Embedding Computer Activities into the Context of Preschools

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Abstract
Computer activities are all too often employed in preschool (and kindergarten) activity rooms with little regard for what is going on beyond the computer. Consequently, in those circumstances computer time is lacking appropriate context that could help link computer activities with the educational themes surrounding non-computer activities. Providing technical computer training to preschool and kindergarten teachers is often not sufficient to originate activities that embed that context beyond simple connection such as: drawing food in the computer when the non-computer activities deal with healthy eating habits; playing a math game when the activities are math-oriented; etc. At the University of Trás-os-Montes and Alto Douro, in north-eastern Portugal, the authors have been working since January 2000 in the contextual integration of computer activities in preschool and kindergarten, devoting special attention to activities with powerful educational features, such as computer programming. These efforts also included different ways of presenting the overall idea of full context for computer activities to future preschool teachers and developing with them sample activities where those ideas are implemented. This paper aims to provide work samples that serve as examples of how a powerful environment, such as a computer-programming or customizable computer environment can be embedded in the overall context of the noncomputer activities.

Preschool activities and computer activities

The specific goals of young children education vary among countries. But a basic idea is common to most national educational systems: that preschool and kindergarten should strive to better engage children with the World, by helping them develop their personal and social skills. This definition is often contrasted with formal schooling, by saying that preschool and kindergarten education does not have a curriculum, but rather guidelines for content development by teachers (Ministério da Educação, 1997).

A preschool activity can thus be focused on a social skill (such as peer interaction among children), or on personal skills (such as running and manipulating small objects – physical skills; or mathematics activities – cognitive skills).

An important set of activities is that of world-knowledge activities, which aim to draw the child's attention to particular features of the world, such as the names employed to identify colours, the distinction between geometrical shapes, the composing parts of an animal, the features of each season, the origin of each kind of food, etc.

Besides the particular knowledge content of each activity, these activities' strong ties with real world phenomena render them particularly rich in opportunities for learning. For instance, knowing where milk comes from obviously involves finding out what a cow is, how it is milked, and so on; but it can also involve notions such as the size of a cow and comparing it to the preschool room, and estimating how many cows would fit there; it can involve the exploration of how the milk goes from the cow to the supermarket shelves, and involve social elements such as transactions, buying, selling, advertising; it can involve playing a child-theatre piece or a playground game about herding cows, which will include significant physical activity; and it can include making cow puppets or drawings, with associated skills of representation and fine control. The use of preschool educational activities in this manner is often within the scope of *design projects*. In such projects, students design and create artefacts (either alone or in a group), which can then be shared and discussed with others, or enjoyed as a final piece. Such artefacts can be physical items such as a flower garden, or a doll-house (or even a doll-igloo). But they can also be immaterial items, such as a story or a theatre play. The educational value of such design projects has been achieving growing recognition (*e.g.*, Harel, 1991; Papert, 1993; Kafai, 1995).

Computer activities for the age group of preschool and kindergarten (in Portugal, children aged 3 to 5 years) are often restricted by the limited hand-coordination and cognitive abilities attributed to preschoolers, as well as to their attention span in typical "classroom" activities (Johanson, 1998). Such activities may include: drawing in a simple computer-graphics package such as Windows Paint or Linux TuxPaint; playing with edutainment software; and creating small texts, with the support of the preschool teacher. Typically, the product of these activities (drawings, bar or pie charts, texts) is left in the computer or printed and used to decorate some other physical piece, *i.e.* framed or glued. The integration of such activities in the overall preschool context does not fully take advantage of the potential of the computer: "*What we as early childhood educators are presently doing most often with computers is what research and NAEYC guidelines* [(NAEYC, 1996)] *say we should be doing least often*" (Clements, 1994, as cited by Haugland, 2000).

Currently, "*research on young children and technology indicates that we no longer need to ask whether the use of technology is 'developmentally appropriate'* (…). *Unfortunately, not everyone reads the research!*" (Clements & Sarama, 2002). Seymour Papert, for instance, protested that using computers in traditional educational ways was basically turning them into gadgets, and making education more expensive (Papert, 1980). Research also recommends that the computer is integrated in other activities, with broader scope, rather than simply used to duplicate current educational methods (Davis & Shade, 1994; Clements & Sarama, 2002; Tsantis, Bewick & Thouvenelle, 2003).

