The Proceedings of the 23th Annual Conference of the European Teacher Education Network

ETEN Proceedings Editors

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ETEN 23
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Preface

This publication reports papers presented at the 23th annual ETEN Conference in Hasselt, Belgium, which was hosted by the KHLim-Limburg Catholic University College, in April 2013.

The theme for the conference was *Education designed for all.*

The keynote speaker, Dirk De Boe, approached this theme based on his publication *Eduschock.* He asked the question "What does "Education designed for all" mean?" This keynote speech launched the topic for further discussion and reflection during the Thematic Interest Groups (TIG) sessions.

The participants in the TIG's session approached the theme from their particular view and within their own frameworks of reference.

This conference proceedings publication is the result of papers presented in the TIG-sessions during the conference. Some are research papers, some report professional practices and development programs. The papers included in this publication represent some of the presentations on the following Thematic Interest Groups (TIG):

- Arts Education
- Democracy, Religion and Culture
- Educational Technology
- Internationalisation
- Mathematics Education
- Movement Activities, Health and Outdoor Learning
- Myths and Fairytales
- Reflective Practice
- Science Education
- Special Needs
- Technology Teaching and Learning
- Urban Education

The papers for these proceedings were received from the TIG leaders who acted as the main reviewers, attesting the suitableness of the papers for this publication.

The editorial board congratulates all the authors for the important contribution that was made to allow this publication be ready in time.

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The art of mime in education: a rich learning tool

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Abstract

Latest work within the Learning Through the Arts field included a variety of visual and performing arts activities such as drama, music, dance, film, etc. Rarely do studies focus on mime as a teaching and learning tool. In this paper, the art of mime is explored through a hands-on workshop whereby participants go through the various steps of a mime activity. As such, they work in small groups to design, perform, and finally reflect on meaning and meaning production. The activity is then videotaped and features of the use of the digital camera are highlighted. Thus, the paper explicates the salient features of the mime and the use of the digital camera as educational tools.

1. Introduction

According to Wikipedia, the word 'mime' has a Greek origin; it is derived from the Greek word "μίμος"—*mimos*, which means "imitator, actor". The online encyclopedia Britanica.com defines mime as*…the art of portraying a character or a story solely by means of body movement (as by realistic and symbolic gestures)*. It is therefore a way of communication whereby the verbal word is replaced by the non-verbal, gestural act.[1] While we all resort to non-verbal language in so many various contexts either to replace the spoken word or to support it (i.e., calling someone, signaling the end of some event, etc.), the art of 'mime' evolved to becoming an integral part of the industry of entertainment (Gittens, 2007; McGee, 2011; among several others) and lately as part of the growing field of edutainment (Feder, 1992; Maley & Duff, 2005; Farmer, 2009; Jones, Curtis & Allen 2012; etc.).

Incorporating the art of miming in teaching and learning is of major salience to the field of education. In 1992, for example, Feder published a highly informative book titled '*Mime Time*' and includes forty-five mime activities especially designed to be used in classrooms of various young and older learners. Along the same line, Farmer (2009) publishes a book titled '*101 Drama Games and Activities: Theatre Games for Children and Adults Including Warm-ups, Improvisation, Mime and Movement*'. The book, highly grounded in research, provides teachers and educators with a large array of educational activities including mime, storytelling, and improvisation. Most importantly is the shrewd highlight of mime skills through educational and enjoyable activities.

This paper promotes the very field of mime in education for it presents a well structured mime activity, composed of four sections, presented and performed at the European Teacher Education Network (ETEN) 2013 within the Arts Education TIG session. Most importantly has been the use of the digital camera to film all parts of the mimes. The use of such powerful tool in promoting learning exhibits major educational implications. In other words, building on recent research in the field of the use of the digital camera in education

[1] See Lust (2000: 19-30) for a highly informative chapter about the history and value of *mime*.

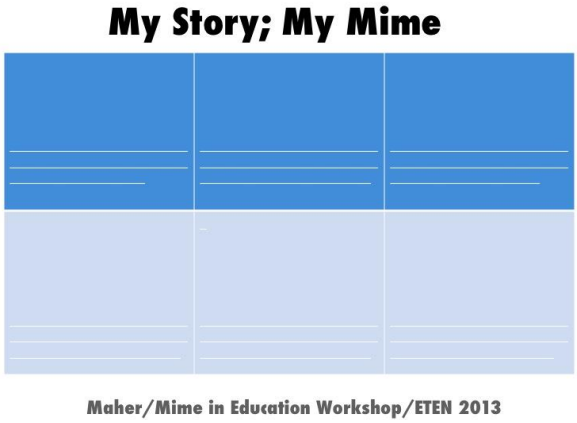
(Theosodakis, 2009; Bahloul & Graham, 2012; among several others.), the paper shows a second and novice dimension to the use of miming in education in which much more learning takes place after the activity itself. Thus, the miming activity is filmed and the production is used as a new resource for writing activities, interpretation, and classroom discussion. In addition, such production tends to enhance participants' motivation, a necessary ingredient for successful learning[2].

The workshop involved the participants in four distinct but inter-related activities: (i) storyboarding, (ii) miming, (iii) writing, and (iv) reflecting. While the first and second activities relate to the participants' own work, the third and the fourth relate to their peers'. In other words, each participant had to storyboard and mime, then to write and reflect on their peers' mimes.

2. Storyboarding

The workshop participants were divided into groups of two and were requested to make use of the storyboarding template, shown in figure 2.1 below, to sketch a short mime with six events including a beginning and an end. While such sketching activity may focus on a specific theme or topic depending on the educational context, participants here did not have any particular restriction.

Figure 2.1 Storyboarding handout



The eight participants were given 1O minutes to brainstorm mimes' topics, settle on a particular six-event mime, sketch it and write a few lines if need be. The grouping and group work are shown in Figure 2.2 below. They are numbered one to four for convenience and ease of reference.

Figure 2.2 Sketching the Mime

[2] See section 5 for a much more elaborate description of other educational features of the digital camera.


Group 1


Group 2


Group 3


Group 4

It is worth stressing here that the sketching exercise is quite complex for it involves a cluster of visual and cognitive skills. In other words, each group is called to choose a topic, ponder a short story, visualize its events, and mime sketch it. In doing so, highly demanding cognitive processes are called upon. Maley and Duff's (2005) observations are quite revealing. They write: "Mime activities can provide a real stimulus to the imagination. From visual clues alone we have to construct a message." (p. 50) They also add: "This is a powerful process both for those carrying out the mime, who have to project themselves through movement and gesture only, and for those who try to interpret it." (p. 50). Within a short and limited time frame which did not exceed ten minutes, the four groups were ready to move to the second stage of the workshop, that is rehearsing their respective mimes. This is attainable given the fact that all participants exhibit various degrees of visual and performing arts skills. For this reason, most groups have finished their sketches before the ten-minute time limit, then started rehearsing their respective mimes.

Rehearsing the Mime

Groups are given up to ten minutes to rehearse their respective mimes taking into consideration a number of simple miming principles.[3] This activity is meant to maximize chances of a much clearer and coherent performance. The groups are thus invited to make use of all the different spaces available in the location should they desire to remain rather discrete. During the rehearsing process, characters experiment with the best ways to mime a particular event, revise certain events, and fine-tune their performances. In addition, groups are not invited to mingle and 'spy' on each others' mimes since the elements of originality and suspense ought to be maximized.

Miming the Sketch

It is quite revealing that two out of the four mimes deal with human relationships. While the first group, for example, addresses the issue of 'dominance' in human relationships, the fourth group elected for 'break-ups'. The other two groups, that is Group 2 and Group 3, focused on 'human success' and 'conference attendees' routine' respectively.

4.1. Mime One: Relationships and Dominance

The first group chose to sketch a story of two people with different authority statuses, one dominant and one reticent. The two characters are sitting next to each other separated by a suitcase on top of which sat a box of candy. The mime focuses on the growing tension between the characters over candy to end with a gentle resolution whereby each one of

[3] See (Kipnis 1988) in particular for simple and easy exposition of mimes and miming principles.

them helps themselves to the candy and the reticent one grabbing the entire box. Figure 4.1.1 below explicates the various stills of the mime.

Figure 4.1.1 *Relationships and Dominance*

As can be seen through the above stills, the two characters went through some conflict. The first still presents the context of the mime. It shows two ladies, one younger than the other, sitting next to each other with a box of candy sitting in front of both of them. The younger one appears to be busy with the mobile phone, and peeking at the other who appears to be reading and not paying much attention to her. The second event shows the younger lady trying to grab some candy hoping the other one does not see her. The third event shows the older lady quite concerned with the behavior of the young lady, even quite shocked. The fourth event shows the older lady trying herself a candy from the same box and showing satisfaction. The fifth event shows the older lady handing the box of candy to the younger lady. The final scene shows the younger lady grabbing the box and turning all the way around to hide it.

4.1.2 Interpreting the Mime

This is a salient step within the miming workshop, a third phase whereby the participants get involved in critical thinking activities through both written and oral reflections. As such, each participant draws on their background, activates their semiotic and pragmatic filters, and produces meaning to a mime they have never seen before. One such interpretation reads as follows:

> "The mime was about two people sitting in a train and looking at their mobile phones. One would like to take some sweets without the other noticing it. Even though she knows it is not allowed, she insists on having some sweets. The other person is watching over her and hoping she does not take the sweets. Then the other person agrees and invites her to have some sweets; finally the other person displays a primitive hungry feeling and grabs the box of sweets."

While most members of the audience showed agreement with the overall interpretation of the mime, an interesting discussion evolved around the location of the event (i.e., a bus, a train, at home) and the relationship between and the nature of the two characters (i.e.,

mother and daughter, two people: one comfortable and one poor and scared, one dominant and one very shy). An interesting discussion was raised after the characters replied that they had not thought of any particular place and neither did they decide about who is involved in such dominant relationship. The audience felt that the fact that the box of candy was put on top of a suitcase suggested that they are traveling, hence the train and bus interpretations. What is of paramount importance is the amount of symbolism in the mime which resulted in a variety of interpretations. The apparent conflict and its resolution via the consent to the eating of candy, for instance, is of major symbolic nature and could be a topic of debate involving the nature of hierarchical human relationships within a language, social studies, psychology, and/or philosophy course.

4.2. Mime Two: Achieving One's Dreams

The second mime we will examine involves a human dream of success. The two characters started the mime with a gesture of dream and ended it with a gesture of championing success. In-between, the characters were involved in a highly competitive triathlon involving swimming, cycling, and running. Figure 4.2.1 shows the various stills of the mime:

Figure 4.2.1 Achieving One's Dreams

As can be seen above, the mime starts with a gesture of dream with both hands moving from top to bottom with a sober facial expression and ends with an opposite celebrating movement whereby hands move upward with a cheerful face. In-between, the characters performed a triathlon, namely swimming, cycling, and running. While the first two activities appeared to be performed in the same place, the last one involved putting shoes on, as seen in still 4.

4.2.2 Interpreting the Mime

The audience's interpretations varied from fine-tuning one's body to accomplishing championship dreams. The characters wanted to stress the initial championship dream through the downward hand movements, a dream gesture which they found to be quite challenging to mime. The triathlon activities were performed with high speech to stress the hard work, and the final cheerful face with the raising of both hands was to show the

successful end. In other words, the mime clearly shows hard work and perseverance, and alludes to achieving one's dreams. However, some interpretations did not include the 'dream', an important aspect of the mime which the characters wanted to stress. However, all participants could see the triathlon activities, the hard work and the end result. In an era where so many people exhibit very high dreams but found themselves in challenging job markets, for instance, the issue of achieving one's dreams is highly relevant and worth pursuing.

4.3. Mime Three: Conference's Daily Routine

The third mime tells the story of the conference participants with such daily routine activities as (i) attending lectures, (ii) visiting museums, (iii) coffee breaks, (iv) and going back to hotels. While the characters had a clear vision of the mime, the audience was rather challenged. The various mime stills are shown in Graph 4.3.1 below:

Graph 4.3.1 Conference's Daily Routine

4.3.2 Interpreting the mime

> "It could be a father and a son, two neighbors, or two friends, or a teacher and a tired and not motivated student, then they drink something, I don't know what? There is may be something in the drink, and then the teacher can work better. Then there are something with teeth, I don't know what…"

It is quite clear that the above interpretation exhibits a high level of challenge as to the exact focus of the mime! This is expressed by the multiple occurrence of the 'I don't know what' expression, the conjunction 'or', and the modal 'may be'. It is worth noting that the interpretation contains a few revealing items. First, the relationship between the two characters (i.e., kinship, neighbors, friends) was not clear and therefore puzzled the interpreter. Second, noticing that the characters were much more active after having a drink suggested that there is something in the drink, alluding therefore to the use of some sort of stimulating drug. Thus, an unclear relationship added to an unclear drink content render the

entire mime highly ambiguous and shows the extent to which individual filters play salient roles in interpretation. This is further supported by the following interpretation:

> "I thought it is about starting the day and ending the day; it is a lovely day; they started to have a breakfast together; then they go to work and some one is showing something to someone else; then the day is over and then they drive home."

Despite the clarity of the interpretation, it remains quite puzzling how the weather information got in? One possible answer may relate to the current weather conditions which inspired the interpretation. In fact, the conference was taking place in Hasselt, Belgium during he month of April; the weather was changing: raining and cloudy at times, sunny and warm at other times. It is probably what the interpreter was wishing for that found its way through the initial events of the mime. In other words, the interpretation of the mime does not seem to be based on the mime itself, but on the background of the interpreter, hence an active participation in meaning production. This is further illustrated by another instance where the interpreter qualifies the drink as 'beer' in still 4. It is the interpreter's culture that is giving meaning to the content of the mime, and this is very likely to be NON controversial. We tend to see events on the basis of our own experiences and cultural backgrounds. In short, this mime was quite ambiguous. As such, every interpretation exhibited a number of features reminiscent of one's culture, background, and state of mind. The interpretation below is another illustration of this conclusion:

> "I saw an educational situation involving two people: one is hierarchically dominant and the other has to listen; and it changes from a position to another; than at the end they drive a tandem, they become a tandem."

