Digital Technologies at Preschool: Class Scenarios

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Abstract: Digital technologies are intensely entering preschool education. Because of this the teacher has to solve a broad palette of questions: from his/her own professional development through the choice of appropriate technologies and activities to very practical questions of managing children. Integral part of our ongoing research in preschool classes is to (i) consider pertinence of various kinds of digital technologies for that age group, this learning environment and learning goals; (ii) design and evaluate concrete software environments and their integration into complex activities; and also (iii) inquire about possible scenarios and questions related to organizing such activities in a preschool class. In our paper we specify four types of scenarios which proved to be adequate. We present our observations from concrete learning situations. We discuss their benefits and drawbacks, the options they offer to the teacher, who exploits digital technologies for developing cognitive skills of children.

Keywords: digital technologies integration, preschool, class management

1. Introduction

Digital technologies (DT) are interesting and inspiring for various groups of users, preschoolers not being any exception. This phenomenon is being reflected by curricular documents on preschool education in many countries all over the world. Many children\textsuperscript{1} commonly meet such technologies at their homes as well. Thus, many questions emerge for the preschool teachers, including the following:

\begin{itemize}
  \item Will DT help fulfil my teaching goals in better (i.e. more efficient, attractive, safe and realistic) way?
  \item Which DT should I employ when working with my preschoolers?
  \item How should I work with children and DT?
\end{itemize}

\textsuperscript{1}this is true for many countries – unfortunately, not for all
- What will children gain by exploiting such tools?

There are many research studies, which explore the issue of 5 to 6 year old children working with modern technologies from various aspects, see e.g. (Hayes and Whitebread, 2006), (Fails, et al., 2005), (Wyeth and Wyeth, 2001), or (Yost, 2003). Among them, we can find reports from psychologists, educators, sociologists and computer scientists. The topic is highly attractive and has a potential to be examined by various disciplines. It is of particular concern to us mainly because of its educational and informatics context. In our preschool research\(^2\) we are engaged in designing adequate educational software environments (interventions), developing and implementing them into complex activities. We explore different kinds of DT and search for safe and productive ways of their integration into learning processes of preschoolers. We work with a concrete preschool class throughout a school year. We collaborate with the teacher in order to prepare and conduct activities with integrated DT on a regular weekly basis.

In our research, however, we are constantly confronted with a whole spectrum of practical problems – most of them will also emerge in front of a teacher who will adopt and apply our (or similar) new pedagogies. Note, for example, that the teacher going to use DT must himself/herself be digitally literate, must know (in many senses) how to work with various types of technologies. Beside didactical questions and proper choice of DT, he/she must cope with secure and efficient integration of DT into the preschool learning environment and solve many practical questions of managing the group of children working with DT, see Figure 1.

![Figure 1](image_url)

Figure 1 Teacher is expected to solve a palette of conceptual and practical questions.

In our research, we have already designed and conducted several kinds of activities. If we try to classify them into categories, we can do it along two following variables: digital technologies and size of the group of children. Figure

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\(^2\) In Slovakia, preschool education is organized nation-wide as the last school year of the kindergarten, for all 5 to 6 year old children. So far, it is not compulsory but recommended for all children who then – at the age of 6 – enter official schooling. However, at present we are in the process of transforming the preschool year into regular and compulsory education.
2 shows a table where horizontal axis represents five sectors of DT which we have implemented in our preschool class so far; vertical axis represents various sizes of groups of children we are working with in the classroom. Inside the table, each dark circle depicts that we have already applied corresponding DT with that particular size of the group of children in one or several activities.

<table>
<thead>
<tr>
<th></th>
<th>programmable toys</th>
<th>domain specific software</th>
<th>domain free software</th>
<th>tools for research</th>
<th>tools for media creation</th>
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<tbody>
<tr>
<td>one-to-one</td>
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<tr>
<td>small group</td>
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<td>large group</td>
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<tr>
<td>entire class</td>
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</table>

Figure 2 Activities, which we have run so far, can be classified according to two criteria.

2. Various Scenarios of Working with DT

As researchers working in the preschool environment, we have our research goals and therefore it is sometimes convenient for us to work with individual child, at another time to work with the whole class or its part. Based on our existing experience, certain scenarios of related activities are gradually materializing. In our paper, we will characterize in detail each line in Figure 2, i.e. various types of activities from the point of view of organizing children into groups of different sizes.