We believe that using a virtual computer environment can significantly expand the range of activities that can be embedded in the overall (non-computer) context, and in fact make them crucial to non-computer activities, rather than being a simple add-on.

To present these ideas, we will present small examples to illustrate them. With each example, comments will specify the specific contextualization idea it aims to cover.

I drew that tail! – Rendering images familiar

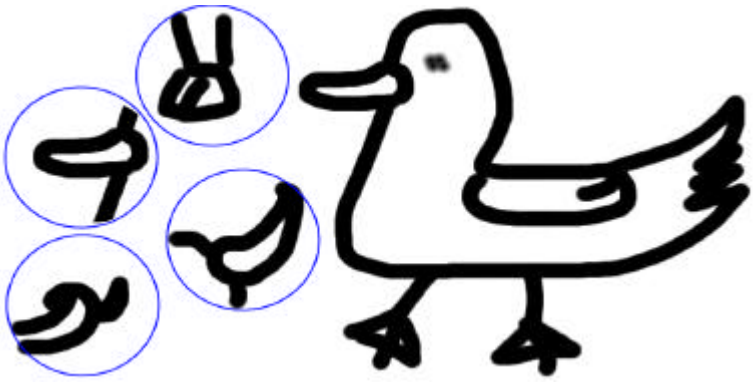

Figure 1 - Matching animal's parts to an animal

Figure 1 show a simple matching game. The four circled images on the left are animal parts (top to bottom: hoof, beak, horn, pigtail). One of them belongs to the bird on the right.

Typically, this activity could be included out-of-context, as an isolated game, or used only when the overall context of activities is one of "animals are made of parts" – hopefully the child player would thus be more prone to focus on the concept.

In the above figure, one important feature is however represented: the bird and other animals are meant to be drawn by children and then used by the room teacher to build the matching activity, using any program usable for building interactive activities, such as Microsoft's PowerPoint or Animated Programs' ToonTalk. The teacher can also cut pieces from each animal and use those pieces and the original pictures to develop the matching game. With this simple feature, the children when drawing are not just ending their activity there: they are contributing to a game to be developed by the teacher, which they will then play afterwards.

The idea being presented here is: if the computer is the final setting of the activity, then it can originate outside the computer beforehand (animal parts identification with pets, toy animals, etc.), and in the computer itself it can involve pre-activities (drawing, in this case) aimed at bridging those original off-computer activities with the final intended computer activity.

The larder is well-stocked! – Computer as source

The converse of the previous example occurs when the final activity takes place off the computer, rather than at the computer. Such as example is when the result of a computer activity determines something in the real world. Perhaps the simplest example is when the preschool teacher acts as referee or judge to confirm the eligibility of the computer activity.

For instance, suppose that in Figure 1, instead of a bird and animal parts, we had the dark silhouette of a fruit and several fruit pictures as matching options. Getting a proper match could also mean that the child was entitled to receive a real fruit (or a toy one, or a fruit card), and stock it in a "larder" in the preschool room. That, in turn, could be an activity involved in a broader context, such as the benefits of keeping a larder stocked during winter, when one lives far from drugstores

or supermarkets, or depending on roads that may become temporarily blocked by snow or landslides.

The idea being presented here is: in the context of an activity that was planned to take place off the computer, the computer may be integrated, by turning it as a source of pieces to be used off the computer. Other examples of uses in this fashion include using the computer as a tool for recording the status of an activity (and to have children check those records to determine their current status later on), and using the computer to communicate by e-mail with another organization (and then wait for an answer to arrive).

Who asked for bread!? – Integrated computer

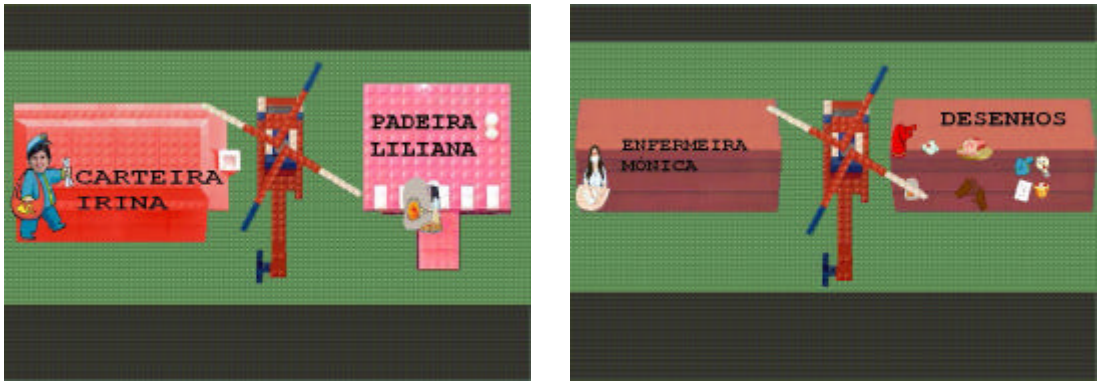

Figure 2 - City with houses for three professionals (plus a "pictures" house)

