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Initiation of verbal expression in young children in Design and Technology education: A case study

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Abstract

Designing is a thinking activity that benefits from expression, because verbal expression serves interaction. Through the integration of exploring, creating and thinking, this interaction can become a stepping stone towards broad thinking and sharing ideas.

Successful interaction needs shared language and knowledge about the rules and means of verbal expression. Therefore teaching approaches that scaffold expression are required.

In the case study reported, the teacher used the thinking hats of De Bono to teach these rules and means to four to six year old pupils. The subject of the verbal expression was a cuddly toy.

This approach proved to support the pupils to be expressive and verbal informative. The hats provided a structure that enabled the pupils to get and express varied ideas. As a result, the class set a starting point for skillfulness in how to express oneself and set a structure in which other subjects could be discussed.

Keywords: verbal expression, pre-schoolers, designing, reasoning, interaction, De Bono thinking hats.

Introduction

Designing is a thinking activity that seeks possibilities (Parkinson, 2007) and benefits from broad subject-related thinking and sharing ideas (Kangas, Seitamaa-Hakkarainen, & Hakkaraine., 2013). Both subject-related thinking and the sharing of ideas need sound strategies to enable them to be implemented in the classroom.

The induction of broad subject-related thinking needs a teaching approach which offers provocative activities that enable pupils to discover how to think and reason (Hiebert & Stigler, 2000; Dewey, 1938). Teaching approaches focusing on the prevention of confusion and offering clear procedures (Hiebert & Stigler, 2000) will obstruct broad subject-related thinking and interaction (Gopnik, 2012) and are therefore inappropriate for introducing a design activity. Starting the design activity with teaching the rules and means of the procedure together with interaction, instead of instructing only one way to proceed (Hiebert & Stigler, 2000; Scheer, Noweski, & Meinel, 2012), may lead to an integration of exploring and creating, resulting in broad thinking.

A related question is 'Who takes the lead in interaction?' The teacher can design a setting and invite the pupils to discuss this context, but can also invite the pupils to discuss their experiences of the subject matter, followed by building a setting based on the experiences expressed. The latter strategy gives pupils the lead and prevents a mismatch in thinking between the teacher and the pupils, which may lead to difficulties in starting a dialogue (Krauss & Chiu, 1998).

Computer gaming is a fine example of the effect of teaching rules and means instead of teaching one way to proceed. In computer gaming, a beginning is known as on-boarding (Chou, 2013) and is

considered successful in so far as the user's attitude changes from curious to smart and competent. On-boarding is about teaching users the rules and tools to play the game. If a user feels stupid during on-boarding, the game designer is fighting an uphill battle along with the user (Chou, 2013). This also applies to education in that teachers are fighting an uphill battle along with pupils, who are feeling incompetent.

The research described in this article on the initiating of a learning activity was inspired by game designers' ideas about on-boarding. A translation of their ideas to Design and Technology Education could be 'changing pupils' feelings during the introduction of an assignment from curious into smart and competent with respect to the execution and completion of the assignment.'

Teachers can influence the quality of the interaction by teaching the rules and means of verbal expression. This is important, because not all pupils will have the same level of social and communicative experience nor the same vocabulary (Mercer, 2013). In order to establish interaction, ideas need to be verbalised into informative expressions that are recognisable as such by the whole class. Well-functioning communication is 'paved' with social interaction and related language (Lemke, 2000).

This teaching of rules and means of verbal expression will also support a larger goal; "It is in the interests of society that children are taught how to become effective 'interthinkers' by using or educating the social brain" (Mercer, 2013, p. 164). In this paper we describe ways of inducing thoughts in young pupils, followed by the transformation of those thoughts into verbal expressions.

Research questions

The central question of this research is:

> How can a teacher initiate verbal expression in young children in Design and Technology education?

Verbal expression is seen as a two-step process: first thoughts have to be induced, then they have to be transformed into verbal expressions. The sub-questions are therefore:

> How can teachers induce subject-related thoughts in pupils?

And:

> How can teachers enable the transformation of those thoughts into informative verbal expressions?

Format of this paper

Expressive behaviour is related to autonomy and natural learning. The objective of "making the pupil feel smart and competent," translated from game design, can be realised in a learning situation where verbal expression is welcomed (Krauss & Chiu, 1998), pupils' autonomy is standard (Greene & Azevedo, 2007), and natural learning is recognised (Gopnik, 2012, 2016). The following section on the theoretical framework contains a discussion of the literature dealing with autonomy, verbal expression, and natural learning, their mutual relations, and their consequences for the learning process.

The subsequent case study section discusses the introduction of the "thinking hats" (De Bono, 2009) as a tool for verbal expression, applied to cuddly toys in a primary class of 4 to 6 year old pupils. It describes the participatory observation of an induction of expressiveness in young children and the subsequent development of informative verbal expression. The last section contains conclusions and recommendations for implementing these approaches in order to stimulate verbal expression at the start of a design activity. This section ends with implications for further research.