The use of a 'tandem' bicycle does not clearly show in the mime. In fact, some have mentioned the bus and others the car. The use of 'tandem', as a means of transportation, clearly relates to the culture and experience of the interpreter. While tandem bicycles are commonly used in some parts of Europe, especially the Scandinavian countries, they are rarely used in other parts of Europe such as France, Italy, and Spain, for instance. This prediction is born out since the interpreter comes from a Scandinavian country.

Finally, having been confronted with a variety of interpretations, the two characters realized that their mime was indeed hard: "it is funny if you combine all interpretations and all comments, that is actually what we did, *but we have not been very clear*; that is obvious because it took a while to know what we exactly did" (emphasis is ours), replies one of them. The other simply reminded the audience of the mime events: "After the presentation of our colleague, we went to a museum where there was a guide and one has to listen, then we had lunch, then we listened to the different presentations, and at the end of the day we went back to the hotel by bus."

4.4. Mime Four: Relationships and Breaking-Up

The fourth and last mime was quite straightforward. It tells a story of two people trying to get back to each other but fail to do so in the end. The various stills shown in Figure 4.4.1 below illustrate the mime events.

Figure 4.4.1 Relationships and Breaking-Up

As the mime stills show, the characters divided their respective roles: one comes to inform the other one of a breaking-up decision, and the second warmly welcomes her and tries to negotiate a come back; however, the efforts fail and the split had to take place despite all initiatives.

4.4.2 Interpreting the Mime

The workshop participants were asked to provide a title to each mime. While it was quite challenging to come up with a straightforward title for the first three mimes, it was rather simple for this one. One member of the audience said: "I have a title: *Broken Hearts*". A second says: "I thought it was very difficult to split-up; should we do it? Yes, No, Ya, Ok…". A third one summed up the mime as follows: "I also thought that this mime is about breaking-up, and the first person felt sorry for it or he was not happy that he has to do it and the woman was waiting and dreaming, and then ..well…the breaking-up happened, and then both were not very happy with this, but the breaking-up had to happen…bye bye…". Despite the straightforward nature of the interpretations, we note here the reaction of the characters, especially when one of them says: "I think every thing you have said and your interpretation is what we wanted to convey through this mime, *but I was very very touched when I heard your interpretations; it was very nice; you added feelings in your interpretations*."(emphasis is ours) Such reaction adds a new dynamic and interpersonal dimension to the mime; not only does the audience tell a story, they also feel what characters feel which creates in turn a sense of solidarity between the characters and members of the audience.

5. The use of the digital camera

During the workshop, the conductor used the camera to film most parts of the activity. In fact, all stills shown above are a result of the filming; hadn't the workshop been filmed, we

would not have had access to such stills.[4] In addition, the mimes will be available through a Learning Through The Arts web site (www.lt-ta.org) should some researchers opt to make use of the mimes for similar or other educational purposes. In fact, the videotaped mimes constitute a resource which may be used in a variety of educational contexts. In a language learning class, for instance, mimes may be shown and students could be asked to write out their respective interpretations after which a number of discussions about their different interpretations could take place. A second activity with language learners could involve their writing skills, that is writing the short dialogue between the two characters of the mime, which in turn may be placed on the audio track and played as a voice-over. Such voice-over activity will involve learners' writing, reading, listening, and speaking skills. In short, using the camera to film such an activity helps reflecting much more closely on the mime and proves highly useful in generating new appealing content.

6. Concluding Remarks

The 'Mime in Education' workshop presents a number of features that are quite unique for they combine myriad skills in such a short time. Workshop participants quickly created and improvised scenes; they also used storyboards to sketch and write mimes. In addition, working in groups assists in improving learners' social bonding skills which, in turn, develops group awareness and trust through such group dynamic activities. Most importantly is the exploration of physical theatre as the participants embrace different characters and act out their respective scenes. This effort recalls the use of story-telling in education, a tool that is highly innovative, learner-focused, and quite entertaining. Finally, the 'Mime in Education' workshop engages learners in meaning production through fun and enjoyable activities which empowers them and boosts their sense of confidence. In short, the mime activity puts the learner at the forefront of learning for it promotes their own voice and change them from mere consumers of meaning to full fledged producers. Hill (2002) comments on the use of mime in the foreign language classroom: "With the right group, this can produce some amusing and enjoyable moments, while still providing an effective learning experience." (p. 104).

References

Bahloul, M. (2012). The Camera in the Classroom: Challenges and Opportunities. In M. Bahloul & C. Graham (Eds.), *Lights! Camera! Action and he Brain: The Use of Film in Education* (pp. 1-13). London: Cambridge Scholars Publishing.

Bahloul, M & Graham, C. (2012). *Lights! Camera! Action and he Brain: The Use of Film in Education*. London: Cambridge Scholars Publishing.

Bailey, B. (2012). Addressing Every Day Problems and Constructing Situated Identities. In M. Bahloul & C. Graham (Eds.), *Lights! Camera! Action and he Brain: The Use of Film in Education* (pp. 1-13). London: Cambridge Scholars Publishing.

[4] See Bahloul 2012, Bailey 2012, Hornos 2012 for interesting discussions on the value and benefits of the use of the digital camera in teaching an learning.

Ellis, B. (2011). *Learning from the Land: Teaching Ecology through Stories and Activities.* Colorado, United States: Libraries Unlimited (ASIN B00D5T9QFI).

Feder, H.J. (1992). *Mime Time***.** 2 Sub edition, United States: Meriwether Publishing Ltd.

Farmer, D. (2009). *101 Drama Games and Activities: Theatre Games for Children and Adults including Warm-ups, Improvisation, Mime and Movement*. 2nd edition, United States: CreateSpace Independent Publishing Platform.

Gittens, I. (2007) *Top of the Pops: Mishaps, Miming, and Music: True Adventures of TV's No. 1 Pop Show*. London: BBC Books.

Hornos, M.G. (2012). Recording Role-Play Strategies in the ESL Classroom: English for Tourism and Hospitality. In M. Bahloul & C. Graham (Eds.), *Lights! Camera! Action and he Brain: The Use of Film in Education* (pp. 1-13). London: Cambridge Scholars Publishing.

Hill, B. (2002). Video in language learning: developing oral skills. In Swarbrick, Ann edition, *Aspects of Teaching Secondary Modern Foreign Languages.* RoutledgeFalmer: London.

Jones, D., Curtis, E., Perry, S.A. & Mock, A. (2012) *Mime Very Own Book*. Medallion Press Inc: Florida, United States.

Kipnis, C. (2011). *The Mime Book*. Colorado Springs, United States: Meriwether Publishing LTD.

Lust, A.B. (2000). *From the Greek Mimes to Marcel Marceau and Beyond*. Lanham, Maryland, and London: The Scarecrow Press Inc.

Maley, A. & Duff, A. (2005). *Drama Techniques: A Resource Book of Communication Activities for Language Teachers*. London: Cambridge University Press.

McGee, A. (2011) *Mime: Language of the Heart: Pantomime Acting, Skit Production and Troupe Formation Principles*. United States: Heartbeatmime.

Theodosakis, Nikos. (2009) *The director in the classroom: how filmmaking inspires learning.* Canada: Published by the author.

[<TOC<]

Democracy, Religion and Culture

In dialogue with the snowman: Exploring religion in a whirlwind cabin

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"Once upon a time there was a snowman who was melting. He had no hope anymore until his friend, the Christmas tree arrived. He had an idea and put him at the top of a mountain. Of course there was a lot of snow and it was cold. Here he could live, but he missed everyone. But when winter came, he could go back to his friends. And this happened every year. And everyone was happy ;-)!!!"

(Anonymous, 6th grade)

This story was written by a pupil in the sixth grade (in the Netherlands this means the pupil is approximately 10 years of age) of the Koningin Julianaschool in Apeldoorn, the Netherlands. The subject was creative writing, the topic was "another Christmas story" and this was all part of a bigger project called De Lichtstad (e.g. The City of Light). This project was a Christmas project and was intended to help the children discover for themselves what, at least an element of, Christmas meant to them. This made it a religious project or, maybe more correct, a project of life philosophy (Schoemaker, 2013).

As teachers, we want to help children in developing their knowledge, their abilities and their personality, all so that they will become strong people who will know how to handle themselves in society. In this paper I want to investigate how a teacher can help this pupil to grow as a person. To do so, I want to discuss three different dimensions of this story; the dimension of writing itself, the dimension of creativity and the dimension of religion or life philosophy.

Writing itself

The Dutch organization SLO (Stichting Leerplan Ontwikkeling, which is the government related organization for curriculum development) wants teachers to look at three different aspects of writing: communication, expressiveness and conceptualization (van Gelderen, 2010). The aspect of conceptualization, as in using writing to study, is of no relevance to this paper, so I will not go into this. Looking at the communication, means looking at spelling, at making good sentences and at thinking about the reader and asking yourself if you give the reader enough information to understand what you want to communicate. As you can see, this pupil knows pretty well how to perform on all these aspects.

Looking at expressiveness means looking at the way the pupils write poetry or short stories. This has a technical aspect as well as a personal aspect. When looking at the technical aspect of expressiveness, a teacher can teach children how to rhyme or which are the 5 main elements of a plot (exposition or opening scene, rising action, climax, falling action, denouement or closing scene). The personal aspect is a lot more difficult for a teacher, because how does he know if the writing of a pupil is personal? For a child in sixth grade, SLO describes how the most important way to help the pupil is by creating a context before starting to write. By this, they mean that a pupil, or the whole class, first start by making an inventory of different ideas, reading about a certain subject and taking notes. The more they

learn how to do this, the more the children will be able to write a personally inspired poem or story (van Gelderen, 2010).

The contextualization certainly took place writing the story above. As I wrote, it was part of a larger project called De Lichtstad. This project was organized around a storybook called De Lichtstad (no author, 2012). In this story, two rivaling cities both get an order from the king to transform themselves into a city of light. Both cities are certain of winning this competition, even though they do not have a clue what a city of light actually could be. Following this story, all teachers and classes were asked to transform their classroom in a city of lights. They should use as many school subjects as possible to discover what a city of light could be and to decide how they would build their own city. At the end of the project, they would invite all parents and everybody else who would like to come, and they could visit all classrooms (or cities) to see which was the best or which inspired them the most. This was their Christmas celebration.

In this sixth grade, they started by making a mindmap to explore what they already knew (Schuppert & van den Bogeert 2012). In geography, they did research on the Dutch multi cultural society. Every morning, they started with reading a passage from the Bible, talking about different religious rituals concerning light or investigating how they could be a light for someone, or who was a light for them. And in creative writing, the pupils were asked to write "another Christmas story" (Oosterheert, 2007).

Taking the children through this process, is the technical aspect of stimulating expressiveness. But it is even more interesting to look at the personal aspect of expressiveness (van der Harst, 2007). The first personal choice to be recognized is to look at which Christmas story the pupil chose to change into "another Christmas story".

In this particular class, the children chose five or six different main Christmas stories to alter. Eight children chose the Biblical story of the birth of Jesus. Six children chose the story of Santa Claus, flying through the air in his sleigh to distribute presents. Six children chose a story about Christmas decorations. Five children chose the story of friendship, warmth and restoring broken relations. Only two children chose the story of the city of lights, which surprised me because this was the main story that was being told during these two weeks. And there were also two pupils who did not really use a famous story but who did something else (Schoemaker, 2013).

The diversity of Christmas stories shows, first of all, that Christmas is a holiday with a lot of different aspects, both secular and religious. It also shows that, even in the school context, it is not obvious that the pupils choose stories that are told in school. The fact that only two pupils chose the story of the city of light proves this, but also the fact that this is a protestant school and still only eight pupils chose the Biblical story. This probably shows that, also for children whose parents choose a Christian school, the Biblical story is not the major Christmas story for these children.

It is always difficult to interpret why a pupil chooses a certain story. But it is at least probable that it tells more about the pupil than it tells about the story (van Weelden, 2012 or Schoemaker, 2011 - 2). If we want to understand why a pupil chose this story, we have two ways of finding out. The first would be to ask the child. This is, by far, the best way to find out. But as this pupil was anonymous, in this case I could not ask the child. The second possibility is to look at what the pupil did with the story (Kropac, 2007). What changes did he make and can we discover why? To look at this aspect, I first have to say something more about expressiveness, not as an aspect of writing, but as an aspect of creativity.

Creativity

“Jeder Mensch ist ein Künstler”, every man is an artist, said the German artist Joseph Beuys. Everyone is creative and especially children seem to be. When we give our pupils lessons in creative writing it is not so much that we teach them to be creative, because they already are. But then, what do we teach them? The most important thing we can teach them, is to know what it means to be creative. By giving the pupils a definition, we can also help them to be aware that they are creative and what they can do with this.

Often the definition for creativity is thought to be the ability to make or think of something new, something that was never here before. If this were the case, there are very few creative people or creative moments, because something really new is seldom found. A more practical way of looking at creativity, is when you define it as the process of combining two things that were never combined before.

The most famous example of a creative moment is when Archimedes, the Greek scientist, was looking for a way to find out if a beautifully crafted crown was made of pure gold. When he could not find a solution, he took a bath and noticed that the water flowed over the edge of the bath as he stepped into it. This made him so excited that he ran out into the street, without his clothes on, crying ‘EUREKA, which means, I found it. Combining the problem of the crown, with the idea that the water rose when he stepped into the bath, he figured out that this would be a means to measure the volume of the crown. He also combined the idea that a kilogram of stones has a larger volume than a kilogram of feathers. So he made up a hypothesis that every material had its own way of combining the volume and the weight, its specific gravity (Schoemaker, 2011 – 1).

When we stimulate children to be creative, we actually stimulate them to combine two things they know into something that is new, at least to them. I explain it in ‘this way so that you can see that this is the basic principle of social constructivist learning (Oosterheert, 2007). I also explain it in this way so that we see that most things children do, all day, and certainly in school, is being creative, is connecting different things to increase their knowledge and their way of understanding the world.

When we talk about creative writing, we also stimulate our pupils to combine two things that are not usually combined. Sometimes we specifically give pupils two things to combine; write about something you experienced during your vacation, but write it as a recipe. More often, we do it unwittingly. When we ask a pupil to write “another Christmas story”, we actually ask the pupil to combine a known Christmas story with something else. The pupil has to decide on how he wants to combine it. Usually he will combine it with the thing most at hand: his own life. This could be something he has read, he has seen on television or something he has experienced himself. It is always something that has meaning to him. Otherwise he would have forgotten about it. This process is so evident, that different creative and artistic therapies are based upon this principle.

