstract system. So far, phonemic awareness has been dealt with in the framework of scientific disciplines outside pedagogy. A number of studies by speech therapists and cognitive psychologists have shown that phonemic awareness is a predictor of school success (see example: Carroll, Snowling, Hulme, Stevenson 2003, p. 913–923) as well as a precursor of learning disorders, especially dyslexia (Caravolas, Mikulajová, Vencelová, 2008, p. 98). At present, the systematic development of phonemic awareness is finally considered to be very important in pedagogy as well (see example: Petrová, Valášková 2007, p. 65). Although phonemic awareness is not enough to teach a child to read with understanding, it is a prerequisite condition for the introduction of the techniques of reading, as we have already pointed out in the introduction. If we want to develop different levels of phonemic awareness, it is necessary to first diagnose the individual phonemic awareness level in each child.

2.2. The absence of a diagnosis of phonemic awareness in kindergarten as a second reason

A diagnostic tool for nursery schools has yet to be developed for the diagnosis of early literacy, and also for the diagnosis of phonemic awareness. It was drawn up only for practice (see example logopedics diagnostic : Mikulajová 1995, p. 39–67; Nádvorníková 1995, p. 122–145). But, there are differences between logopedics and educational diagnosis. Speech therapy diagnosis is mainly focused on children with special

needs; looking for particular deficiencies and deviations from the norm; particularly trying to quantitatively analyse performance. It is implemented primarily through a battery of tests; the therapeutic diagnostic and the diagnostic therapy are usually strictly separated. The view of the educational diagnosis changes (see example: Gavora 201, p. 9–25). Traditional diagnosis is replaced by a dynamic diagnosis (Pupala 2001, p. 201), which focuses on the monitoring of progress and the process of changes in a child. In fact, there was no diagnosis in Slovak kindergartens. Now there are training materials available which can be used in the framework of pedagogic diagnostics in kindergarten (Valachová 2009, p. 45). But, the diagnosis of phonemic awareness here is reduced to general recommendations for practice, without more specific and systematically arranged examples. In our incentive program, "Phonemes – our friends", we have created a specific diagnosis of phonemes. Diagnosis is part of the stimulation process and it has a "developing" character (Pupala 2001). It is carried out before, during and even after the promotion has finished. Otherwise, the educational intervention would not have the desired effect. We used computer and other digital resources for the construction of the incentive program – "Phonemes – our friends". We have tried to encourage the development of digital literacy as part of early literacy.

2.3. Digital technologies as tools to promote the development of phonemic awareness as the third reason

Digital technologies are currently being used by children at an early age and are already part of their lives. This is evidenced by a survey (Lacková 2008, p. 155): the computer is actively used not only by 6 year-old children, but by four-year-old children as well. Children before joining the first class of elementary school know how to turn the computer on and off, and know how to use the mouse. Parents support and endorse their interest in computers (Lacková, Valášková 2011, p. 1–8). Based on our surveys and observations in practice, we agree with the views of experts (Gašparová 2011, p. 74; Kalaš 2011, p. 28–29; Kalaš 2013, p. 256 etc.), who consider it to be necessary to have children in kindergarten learn to work with computers and other digital resources in a systematic way. We

have verified that children of preschool age (Lacková 2011, p. 142), on the basis of targeted stimulation, can handle the use of computers on the elementary level. We have tried therefore to encourage the interest of children in digital technology and use it to stimulate phonological awareness in preschool children. In our incentive program "Phonemes – our friends" (see Section 4), the use of the computer is essential. Therefore, if we want to develop digital literacy among children, it is also necessary for the educators to have this competency, and also to develop it further. One of the reasons why we created an incentive program through computer use, was an effort to inspire nursery school teachers to work with computers. Also, from a practical point of view, we saw the attempt to stimulate phonemic awareness through audiovisual means as useful and functional. Our program is based, in particular, on the spoken language. It is mainly based on listening, rhyming, dividing words into syllables and, later, the allocation of phonemes. Children can perceive abstraction (like the syllable and the annoucement) not only in audio form, but also visually through so-called placeholders, which are later replaced by the letters.

3. Research verification of the pilot program "Phonemes – our friends"

The pilot version of the incentive program we´ve created includes 15 interactive presentations (Lacková, Valášková 2011a, p. 1–8; Lacková, Valášková 2011b, p. 298–308). We have also created a pilot version of the diagnostic tool, which is a set of diagnostic tasks. When compiling, we respect the levels of phonemic awareness development (see sub-section No 2.1). Tasks are sorted by difficulty (from lowest to highest, rhyming identification-the ability to manipulate with phonemes). The diagnostic tool we used as a research tool.