Theoretical Framework

Autonomy can support feeling smart and competent by providing pupils with room to act from their actual experience, needs, and knowledge. In this way, it can also support expressive behaviour (Krauss & Chiu, 1998) and natural learning (Gopnik, 2012). Children basically learn by looking and by listening (Gopnik, 2016), and through imitation and conversation. They develop hypotheses which they subsequently test. This natural learning process is, however, disrupted by loss of autonomy. Authority can overrule the self-development of knowledge and can obstruct proper understanding (Gopnik, 2012). Below, the concepts of autonomy and natural learning are further explained.

Autonomy

When pupils have a choice about the task: its starting point, the target, the end situation and the way the task is evaluated, they are enabled to think about the task from their own actual experience, needs and knowledge. Consequently they will experience autonomy, which enables them to be more active. Student choice can be provided before the start of a task phase by teachers consulting pupils, but also during a task phase. The latter method offers pupils choices in assignments and/or in ways of handling assignments. The likelihood of feeling smart and competent during the entire assignment will grow through autonomy. The grade to which a pupil can be active in all phases of a task determines the grade of academic achievement (Greene & Azevedo, 2007).

Autonomy is a key for promoting the self-management of a task into the self-direction of a process, whereby the task is treated as a means rather than as an end (Scheer et al., 2012). Dewey (1938) regarded these autonomous pupils as plan builders; they are building their own plan towards mastery, while the teacher feeds in content and responds to demands. Mert (2014) argues that active participation in the identification of aims, rules and feedback on the task enables pupils to develop their maximum potential.

Candy (1987) notes that in a learning situation, two types of autonomy can be distinguished: situational and epistemological.

- *Situational autonomy* comprises two dimensions: self-management skills and personal autonomy. Self-management skills are practical skills necessary for the pursuit of the pupil's own targets, while personal autonomy has a pupil component: assertiveness, and an external component: low external constraints, pressure and direction.
- *Epistemological autonomy* involves anticipatory schemes and learning strategies. Anticipatory schemes help pupils to make informed judgements about the content to be learned, and learning strategies help pupils to employ appropriate strategies of inquiry.

Natural learning

Children's learning can flourish through autonomy. Gopnik (2012) shows in research on scientific thinking in young children that very young children's learning and thinking are strikingly similar to much learning and thinking in science, because young children already have mental models of the world. These mental models assist hypothesis testing and experimenting. Gopnik describes an experiment in which an adult woman showed infants a box filled with white and red balls. With eyes closed she randomly took some balls from the box. These balls were put in a small empty bin. Next she showed the content of the bin. When the distribution of balls in the bin matched the distribution in the box, the infants looked for a short time. When the distributions did not match, the infants looked for a longer period (Gopnik, 2012). This shows that even young infants have expectations and mental models about distributions.

Another experiment shows that by watching what other people do and what happens as a result, children develop their own ideas about causal relationships:

> In a lab study (Buchsbaum, Gopnik, Griffiths, & Shafto, 2011), 4-year olds saw an experimenter perform five different sequences of three actions on a toy, which was activated or was not activated according to each action. A statistical analysis of the data would suggest that only the last two actions were necessary to activate the toy. When children got the toy, they often produced just the two relevant actions, rather than imitating everything that the experimenter did. (Gopnik, 2012, p.1626)

When pedagogical content was added to this experiment by saying "Here's my toy, I'm going to show you how it works," a remarkable effect occurred. The children tended to assume that everything the adult did was causally effective and to imitate all her actions (Gopnik, 2012). This experiment shows that children are sensitive to the intentions of others, particularly to their intention to teach. They may draw different conclusions from the evidence that teachers give them than from the evidence they gather themselves (Gopnik, 2012). These experiments suggest that the way early childhood education takes place is extremely important. The pedagogical content of structured and academic early childhood programs can kill broad exploration. Early childhood education should scaffold children's probabilistic approach during exploration and play (Gopnik, 2012).

In the field of Design and Technology Education, research into the programming comprehension of young children has come to a similar conclusion (Strawhacker & Bers, 2014). The researchers concluded that children were able to understand the concept of repeat loops as an abstraction of a linear program. They saw this level of abstract understanding as an indication that the children realised that their robots abstractly represented animals. Observation of children's spontaneous play showed that the children had no trouble with switching between talking about the robot as a living animal and as an inanimate object.

In 1929, Piaget concluded that symbolic reasoning is absent until the age of seven. These recent findings raise doubts about this finding. Piaget's conclusion may hold when open questioning is used. However, when focused questioning about an everyday context is used, pre-schoolers already are able to provide an answer by using abstract thinking (Gopnik, 2012).

Hypothesis testing and education

These recent studies (Gopnik, 2012; Buchsbaum et al., 2011) show that it is natural for children to develop and test ideas (hypotheses) about practices. This is very relevant for Design and Technology Education, because hypothesis testing is an important feature of Design and Technology Education (Parkinson, 2007).

