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Technology play in upper primary school

Background

From the Norwegian curriculum, implemented in 1997:

"*Play is a self initiated activity, and is an important source for learning*. *(..) A playful attitude towards organized tasks and activities may create motivation and interest and make learning exciting and versatile (My translation)(Ministry of Education 1996).*"

Play is defined as a working method in school, but with prime focus on grade 1-4 (6-9 years old). A former education minister, Gudmund Hærnes said that play is important from childhood according to research. The curriculum describes the integrated human consisting of the human seeking for meaning, the creative, working, co-operating human, she/he cares for the environment and has general education: by play all of these humans are developed (Trageton 1997). Play is a working method in the Austrian primary school. This is based on research where play was included in the teaching, done by Professor Hartmann in Vienna. What happens if older pupils are allowed to play? Hartmann recommended Stord/Haugesund College in 1996 to include play up to high school to see how a total play programme can develop the personality of the pupils (Trageton 1997).

In Ervik's (2001) project, the pupils had play on the timetable at all grades in primary school (7-12 years old). In 6th grade the teachers had a discussion with the pupils if they were too old to play. The pupils denied this; they got more inspired to learn by playing. Play may prevent boredom at school. The pupils and teachers will have more fun together and the children will learn more when situations are more pleasurable. Also, the theory of multiple intelligences from Gardner (1993) says that learning is better when several intelligences are in use. As stated by Goellner (1994), I also believe that through a play-based curriculum educators can relax about the worry about addressing the eight intelligences through content presentation.

Mathematics and physics are among subjects where Norwegian teachers have the biggest challenges; especially in physics there are weak traditions in primary school (Wedøe 2001). Play may be one step in simplifying learning of physics and technology; it will help permanent operative learning also for older children, as noted in the theory from Piaget (1972).

Technology in school

In order to encourage students to choose mathematics and science in upper secondary school (15-18 years old) the Norwegian Society of Engineers (NITO) initiated a pilot project in 1996, introducing design and technology elements in Norwegian primary and secondary schools, where the subjects *Science and Environment*, and *Art and Craft* are central. The project is a collaboration between professional organizations and educational institutions.

NITO's (1996) aims for the project are:

- To give pupils in primary and lower secondary school a better knowledge of everyday technology
- To increase the understanding of the links between technology and science
- To place technology and its development in its proper context in history and society
- To develop practical and aesthetical skills in making products
- To develop skills in using computers in the design process
- To be a support for mathematics and science teaching
- To contribute to establishing technology as being a part of general education

How are the children in upper primary school?

Children at the age of 10-13 years old are either in the realistic phase which is characterized by increasing degree of realism of the external environment, or in the expressive phase where increasing dream thinking, consciousness of their feelings, description of mood and internal reality are typical (Trageton 1992). Imitating real constructions might be a good play activity for children in the realistic phase since it may reflects their wish to understand the world. For children in the expressive phase such activities may be means to focus on the reality. It might also be early enough to prevent negative feelings for typical "boy things" by girls in the expressive phase. In accordance to Bjørlykke (2000) the girls were as good as the boys in typical boys arenas in a house-building project.

What are the relevant theories of play related to technology activities?

It is possible to explore rules and physical laws in the technology activities. This can be classified as exploratory representational play (Wolfe et al. 1998). In the process of constructing a car, the pupils make hypothesis how to design it to make it go fast. Divergent thinking is important to find good solutions. Some pupils may find such activities very interesting and forget the time and experience the condition of flow. Some pupils will probably not experience the mentioned activities as play. A playful attitude from the teacher, and enough time for the activities may help. Too high expectations from teachers and parents must be prevented; it can suppress the joy of the children.

The technology activities often seem very close to work, and some researches will not consider them as play. However, in many situations there is no clear way to tell if activities are play or work. Comenius (1966 as quoted by Trageton 1997) did not distinguish between play and work. A work-like play is typical for the oldest children in preschool and in lower

primary school. Schiller (1970), as quoted by Trageton (1997), considers play as a basis for the aesthetic work. In related to the design part, this is very important. Goodman (1974) found that there is no separate word for play in so-called primitive cultures. They worked while they played, and played while they worked. Piaget (1972) considers constructional games at the boundary between games and non-ludic play behaviours. However, constructive play and dramatic or pretense play can often go hand in hand.

The house building project is very similar to the concept of Reggio Emilia preschool (Malaguzzi 1995). Trageton (1997) considers this concept as a total definition of play, which connect the cognitive, emotional, creative and social sides of a human to one aesthetic unity. There are similarities between this concept and the workshop pedagogy concept of Trageton, where construction- and sosiodramatic play are combined (Trageton 1992). Another similar concept is frame play (Broström 1989) used to raise the level of play of the oldest children in preschool. It is something between sosiodramatic play and drama, and it is often combined with construction play. The children set the framework for the play, making necessary requisites and dramatize around it. What is important in these concepts is to make space for play during the construction part, since the process is of same importance as the final product.