This means that, when the pupil wrote her “another Christmas story”, she (I imagine it to be a girl) combined the Christmas story of friendship and being there for each other, with something, probably some of her own experiences or maybe even fears, into a new, creative story about a snowman who started to melt. Knowing this, it would be very interesting to hear from this pupil what she was thinking of when she was writing this story. Remember that I stated that education is meant, not only to teach children knowledge, but to make them

strong people who can handle themselves in modern-day society. By translating this story back to her own life, a teacher can offer her a way to reflect on the way she handles the problems she comes across.

By the way, there is another aspect of creativity that is shown in this story. What is described in this story is a dilemma that has no good solution. When the snowman wants to live, he has to go to the top of the mountain (and will be lonely). If he does not want to be alone, he has to go down to the valley (and melt). When you want to start a creative process, you always have to start with an unsolvable dilemma. In different writings about creativity, they talk about the tension between recognition and alienation (Grözinger, 1987 and Schoemaker, 2011 – 1). When you talk with your pupils about these dilemmas, your goal should not be to help them find a solution, because in general there are no solutions. Your goal should be to help them find a way that they can live with these dilemmas, because they will always exist. But when we start talking about these dilemmas, we are no longer talking about creativity, but we are talking about religion or life philosophy.

Life philosophy and religion

Before I go into the aspect of life philosophy or religion, I would like to make a few remarks on the Dutch educational system. In the Netherlands we have three different kinds of primary education; 'openbaar onderwijs' (public schools which are neutral in their religious identity), 'bijzonder onderwijs' (publicly funded schools which can have a religious or reform pedagogical identity) and private schools. Approximately 40 % of all children attend 'openbaar onderwij's, 60 % attend 'bijzonder onderwijs' and hardly any children attend private schools. This means that 60 % of the parents choose to send their children to religious schools even though only 10 % of the Dutch people are actively committed to a certain religion. This means that many of the children who attend 'bijzonder onderwijs' (religious schools) do not have a religious background (Zondervan, 2012).

This leads to two interesting discussions. The discussion in the 'bijzonder onderwijs', is on how to deal with the non-religious children in a religious school. For a long time 'openbaar onderwijs' wanted to be completely neutral in religious matters, mostly by not addressing these issues. The last couple of years these ideas started to change. With a lot of people coming form (mainly) Muslim countries, they recognized that you have to address religious issues. But also did they recognize that for many people you cannot separate education from peoples beliefs. To grow up as a strong person, you also need to help children develop their own beliefs (Zondervan, 2012). This led, among other things, to the conclusion that both 'bijzonder onderwijs' and 'openbaar onderwijs' started to be interested in, let us call it, life philosophy. When we talk about life philosophy, we mean something that has the same function as religion, but is not (necessarily) committed to a certain faith (like Christianity, Islam or Judaism). As we say; everybody has a life philosophy but not everybody has a religion (E.T. Alii, 2009). When we talk about life philosophy we mean morals, the forming of an identity, dealing with the big moments in life as birth, death and severe illness, and also dealing with the ambiguities of life; feelings of belonging, the monster under your bed, the demons from your past or how you want to control the world even though you know this is impossible. Children have to learn to deal with these issues, in a religious or a non-religious way.

Looking at the story from this perspective, it is clear that the author talks about issues of life philosophy. How do you cope with the idea of melting away? How do you deal with feelings

of loneliness? How can you help a friend in need? When you agree that helping a child develop itself also in its dimension of life philosophy, it is important to notice these signs and act upon them. To help teachers, Jef de Schepper made a list of 10 skills that children should develop: perceiving, exploring, representing, arguing, communicating, handling situations, handling tradition, connectedness, trust and transcendence (Schepper, 2004, p. 213). As you can see, these skills are not purely religious or concerning life philosophy. These skills have a life philosophical dimension, just as life itself has a life philosophical dimension.

Using these ten skills as a guideline to interpret the story of the snowman, it gives us a better perspective on what is important to this pupil and how she is able to handle the different skills.

She *perceives* the difficulties of choices and recognizes how some choice will always remain a dilemma. She explores different options of coping with this dilemma and chooses a way to *handle this situation.* She has the ability to represent the dilemma in a narrative sense. If she knows how to *represent* it in a rational sense, is something we do not know. Skills like *connectedness* and *trust* are also in good hands with this pupil.

Dialogue School[5]

It is one thing to recognize how a pupil communicates his life philosophy, how to stimulate your student is another. For a long time religious education in 'bijzonder onderwijs' was considered to be a transfer of knowledge and values. With the change from teaching religion to guiding in the personal development of a life philosophy, this concept had to change. One of these concept-changes is the project Dialogue School. This is a project where the HAN University of Applied Sciences, faculty of childhood education works closely together with three primary schools to develop a didactics in guiding in the development of life philosophy.

To explain the didactics, the metaphor of a whirlwind cabin is used. In this cabin float a lot of pieces of paper with possible religious or philosophical influences a child could experience in everyday life. When a child steps into this cabin, he can try to catch as many pieces of paper he can. This is similar to how a child experiences his life: he experiences a lot of influences and some will stick to him. When the child leaves the cabin with all these pieces of paper, he could make a selection which pieces are important to him and which are not. In the metaphor, the pieces of paper have the shape of pieces of a tangram puzzle. With the kept pieces, he could put them together and create an image that is inspiring to him. This is his life philosophy. At least for this moment.

Following this metaphor, the teacher has 5 tasks to perform:

1. make children aware of the different influences

2. add extra influences which you think are important

3. stimulate children to choose which influences they want to keep an which they throw away

4. stimulate children to combine these influences into an own inspiring identity

5. learn children how to communicate their ideas and how to learn how to act upon them

[5] More information on the project Dialogue School can be found on the website www.samenonderwijsmaken.nl, Dialoog School.

The project Lichtstad was designed as part of the bigger project Dialogue School. In this project, you can see how the different steps are working. The teacher started out by making a mindmap (step 1). This is how the children discovered what they already know. The teacher also used subjects like geography to show the children that different topics have a religious dimension. That children undergo different influences, also outside the school, is also shown in the fact that the children use different Christmas stories even though they were not a part of the program.

De teacher also added new "pieces of paper". Every morning they read stories from the Bible or stories from different religions and offer activities to stimulate the socio-emotional skills (step 2). The teacher stimulated the class as a whole to make choices (step 3) when they had to decide on what to show the parents. The children were stimulated as individuals when they were asked to write "another Christmas story". They not only chose which Christmas story they wanted to use, but also which influences they wanted to use to change it.

It was difficult for the teacher to find a way in which the children could combine the different choices into one inspiring image (step 4). It was only later that she recognized that, by asking them to write the story, she was actually stimulating the pupils to make these connections. And in the same process she had also stimulated the children to give words to their life philosophy. In the case of the story of the snowman, the child had even found a way to act upon a difficult dilemma in life in general, or maybe in her own life.

Conclusions

Something as simple as asking pupils to write a story can help a child to develop in many different aspects of his education, so that he can become a strong person. But it is important, that teachers are not only aware of these possibilities but also can act upon them. One of the possibilities to help children to become strong people, is using the didactics of Dialogue School.

Literature

Alii, E.T. (2009). *Godsdienstpedagogiek.* Zoetermeer: Meinema.

Gelderen, Amos van, e.a. (2010). *Leerstoflijnen schrijven beschreven*. Enschede: SLO.

http://www.slo.nl/downloads/2010/leerstoflijnen-schrijven-beschreven.pdf

Grözinger, Albrecht (1987) . *Praktische Theologie und Ästhetik*. München: Kaiser Verlag.

Harst, Aat van der, Berg, Bas van den, Fortuin-van der Spek, Cocky (2007). *Verhalen verbinden*. Amersfoort: CPS

Kropac, Ulrich (2007). "Wenn eind Mensch stirbt, kommt der Staubsauger-Engel und saugt die Gedanken und die Seele aus – aber nur die guten": ein Projekt zur thanatologischen Kompetenz von Kindern. In: Bucher, Anton A., Büttner, gerhard, Freudenberger-Lötz, Petra, Schreiner, Martin (2007). *"Man kann Gott alles erzählen, ach kleine Geheimnisse", Kinder erfahren und gestalten Spiritualität.* Stuttgart: Calwer Verlag.

No author (2012). *De Lichtstad*. Hilversum: Kwintessens.

Oosterheert, Ida (2007). *Leren over leren*. Groningen/Houten: Wolters Noordhof.

Schepper, Jef de (2004). *Levensbeschouwing ontwikkelen*. Hilversum: Kwintessens.

Schoemaker, Tom (2011-1). Een deurtje openen. in: Schoemaker, Tom e.a.. *Midden in de week… maar zondags niet.* Gorinchem: Narratio.

http://www.samenonderwijsmaken.nl/dynamic/media/1/files/Levensbeschouwing/een_deurtje_openen.pdf

Schoemaker, Tom (2011-2). Roodkapje en de kunst van het levensbeschouwelijk begeleiden. in: Schoemaker, Tom e.a.. *Midden in de week… maar zondags niet.* Gorinchem: Narratio.

http://www.samenonderwijsmaken.nl/dynamic/media/1/files/Levensbeschouwing/Roodkapje_en_de_kunst_van_het_levensbeschouwelijk_begeleiden.pdf

Schoemaker, Tom (2013). *De Lichtstad*. research report only published on the internet.

http://www.samenonderwijsmaken.nl/page/78/eigen-onderzoek.html

Schuppert, Linda, Bogert, Annelies van den (2012). *Mindmappen op de basisschool.* Vlissingen: Basalt.

Weelden, Vincent van (2012). *Luister goed, dan hoor je wat ik denk.* thesis at HAN University of Applied Sciences faculty of Childhood Education. http://www.samenonderwijsmaken.nl/dynamic/media/1/files/Levensbeschouwing/luister%20goed%20dan%20hoor%20je%20wat%20ik%20denk.pdf

Zondervan, Ton (2012). Leren voor het leven. In: Mulder, André and Snoek, Hans, *Werken met diepgang*. Zoetermeer: Meinema.

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<TOC<

A study of the religious orientation of public school districts located in the bible belt of the United States

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Abstract

This paper examines the religious orientation of public school districts in a geographical region of the United States known as the Bible Belt. The hypothesis for this study was that public schools located in the Bible Belt would have a sacred religious orientation. If that were true, those public schools would allow religion so long as it was the preferred religion in their surrounding community. Results showed that while some school districts appeared to be sacred on a number of issues touching religion, the predominant orientation was to honor all religions but prefer none.

Religion in the Public Schools

The struggle to accommodate one person's right of religious expression while not infringing upon another person's right to be free from religious coercion has existed since our Founding Fathers first drafted the Bill of Rights more than 200 years ago. The genesis of the controversy lies in the First Amendment to the United States Constitution, which provides in pertinent part that, "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof."

The First Amendment, including the Establishment Clause and the Free Exercise Clause (referred to collectively as the Religious Liberty Clauses), was made applicable to the states by the Fourteenth Amendment to the U.S. Constitution. Section 1 of the Fourteenth Amendment provides, inter alia, that, "No State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States." Read together the First and Fourteenth Amendments mean that states have no more right to make laws or policies that establish religion, or to prohibit the free exercise thereof, than does Congress, a principle of law recognized by the U.S. Supreme Court in *Engel v. Vitale* (1962).

Moreover, it is a well-settled precept of law that in America there is a wall of separation between Church and State. The United States Supreme Court recognized in the case of *Everson v. Board of Education* (1948) that the Establishment Clause of the First Amendment was enacted to erect that wall.

Despite the language of the Religious Liberty clauses and of the subsequent decisions interpreting them by the U.S. Supreme Court, the arena of religious freedom has been fertile ground for litigation over the last half-century. In no arena has that battle raged more intensely than in our nation's public schools. Issues of daily prayer, scripture readings, moments for silent meditation, and invocations at extracurricular activities, graduation ceremonies, and before school board meetings have been so troubling as to necessitate intervention by the United States Supreme Court.

The U.S. Supreme Court has granted certiorari numerous times over the past 60 years to interpret the meaning of the Establishment Clause, especially with regard to prayer. The Court has declared unconstitutional (a) a program of daily classroom prayer adopted by the agency charged with overseeing the operation of public schools in the state of New York (*Engel v. Vitale,* 1962); (b) a Pennsylvania statute which required that at least 10 verses from the Holy Bible be read over the intercom by students, without comment, at the beginning of each public school day (*Abington v. Schempp,* 1963); (c) a Maryland statute which authorized that each school day would begin with a reading, without comment, of a chapter in the Holy Bible and/or a recitation of the Lord's Prayer (*Murray v. Curlett,* 1963); (d) an Alabama statute that authorized a period of silence during the school day for meditation or voluntary prayer (*Wallace v. Jaffree,* 1985); (e) an invitation extended by a school to clergy to give the invocation and benediction at a public school graduation ceremony (*Lee v. Weisman,* 1992); and (f) a public school policy that permitted, but did not require, prayer to be initiated and led by students at high school football games (*Santa Fe Independent School District v. Doe,* 2000).

The U.S. Supreme Court has not restricted its interpretation of the application of the Establishment Clause in the arena of public education to cases involving prayer. The Court has also struck down as unconstitutional (a) a program that upon parental request allowed students to attend religious classes in a public school during regular school hours (*McCollum v. Board of Education,* 1948), (b) an Arkansas statute which made it unlawful for a public school teacher to teach or to use a textbook that teaches evolution (*Epperson v. Arkansas,* 1968), (c) a Kentucky statute that required the posting of the Ten Commandments on the wall of each public school classroom (*Stone v. Graham,* 1980), (d) a Louisiana statute that required public schools to give balanced treatment to creation science and evolution science (*Edwards v. Aguillard,* 1987), and (e) the denial by a local school board of a request

by students to form a Christian club (*Westside Community Schools v. Mergens,* 1990). However, the Court upheld as constitutional a New York statute that permitted students to attend religious classes off campus by and at the expense of a religious body (*Zorach v. Clauson,* 1952).