The ability to test hypotheses is influenced by autonomy, because by hypothesis testing, self-developed conclusions may differ from conclusions drawn from evidence provided by teachers. Explicit teaching can result in bias and hence loss of autonomy. Hypothesis testing is appropriate for all ages; it can be used consciously by very young children, when an adequate task structure is presented. The conclusion of research by Howe, Tolmie, Duchamp-Tanner, and Rattray (2000) was that hypothesis testing needs a setting where pupils are required to formulate conceptual knowledge into researchable ideas, investigate ideas through manipulation (procedural knowledge growth), prediction and observation, and evaluate ideas in the light of evidence. In such a setting, hypothesis testing can facilitate the integrated acquisition of conceptual and procedural knowledge. For instance, when they are learning about electricity, the pupils need a researchable idea such as 'When the power circuit is closed, what happens to the lamp? Will it light up or not light up?' When testing this idea, pupils learn by manipulating their conceptual (What happens when the circuit is closed?) and procedural (How can I close the circuit?) knowledge about power circuits.

The implementation of hypothesis testing in education is not that easy; conceptual growth needs debate and dialogue (Piaget, 1985), whereas procedural growth needs guidance, with carefully tailored and individualised attention (Vygotsky, 1978). As has been discussed, in the context of children's natural learning processes, authority figures may tend to have an undermining effect on dialogue, because explicit teaching may tend to encourage children to consider fewer hypotheses

than they otherwise might have done. It seems that students in a "discover" orientation learn more than students in a "listen" orientation (Schneider, Bumbacher, & Blikstein, 2015). Giving a detailed explanation of a science phenomenon does not prompt scientific thinking, whereas encouraging play, presenting anomalies and asking for explanations might well do this (Gopnik, 2012, p. 1627). An effective design task encourages children to puzzle instead of passively listening. For instance a teacher can, after demonstrating a phenomenon, ask the pupils for an explanation.

The tension between guidance and dialogue may be resolved by implementing non-authoritative guidance, which serves the pupil's goals rather than requiring coping behaviour. This modest guidance also allows teachers to have a productive dialogue with pupils on a more or less equal level of authority (Howe et al., 2000). A teacher acting as a well-informed passenger can enable a pupil to drive. Research on computer-supported collaborative learning has demonstrated that a team of an experienced passenger and an inexperienced driver (student in a discover condition) achieves similar learning goals to those of a team of an experienced passenger and an experienced driver, and much more than an inexperienced passenger (student in a listen condition) and an experienced driver (Schneider et al., 2015).

A hitherto undiscussed aspect of this modest guidance by teachers is the guidance that supports the verbal expression of the children's thoughts.

Expression

Expression, "the act of transforming ideas into words" (Collins English Dictionary, 2014), is an important means for sharing ideas in the process of learning. Competence in verbal expression is gained by practice. Both these concepts are relevant for Design and Technology Education, because sharing ideas is an important feature of designing, and competence in verbal expression enhances the process of sharing ideas.

In general, sharing ideas among pupils and between pupils and teacher also benefits class dialogue (Krauss & Chiu, 1998), collaboration, non-authoritative guidance, and formative evaluation. Another important aspect of competence in verbal expression is the improvement of pupils' insights, because verbal expression is a thoughtful, deliberate process, whereby the expressed ideas are the result of reflection on spontaneous thoughts.

Without verbal expression, interaction between pupils and teacher is not possible. Therefore, this article, and the case study described below, focuses on inducing verbal expression.

Case Study

Context

The case study was conducted at a Dutch Montessori school where the researcher was a primary teacher for 15 years. Her speciality during that time was the development of Montessori adapted Design and Technology Education for all classes. Dr. Montessori believed that children have an innate ability to learn (Montessori Educators, 2016). This proposition is shared by contemporary researchers like Gopnik (2012, 2016) and Strawhacker and Bers (2014). Montessori intended her so-called "cosmic education" to support the natural development of the human being from birth to maturity. Therefore self-guided and self-controlled discovery plays an important role in Montessori education. It can be argued that Design and Technology Education historically has a natural place in Montessori education.

Montessori teachers are guides; primarily by being observers monitoring development, and recognising and interpreting pupils needs. The teacher provides a link between pupil and environment by introducing elements of the environment in a detailed way (Montessori Educators, 2016).

Besides being a guide, the Montessori teacher is a facilitator, whose task is to support pupils in their process of self-development.

Methodology

This case study formed part of the project 'Design your own cuddly toy.' Data were collected by the researcher through participatory observation, accompanied by video recording. The analysis was by transcribing the pupils' attitudes, gestures and speech shown on video. After transcription, all collected data were interpreted.

All the research was conducted in one Montessori primary class of 28 boys and girls aged four to six years old. Eight of them were 4 to 4¾ years old, ten pupils were 4¾ to 5¾ years old and 10 pupils were 5¾ to 6¾ years old. The researcher was the class teacher for all these pupils from their start at school onwards.

The participatory observations took place in the last week before the start of the 2016 summer holidays.