Scenario 1: Working with one child

When a teacher individually works with a child, an interesting situations occur. 

Example A: A child is drawing on the computer and the teacher is assisting her. The child is working in the domain free software environment, she is getting familiar with its functions and also with handling the mouse, tablet or touch-screen display. The child proceeds step by step from simple drawing to the use of the Undo function, stamping and filling area features. At last she puts her ‘digital signature’ on the picture – by stamping the initial letter of her name. The software also allows to paste photography of herself into the picture.

Benefits: The face-to-face work with a child enables the researcher to focus fully on the defined research subject. He/she doesn't have to deal with other organizational issues, he/she can entirely concentrate on the interaction with the child. Such scenario brings some benefits to the teacher as well. Although current

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3 a child-friendly graphic editor
digital technologies offer advanced possibilities of interactivity and feedback, individual work of a teacher with a child and educational environment presents additional contribution to the child's learning. Children's encounters with DT are enhanced when practitioners use guided interaction (Plowman and Stephen, 2006) instead of reactive supervision. Teacher gets to know the child closer, in more personal way. This experience can help her:

- to adapt digital technology and its settings so that it better suits individual needs of the child,
- to define and elaborate the difficulty levels for the activities the child will solve,
- to integrate the work with the technology into broader context so that the child can better grasp the abstraction set by digital technologies.

Most of the preschool children like painting – this is true mostly for girls. However, some children avoid it. Still, all boys of our partner preschool class have enjoyed painting on the computer since it is dynamic and interactive.

Figure 3 Graphic editor customized for young children’s drawings.

Janko was afraid of painting. He didn’t want to draw on the computer. He became more self-confident when his friend sat near to him and to the computer. When Janko was trying to draw with stamps, brushes and filling areas, he enjoyed this kind of drawing and the presence of his friend was not needed anymore.

**Drawbacks:** Individual work with DT is problematic because of the need to provide activities for the whole class simultaneously. It requires active involvement of one or more teachers or adult assistants. One or more teachers can work individually with each child. At least one teacher is still needed to work with other children. This scenario is hardly manageable in our kindergartens at present\(^4\) and occurs rarely and only in exceptional occasions.

\(^4\) one teacher in the classroom most of the time
On the other hand, frequent individual work might suppress development of other competencies of a child since he/she has to learn to share his or her (technological) toy with another child, put up with others' needs as well as to compromise in common problems. The number of digital toys or computers is also the limiting factor for the individual work with children.

**Reflection:**
- Individual work with children has enabled us to carefully observe and understand children's personalities. We have had enough space for individual dialogues, taking notes and studying their progress. Children loved to tell us about the experiences they liked or disliked.
- Many children got used to some features of the graphic editor very fast (e.g. Undo function, cleaning up entire canvas etc.).
- Individual work with children gave us precious opportunity to customize the desktop environment: we hid several control tools, changed the size and shape of drawing tools and so on. Subsequently, we tested all improvements with other children and iterated the changes repeatedly.

**Scenario 2: Working with a small group**

We consider a group of children to be small if it has from 2 to 5 members.

**Example A:** Together with their teacher, a group of children has created a map of a town with number of buildings and roads from the paper mats. They have placed several toy figures on the town plan. Afterwards they use a programmable toy robot, they program it so that it moves to specified place and beeps. They interpret the sound as the sound of an alarm clock – it **wakes that figure up.** First they awake all figures in the same way, then they think out and solve other tasks for the programmable toy (**let's drive the sick squirrel to the vet, let's carry the shopping to the Grandma** etc.)

**Benefits:** Working in small groups gives children the potential to acquire collaborative experience and build team relations. The personality of each child and self-expression gets enough space – especially in comparison to scenarios 3 and 4. Working with one concrete technology and a small group of children is easily guided by the teacher. One child can use the technology for certain time, others watch him/her – they can learn, help the others or argue about the solution. This scenario gives space to child-initiated and child-oriented approach.

Samko has never worked with the Bee-Bot, today he sat among other children and watched them to control it. When it was his go, he designed the route for the robot with no problems or questions.