In addition to deciding numerous cases implicating various religious issues, in *Lemon v. Kurtzman* (1971) the U.S. Supreme Court went so far as to articulate a three-part test to determine whether a state statute was constitutional under the Establishment Clause. The Court held that in order to pass First Amendment muster a statute must (a) have a secular legislative purpose, (b) have a principal or primary effect that neither advances nor inhibits religion, and (c) not foster an excessive governmental entanglement with religion.

Our nation's highest court has also decided cases implicating the Free Exercise Clause of the First Amendment in the context of public schools. The U.S. Supreme Court declared unconstitutional a compulsory school attendance law in Wisconsin, on the grounds that it unduly burdened the religious beliefs of Amish parents by requiring their children to attend school to the age of 16 (*Wisconsin v. Yoder,* 1972). The Court also declared unconstitutional a local school board regulation that compelled students to recite the Pledge of Allegiance and salute the American flag at the beginning of each school day (*West Virginia State Board of Education v. Barnette,* 1943). In doing so, the Court reversed an earlier decision in which it characterized a similar edict to be a matter of educational policy within the realm of the state legislature (*Minersville School District v. Gobitis,* 1940).

In the process of deciding the foregoing cases, the Supreme Court has established legal precedents that should logically and rationally guide the policy decisions of every public school board member, administrator, and teacher in the United States with regard to religious liberty in schools. Furthermore, there is a wealth of resources available to school districts wishing to adopt formal policies on religion.

One theory that has been advanced for the incongruence between law and practice is that local practice is influenced by the cultural norms, values, and beliefs of local school boards, school administrators, and the surrounding community with regard to matters of religion in public schools. Charles C. Haynes, a noted expert in the field of First Amendment law and public education, has characterized the ongoing debate over religion in public schools as a cultural war involving three sharply divided viewpoints (Haynes, 2006a).

In "*The Bible and Public Schools*," Haynes (2006a) theorized that individuals on one end of the spectrum believe that the separation between Church and State should be absolute and schools should be places where religion is excluded. Haynes (2006a) used the term "naked" to describe these schools. A somewhat neutral view is held by those people who believe that public schools should neither inculcate nor inhibit religion, and believe that public schools must protect the religious liberty rights of students of all faiths and of no faith. Haynes (2006a) described these institutions as "civil public schools." At the opposite end of the spectrum are those people who advocate public schools in which their religion is the preferred one in school policies and practices. Haynes (2006a) identified this latter approach particularly with the rural South.

The purpose of this study was to determine if public school districts in the Bible Belt have a sacred orientation toward religion. In order to make this determination, published policies were analyzed and superintendents of public school districts publishing policies were interviewed to measure the degree to which cultural norms, values, and community beliefs influence the policies and practices of public school districts toward religious liberty. Data was collected in this study on (a) the existence of school district policies addressing religious liberty in public schools, (b) the contents of such policies, (c) the practices that occur in school districts that have policies addressing religious liberty, and (d) the influence of the local community on the attitudes, beliefs, norms, and values of superintendents on religion in public schools.

Three objectives were established in order to determine if public school districts in the Bible Belt were predisposed toward a sacred religious orientation. The findings of this study will be presented in the context of those objectives, which were

(1) Analyze, compare, and contrast the policies and practices of Bible Belt public school districts in matters of religion;
(2) Analyze, compare, and contrast the congruence between policies and practices for those school districts on matters of religion; and
(3) Determine the influence of the local community on the attitudes, beliefs, norms, and values of superintendents on religion in public schools.

Discussion of Findings

Policies and Practices- In terms of school district policies, the religious orientation of school districts was predominantly civil; districts tended to honor all religions but prefer none. This orientation is not surprising, given the logical conclusion that district policies are often crafted by state departments of education or state school board associations. It seems reasonable that those policies would be based on legal mandates such as the Religious Liberty Clauses of the First Amendment, No Child Left Behind, the Equal Access Act, the Protection of Pupil Rights Amendment, and well-settled federal antidiscrimination law. In fact, all of those laws formed the basis for various policies in the selected school districts.

There is ample evidence to support the conclusion that, from a policy perspective, school districts have a civil religious orientation. An air of neutrality was pervasive. For example, the typical policy on prayer provided that it had to be student-led, student-initiated, and voluntary, free of coercion, and could not disrupt the educational process. It could be neither school-sponsored nor school-directed. In those districts which provided a daily moment of silence, the policies were usually drafted to state that the activity was not intended to be religious, that school officials were to neither encourage nor discourage use of the time for prayer, and that coercion of students who desired to abstain would not be tolerated.

With regard to other religious activities, the norm was a policy which protected the right of students to voluntarily pray, express their religious viewpoints, and join organizations of like-minded students. The freedom of students to read religious literature and to participate in prayer groups and other religious gatherings before, during, and after school was also routinely acknowledged. At the same time, however, typical policies also provided that students would not be harassed, ridiculed, persecuted, or intimidated due to their beliefs or participation, or lack thereof.

Another common denominator was the equal nature of the orientation; equal access for the use of school facilities, equal educational opportunities, equal employment opportunities, and equal access of student organizations. The prevailing themes were nondiscrimination and creating a working and learning environment free from religious harassment.

The orientation of school districts seemed to shift somewhat from civil to naked in the classroom, where the environment tended to more closely resemble a complete separation of Church and State from an institutional perspective. Instruction was required to be secular, neutral, and objective, and usually confined to the study of religion in an historical or literary context. There was a more civil orientation with regard to students, who typically were given the right to express their religious viewpoints in class.

Contrary to the predominantly civil orientation of school districts in the context of policy, a study of school district practices revealed a greater mixture of civil, naked, and sacred orientations, the latter characterized by a mindset that the local religion was the preferred one. The predominant orientation tended to be civil, with isolated pockets of districts with sacred or naked orientations.

For example, superintendents from 12 districts spread out across eight states said that either a prayer or a moment for silent reflection occurred in conjunction with Friday night football games. The norm was for the prayer to be student-led, but there were isolated districts in which prayer was voiced by a local minister or by an adult from the community. Neither prayer nor a moment of silent reflection occurred at four districts in Kentucky, Louisiana, Mississippi, and Tennessee.

There was also student-led prayer before graduation in nine districts located in six states, but no prayer was voiced in two districts in Alabama and Mississippi. A sacred orientation was present in a Kentucky district where the superintendent, who professed to be a devout Christian, admitted to delivering a religious message from the Bible at graduation.

Isolated areas of school districts with sacred practices were found in other areas as well. For example, seven school districts in six states held baccalaureate services in a local church. While attendance was not mandatory, it is reasonable to assume that students in the graduating class, and their parents, could face the dilemma of missing a milestone event or being exposed to religious beliefs that troubled them. Eight school districts in seven states did not have a baccalaureate service, which could be viewed as a naked orientation toward religion.

A mixture of religious orientations was found in the area of teaching and instruction. Superintendents of 17 districts in eight states said that teaching about religion was confined to an historical or literary context, indicating somewhat of a naked orientation. However, six

school districts in Alabama, Arkansas, Mississippi, and Tennessee said that a class on the Bible was being taught or would be shortly as an elective, which would indicate a more civil orientation. That orientation was also on display in the near unanimity among districts in allowing students to express their religious views in a class assignment, and in providing an alternate assignment or favorable consideration if the student had a religious objection to an assignment.

District practices on encouraging or discouraging religious activities revealed a division between civil, sacred, and naked districts. Twelve superintendents in six states said that their districts were neutral, neither encouraging or discouraging religious activities. Two superintendents in Louisiana and Texas avowed that no religious activities occurred in their districts. A Mississippi superintendent urged caution, fearful that allowing religious expression would open the door for devil worshippers, and a Kentucky superintendent admitted to promoting Christianity in a way that would not draw undue attention to it.

Another area where school districts were split between orientations was in the distribution of religious literature. Nine districts in seven states allowed representatives from Gideons International to distribute copies of the Bible on their campuses, which was evidence of a sacred orientation. While the prevailing practice in those districts was to place the Bibles on a table in a common area, it is instructive that texts representing other religious beliefs were not made available. In fact, one Kentucky superintendent said that the practice would stop in his district if administration was required to pass out copies of the Quran as well. An equal number of districts, nine in six states, did not allow the distribution of any religious literature on campus, which would indicate a naked orientation toward religion.

Student dress was an area in which a civil orientation controlled. Seventeen districts in eight states allowed students to wear religious garb, provided that there was no distribution of the educational environment. While that garb tended to be clothing with religious words or symbols, five superintendents in Georgia, Mississippi, and Tennessee said that they would allow a Muslim girl to wear a Berka. However, there was one isolated instance of a sacred orientation, found in the Kentucky district whose superintendent implied that any study who wished to wear a t-shirt communicating a religious message other than support for the local church was an extremist.

Congruence between Policy and Practice- Two questions are raised and addressed in this section. Firstly, does congruence of policy and practice exist within the sample of school districts whose policies were studied and whose superintendents were interviewed? Secondly, does congruence exist within those individual districts from one religious issue to the next? In other words, is it possible, for example, that a school district be sacred with regard to the distribution of religious literature but civil on prayer?

As a starting point, every superintendent interviewed said that there was congruence between religious policies and practices in their respective districts. It should follow, then, that if policies were almost universally civil or naked, the practices described as occurring by the superintendents would be almost universally civil or naked. For the most part, that hypothesis proved to be true.

However, while there were no written policies identified as sacred, there were instances of sacred practices in those districts where data from superintendent interviews could be compared to policies in place in those districts. For example, one school district in Texas allowed Gideons International to distribute copies of the Bible on school grounds, despite having a policy that prohibited the distribution of religious texts or materials used in an appropriate course of study. It is worth noting that the superintendent, in the context of responding to a question on offering a Bible course, did not want to be drawn into equality for all world religions. The superintendent did not want to be required to teach the Quran because his faculty erred in trying to teach the Bible.

There were other instances as well. Seven school districts in Arkansas, Kentucky, Louisiana, Mississippi, Tennessee, and Texas held baccalaureate ceremonies in a local church. However, three of those districts had express policies that prohibited the district from taking an action respecting the establishment of religion, that pledged neutrality on matters of religion, or that prohibited the district from promoting any religious belief. It can be argued that simply holding a school district activity on church grounds communicates school sponsorship of that particular faith to all those in attendance.

In the context of internal district congruence, there were instances where districts had mixed religious orientations depending on the issue. For example, a superintendent of one Kentucky district who described himself as a devout Christian admitted to several personal practices that would constitute a sacred religious orientation. Those practices included (a) the delivery of a religious message based on the Bible at graduation; (b) eating

in the cafeteria and saying a prayer over his food to initiate discussion about religion with students; (c) allowing the Bible to be passed out on school grounds, with the caveat that the practice would stop if the Quran had to be distributed as well; and (d) sometimes leading prayer at Baccalaureate. However, the superintendent also said that he would not want a student to be penalized for having a religious objection to an assignment.

Another Kentucky superintendent admitted to encouraging Christianity, but not in an overt way. Yet, baccalaureate ceremonies were not held in his district, instruction was confined to a discussion of religion in a historical context, there was no issue with granting a student's request to be excused from an assignment on religious grounds, and the distribution of religious literature on campus was not allowed. Although an Arkansas superintendent could not define a "legitimate religion," that term was used as the district's standard for those materials allowed to be left in the office for distribution. However, the superintendent would have no issue with honoring a student's objection to a class assignment on religious grounds.

Attitudes, Values, Norms, and Beliefs of Superintendents—Superintendents were asked to express their opinions on two questions regarding religion. The first question concerned their perceptions about the current reality and the desired reality of religion in public schools. In the second question superintendents were asked to describe the influence of the local community on their policies and practices.

Superintendents almost universally described the current role of religion in public schools as nonexistent. The most often cited reason was legal mandates. While approximately one fourth of superintendents expressed agreement with separation of Church and State, others were frustrated at not being able to do what they believed best for students on the local level. One Arkansas superintendent suggested that perhaps those mandates were not as chilling on religious expression as districts interpreted them to be. The fear of litigation from offended parents or watchdog organizations such as the American Civil Liberties Union may cause districts to swing too far the other way, and in fact fear of the ACLU was specifically cited by two superintendents. If that were prevalent, however, one would expect to find more districts with naked religious orientations, and that was not the case in this study. The orientation of most districts on most issues was either civil or, to a lesser extent, sacred.

Among those superintendents who argued for an expanse of religious influence in public schools, the vast majority of them argued not for the teaching of religious faiths but rather for what was described by some as character education. The prevailing feeling among those superintendents was that students need greater training in morality, and that such training could appropriately come in the context of Bible-based religious instruction. Unspoken was the implication that only the Christian faith could appropriately be the basis of sound moral instruction- which, in and of itself, is a sacred orientation toward religion.

Regarding the impact of local culture on policies and practices, 17 superintendents in eight states said that because of legal mandates their local communities had minimal if any effect on school district policies. That should not be surprising, given that policies published by school districts on the internet could be quickly and easily verified for compliance with statutory and common law. That is not necessarily the case with school district practices, which are more readily out of the public eye and cloaked by the homogeneity of the surrounding community. As one of the Kentucky superintendents phrased it, laws and statutes are open to interpretation and loopholes for those creative enough to find them.

In the context of religious practices, three superintendents denied that those were affected by the local culture. In each instance, there was an acknowledgement that practices had to follow policies. Two others talked about the erosion of local influence as government intervened more and the population grew more heterogeneous. At the opposite end of the spectrum was the unapologetic Kentucky superintendent who was excited to find a school and community that shared his moral values and beliefs. Most superintendents, however, seemed caught in the struggle between fulfilling their legal obligations regarding religion in public schools and a desire to accommodate local wishes where they could. That struggle perhaps accounted for those situations in which districts had a mixed orientation depending on the nature of the practice.

Conclusion

The original hypothesis for this study, based upon theories of Charles Haynes regarding the religious orientation of public schools, was that public schools located in the Bible Belt of the United States would have a sacred religious orientation. If that were so, those public schools would allow religion so long as it was the preferred religion in their surrounding community. It seems logical that internal consistency of orientation on religious issues within individual schools should be implied within Haynes' theory.

Neither was found to be the case for the sample of 64 school districts and 22 superintendents researched from Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, and Texas. While some school districts did appear to be sacred on a number of issues touching religion, the predominant orientation was civil; school policies and practices that honored all religions but preferred none were the norm. Inconsistency of orientation was found within school districts, with different orientations evident depending on the issue at hand.