Case study design

Design your own cuddly toy

Pupils needed to know the desirable features for a personal cuddly toy, before they were allowed to start designing one. Therefore the pupils had to find out what made a cuddly toy appealing.

To provide familiar objects, the teacher asked the children to each bring in their favourite cuddly toy. To provide simplicity, the six thinking hats of de Bono were used (de Bono, 2009), because these hats enable the wearer to focus on one aspect of an object at a time.

1. White hat: Facts. Calls for information
2. Yellow hat: Benefits. Explore the positives.
3. Black hat: Caution. Spot negative things, difficulties and dangers.
4. Red hat: Feelings. Express emotions and feelings.
5. Green hat: Creativity. Focus on possibilities, alternatives, new ideas.
6. Blue hat: Process. Big picture, thinking about thinking.

To provide modest guidance, the teacher opted to demonstrate the function of the hats beforehand. During this activity she asked simple questions in order to help the children remember exactly what each hat meant.

Execution

The hats were made from simple paper strips in the appropriate colours. The blue hat was left out, because it seemed too complicated to explain the purpose of this hat to the four to six year olds.

First the teacher demonstrated the hats to the assembled class. She took three dolls from the play corner: a black and a white baby doll and a fairy tale doll, Snowy White. The teacher put the red hat on her head and said: "With this red hat on I look at the dolls with feeling. Which doll do I like and which one don't I like? Do I think a doll is funny or lovable or comforting?" She picked the black baby doll and said: "This one has adorable eyes, because of his eyelashes. It's as if he's looking at me and saying 'Hold me!' That's why I like this one the most."

Then the teacher put on the yellow hat and said: "With this yellow hat on my head I pick out the good things or nice things. When I touch something, what feels nice? When I look at something, what is nice or good to look at?" She picked up Snowy White and said: "She feels really nice." Then she picked up the white baby doll and said: "She has a beautiful dress."

Then the black hat. With the black hat on, the teacher said: "With this black hat on I pick out silly or nasty things. When I touch something, what doesn't feel nice? When I look at something, what looks

ugly or unattractive?" She picked up the black doll and said "She is stiff and rigid. I don't like that." She picked up Snowy White and said "She is dirty."

Next was the white hat. "With this white hat on, I describe facts, such as softness or smoothness or roughness or the details I can see." The teacher picked up Snowy White and described: "I feel softness, I see blue eyes, brown hair, a yellow collar, a blue dress."

Last was the green hat. "With the green hat on, I think of any unusual things I can do with these dolls. Normally you cuddle a doll or pretend it's someone in a make-pretend game." The teacher picked up Snowy White and threw her in the air, saying: "but I can throw it in the air as well." She caught her again and said while looking around: "I can give her to a sad person to comfort her."

First try-out: Familiar dolls

After demonstrating this, the teacher invited the children to talk about one or more dolls while wearing one of the hats. Half of the class (approximately 15 children) wanted to do this. Queena (6¾ years old) was the first one to choose a hat. She took the red one. Her attitude was enthusiastic, but she could not find any words to express her feelings about the dolls.

Next was Vos (5¾ years old). He chose, without any hesitation, the black hat and he was glowing with pleasure with the hat on his head. When it was his turn to mention the silly or nasty things about a doll, he chose Snowy White and said: "This is the ugliest doll." The teacher asked him why. At first he did not have many words to explain what he meant, but he played his role as a presenter with so much pleasure that the teacher dared to ask him why over and over again. After some time he mentioned, while handling the doll in a suitably expressive way, some ugly features of the doll: "The colours of the doll. Yellow, red, pink and black are all silly."

Imke (6¼ years old) chose the yellow hat. She did not show much emotion. The nice things about a doll were easily verbalised in a rather contemplative way: "I like the princess, because of her colours: red, blue and yellow. These are my favourite colours. I like the white baby doll because it has black hair. I like the black baby doll because it's easy to play with."

Brecht (6 years old) chose the white hat. Wearing this hat she gave a detailed description and while she was talking she seemed to open up and see more and more details. Her attitude was calm.

The green hat was not very popular. Eefje (5¾ years old) took up the challenge. She came up with a nice new idea by making two dolls quarrel with each other: "Baby doll is frightened out of her wits by seeing Snowy White. She never saw a doll like this before." Her expressive role-play game with the dolls made everyone laugh.

Then time was up. The teacher invited the pupils to bring in a cuddly toy from home over the coming days, in order to talk about it while wearing one of the hats. The teacher promised to record all their presentations on video.

Second try-out: An unfamiliar cuddly toy

The next day none of the pupils brought in a cuddly toy. Some of them told the teacher that although they wanted to bring one, their parents did not let them do so, because of the class rule not to bring personal toys into the classroom. The teacher had expected this, so she brought in a cuddly toy herself, a monkey.

The class sat in a circle and the teacher put the monkey on a carpet in the middle. Again five pupils were given the opportunity to choose a hat. Melanie (5¾ years old) chose the white hat. She started hesitantly. The teacher had to question her ("What do you see?") to get her to verbalise some of the features ("I see brown hair. Eyes. Nose"). After pointing at the feet of the monkey, she said "hands." After being asked what this animal is called, she responded: "Monkey."