The combination of the two previous ideas is that the computer can be both the destination of an off-computer activity and a source of materials for off-computer activities. But this means that the computer can be entirely involved in an activity, rather than being an “extra” part of it.

Figure 2 is from an activity developed in the ToonTalk programming environment, based on the concept of interchanging services among professionals. The mailwoman needs bread from the baker, who needs shots from the nurse, who needs letters and bread...

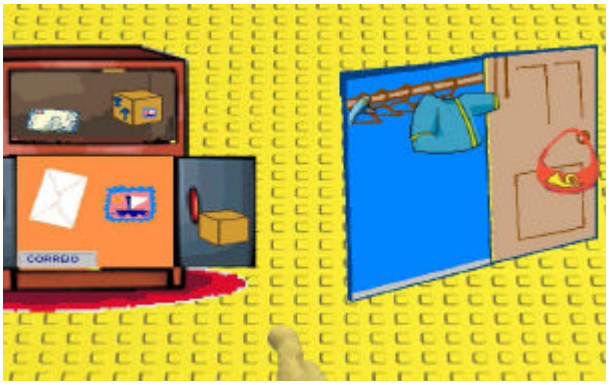

Figure 3 - Postwoman's items and uniform

The inspiration for this sample activity was a simpler version of it, developed between November 2003 and February 2004 by three second-year college students under the orientation of

Leonel Morgado (Irina Brandão, Liliana Miguéis and Mónica Pereira, course "Informática no Ensino", Preschool Teaching Degree, University of Trás-os-Montes and Alto Douro). It is intended for use in a preschool room where the overall theme "professions" is already being developed. Children can develop many activities under the context of that general theme, and in that course assemble several pictures associated with professions. For this example, we'll consider the professions of mailwoman, baker and nurse. The pictures can be uniforms and items such as stamps, pastry, bread, etc.

Some of the assembled pictures (originating in Web sites, books, children's drawings, etc.) can then taken into the ToonTalk environment, available for the children to use, along with other pictures brought in by the teacher (Figure 3).

Each group of children, having been acquainted with a specific professional's "tools of the trade", can use the pictures to decorate a house for that professional.

So far, nothing renders this activity different from the previous examples. But this decoration is just the activity preparation; the actual activity kernel takes place afterwards.

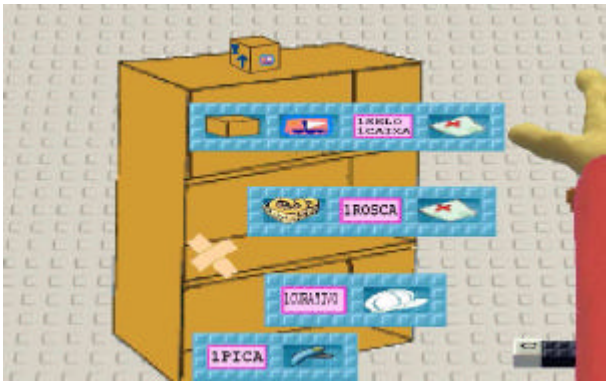

Figure 4 - Set of request in a house

In the course of the preschool day, in another (off-computer) activity, the need may arise (or be created by the teacher) for a specific product – say, a cake from a baker. The child that needs that cake can go to the computer, enter the ToonTalk environment and enter the baker's house. There, that child can leave a request for a cake. This can take several forms: the number "1", the text "cake" and the name of the requesting child; or a picture of a cake and the photograph of the requesting child; or the picture of a cake and an object representing the profession role-played by the requesting child! For instance, in Figure 4 several requests have been found at a house: top to bottom, there is a request for a parcel and a stamp from the nurse (identified by the nurse's cap); a request for a cookie, also from the nurse; a textual request for band-aid from the baker; and a request for a medicine shot from the postwoman. Clearly, some of these requests must be in the wrong house, since no professional can deal with them all (unless some child was role-playing a services contractor!).