Aims

Langeland School (grade 1-7, 6-12 years) is one of 19 schools which participates in NITO's project, and it is my research arena. The three aims for my work there:

- To promote technology learning by using play as a working method
- To motivate teachers to actively encourage the children to play
- To examine what the pupils learn from NITO's project during play with focus on mathematics and physics knowledge

Methods

The first task will be to map the ongoing situation. Strategies will then be made on how to increase the play element in the activities and to motivate the teachers to encourage play.

Observations

The observation scheme from Pascal and Bertram (1996) will be used as a base for the observations. Activities will be recorded on videotape to study play. I will look for answers to the following four questions:

1. What percentages of the children are playing, and for how long time?
2. What are there differences in play between girls and boys?
3. Are the pupils cooperating in the construction phase of the activities?
4. Which forms of play are observed? Does pretense play happen?

Interview

Interviews of the pupils about the different technology activities can be informal where the pupil can talk freely about the lessons. Structured interviews will focus on what they feel, are they playing, learning content –is it easy or difficult, what they experience they have learned. A questionnaire with simple questions can be used as well. It has the advantage to be fast and many can participate, the disadvantage is fewer details. It can also be used as a starting point to find pupils to interview.

Learning content

Task analysis will be done to get information of what the pupils may learn. What the pupils have learned will be evaluated in cooperation with the teachers.

Student involvement

The plan is to include teacher students in their teaching practice and in larger student projects, in the play research.

Activities at Langeland School

Table 1 Technology activities at Langeland School (Bjørlykke and Åsheim 2001)

Table 1 shows the technology activities for each grade at Langeland School, but I will concentrate on grade 5-7. Two of their activities are described in more detail below. The pupils have two activities each year, some activities may last one week and others up to a year.

Grade	*Curriculum*	*Technology activity*
1- 2	Basic forms Material knowledge	Houses from cardboard boxes.
3	Structure and forces Something which floats, and something which flies	Bridges from everyday materials Boat made from a lump of putty Warm air balloon Helicopter from reels
4	Lever Space Gear	Cardboard model with birds Study objects with levers Planetarium Water wheel or wind mill
5	Architecture, styles, methods of construction Figures, patterns, characteristics Magnetism	House building Tangram – Chinese puzzle Compass
6	Refraction in glass and water Motion and construction	Telescope/camera Water glass Mechanical toy
7	Electricity	Electric car or door bell

House building (Langeland School 2001)
The ten steps are:
1. Studying the houses in the neighbouring area, from old to new ones.
2. Discussion about what the house should look like.
3. Drawing the houses.
4. Further discussions between the teacher and the pupils, where the teacher shows how a ”normal” house is connected to doors, windows, stairs, etc.
5. The pupils make the drawing of the house.
6. The plane charts are evaluated together with the teacher before the pupils build their houses.
7. Building the houses.
8. Painting the houses.
9. Installing light.
10. Decoration of the house with curtains, wallpaper and furniture.

This is analogous to the process for building a house in real life and this is what the pupils are supposed to learn.

Constructing a electric car (Bjørlykke 2001)
The three steps are:

1. Pupils are supplied with wheels, electric motor, propeller and given the assignment: Build a car. The pupils choose material for the body.
2. Construction of the car. The pupils shall try and fail, but the teachers are giving advises to avoid totally frustrated pupils.
3. Car race and competition in design.

Expected results

I believe the amount of play will vary during the technology assignments. It will probably be easier to motivate pupils to play in some parts of the technology activities, and it will also differ between the children. Some may find step 1-3 in the house project playful with opportunities for dreams and creativity. What pupils do in steps 4-6 is well defined, but my impression from talking with teachers at Langeland is that they do not follow these steps exactly. The pupils build their houses much as they want to. Some will experience the construction phases as play, while others will experience this phase problematic. Installing of light was a big event for the pupils. Organizing of the house project today is not adjusted play as working method. Improvements to increase play possibilities will be considered together with the teachers at Langeland. In the car assignment, obstacles in getting a high speed may interrupt the play.

There are opportunities for sociodramatic play in the technology activities, such as playing different professions involved in house building. In this I think the teacher’s planning and motivation of the pupils are important. Play as a working method is not a part of NITO’s project; therefore, play is yet not in focus by the teachers involved. However, Bjørlykke (2000) observed that several girls were playing when they decorated their houses.

As in the workshop pedagogy, as in the Reggio Emilia concept, and as in frame play used by teachers in Nordic countries, pupils can play with their new toys when they are ready. In the house project they can play the whole process including all occupations involved. Many of the children will probably enjoy the car race, but the cars can also be used in play combined with other constructions such as roads, bridges and tunnels.

Conclusion

There is as yet no systematic observational research study about the practical use of play as a working method in learning science and technology content and procedural knowledge in upper primary school. However, the importance of play can also be considered in a wider perspective: Huizinga (1993, as quoted by Trageton 1997) says that a flowering culture has an excess of playful people. My wish is therefore to make a contribution in developing "*Homo ludens*" who experiences design and technology as a part of her/his culture.

Thanks to Leif Wedøe and Arne Trageton for introducing me to the interesting field of play.

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