References

Abington v. Schempp, 374 U.S. 203 (1963).
Edwards v. Aguillard, 482 U.S. 578 (1987).
Engel v. Vitale, 370 U.S. 421 (1962).
Epperson v. Arkansas, 393 U.S. 97 (1968).
Everson v. Board of Education, 330 U.S. 1 (1948).
Haynes, C.C. (2006a). Overview: Religious liberty in public schools. Retrieved on September 18, 2006 from http://www.firstamendmentcenter.org/rel_liberty/publicschools/overview.aspx
Lee v. Weisman, 505 U.S. 577 (1992).
Lemon v. Kurtzman, 403 U.S. 602 (1971).
McCollum v. Board of Education, 333 U.S. 203 (1948).
Minersville School District v. Gobitis, 310 U.S. 586 (1940).
Murray v. Curlett, 374 U.S. 203 (1963).
Santa Fe Independent School District v. Doe, 530 U.S. 290 (2000).
Stone v. Graham, 449 U.S. 39 (1980).
Wallace v. Jaffree, 472 U.S. 38 (1985).
West Virginia State Board of Education v. Barnette, 319 U.S. 624 (1943).
Westside Community Schools v. Mergens, 496 U.S. 226 (1990).
Wisconsin v. Yoder, 406 U.S. 205 (1972).
Zorach v. Clauson, 343 U.S. 306 (1952).

<TOC<

Mathematics Education

Preservice teachers' knowledge on elementary geometry concepts

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Abstract

This text is based on research, which is still in progress, whose main objective is to identify and understand what the main difficulties of future mathematics teachers of basic education are, regarding their knowledge in geometry in the context of the curricular unit of Geometry during their undergraduate degree. We chose a qualitative approach in the form of case study, in which data collection was done through observation, interviews, a diverse set of tasks, a diagnostic test and other documents. This paper focuses on the test given to prospective teachers at the beginning of the course. The preliminary analysis of the data points to a weak performance of future teachers in the test issues addressing elementary knowledge of Geometry.

Keywords: elementary concepts of geometry, initial training for teachers, geometrical knowledge

Introduction

The constant acknowledgement of the lack of basic structuring concepts among the students who apply, and have been applying since 2007/08, to the bachelor degrees of Basic Education (LEB), opened the way to the intention of learning how teaching mathematics could lead, not only to learning mathematics, but also to learning about mathematics. We aim at understanding how to develop, among the students of LEB, solid training in mathematics and didactics, as well as a more positive attitude towards mathematics and geometry skills. Concerning the importance of liking mathematics and enjoying teaching it, Braumman (2004) says that social influences and, mainly, the influence of teacher, are crucial. He also mentions that it is important for the teacher of the 1st cycle to like Mathematics and to transmit that liking, since it is impossible to feign a liking which doesn't exist (Braumman, 2004). Therefore, we hope that these students, in their teaching activity, will able to awaken their joy for mathematics and, consequently, make them more skilled in mathematics.

The different curricular recommendations and orientations, at a national and international level (e.g. PMEB, DGIDC, NCTM), regarding geometry for the 1st and 2nd cycles, assume that future teachers are proficient in these matters. Therefore, we decided to search, identify and understand how future teachers relate with each other regarding their perceptions and knowledge of the contents concerning geometry in a common classroom environment.

Teachers' initial training

Teachers' training has been a research field, especially since the 90s. Since then, the research concerning initial training for teachers has been huge, and there's a considerable amount of research in relation to the knowledge developed by future teachers in order to teach (Ponte & Chapman, 2008). Many of these studients do not consider "the mathematical knowledge they are developing in terms of the development of subject knowledge for teaching" (Oliveira & Hannula, 2008, p. 16). Several teachers' trainers (e. g. Ball, Bass, Sleep & Thames, 2007; Bullough & Gittlin, 2001; Korthagen, Kessels, Koster, Lagerwerf & Wubbels, 2001, Loughran, 2006; Ma, 2009; Segal, 2002; Shulman, 1986) mention questions regarding the teacher and teachers' training. However, for several reasons, these contributions have failed in providing an answer for some dilemmas that still persist today in training teachers.

One of the goals of initial training is to develop practical knowledge and skills in teachers so that they, not only reproduce them but also, so that their practice is more dynamic, interactive and reflexive (Vale, 2002). This idea is sustained by Shulman (1986) when, regarding teachers' training, he mentions that education researchers' task is to understand the phenomena behind educations, to learn how to improve its implementation and to discover ways to prepare and train educators and teachers. Several researches highlight the importance of providing the teachers, during their training, with experiences which increase their mathematical knowledge and their knowledge about mathematics (e.g. Ball et al., 2007, Ma, 2009). However, the development of the necessary knowledge to fulfil the teaching profession comprehends different components which, during the last few years, have been described in several ways, not moving away too much from the teacher's knowledge model of Shulman (1986). In the decade of 1960, research shows that knowledge and pedagogy are in-dissociable parts of comprehension (Shulman, 1986).

Nowadays, it's consensual that, in order to teach mathematics, it's necessary to develop not only mathematical knowledge and knowledge about mathematics, but also knowledge on how to teach, considering both didactics and pedagogy. Ma (2009) says that “a limited understanding of the subject confines the teacher’s capacity to promote conceptual understanding amongst students” (p. 83). She also says that among teachers “pedagogical knowledge may not compensate for the ignorance of the concept” (Ma, 2009, p. 135). Wu (1999) states, particularly, that the teacher cannot teach what s/he doesn't know. In order to be a good professional, capable of teaching maths, it's crucial to deeply know mathematics and therefore, as maintained by Hill, Sleep, Lewis and Ball (2007), it's crucial to have the ability of putting to work the strategies which are capable of making the students learn. Also Ponte and Chapman (2008) mention that in order to teach properly, the teacher must know the contents of what s/he is teaching, the students, the context and the teaching techniques. Furthermore, teachers teach what they are.

This makes us analyse whether we have been taking the necessary steps concerning the initial training of our basic education teachers. In Ponte's opinion (2006), there are many critics concerning teachers' training and, within our society, we can perceive a lack of confidence concerning the quality of the initial teachers' training. There are even some who consider that everything that is done in this domain only increase the problems that education faces. However, the current model of teachers' training, according to Bologna, deeply changed the weight of mathematics curricular units. A lot of the basic education teachers' training courses of the different variations comprehended (except the mathematics and sciences variations) only 120 hours of mathematics, which is quite insufficient on order to overcome the weaknesses faced by teacher candidates' basic and secondary education. However, the model that follows the Bologna process has yet another problem as it provides a wide basic training, allowing candidates with different backgrounds to have access to the training of future basic education teachers. A lot of these candidates studied humanities and, therefore, have little preparation concerning mathematics, or a small success rate in mathematical courses.

Learning mathematics “is like a multi-storey building. The foundations may be invisible from the upper floors but they are the ones which hold the whole building” (Ma, 2009, p. 205). As trainers, it's quite difficult to diagnose which foundations the students are missing. Students

are afraid to show their scientific weaknesses thinking that with more knowledge they will be able to overcome them. It's the same as if we try to add one or two floors more to a building designed only to have two floors, without strengthening its foundations, which would undoubtedly lead to its collapse. Therefore, it's crucial that future teachers know the basic concepts (the foundations) very well in order to understand other more complex concepts (the upper floors) or else they should take down the whole building and build it up again.

There is a goal that seems to be consensual within teachers' training which is "to develop the reflective capacity of future teachers so as to contribute to their formation as responsible professionals who are autonomous, ethically challenging, and able to effectively reflect on their teaching practice" (Oliveira & Cyrino, 2011, p. 111).

We can say, then, that besides other skills, a good teacher should not only be passionate about what s/he teaches, but also have a mathematical and didactic knowledge which allows him/her to identify: what s/he can teach, how, and what the student is capable of learning.

Teaching and learning geometry

Our teaching system allows the student to progress without having succeeded in mathematics, without having absorbed basic and structuring concepts, particularly concerning geometry. Previous orientations concerning school mathematics weren't very concerned with geometry. His relevance was recovered during the recent PMEB (Mathematics program for basic education). This is ascertained by Veloso (2008) when declaring: "How is it possible to spend 9 years looking at cylinders and cones without once imagining to cut them and see the plane?!!" (p. 19). Therefore, the hardships which geometry is facing are quite predictable. The PMEB assumes that, throughout the three study cycles, teaching and learning mathematics goes through a development process based on four fundamental foundations: the work with numbers and operations, the development of geometrical thinking, algebraic thinking and the work with data. Once some of the relevance that geometry had thirty years ago was recovered, it seemed pertinent to direct our research towards the study of the acquisition of geometrical basic concepts of future teachers for the 1st and 2nd study cycles.

The study of geometry is crucial for the mathematical education of our youth. During the 1st and 2nd study cycles, children start to develop the cognitive structure which enables rational thinking within a linear and deductive thinking system. As suggested by the Principles and Standards for School Mathematics, during the first years, children should start building mathematical arguments which are inductive about ideas and geometric connections (NCTM, 2000). The development of mathematical arguments enables the transition from informal to a more formal thinking method, which stresses mathematical reasoning, including the inductive and deductive processes, the formulation and reasoning of conjectures and the classification and definition of geometrical objects. Concerning geometry, the Mathematics program for basic education particularly stresses the visualisation and comprehension of properties of geometrical figures, understanding how important these are for the development of the student's spatial awareness and also introduces the study of geometrical transformations from the first years, which is progressively widened and more deeply analysed during the more advanced years.

For several years, mathematics educators have been studying the Van Hiele levels (e. g. Burger & Shaughnessy, 1986; Gutiérrez, Jaime & Fortuny, 1991; Jaime & Gutiérrez, 1994; Saads & Davis, 1997) and space visualisation skills (Arcavi, 2003; Battista, 2007; Battista & Clements, 2002; Saads & Davis, 1997). According to Battista (2007) it's important to develop, within the child, the skill to "see", analyse and think about the spatial objects and their images. Also according to Vale and Barbosa (2009) “to see” is a very important component of generalization and it should be explored from early years. Concerning the role and importance of visual representation, Arcavi (2003) defines “visualization is the ability, the process and the product of creation, interpretation, use of and reflection upon pictures, images, diagrams, in our minds, on paper or with technological tools, with the purpose of depicting and communicating information, thinking about and developing previously unknown ideas and advancing understandings” (p. 217). Besides visualisation, geometrical skills involve two other important cognitive processes: construction and reasoning (Duval, 1998). Reasoning is strengthened by the means of the relations which are established when looking for geometrical objects in certain conditions.

However, mathematics in general and geometry in particular, do not accept the lack of basic concepts where other more complex ones are based. Geometry is like a net of

interconnected thoughts and concepts and of representation systems used to conceptualize and understand physical and imagined spatial environments (Battista, 2007). If there is a broken cycle, we must understand exactly what went wrong. This idea, supported by van Hiele's theory, finds its way as a reference for teaching geometry. Therefore, it is important to understand the constructive, global and progressive process of Hiele's theory for teaching and learning geometry. This theory presupposes the existence of five sequential levels for the development of geometrical thought. These levels get progressively more complex and the student's evolution throughout the levels is determined by the teaching methods. Van Hiele also considers that the teacher has a crucial role within the process of teaching and learning of his/her students. The teacher must define the adequate tasks and activities which are able to lead the students to reach further levels of thought. In order to assess the level of development of the students, the teacher needs a tool which allows him/her to assess whether the student has progressed and how so. According to van Hiele's theory, the progression in these levels happens as students develop their geometrical maturity. Geometrical thought is developed, gradually, starting by recognising figures and going on to its differentiation up to the emergence of deductive reasoning.

The development of geometrical thought is an important auxiliary to solving problems in students' daily lives. However, the acquisition of these ideas depends greatly upon the teacher and his/her knowledge according to Gomes (2003) when stating that the teacher's knowledge of the contents is crucial to the students' learning process, and Jones (2000) when referring that the success of teaching geometry depends upon the teacher's knowledge and teaching methods.

Taking into account the considerations made up to now, we decided to direct this communication towards the analysis of the Test as a means of diagnosing and characterising the students' geometrical knowledge at the beginning of their study of geometry.

The study

The on-going study is developed within the context of a second year class of LEB, at the beginning of the curricular unit of geometry of the second semester, taught by a teacher who is the first author of this paper. Our main goal is to identify and understand the main difficulties of the students regarding geometry. Based on the previous knowledge the

students acquire in basic and secondary education, we intend to identify possible weaknesses so that we can understand, throughout the curricular unit, how this knowledge progresses. Therefore, in the first class of the curricular unit, we gave a test to the twenty four students in the class that we chose to the research.

This study took place in a classroom environment where the participants were the class students, the teacher and the researcher who had a role of non-participant observer. The selection of this class among four classes was based, mainly, on criteria of good informer students and availability.

Results and discussion

As was already mentioned, we will analyse some of the answers obtained in five of the Test's answers. However, before that, in order to have a global idea of the class, we will start by contextualising the Test and analysing the results obtained by the class.

During the first class of geometry curricular unit, we gave the Test to the class which was going to be the object of the research. This Test was created based on adapted questions taken from national tests, assessment tests of the 1st, 2nd and 3rd cycles, as well as from international tests, TIMSS, PISA and van Hiele's test. The Test has twenty five questions and while creating it, we took into account, not only the specific knowledge of some geometry topics (65% of the questions were about plane geometry and 35% about space geometry), but also transversal skills: solving problems, communication and reasoning.

Table 1 sums up the results of the class (%) spread by the transversal knowledge and skills. In 1032 possible points only 347 we obtained, that is, 33.6% of correct answers.

KNOWLEDGE AND SKILLS

Knowledge and understanding of mathematical concepts and knowledge	Reasoning	Communication	Solving problems
34%	35%	33%	31%

Table 1 – Percentage of the class' results divided by knowledge and skills

Despite the way in which questions were grouped by knowledge and skills being debatable, we take it as a reference to assess the level of some basic geometry knowledge.

This first element that characterises the class proves our idea of the insufficient basic geometry knowledge. The results show a low level of basic knowledge acquisition. None of the transversal skills and knowledge set by the PMEB reached even a 36% success rate. There were only 34% correct answers in knowledge and understanding of concepts and mathematical knowledge. Solving problems proved to be the weakest point for these students, with only 31% correct answers, followed by question involving communication with a 33% success rate. Concerning questions involving reasoning, only 35% of the students answered adequately.