3.1. The methodology and realization of the research

The basic aim of the research was to diagnose the level of phonemic awareness among children in kindergarten, before and after the

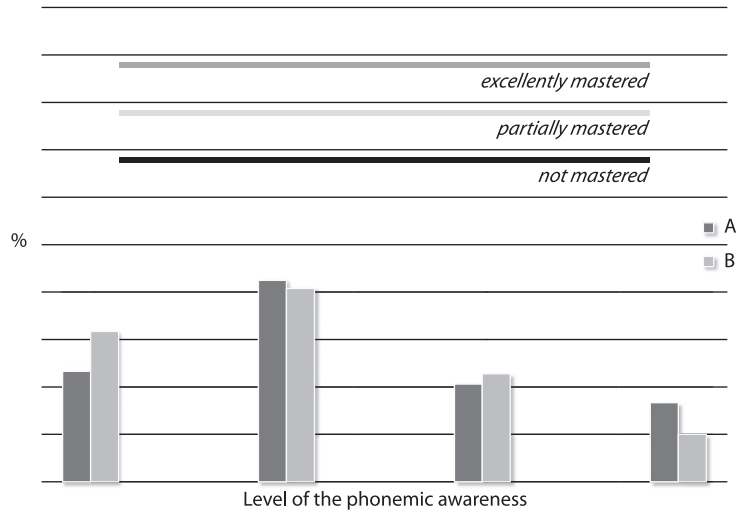
application of the pilot version of the educational program – "Phonemes – our friends". The research method was an experiment. We wanted to verify the stimulus program in kindergarten and at the same time determine the effectiveness of the research (diagnostic) instrument. The research sample consisted of 30 children. In one class, we created an experimental group (A), where we used our program, and in the second class we compiled a control group (B), where the children's education continued without this stimulus program, as well as without further deliberate stimulation of phonemic awareness. Each of the two groups consisted of 15 children under the age of 5. Our aim was to determine the progress (or subrogation) in phonemic awareness in children in kindergarten, and not only in the group where we applied the program, but also in the group where this program was not used. Therefore, we established two basic assumptions (hypotheses): 1. the level of phonemic awareness will be higher among children (experimental group) after the application of the program, compared with the level before the application. 2. The level of phonemic awareness among children (experimental group) who worked with the program will be higher than the level of children (the control group), who worked without it. The diagnosis was carried out in two stages, with a 2.5-month break. In both groups (A, B), we used the same method of diagnosis, both before and after the experiment, i.e. pre-test and post-test. When phonemic awareness is being diagnosed, each child works on the tasks separately and can choose from a number of options. The pre and post-test diagnostic data obtained was entered onto the recording sheet, assessed, and comprehensively evaluated, based on prepared assessment categories. We further processed the data into tables and graphs (see more: Lacková, Valášková 2011).

3.2. The results of the pretest of pilot studies

We diagnosed 4 levels of phonemic awareness with a pretest: a) the ability to identify rhymes, b) the ability to divide words into syllables, c) the ability to divide words into phonemes, d) the ability to manipulate the phonemes (see Graph 1). Concerning the identification of the rhymes, we found that in the experimental group, only 1 child was able to find all

the words that rhymed. Other children rather accidentally solved the task and, when talking with them later, they could not distinguish or create a simple rhyme. Therefore we complexly consider this level as not mastered. We saw similar results in the control group as well (see Graph 1). It was a surprising fact for us as we assumed that the children would be able to identify rhymes, since they repeat various rhymes on a daily basis in kindergarten. However, in line with other research (see Section 1), we found that they are not able to create rhymes, this should be systematically and purposefully taught. Therefore, our software includes these types of tasks. Regarding the tasks aimed at diagnosing the ability to divide words into syllables, we found that only 5 children from the experimental group (A) were 100% successful in syllabizing. This was an interesting finding for us, because in kindergarten such activities are carried out, but clearly without the desired effect, as is also confirmed by other studies (see Section 1). Since some of the children solved at least part of the tasks, we considered the level of dividing the word into syllables in this group as partially mastered. In the control group (B), the results were similar to those in the experimental group (see Graph 1). Only four children from all

Graph 1: Comparison of the pre-test results of the control (A) and experimental (B) groups.