Then it was Imke's (6¼ years old) turn, with the red hat on. She did not have much to say either. The only thing she said was: "It makes me happy" (but she did not display happiness).

Matthijs (6½ years old) wore the yellow hat. Normally he is a verbally skilled boy, but now he did not say much at first. After starting to touch the monkey, he began to speak. "I like how it feels, soft" (touching the fur). After being questioned about nice or pretty aspects, he said: "It's a funny cuddly toy, because he feels so soft."

Sjoerd (5½ years old) put on the black hat and was very eager to say something, but his talking was also hesitant at the start. The teacher asked him "What is silly?" He answered "I don't know." The teacher asked "Ugly?" He answered "I don't know." The teacher said: "Okay, grasp the monkey and look closer." He did. He took some time to get acquainted with the cuddly toy. Then a provocative element of his personality took over and he started to act up, while voicing his disapproval: "The brown eyes are silly." Holding it high, he dropped the toy on purpose.

The green hat was first worn by Jessie, a 4½ year old girl. She was eager to say something, but did not manage to express herself in either words or behaviour, except for "I don't know." Sharona, a 6¼ year old girl, took her place. Her provocative side took over and at first her behaviour expressed aversion (black hat behaviour). So the teacher questioned her: "What would be funny for Monkey?" Then she came up with some creative ideas: "He has to wear a nice hat for his first birthday" and "He has funny fur." After being asked "What else can you do with this monkey?" she answered: "playing zoo."

Figure 1: Pupil discussing familiar cuddly toys (2016)

Third try-out: Familiar cuddly toys

Over the next three days ten pupils each brought in their cuddly toy. They were allowed to discuss their toys with as many hats on as they liked. It was remarkable that both younger and older pupils, boys and girls, wanted to talk (see Figure 1 above).

Stefan (5½ years old) with a cuddly snake.
Black: I think it's silly, because it has orange spots. And its red tongue is silly too.
Red: Nice tongue (grasping it), it feels very gentle.
White: I see a mark, a hole in his chin, the bottom is red.
Yellow: It's nice that he has a big head, a nice shape, a nice mark.
Green: Tomorrow it's winter [in reality it was midsummer at that moment!] and then I'll wear my snake as a scarf.

Eefje (5¾ years old) with a bag in the shape of a sheep.

Black: I think it's silly that he has this hair (she grabs the hair and shakes the cuddly toy), I can hit something with this sheep, that's why I think it's silly, because I think he's lovely. This white colour is strange! Real cuddly toys don't have zips and can't open up.

Green: Sheep stay warm in winter. Funny that he has the same colour as the white hat. Funny that the eyes have the same colour as the black hat.

Yellow: He can get nice and big when I put things inside him. He just did a wee-wee.

Red: Normally I feel sad when I see him, because I want to hold him very much. He's so sweet! Do you know he really can speak to me? But today I feel happy about what he's saying, because he's always telling me 'please take me to school with you' and today it was allowed!

Kiki (5¼ years old) with a cuddly dog.

Red: [She hugs the dog] He has gentle ears, that makes me happy and I can hug him. [She grasps the tail and moves it back and forth].

Green: [Looks and thinks, and plays a make-pretend game with her dog, without words].

White: I see ears, tail, a white tummy. I see him laughing.

Koert (4¾ years old) with a cuddly bear.

Red: He's lovely, because he has two different eyes.

Black: He's silly, because he has two different eyes.

Yellow: He's funny, because he has tufts of hair on his ears.

Marilene (4 years old) with a cuddly bear.

Black: [softly] He's silly because he has black eyes. [The teacher asked her if she wanted to say anything more] No, it's too difficult.

Fourth try-out: comparison of one familiar cuddly toy with two unfamiliar ones

The last day was a bring your own toys day. This was a complicating factor because it caused distracting unrest in class. The younger pupils showed expressive, difficult to correct behaviour; they became their own car, doll, etc. Very noisy!

Three girls – Queena (6¾ years), Imke (6¼ years) and Eefje (5¾ years) – wanted to talk about their cuddly toys on video. Because all three were just under or just over 6, the teacher decided to check out their comparison skills. The teacher seated them together with their toys (a pink bear, a Barbie doll, and a pink troll with a pulling string) on a table. The teacher told them to pick a hat in turn and talk about their own toy.

Subsequently, with the same hat on, they had to compare their own toy with the other two and mention similarities, contrasts and differences. Queena started, with the red hat on. She did not know what to say. So the teacher told her to choose a different colour. She chose the black hat, but she still did not know what to say. She was looking to the other girls for help. Eefje whispered something in her ear. Afterwards she chose the green hat. She said about a toy with a pulling string: "I think this one needs a battery." When the teacher asked her what kind of funny things could be done with the toy, she answered: "Turning round." When the teacher asked her what funny thing can be done with all three dolls, she answered: "Turning round." Wearing the yellow hat she said that all three dolls made her happy.