We will now analyse the class performance in five of the twenty five questions. We have selected at least one question per knowledge and skill.

Question 3 – "Explain why the following statement is true: *A right triangle cannot be equilateral.*"

This question is part of the reasoning category. It concerns plane geometry concepts related to the triangle. It demands knowledge about the internal angles of a triangle and also about the classification of triangles by internal angles and by the relative lengths of the sides. Given the needed knowledge, despite being basic, we didn't expect good outcomes by the students.

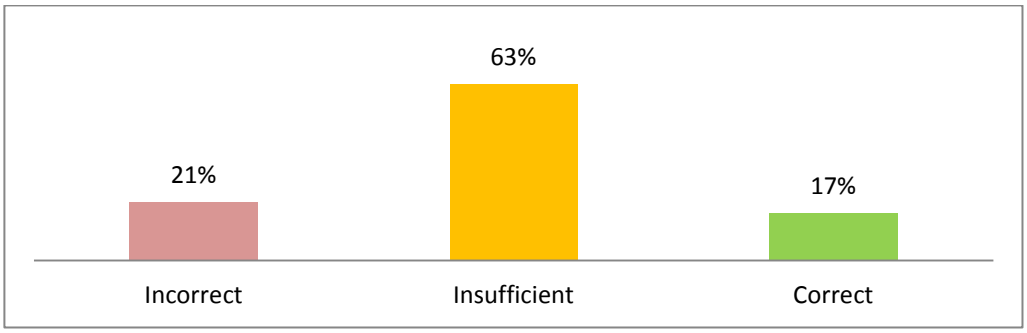


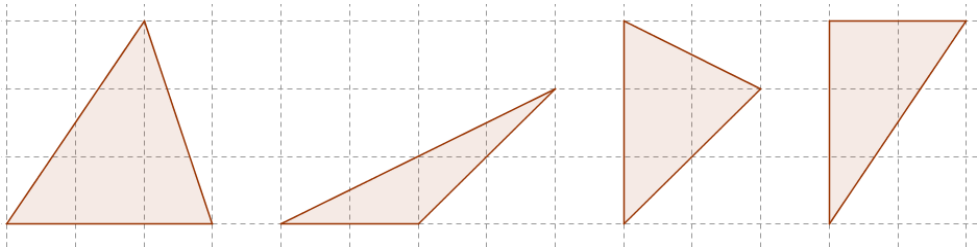
Figure 1: Student outcomes to question 3.

17% of correct answers and 63% give an insufficient explanation. The mistakes in some answers are interesting. A student said: "A right triangle has a 90^0 angle; an equilateral triangle has two equal sides and one that is different so it cannot have a 90^0 angle." The student mistakes the notion of equilateral triangle by the notion of isosceles triangles. Another wrote: "Because an equilateral triangle has all angles with an amplitude of 45^0 and therefore, if this is a right triangle, this is, with an angle of 90^0, it is not possible that it is simultaneously an equilateral triangle". The student doesn't realise that $45^0 x 3 \neq 180^0$. With this

answer, we don't know whether the student is aware that the sum of the internal angles of a triangle equals 180^0.

Concerning the results obtained in this question, our expectations were confirmed.

Question 4 – "For each of the triangles draw, on the figure, a height."



This question falls into the category of knowledge and understanding of concepts and mathematical knowledge. Within plane geometry, concerning the triangle, this question concerns basic knowledge of one of its elements: the height. We expected a high percentage of correct answers.

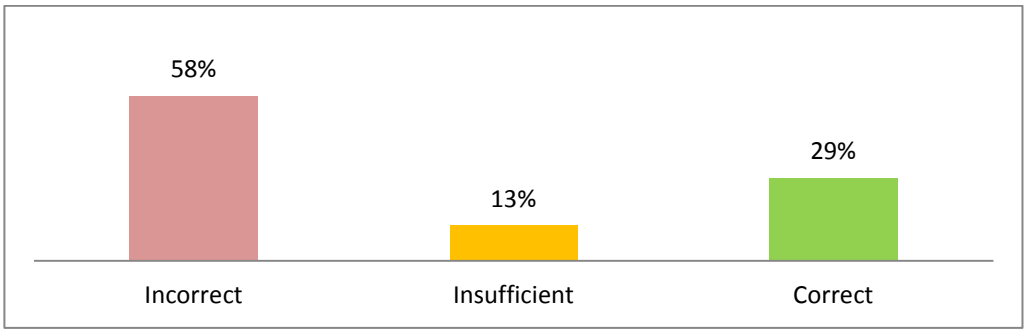


Figure 2: Student outcomes to question 4.

However, according to Figure 2, only 29% of the students were able to answer correctly. This was a low outcome considering what we expected: the knowledge needed - the height of a triangle - is basic. In figure 3 we typified an answer of these students.

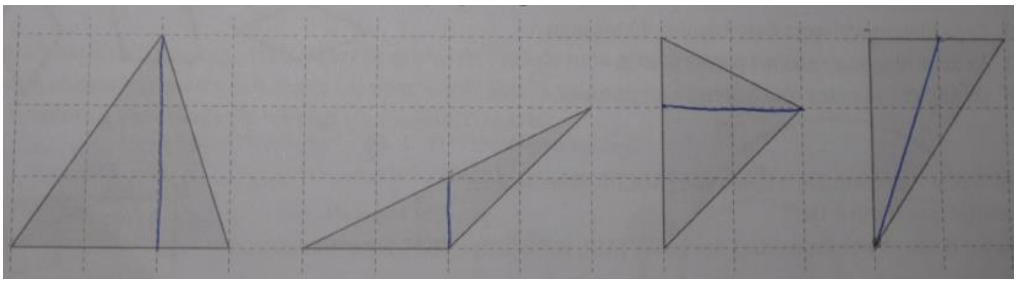
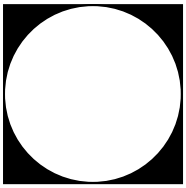


Figure 3: One of the responses to question 4.

Question 6 – “The sweaters of the participants in a handball tournament will have the drawing showed in the figure. Cátia will call Mr. Tomás. She needs to describe the drawing in order for him to do it. Put yourself in Cátia's role and describe the drawing for Mr. Tomás.



The question was adapted from the mathematics assessment test for the 1st cycle of basic education in 2008 and falls into the communication category. We expected a good performance by the students in this question given that it concerns plane geometry and involves the circle, the square and the notion of in-circle.

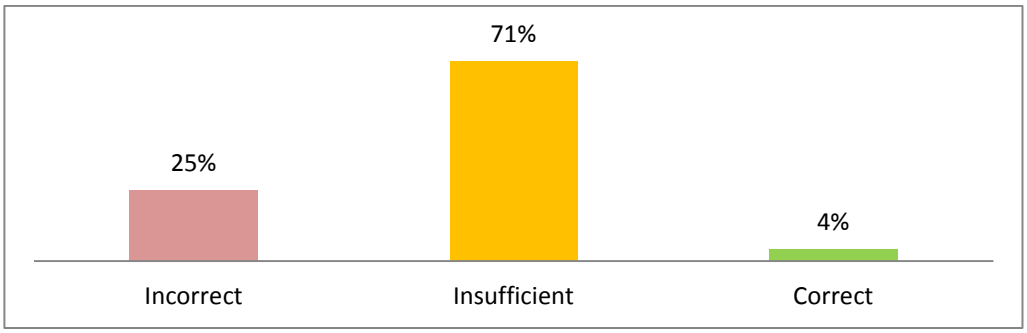
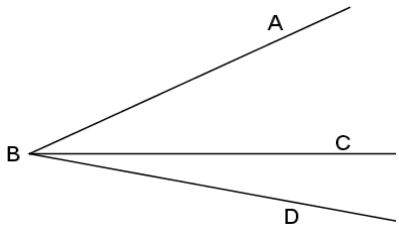


Figure 4: Student outcomes to question 6.

4% of correct answers as only one student answers correctly. 71% of the students gave and insufficient answer and 25% didn't answer. These results were surprising, as well as some of the answers. One of the students wrote: “… a black background square superposed by a white background circumference”. Another student said: “The figure represents a square and inside it there a solid figure, in this case, the circle" And another wrote: “A black square with a white circumference. The diameter of this circumference should be half of square's measurement (or the perimeter of the circumference should touch all the sides of the square)”.

The difficulty showed in mathematical communication, the confusion and lack of basic concepts showed by the answers of these students to answer a simple question is a factor that should worry all of us, educators.

Question 11 – “How many angles can you identify in this figure? Mark them clearly.”



This question falls into the category of knowledge and understanding of concepts and mathematical knowledge. Within plane geometry, it

concerns the notion of angle. This being a question that demanded not only the notion of angle, but also the understanding of the concepts of complementary and supplementary angles, we didn't expect a good outcome for this question.

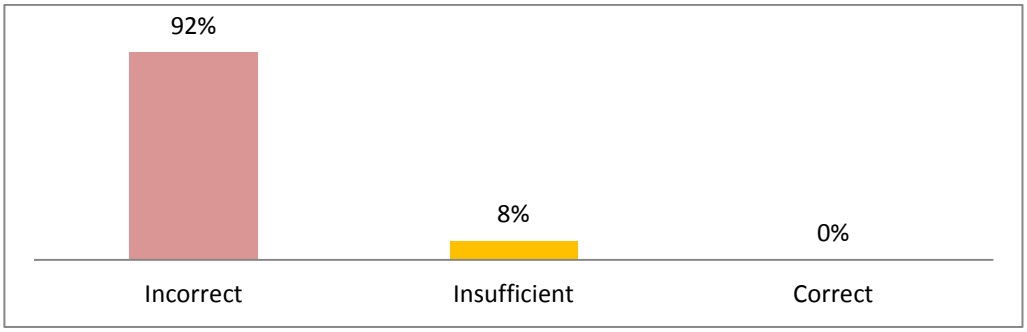
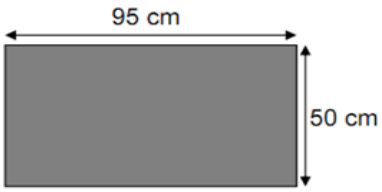


Figure 5: Student outcomes to question 11.

Despite the fact that we didn't expect a good outcome, figure 5 shows the lack of a single correct answer (eight angles) and this was a surprise. Only one students was able to identify six angles and another one four angles. Of the remaining, one student did not answer, three students identified only two angles and eleven students identified three angles. As educators, we should be worried by the low performance of students in question involving visualisation.

Question 12 – "Ana put twelve photos, without superposition, in a rectangular card with the dimensions marked on the figure. Each photograph has the form of a rectangle 20cm long and 15cm wide. What is the area of the card that hasn't been taken by the photos?



The question was taken from the mathematics assessment test for the 1st cycle of basic education in 2010 and falls into the problem solving category. This is a plane geometry problem involving the area of the rectangle where the student can sketch the steps that need to be taken to solve it. Given that the concepts involved in this question are basic, we expected that a good part of the students was going to be able to solve this problem. However, none of the students was able to solve the question correctly.

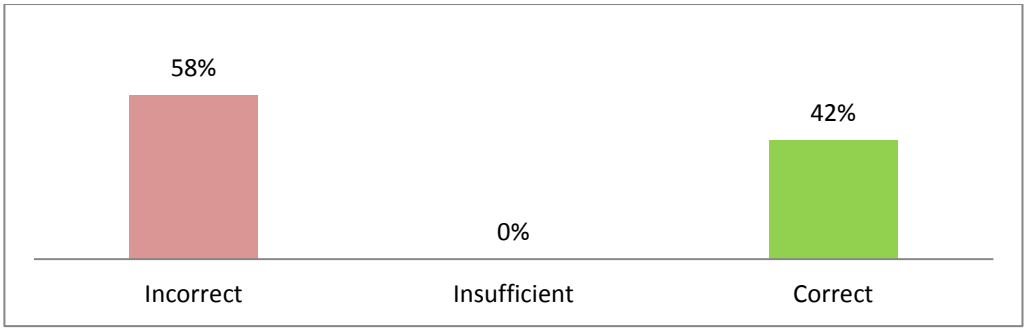
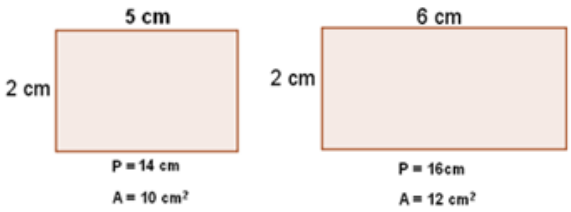


Figure 6: Student outcomes to question 12.

The analysis of the graph of figure 6 shows that over half of the students weren't able to think of a correct strategy to solve a simple problem of subtraction of areas.

Question 13 – "In a class of the 5th grade, a student got in the classroom and said to the teacher: *Teacher, I've found a new rule: In any figure, if we increase the perimeter, the area will also increase. I brought an example to prove it is true.* Put yourself on the teacher's shoes. How would you comment on the conjecture of the student?"



This question was adapted from Ma, 2009, and falls into the category of reasoning and, within plane geometry, it concerns the relation between the perimeter and the area of a rectangle. Given that this is a conjecture that is apparently obvious, we had a low expectation, but we were far from imagining that there wouldn't be any correct answers, as figure 7 shows.

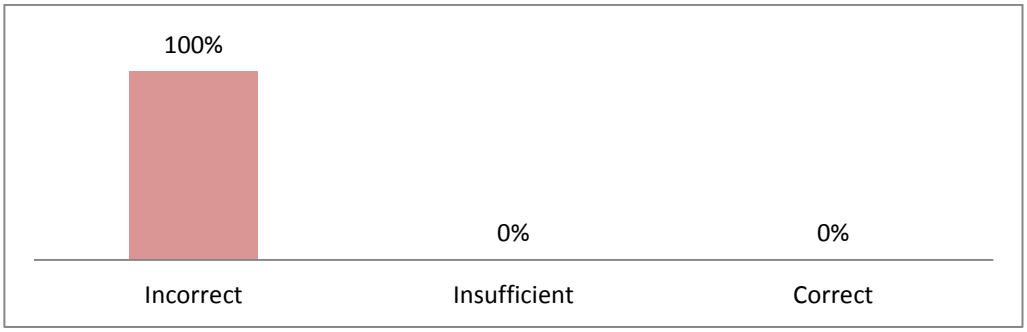


Figure 7: Student outcomes to question 13.