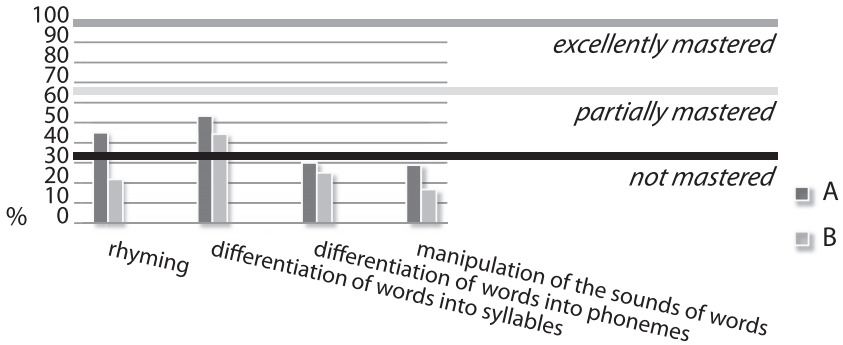


groups successfully completed the tasks on syllabizing. These results make us sure that activities of this type should be systematically and thoughtfully included in kindergarten education. Therefore, we also included systematic activities on syllabizing in our incentive program. Through the tasks aimed at diagnosing the ability to divide the words into phonemes we found that in the experimental group (A), no child had a 100% success rate. Only 3 children successfully identified the phoneme at the beginning of the word. The whole group was unable to identify the phoneme at the end of the word and assign the graphic symbol to the phoneme. Some of the children gained points by accidentally solving the task and 11 children (73%) could not solve tasks of this type at all. Therefore, we diagnosed the level of spelling as not overmastered in the experimental (A) as well as in the control group (B). Both groups had very similar results (see Graph 1). We assumed such results before the application of the program. The reason was that the vast majority of children did not know how to syllabize or assign the appropriate graphics scheme (see results below). And a mastered level of conscious syllabizing is an obvious precondition for completing such tasks. It should be noted that the division of words into phonemes is a very difficult task for children of preschool age, if they are not deliberately prepared for this activity. We have therefore included tasks on spelling-the division of the words into phonemes in our incentive program. We assumed that the experimental group would be more successful in solving the tasks on spelling in the posttest. Based on diagnosing the most difficult level of phonemic awareness – the ability to manipulate with phoneme, we evaluated this level as not mastered both in the experimental and control group (see Graph 1). Again, we expected such a result, since such educational activities are not implemented in kindergartens. It has been confirmed that achieving the highest level of phonemic awareness is not spontaneous and there is a need for a systematic stimulation in kindergarten, and continued stimulation in the first year of elementary school. So, children in both groups had nearly the same results in the pretest. Almost all of the children managed to solve only some of the tasks aimed at syllabizing and were unable to solve the tasks of a greater difficulty together with the tasks aimed at rhyming.

3.3. The results of the validation of the pilot posttest

After comparing the values in pretest and posttest in both groups for the level of identification of rhymes, we found that the children in the experimental group (A), which worked with the stimulus program, reached a higher score in the posttest. There has been progress. In contrast, among children in the control group (B) we could see the stagnation to subrogation (see Graph 2). The results of the research show that in 2.5 months there was no progress in kindergarten without the systematic stimulation of phonemic awareness. However, we observed progress in 2.5 months in the experimental group (A), solving the tasks aimed at dividing the words into syllables. In posttest they reached a higher score and were more successful than the children in the control group (B), (see Graph 2). These children, after the educational program "Phonemes – our friends", began to understand the concept of long and a short syllables, and mastered the matching of graphic schemes to words. In the control group, there was no progress. Once again it is confirmed that without intentional stimulation, children may prove to divide words into syllables. But, they are doing it rather intuitively and not with understanding, because they do not know how to work further with syllable schemes. Also, in the evaluation of the tasks focused on the division of words into

Figure 2. Comparison of the post-test results of control (A) and experimental (B) groups.

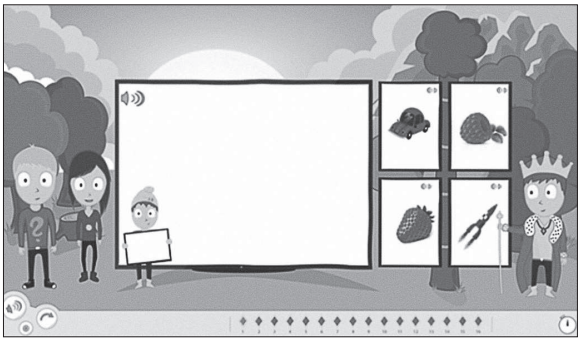


phonemes, we saw progress in the experimental group (A). In comparison with the control group (B), they were more successful (see Graph 2). Again, we expected improvement. It is confirmed that in order to achieve the highest level of phonemic awareness there is a need for a longer term of phonemic stimulation. Even though for many of the children the tasks were difficult, some of the children solved them. It was confirmed that even the most difficult tasks can be included in kindergarten programs.