Then it was Eefje's turn with a yellow hat. She pulled the hair of the troll with the pulling string. Spontaneously she said she liked this hair. Then the teacher asked her to talk about something that all three toys have in common. At first she started to talk about the eyes. When the teacher asked the other girls as well, she suddenly said: "I know a good way they're alike: all three are pink!" Then with the white hat: "All three have eyes, they all have legs." Next the black hat. With a naughty look on her face and her hands on her hips, she said of the toy with the string that its hole was silly. When the teacher asked her to mention something silly about all three toys, she said it was silly that one is

human and the other one is not. She said nothing about the toy with the string. All this time Queena was staring, not involved. The other girl (Imke) tried to direct her in verbal and non-verbal ways.

Imke put the black hat on. She said spontaneously that it was silly that one toy had whiskers. When the teacher asked whether they all have something silly, she answered that she did not know. So then she put on the white hat. Now she saw that all three toys had something black. After this she wanted the yellow hat. With this hat on she spontaneously said that the funny thing about one toy was that it could clap its hands, the funny thing about the toy with the pulling string was that it showed its tongue, and about the Barbie doll she said something that the teacher did not understand. The teacher asked in what way they were alike. She answered: "I don't know." The last hat she put on was the red hat. She said that it made her happy to pick up the cuddly toys. This did not count for the Barbie doll. After this hat she was finished.

Interpretation

In the case study, the teacher used familiar objects (cuddly toys) and non-authoritative guidance (instruction by demonstration without adding pedagogical content, while welcoming expressive behaviour). A simplifying instrument (the thinking hats) encouraged the pupils to act and speak. Free choice was allowed in the colour of the hat to be worn in order to enhance the pupils' autonomy. While the pupils were expressing themselves, the teacher provided modest guidance by means of simple questions to support the pupils' procedural knowledge about the meaning each hat.

There was a marked difference between the pupil's behaviour when handling the unfamiliar cuddly monkey and their own familiar toys. The unfamiliar toy caused some hesitance in the pupils' expression. This hesitance was decreased by touching. Apparently, touching the toy helped the pupils to overcome their hesitance. They handled their own cuddly toys in a decisive way. It was striking that the pupils did not handle their own toys as objects, but started to role play using two characters, one for the toy and one for themselves.

Difficulties arose when comparing their own toy with two other toys. When playing with their own toys, the pupils were expressive, but expression about the unfamiliar toys was poor. It is important to note that during this activity the class was really noisy and distracting, maybe because this was a bring your own toys day.

After being instructed about the thinking hats, all pupils were invited to talk about the toys in front of the camera. In practice, not all pupils got the chance to do this. The two-thirds of the class who got the chance all managed to be expressive. Compared to the older pupils, the younger pupils wanted to talk about the toys just as much and knew which ones to choose, but they verbalised fewer features of their own toys and showed more uneasiness. The younger pupils also chose fewer hats (one to three) to wear.

The older pupils were very expressive and chose four or five hats to wear. Five pupils started talking about their own toys with the black hat on, three with the red hat on, one boy with the yellow one and one girl with the white one. The black hat gave rise to plenty of fun and made the pupils lively and cheerful when discussing the features of their own cuddly toys in a negative way. When discussing their toys with the yellow hat on, they often mentioned the same features but in a positive way. Not all pupils liked to be negative about their own cuddly toys; these pupils chose to be loving or positive or factual. For the older pupils, the green hat evoked creative ideas. For one six year old girl the green hat had the same provocative effect as the black hat.

Conclusion

Designing, a core activity of Design and Technology Education, needs verbal expression to enable broad subject-related thinking and the sharing of ideas. The central question of this research was "How can a teacher initiate verbal expression in young children in Design and Technology education?" The sub-questions were "How can teachers induce subject-related thoughts in pupils?"

and "How can teachers enable the transformation of those thoughts into informative verbal expressions?"

How can teachers induce subject-related thoughts in pupils? The literature indicates that feeling smart and competent due to familiarity with the subject matter, in conjunction with modest guidance, is the best way to achieve autonomy, natural learning and expressive behaviour at the same time, together with a subject-related question, this can lead to the induction of subject-related thoughts.

The research data show that in the case study a setting was created where all pupils could feel smart and competent.

The research question for the pupils, "What makes a cuddly toy attractive?" together with the use of familiar objects (their own favourite cuddly toys) induced subject-related thoughts. The instruction by prior demonstration of the function of the hats without adding pedagogical content, together with simple questioning during pupil expression, constituted modest guidance. The questioning during pupil verbal expression supported the pupils' procedural knowledge in terms of remembering the meaning of a particular hat. For instance, the teacher asked "What do you see?" for the white hat, or "What is ugly about this cuddly toy?" for the black hat, or "What is attractive?" for the yellow hat. The pupils exhibited expressive behaviour and motivation to express themselves, which can be regarded as a particularly relevant result. Evidence for the importance of familiarity for feeling comfortable can be found in that there was a marked difference between pupils' behaviour while handling the unfamiliar cuddly monkey and their own familiar cuddly toys. The unfamiliar cuddly toy caused hesitance in their expressing.