The students confirmed the conjecture, that is not always true, and their answer can be typified in one of the students' answers: "Very good, I see that you now understand that if the

perimeter increases that means that the length of sides also increases implying, naturally, that the area also increases, given that it also depends of the length of the sides".

It is easy to answer this kind of question incorrectly for this is a new formulation for these students. It demands more than the simple geometry knowledge. It involves didactic knowledge and the knowledge of assessment of oral presentation at a retroaction level. The students don't usually reflect on their learning or question themselves on what the teacher is teaching. And mathematics needs a lot of "curiosity".

Final considerations

These results confirm one of the pre-suppositions of this study which is the weak preparation of future teachers and the results are according to the results obtained by the students on the different levels of their basic education. And these are the students who will be the future teachers of these levels of education. Therefore, it is important that we, as mathematical trainers and educators, give special attention to the geometry topic, identifying possible weaknesses in the knowledge of future teachers in order to make initial training overcome those same deficiencies in a timely manner.

These results, which identify some of the flaws on the geometrical knowledge of these students, in accordance to the results obtained in some studies concerning initial training (e. g. Gomes, 2003), are the starting point for the widened study, of which this presentation is part, and may lead to a set of strategies and recommendations for the designing of the curricular programme for geometry.

Bibliographic references

Arcavi, A. (2003). The role of visual representations in the learning of mathematics. *Educational Studies in Mathematics*, 52, 215-241.

Ball, D., Bass, H., Sleep, L. & Thames, M. (2007). A theory of mathematical knowledge for teaching [CD-ROM]. *Proceedings of the 15th* ICMI Studdy. The Professional Education and development of Teachers of mathematics. Águas de Lindóia, Brasil, 15-21 may 2005. UNESP.

Battista, M. T. (2007). The development of geometry and spatial thinking. In Frank K. Lester, Jr. (Ed.). *Second Handbook of Research on Mathematics Teaching and Learning* (pp. 843-908). Reston: NCTM.

Battista, M. & Clements, D. (2002). Using spatial imagery in geometric reasoning. In D. L. Chambers (Ed.), *Putting research into practice in the elementary grades* (pp. 174-178). Reston: NCTM.

Braumman, C. (2004). A matemática e diferentes modelos de formação. In A. Borralho, C. Monteiro & R. Espadeiro (Orgs.), *A matemática na formação do professor* (pp. 75-82). Lisboa: Secção de Educação e Matemática da Sociedade Portuguesa de Ciências da Educação.

Bullough, R., Jr. & Gitlin, A. (2001). *Becoming a student of teaching: Methodologies for exploring self and school context.* (2.ª ed.). London: RoutledgeFalmer.

Burger, W. & Shaughnessy, J. (1986). Characterizing the van Hiele levels of development in geometry. *Journal of Research in Mathematics Education*, 17, 31-48.

Duval, R. (1998). Geometry from a cognitive point of view. In C. Mammana & V. Villani (Eds.). *Perspectives on the Teaching of Geometry for the 21st Century,* 29-83. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Gomes, M. (2003). *Um estudo sobre o conhecimento matemático de (futuros) professores do 1.º ciclo. O problema dos conceitos fundamentais em Geometria*. Tese de doutoramento. Universidade do Minho, Braga, Portugal.

Gutierrez, A., Jaime, A. & Fortuny, J. M. (1991). An alternative paradigm to evaluate the acquisition of the van Hiele levels. *Journal of Research in Mathematics Education,* 22, 237-251.

Hill, H. C., Sleep, L. Lewis, J. M. & Ball, D. L. (2007). Assessing teachers mathematical knowledge: What knowledge matters and what evidence count. In Frank K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 111-156). Charlotte: Information Age Publishing.

Jaime, A. & Gutierrez, A. (1994). A model of test design to assess the van Hiele levels. *Proceedings of the 18th* PME Conference, 3, 41-48.

Jones, K. (2000). Teacher knowledge and professional development in Geometry. *Proceedings of the British Society for Research into Learning Mathematics*, 20 (3), 109-114.

Korthagen, F., Kessels, J., Koster, B., Lagerwerf, B. & Wubbels, T. (2001). *Linking practice and theory: The pedagogy of realistic teacher education.* Mahwah, NJ: Lawrence Erlbaum Associates.

Loughran, J. (2006). *Developing a pedagogy of teacher education: Understanding teaching and learning about teaching*. London: Routledge.

Ma, L. (2009). *Saber e ensinar matemática elementar*. Lisboa: Gradiva.

Ministério da Educação (2007). *Currículo nacional do ensino básico.* Lisboa: ME, DGIDC-DEB.

National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston: NCTM.

National Council of Teachers of Mathematics (2001). *Normas para o currículo e a avaliação em matemática escolar. Geometria do 2.º e 3.º ciclo.* Tradução da Adenda Séries do NCTM. Lisboa: APM.

National Council of Teachers of Mathematics (2008). "Princípios e normas para a educação matemática". (2.ª ed.). Lisboa: APM.

Oliveira, H. & Cyrino, M. (2011). A formação inicial de professores de matemática em Portugal e no Brasil: Narrativas de vulnerabilidade e agência. *Interacções*, 18, 104-130.

Oliveira, H. & Hannula, M. (2008). Individual prospective mathematics teachers: studies on their professional growth. In T. Wood (Series Editor) & K. Krainer (Volume Editors), *International Handbook of Mathematics Teacher Education*, 3 (pp. 13-34). Rotterdam, The Netherlands: Sense Publishers.

Ponte, J. (2006). Os desafios do processo de Bolonha para a formação inicial de professores. *Revista de Educação*, XIV (1), 19-35.

Ponte, J. & Chapman, O. (2008). Preservice mathematics teacher´s knowledge and development. In L. English (Ed.), *Handbook of International Research in Mathematics Education* (2nd ed.) (pp. 223-261). Mahwah, NJ: Lawrence Erlbaum Associates.

Saads, S. & Davis, G. (1997). Spatial abilities, van Hiele levels and language use in three dimensional geometry. In E. Pehkonen (Ed.), *Proceedings of the 21st* Conference of the International Group for the Psychology of Mathematics Education, 4 (pp. 104-111).

Segall, A. (2002). *Disturbing practice: Reading teacher education as text*. New York: Peter Lang.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15 (2), 4-14.

Vale, I. (2002). *Didáctica da matemática e formação inicial de professores num contexto de resolução de problemas e de materiais manipuláveis*. Tese de doutoramento, Universidade de Aveiro. Lisboa: APM.

Vale, I. & Barbosa, A. (2009). *Padrões. Múltiplas perspectivas e contextos em educação matemática*. Viana do Castelo: ESEIPVC.

Veloso, E. (2008). Notas sobre o ensino da geometria. Há vida para além dos prismas, paralelepípedos, cubos, esferas, cilindros e cones. *Educação e Matemática*, 96, 18-19.

Wu, H. (1999). Professional development of mathematics teachers. *American Mathematical Society*, 46 (5), 535-542.

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Visual patterns and the development of creativity and functional reasoning[6]

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Abstract

Creativity has been recently recognized as an important factor of progress. However, its development has not been a priority of the school and, in particular, of Mathematics. Also, it has not been a topic greatly studied, especially in what concerns 'normally' (not gifted) students. On the other hand, students often reveal many difficulties in functional reasoning. Some studies have concluded that an adequate exploration of visual patterns may contribute to overcoming these difficulties. However, they suggest that we should continue to study their impact on other publics and in other contexts. Thus, we developed a qualitative (exploratory) case study aiming to find out to what extent the exploitation of tasks focused on visual patterns contributed to the development of creativity and functional reasoning in students of the 8th grade. Participant observation, inquiry and documental analysis were the main sources of data collection, supported by various instruments. The data collected were submitted to content analysis, guided by categories. Some of them emerged from the research questions and others were defined during the analysis. Generally, it was found that students improved their performance in tasks which resolution required the mobilization of functional reasoning. There was also a remarkable improvement of creativity in what concerns fluency, flexibility and originality. Some of the representations about creativity also evolved positively.

Keywords: Creativity, visual patterns, Algebra, Functional reasoning

Introduction

Life in modern society requires that people be creative, thus capable of producing innovative solutions to the problems they deal with. Unexpectedly creativity was found to be a transversal competence, shared by all content areas. School in general and Mathematics in particular are not aware of this reality and thus do not contribute to the development of creativity in the pupils, because they control excessively their reactions (Robinson & Aronica, 2009).

In Portugal, recent guidelines on education tend to value algebra a lot (ME – DEB, 2001; Ponte, Serrazina, Guimarães, Breda, Guimarães, Sousa, Menezes, Martins & Oliveira, 2007)

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and, consequently, functional reasoning. As a matter of fact, developing functional reasoning is one of the most important goals of algebra. Nevertheless, students reveal much difficulty in functional reasoning (Warren, 2000; Barbosa, 2010; Tanisli, 2011).

According to several authors (e.g. Blanton & Kaput, 2004; Warren & Cooper, 2008; Vale, Barbosa, Barbosa, Borralho, Cabrita, Fonseca & Pimentel, 2011), making the students *see* visual arrangements and detect the underlying structure could help them to improve their performance in functional reasoning. Moreover, visual representations could also lead to more creative findings (Barbosa, 2010).

These were the basic ideas of a study we conducted, mainly focused on: i) developing creativity, ii) improving functional reasoning and iii) using visual patterns exploration as a tool to develop crossover and specific mathematical competences. Its main objective was to identify the representations of students attending the 8th grade on creativity and to evaluate the impact of the implementation of a didactic sequence about "Sequences and regularities", using tasks focused on the exploration of visual patterns and the discussion of the several solutions found, on the development of creativity and functional reasoning.

Theoretical Framework

Teachers are aware of the declining of the interest for Mathematics and the abilities it develops in the students. For Vale et al. (2011), this reality results from the fact that more and more students see Mathematics as an ensemble of procedures one must know by heart.

But an effective learning of Mathematics demands that the students are actively engaged in diverse and significant tasks (Doyle, 2007; Stein & Smith, 2009). According to NCTM (2000), students must do routine tasks, but they should also be involved in good tasks – the ones that make them aware of essential mathematical ideas by presenting them as challenges to overcome.

At the same time, mathematicians and researchers on mathematic education defend that exploring patterns is the essence of Mathematics (e.g. Davis & Hersh, 1995; Orton & Orton, 1999; NCTM, 2000; Devlin, 2002). Several studies were conducted showing that tasks involving repeating, growth, linear, nonlinear, numeric and figurative patterns promote algebraic thinking, including symbolism attached to it, and the development of the ability to generalize and thus the exercise of functional reasoning (e.g. Stacey, 1989; Rivera & Becker, 2005; Lee & Freiman, 2006; Amit & Neria, 2008; Radford, 2008; Vale & Cabrita, 2008).

Thus, tasks focused on pattern exploration may be an interesting tool for the development of mathematical abilities. Visualization is recognized by many experts in education in mathematics as an essential ability to develop. According to Vale et al. (2012), it must not be seen as mere illustration; it must be considered as an important piece in reasoning, problem solving and proof.

Seeing that a characteristic of the data is repeated may help to identify a pattern. Lee & Freiman (2006) state that *seeing* a pattern is the first step towards the ability to identify and explore patterns.

Seeing in different ways implies, for example, the ability to identify disjointed sets that, once they are assembled, compose the original figure. This is called *constructive generalization* (Rivera & Becker, 2008). One strategy suggested by Rivera (2007) in this context is supported by a kind of symmetric numbering: the students identify the symmetry in the figures they are presented, count the elements in one of the parts and multiply the number of elements of that part by the number of equal parts. But *seeing* may also imply the observation of superposed subsets, counting some of those elements several times and then subtract. This is a *deconstructive generalization* (Rivera & Becker, 2008). Barbosa (2010), based on Rivera & Becker (2008) and Taplin (1995), concludes that the pupils tend to use more frequently constructive than deconstructive generalizations, because the latter imply a greater level of visualization.

Creativity is the ability to produce something that is original and useful at the same time (Sternberg & Lubart, 1999). It is not exclusive of scientists or artists: we all use it in everyday life (Pehkonen, 1997).

Although there is no consensual definition for creativity, we chose the one presented by Torrance (1974), which includes four elements: fluency, flexibility, originality and elaboration. Fluency is the ability to generate a great number of ideas and refers to the continuity of those ideas, use of basic knowledge and flow of associations. It can be measured by the number of correct responses, solutions, proposed by the student during the same task (Silver, 1997; Conway, 1999). Flexibility is the ability to produce different categories or perceptions, whereby there is a variety of different ideas about the same problem or thing. It reflects when students show the capacity of changing ideas among solutions. It can be measured with the number of different categories of solutions that the student can produce. Originality is the ability to create unique, unusual, totally new or extremely different ideas or products. It can be measured analyzing the number of responses in the categories that were identified as original, by comparison with the number of students in the same group that could produce the same solutions. With regard to Mathematics, originality may be manifested when a student analyzes many solutions to a problem, methods or answers and then creates a different one (Silver, 1997; Leikin, 2009; Vale et al., 2012). Elaboration is related to the presentation of a large amount of details in one idea (Adams & Hamm, 2010).

Method

The method used to accomplish the investigation was a qualitative one (Bogdan & Biklen, 1994), focused on an exploratory case study (Yin, 2010). The data collection was directed to twenty-five 8th grade students, the whole class and, in particular, to three pairs of students: Manuel and Gonçalo, because Manuel's vision of creativity proved to be completely different from his classmates; Joana and António, because this pair used unique and more complex methods in the tasks' resolution; Margarida and Daniela, because their resolutions were quite similar to the remaining pairs of students' resolutions.

The main sources of data collection were: i) participant observation by the teacher/researcher, supported by audio and photographic records of the work done in class, field notes and logbook, ii) inquiry, through questionnaires and interviews with the case students and iii) a documentary analysis of a variety of documents - the students' tasks

resolutions, the test implemented at the beginning and the end of the study and some official documents produced by the school.

To begin with, we passed a questionnaire, divided into two parts: i) characterization and ii) representations on creativity in Mathematics.