The teacher coordinates taking turns among children, ensures fair opportunity to use the technologies for all. She can monitor progress of each child with the technology use in detail.
The structure and the size of the group (as well as the individual skills of its members) significantly influence the extent of interactions among children. Groups assembled improperly need more time to overcome the communication barriers. Digital technologies present strong icebreaker (see Druin, 1999) which helps bring children of different natures and interests closer or give them opportunity to get to know their friends better and deeper. Children's creativity grows rapidly, if they are not isolated. Most of the children by their nature want to share, show and use technologies together with others.

**Drawbacks:** Activities for five to six years old children should not take longer than twenty minutes. However, children working in a group might not start to cooperate in such short period of time at all. In such case the teacher has to repeat the activity several times or new teams must be created where children communicate more effectively. In comparison to individual work, children have to learn more than handling the device or software environment, they need to communicate and cooperate with others. This requires more time and better teacher's readiness to solve management and communication problems that may appear.

**Reflection:**
- We recommend the teacher to give children opportunity to present the outcomes of their collaborative work. In this way the presenters as well as the audience develop their meta-cognitive skills. The common presentation can also promote stronger relations between team members.

There are some practical findings applicable for preschool age children:
- If the teacher divides children into groups, each child should be given a coloured/pictorial group badge so they know which group they belong to.
- If the group of children is about to produce some outcome, they have to come to an agreement, what and how they would make. We worked with a small group of children who were asked to draw a winter picture. Each member had certain time to draw, then other group member proceeded. If a child had a creative intention with which others disagreed, a conflict arose. We suggested the *fair system of voting* where major opinion would win. Children accepted it very quickly and started to use it in each disputed case.

**Scenario 3: Working with a big group**

We consider a group to be *big*, if it consists of 6 to 10 children (or up to half of the class).

**Example A:** A group of children actors play a part of a movie about specific means of transport together with their teacher (see the ship in Figure 4). Film production with a group of children includes assigning roles to children (captain, deck hand steward, shark...), setting up a simple scene (wooden structure as a ship) and taking pictures (one by one) of children actors by a web camera. The teacher takes a picture of the scene, one or two children move a little bit (steward is serving a meal, a bus is passing etc.) and another picture of the scene is taken.
**Example B:** Ten children and their teacher are sitting around a transparent plastic grid of 9 x 3 squares under which the drawing of a block of flats is placed. Each child has placed the picture of himself/herself in a window on one floor of the block\(^5\). A programmable toy moves in the central strip of the grid as a lift. Children program it to move forward and backward (i.e. upwards and downwards in the building), the toy is supposed to travel from one friend to another.

**Benefits:** Working with a big group is possible only if high level of collaboration is set among children. Preschoolers are already able to concentrate for longer time, if there is a mutual support in solving the problems within the group. The (cognitive) skills of children in a big group, however, vary a lot. We have also experienced rich diversity of ideas, plans and suggestions how to solve tasks.

*Nikolka wanted to move Bee-Bot\(^6\) to her friend Tanicka (5 squares upwards), but programmed a toy to move only one step. Other children advised her what to do. Finally Branko added four steps upwards for her. While the toy was moving, we often observed that children were loudly (and together) counting the steps.*

Teacher organizes activities easier if two halves of the class take turns in the work with DT. The outcome can be more complex than in the work with small groups of children, especially if everyone gets the space for self-realization.

**Drawbacks:** This size of such group brings several restrictions. Before all, if children have to share only one toy or one computer, they have fewer opportunities to take turns than in previous scenarios. Thus, they usually work for shorter periods and become the observers of other child’s work for longer time.

Preschool teacher has to prepare complementary activities besides the work with DT. Moreover, one teacher has to work with the rest of children in parallel.

**Reflection:** We projected the resultant movies to children with one-week delay because we did not manage to complete everything in the same day – children thus

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5 The teacher collected (or took and printed) pictures of all children in previous weeks.

6 the programmable floor robot
could not see the instant result of their work, which clearly proved wrong. The teacher should finalize the movie (the product) in close collaboration with children so that processing the material recorded is not hidden from them. Although editing the material in video-editor goes significantly beyond preschoolers' competencies, they can still support it – e.g. by choosing the music for the soundtrack, sequencing the pictures into correct order (children can assist the teacher) or recording some comments and voices for the movie.