How can teachers enable the transformation of those thoughts into informative verbal expressions? According to the literature, the transformation of such thoughts into informative verbal expression requires the sharing of ideas and competence in verbal expression.

To start this transformation, the pupils have to be capable of sharing their ideas. Given their age, in general, their capability would be low. Therefore, simplicity was necessary for them to be able to discuss their ideas. A simplifying instrument, the six thinking hats of de Bono, was used (de Bono, 2009) to create a simple and clear focus for expressing themselves. This worked for the older pupils, but for the younger ones the transformation was difficult. Compared to the older pupils, the younger pupils wanted to talk about the toys just as much and they knew what to choose, but they verbalised fewer features of their own cuddly toys and showed more uneasiness. The younger pupils also chose fewer hats (one to three) for their talks. The older pupils were very expressive and chose four or five hats for their talks.

Overall, the hats proved to provide a good structure for enabling pupils to be expressive, followed by their informative verbal expression. The pupils could choose from five differently coloured hats. The free choice at the start of the task enhanced the pupils' autonomy and consequently fostered their expressive behaviour.

The expressiveness of some of the pupils was surprisingly rich. The teacher's role was limited interaction, only intervening when a pupil's verbal expression needed further clarification or when the pupils needed guidance. This resulted in growing familiarity with the hats, which in turn contributed to the growth of the informative value of pupils' verbal expressions. The need for guidance decreased over time. Familiarity with the cuddly toys combined with growing familiarity with the hats was reflected in less hesitant and more exuberant behaviour.

We can conclude that the question "How can a teacher initiate verbal expression in young children in Design and Technology education?" can be answered by "Ask a clear and simple question and use a structuring medium, such as the thinking hats of de Bono, in the search for possible answers." All this should be done in a setting where all pupils can feel smart and competent, because of their familiarity with the subject matter and the modest guidance by the teacher. Growing competence in verbal expression, together with gentle support, will enable the pupils to produce informative verbal expressions.

Discussion

Limitations

Not all pupils who showed interest in giving a talk got the chance to do this, so it is not certain whether the plan of instructing the pupils in how to express by demonstrating the procedure of verbal expression worked for all pupils. It did work for the two-thirds of the class who got the chance to give a talk.

Ideally, modest guidance requires familiarity between pupils and teacher. Because the data was collected through the participatory observation of the researcher in the role of teacher, the guidance must be considered as close to ideal (Hoepfl, 1997). Therefore, in order to repeat this research, a researcher could not replace a class teacher; it has to be done by a teacher who knows the pupils well. A teacher could, however, be supported by a researcher, for instance, through lesson study.

There is no close relationship between the findings of this research and other Design and Technology Education literature about verbal expression. Existing literature is mostly on making and sketching. A strongly related source is found in earlier literature about the use of visual cues to help autistic children to self-initiate speech ("Stimulus control is at the heart of this cueing procedure" (Matson Sevin, Box, Francis, & Sevin,, 1993, p. 395)). The visual cue acts as an anchor for building a sentence. This is essentially comparable to the research described in this paper, namely the provision of the simplifying structure of the coloured hats in order to support verbal expression.

Implications for education

The use of the thinking hats resulted in rich verbal expressions about a familiar object. This finding is important for classroom practice, because the introduction of the thinking hats can act as a starting point for developing procedural knowledge about how to express oneself. When pupils became more used to expressing themselves, verbal expression about unfamiliar objects would also improve. Secondly, the hats can be referred to when discussing other subjects or problems.

Literature study combined with observation provided a new perspective on passive silent behaviour. When teachers better understand the mechanism of enabling informative verbal expression, they can support their pupils in developing their expressiveness and in taking the lead in their learning.

This is important for the process of task co-creation, but also for the process of formative evaluation. The formative evaluation process makes use of the ongoing verbal expression of pupil reflection. In this way formative evaluation gives rise to a self-enforcing process of learning (Akker, 2013). A side effect of the iterative production of verbal expression of evidence is that it furthers the familiarity of the context and the use of commonly understood ways of expressing one's own image (Black & Wiliam, 2009).

Each hat colour had its own function in discussing the object.

- The black hat was most suitable for making pupils express themselves freely, reflected by cheerful behaviour.
- The white hat was best for making the pupils aware of a growing amount of detail. This hat is best for practising observation and analysis.
- The red hat was attractive for the pupils, but disappointing in provoking verbal expression.
- The green hat was only suitable for the older pupils and led to unusual and funny ideas.
- The blue hat (which the teacher in the case study left out) is a suitable hat for the moderator, the person who offers modest guidance.

In this way, the hats supported the handling and describing of various distinct aspects of an object. But there was more: the colours changed the pupils' thoughts about the toys. The black hat had the strongest effect on pupils' expressive behaviour; the attitude of some pupils was totally transformed,

as if they were actors in a play. It was remarkable that the black hat evoked much fun and that the pupils felt so comfortable about being negative about their own cuddly toys.