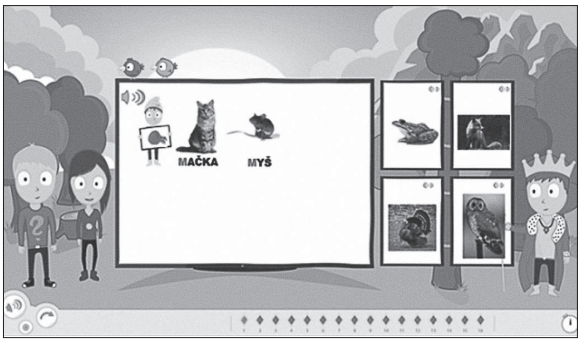
4. Characteristics of an upgraded program "Phonemes – our friends"

In our research, we found that some of the children in the experimental group refused to deal with the tasks that they failed to solve in the pretest. Therefore, we have modified the pilot version of the program before its further use in practice in kindergartens. We have prepared proposals for improving the technical and graphic quality of the digital content of the educational program (see examples below), but we have also enriched it with other activities outside the virtual environment. They are funny and they serve to eliminate the stress of failure, which therefore encourages the stimulation. Our goal is to enable children to deal with the tasks collaboratively and with understanding. We have extended the stimulus program (see more Lacková, Valášková 2014) by: 1. Including additional activities carried out by other digital means (e.g. programmable toys: Bee-Bot, a digital camera, a digital microphone, etc.), as well as activities without using a computer (e.g. games with building blocks, plasticine, combining tangrams), which should support more comprehensively the systematic development of phonemic awareness through the "collaborative learning" (see more: Kostrub 2008, p. 171). We have accepted the progress of phonemic awareness. In a modified version of the program, the activities are also arranged systematically – from the simplest to most difficult, and are put into three files (A. the identification of the syllables and rhymes, B. identification of phonemes, C. dealing with phonemes). There is no requirement that all the tasks with the highest difficulty must

Examples of a computer program



Sample 1: Identification of the messenger - introductory scene to identify the first sounds in a word.



Sample 2: Successful solution in the first section of the activity - assignment of words (names of animals) beginning with phoneme using the placeholder- phoneme M

be mastered by all children. Due to their individual abilities, we assume that many children will be able to successfully resolve the most difficult tasks only after entering the first year of primary school. Therefore, the program is designed not only for preschool children, but also for children in preparatory year of elementary school. It could also be of help to pupils in the first grade of elementary school, mainly in the initial stages of the teaching of reading. In addition, the stimulus program primarily develops the phonemic awareness in a framework of a complex stimulation of

preliteracy, secondarily, it develops the digital literacy of preschool children. Interactive activities are drafted into the form of the game with a story. The characters are of a "linguistic" world. We have created them specifically as material tools to assist in the modeling of mental activity in the light of the principles of mediated learning. Another aim of the program is to expand the vocabulary of children by implicitly exploring (meta) linguistic terms (the phoneme, question mark, syllable, sentence, verse, rhyme, dot). At the same time, children have the opportunity to expand their vocabulary learning the names of animals, as the program is monothematically aimed at this issue. Through the program, we implicitly support the development of written language. Almost all of the activities contain tasks in which we purposely place the entire words in written form written in capital letters. Our goal has also been to promote a strategy for global reading. Some of the more cognitively difficult activities therefore require the child to link the individual phonemes with graphemes. Through this computer program the kids work without the help of the educator and at their own pace. They must find the correct solution separately. The child may check the success rate in solving tasks themself, through the responses of the characters he also receives feedback. The child advances from an easier to higher level of activity only when it is meaningfully completed. Scoring is recorded in the final table, which is displayed at the end of the session (see more: Lacková Valášková 2014). This assessment may also serve as an individual diagnosis for the educator.

Conclusion

Kindergartens in Slovakia lack a program created with the help of computer and digital technologies, which would systematically develop phonemic awareness of children. Therefore, we tried to create this type of educational program accepting current theoretical basis, but also the needs resulting from practice. We hope the final version will be applied in teaching practice in kindergartens.