Children enjoyed both films we produced together; they asked us to show them several times within the following weeks.

**Scenario 4: Working with the whole class**

In this type of scenario, the teacher is working with the whole class at a time.

**Example A:** Children are conducting a research on the most favourite colours. First, each child is asked to colour three outlines of balloons by three different colours. Afterwards they take turns and enter their colour data into specific Logo microworld produced for simple data handling purpose – if a child clicks the balloon in the screen (of the same colour as he/she has coloured), it will move upwards a little bit. The screen is projected all the time on the wall by the data projector so that everybody can see the actual state of research. Important part of this activity is the concurrent discussion about the chart. This process confirms that it is easy and natural for preschoolers to compare thoroughly represented quantities – in other form than numbers! Rising balloons is such representation.

![Figure 5](image)

**Benefits:** All children with no difference in gender, age or level of cognitive skills have to learn to collaborate, take turns, share their opinions, emotions and respect pre-set rules and principles. Whole class approach intensively contributes to the development of such socially oriented competencies. Interactions of the type *child – DT – teacher* bring extra benefits to children. They can express their points of view, present products of their work, argue or look for answers to questions
asked by the teacher – all of this with the support of DT. Necessity to share technology helps children learn to respect specified rules and principles.

In ideal case, only one teacher is needed to use technology with the whole class of children. There is also no need to think about organizing parallel activities for other children. Teacher or researcher pays attention only to one activity both in the phase of preparation and running the scenario. He/she has more space to improve the details of the designed activity.

**Drawbacks:** Twenty is a common number of children in the classrooms of Slovak kindergartens. Use of DT in such classroom puts high demands on the teacher who has to organize whole group in the flexible and productive way. He/she needs to keep children's attention all the time the activity is running. This approach is more **teacher** than **child-oriented**. Teacher has to face uncomfortable role of an arbiter who precisely organizes activity of each child with the focus on educational aims of planned activity. The space for self-expression of a child shrinks nearly to zero. This space is occupied by the most leading individuals who advance their own interests and want to stay in the centre of events – they don't want to wait for their turns. Teacher plays essential role to decide in this case, he/she needs to guarantee fair sharing of DT among all. Some teachers are not willing to do so: “I haven’t got programmable toys here. I find some of them are quite disruptive from the management point of view because there’s an awful I want a go, I want a go! as opposed to looking what it teaches us.” (a preschool practitioner, cited in Siraj-Blatchford and Siraj-Blatchford, 2007).

**Reflection:** Activities based on whole class approach are challenging with regard to monitoring cognitive development of individual children (from the researcher's point of view). We were not able to record entire course of events in the classroom although we used combination of recording video and taking field notes. Children worked spontaneously in the classroom, they created pacts of friends and in many cases they solved the same problem parallelly. Thus, it was possible to study one or two children or to focus on certain subgroup of children as an organic whole.

Work of the children is often motivated by the praise that they expect to obtain. Many software edutainment environments also concentrate on the reward of children. This supports inadequate sense of competitiveness and children like to be better than their friends. The competitiveness of children appears also in situations in which it makes no sense.

*The team of Tomas and his friends has collected more beans by calculating a concrete means of transport than his friend working in another group. Tomas reported this to his friend: „We have got more, we won!“*

Whole class approach can demonstrate to children that **winning** is not important. True winner is the one who learns to collaborate, understand and accept the outcomes of other children.
3. Conclusion

In this ambitious ongoing research we concentrate on various aspects of integrating DT into learning processes in preschool education. We devoted this paper to one of them, namely, different ways of organizing activities, which exploit DT, within the preschool class. Based on our existing experience we have highlighted and presented four scenarios for such activities. They depend on number of children the teacher is running the activity with. Each scenario has – from the point of view of our research, and from the point of practical integration of DT into everyday life in similar environments – its benefits and drawbacks, its offer of opportunities for both the teacher and the child/children.

We are aware of the fact that it is a long way from the form we researchers carry out the activities with preschoolers to these activities being adopted and replicated by the teachers. We know their everyday situation is different. We are also aware of the fact that inevitable and integral component of the process, which we want to foster, is further development of teachers in preschool classes, the development of their complex digital literacy. Yet, we are convinced that designing, implementing and evaluating such activities – and their generalized scenarios – are important steps along this way.

References