Competence in verbal expression assists not only Design and Technology Education but also the development of strong social skills, such as the two related twenty-first century conative skills of "understanding and controlling oneself" and "understanding and interacting with others" (Marzano & Heflebower, 2012). People have to be aware of their own personal knowledge and assumptions before they can look from a different perspective; a prerequisite for collaboration. People manage to interact with others when they are able to express their thoughts about a process and discuss those thoughts with others; a prerequisite for expanding their own knowledge. The results show that the pupils easily developed competence in verbal expression when starting from their actual experience, needs and knowledge.

Recommendations

Practical recommendations for furthering autonomy

Familiarity is furthered through pupils' participation in the composition of the context. The pupils will choose appealing objects on the basis of usefulness, usability and/or desirability (Buchanan, 1999). For example, in the case study, the teacher asked the pupils to each bring a personal toy.

Autonomy is provided by creating shared situational autonomy through instruction and/or demonstration of specific knowledge, and through shared decision-making. This is necessary because when a learning situation is introduced, the situational autonomy is not the same for all participants (Candy, 1987). For example, in the case study, the various hats were demonstrated with a classroom toy, and bringing a cuddly toy from home was a shared decision.

Autonomous behaviour is furthered by valuing it explicitly for its level of autonomy and by valuing the thinking process more than the results. For example, although an effort may remain ineffective, a teacher can praise the initiative and verbalise the good thinking.

Offering non-authoritative guidance causes pupils to be, and remain, active and autonomous. The teacher has to open up to pupils' verbal expressions. In this way, the pupils' verbal expressions can organise or reorganise the teacher's thinking, leading to an alignment of their thinking and the designing or redesigning of assignments. For example, in the case study, it was important for the teacher to notice hesitance and offer guidance towards feeling smart and comfortable; whenever the teacher presumed that an object was unfamiliar, an assignment enabling the pupil to become familiar with the object was needed. In the case study, the teacher said "Okay, hold the monkey and look closer." The effect was that the pupil held the monkey and after some time, the touching apparently caused a connection reflected in expressive behaviour. The pupil started to act up, accompanied by disapproving talk: "The brown eyes are silly." Holding the monkey high, he dropped it on purpose.

Limiting the complexity of the learning context is recommended, because complex situations call for multiple partial solutions to be designed. When the situation is simple, the focus is on one problem and calls for the designing of one solution. Less is more. The Montessori principle of isolation of quality can be used (Montessori, 1912) for this purpose. Zooming in on the details of an object is another way of limiting complexity. For example, in the case study the wearing of one coloured hat at a time made the pupils focus on single aspects of their toys.

Practical recommendations for furthering the informative value of a verbal expression

Knowledge of the language that comes with a situation enables one to speak about the situation (Mercer, 2013). Therefore, connecting the knowledge expressed during interaction and debate with commonly understood ways of verbal expression is an essential part of a lesson (Lemke, 2000).

Questions aimed at focusing on particular components of a situation are a way to synchronise knowledge and correct existing bias (Lemke, 2000). For example, in the case study, the teacher regularly questioned the pupils about the function of the hat they were wearing.

Ample room should be given for all sorts of bias; knowledge bias, but also behaviour bias. Detecting this creates an opportunity for getting onto the same wavelength as the pupils (Krauss & Chiu, 1998). For example, if pupils are distracted at the start of an activity, the teacher can ask what their personal goals are for the coming lesson and subsequently connect teacher goals with pupil goals.

Recommendations for further research

As discussed under Limitations, this research was done within a relationship of familiarity. What can be done to create such a relationship when researchers are unfamiliar with the group they want to research? One way is for researchers is to cooperate with an adult who has a relationship of familiarity with the group they want to research and can deliver modest guidance. In education, a researcher could organise a lesson study for the teachers, focused on modest guidance and verbal expression, and support this lesson study by theoretical and practical input. In both cases, insights into the guidance that furthers expressive behaviour could be obtained.

After the successful use of the hats as a simplifying tool for these four to six year old pupils, it would be interesting to research the application of this tool for guiding passive and contemplative pupils towards expressing themselves. If their behaviour is a result of insufficient skilfulness in expressing themselves, the hats might meet their needs. This also applies to pupils with a poor cognitive structure. The use of these hats, combined with non-authoritative guidance, might lead to improvement.

The hats could also assist the development of engineering habits of mind, like collaboration, teamwork, and concern for the societal and environmental impacts of technology (National Research Council, 2009, p. 131).

Additionally, it would be interesting to research the actual effect of the use of the hats in the 'describe the problem' phase of the design process. Do they make the problem clearer? Do they speed up the design process? What is their influence on the quality of the final products? What is their effect on interim evaluation?

Sound strategies for implementing design activities in the classroom not only benefit verbal expression and sharing ideas in Design and Technology Education, but also verbal expression and sharing ideas in society.

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