These seemingly "wrong" requests pose a nice learning opportunity: suppose this is the nurse's house. The two bottom requests can be satisfied, but the others shouldn't be here, but rather taken to the appropriate houses (postwoman's and baker's). This can be used to start a

preschool-wide debate on the organization of requests within a house. Should one's own requests be kept alongside requests from other people? Should one keep a "record" (*i.e.*, a copy) of the sent requests, and if so, should that copy by stored alongside external requests?

But what if this was another professional's house (a truck driver's house, for instance)? This child could call the child that placed an inadequate request there, and together decide how to solve the problem. However, the teacher could also take part, by prompting the child to decide how a wrong request be handled. Should it be ignored? Should it be returned to the sender? Should the sender (the real child, preschool colleague) be called so that he/she could learn about the mistake? Should the request be helpfully forwarded to the proper professional? And if so, should a note about the mistake be sent to the child who made it?

Getting back to the original request in this example, there was the need for a cake. A child would compose such a request, and place it in the baker's house. Other requests would also have been made during the school day. Sometime during the school day, the child playing the baker will go to the ToonTalk environment and find that there is a request for a cake. That cake can be delivered to the house of the child requesting it, who later will find it has been delivered.

Having been fulfilled the request for a cake, the teacher can be notified, and this can lead to another off-computer activity. For instance, a toy cake, a cake card, cake token or something to that effect can be handed to the child, for continuing with the activity that originated the request for that cake.

But there may not be the necessity for a physical cake token at all! The consequence of delivering the cake in the ToonTalk environment may be that a check mark is painted in a classroom "today's To Do list"; or that beans of toy money needs to be exchanged to "pay" the baker for that "virtual" cake!

The overall idea is: a computer environment can be used not a starting point or ending point of a specific activity, but simply as yet another play setting in a preschool activity room, completely integrated in the context of other, off-computer activities taking place there. Actions off the computer can require a computer action to be complete, and a computer result can lead to off-computer consequences.

You've got it all, you can swim – programming in context

Environments like the one presented in the previous example provide a nice context for using programming skills and constructs, or even full programs.

In fact, the planning of the activity described in that example already included the use of the computer construct known as "communication channels" – ToonTalk's carrier pigeons would be used by children to render easier the sending of requests and the delivery of items. But rather than build up on that example, we opted to present yet another different setting.

The example for this section is centred on sports activities and the necessary equipment. For instance, to swim you need a bathing suit or shorts and a cap, to play tennis you need a racket, tennis shoes and tennis equipment, etc.

Overall, there is a lot of similarity between this setting and the one about professions in the previous example: instead of houses, one now finds buildings for sports; but each child or group of children is in charge of exploring several notions revolving around the kinds of sports taking place in that building, what equipment is necessary, etc.

There is, however, a crucial difference: children don't live in the sports facilities. Rather, there are also more houses in the city, where the children "live". In those houses, pictures for the equipment used in several sports are made available.

Now suppose that for some reason induced by an off-computer activity, a child needs to use a sports facility, such as the pool, for instance. That child goes to "her" house and must assemble all the necessary equipment for swimming. Taking that equipment into the pool house, the child in charge of the pool must check if all the required equipment is there.

But since checking for the equipment is but a matter of comparing pictures, those could be standardized (*i.e.*, same swimming cap picture for all children) and easily compared. So rather than having the child-pool-caretaker to be there whenever another child wants to "swim", that child-caretaker can be suggested (or come up with the idea) of making a ToonTalk program to do the necessary comparisons!

In ToonTalk, such a program can be created entirely while playing in an interactive, animated cartoon-story. Children aged 3, 4 and 5 have made such simple ToonTalk programs, and this setting places a situation where there is a nice motivation for their development. The program can be as simple as asking, using a pre-recorded sound, "Did you bring your bathing suit?" The child wanting to swim presents his/her swimming suit and if the comparison succeeds, then a pre-recorded sound can state "you can swim".

After swimming, the child can proceed with whatever the activity that originated the swimming session required (for instance, recording on paper that one swimming session was performed during a specific weekday).

The overall idea is that within an integrated activity there are often opportunities for including programming embedded in a larger context. Not just for a purpose, but for a purpose within a context.

Programming in such conditions becomes a tool for automation of the environment – an empowering concept.

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