Then, we passed a pre-test, previously validated with students from another class of the 8th grade, in the same school, similar to the one that took part in our study. This validation procedure showed that it was not necessary to change anything neither in the test, nor in the conditions of its application.

The test included six questions. The first one presented three sequences: two pictorial ones and a numeric one. The students were asked to mention the two following terms for each of them. In the second question, they were invited to explore different ways of counting symbols present in a picture and write down the corresponding numeric expressions. The third question presented a situation opposite to this one. The students were given a picture and a numeric expression and they had to draw a way of "seeing" corresponding to the expression presented. The fourth and fifth questions concerned respectively the recognition of an ABCCD, … repeating pattern and a growth pattern. Both asked the students to write an algebraic expression referring to a distant element. In the last question, the pupils are asked to create a sequence of drawings, using a certain formation law.

Then, we implemented the didactic intervention, consisting of a sequence of tasks previously validated and presented (Vale et al., 2011).

The first two tasks was based on the idea that visual arrangement plays an important role in finding calculation strategies more simple and intuitive (Vale et al., 2011) and it were related to visual count. First of all, we presented visual arrangements and we asked the students: i) to explore different ways of counting the symbols included in those visual arrangements and ii) to write the corresponding numeric expressions. Still within these tasks, the students should find a way of *seeing* a visual arrangement using the corresponding numeric expression as a start and other ways of seeing it.

In the following session, the students were given a document presenting the solutions some of them had proposed and a scale of creativity (see Figure 1) and asked to use letters to indicate the assessment they made of each solution and to justify their answer.

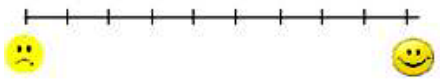


Fig. 1. Scale of creativity

Then, there were five tasks focused on: the identification and description of repeating patterns and growth patterns and their continuation; the identification of the position of certain elements of the module; using functional reasoning to determine distant elements; writing the algebraic expression that allows to determine the position of a certain element of the module; creating visual representations of a given sequence.

After the sixth task, the students were given another document presenting the solutions some of them had proposed and invited to assess them using the scale of creativity.

During all the sessions, the students were organized in pairs (although there was a group of three elements), because they had been working like this since the beginning of the school year. They had to present their solutions to the teacher and the other pupils and the underlying strategies were discussed in the class, in order that everybody reflected on the work done by each pair. The main ideas were registered.

By the end of each class, we collected the students' productions. The field notes were analyzed as soon as possible and they were used to improve the logbook. All these documents and the audio registers were analyzed before the following session, so that the plan could be changed, if necessary.

Two months after the didactic intervention, we passed the post-test and the questionnaire the students had answered in the beginning of the study. This repetition of the questionnaire was intended to collect data allowing us to determine if there had been any changes in their representations on creativity. The pre-test and the post-test had double aims: the initial one gave us an image of the knowledge and competences the pupils had before the didactic intervention and helped to adapt it to them, and the final one allowed us to assess what they had learned concerning sequences and regularities.

All the data collected were the object of content analysis using categories related to: i) the dimensions of creativity – fluency, flexibility and originality –, ii) representations on creativity – novelty, originality, simplicity and others found during the didactic intervention and iii) reasoning – functional and nonfunctional.

We also tried to analyze the main strategies used to see the patterns – constructive and deconstructive. We equally took into account aspects such as the reading direction – horizontal, vertical, oblique and mixed –, the form – rectangular, square, triangular, … – and the existence or absence of symmetry.

Results

In what concerns the representations on creativity, taking into account the analysis of the answers to the first questionnaire, we concluded that the concept of creativity presented by Gonçalo, Joana, António, Margarida and Daniela was related to the idea of generating something new, original and different from the usual: *"For me being creative means making something that does not exist yet, i.e. creating something original or even completely new."* and *"For me being creative means being imaginative, to create something unusual."*

The analysis of the answers given by those students to the second questionnaire revealed that they were associating creativity to complexity, an idea emphasized by Meissner (2011). That idea was already present in the tasks involving the use of the scale of creativity, probably because the students were taking into account strategies related to deconstructive resolution (Rivera & Becker, 2008) presented by their colleagues.

However, Manuel, whose representation stayed the same from the beginning to the end of the study, related creativity to simplicity (*"For me, being creative is being capable of solving*

everyday problems in a simple and fast although effective way."), thus going against the idea expressed by the literature on this topic (Meissner, 2011).

In the beginning, only Gonçalo and Margarida considered that one could be creative in every subject. In their answers to the final questionnaire, all the other students revealed they were aware of this fact: Joana and Margarida mentioned all the subjects, António excluded the mother tongue and Daniela included Mathematics.

The six kept considering that teacher could be creative in Mathematics, but Joana and António thought this was not possible for the students. Their answers to the final questionnaire have shown that their opinion had changed.

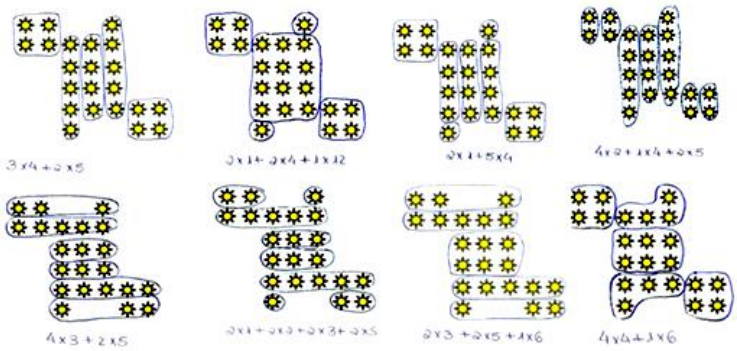
Thanks to this study, these students got aware of the fact that creativity can be a result of team work (Levenson, 2011). We must emphasize that only Joana did not think so in her answers to the first questionnaire.

Most of these students believed since the beginning that creativity may be developed at school, but they thought this institution could be responsible for its underdevelopment (cf. Robinson & Aronica, 2009). Only Gonçalo disagreed with the idea that school did not allow the development of creativity in his answer to the final questionnaire.

There were different opinions in what concerned the possibility of assessing students' creativity: Manuel, Margarida and Daniela thought this was possible, but the others disagreed, according to their answers to both questionnaires.

This happened also for the following statements: "In Mathematics, everything is created, no one can create anything new.", "In Mathematics, you cannot be creative: there is only one answer.", "Mathematics is a creative subject, such as music and arts.", "Creativity must be present in Mathematics classes, so that the pupils can learn better." In their answers to the final questionnaire, all these students disagreed with the two first statements and agreed with the other two. Nevertheless, in the initial questionnaire, Joana and António had agreed with the two first statements, Daniela with the second and Gonçalo e Margarida with the third. All of them agreed with the fourth statement in both questionnaires.

In what concerns the modalities of creativity, the analysis of the answers given to the pre-test and the post-test revealed that all the students improved in terms of fluency: they presented more and more ways of *seeing* (cf. figures 2 and 3).



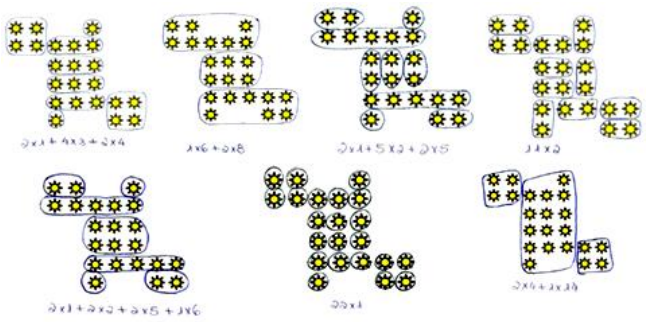


Fig. 2. Ways of counting and corresponding numeric expressions presented by Manuel in his answer to the second question in the pre-test

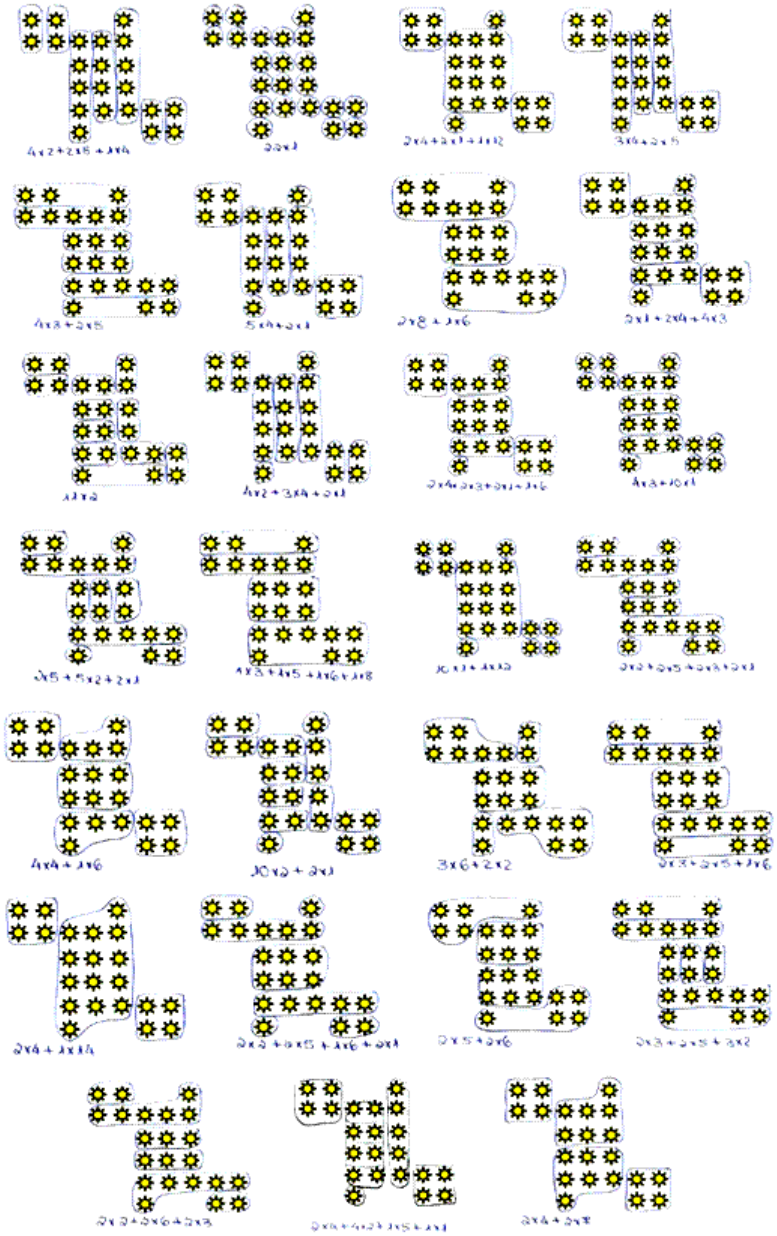


Fig. 3. Ways of counting and corresponding numeric expressions presented by Manuel in his answer to the second question in the post-test

Besides, Gonçalo, António and Margarida revealed a better performance in terms of flexibility, using more deconstructive strategies in the post-test (cf. figure 4) than they had been using during the study.

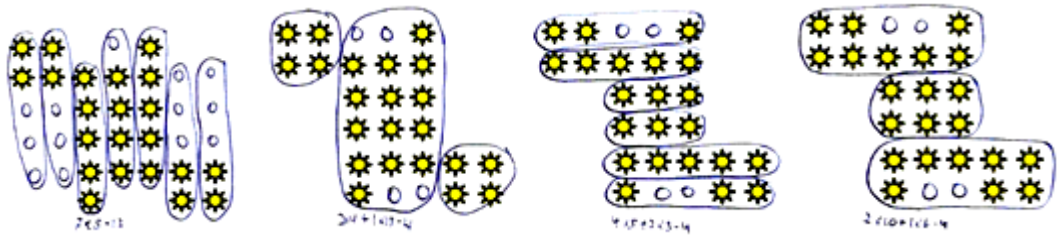


Fig. 4. Examples of ways of counting and corresponding numeric expressions presented by Margarida in her answer to the second question in the post-test

As for originality, Gonçalo, Joana and António presented ways of counting that were referred by very few pupils in the whole class. Joana's ways of counting were exclusive of her (cf. figure 5).

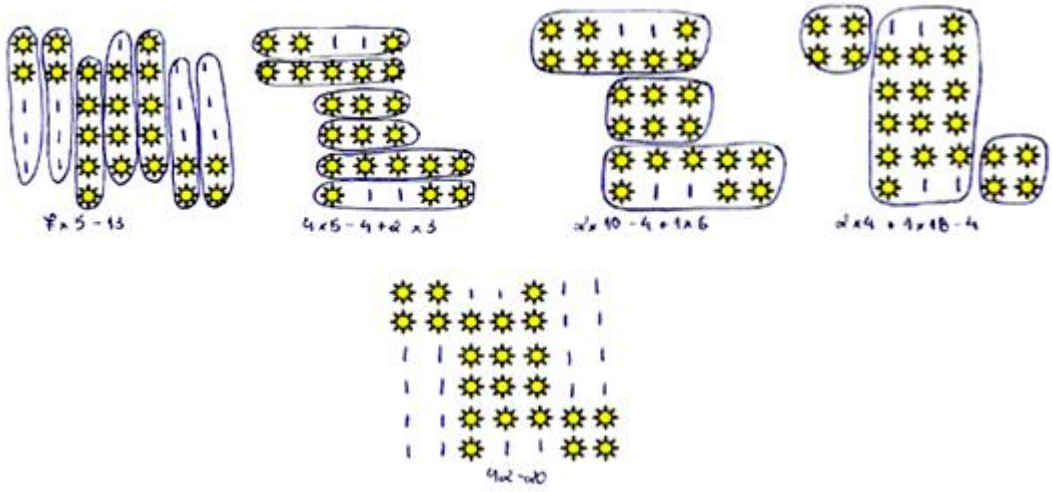


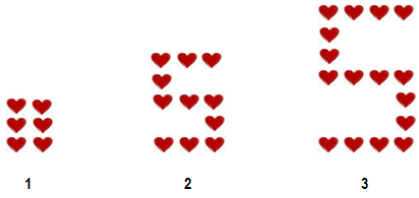
Fig. 5. Examples of ways of counting and corresponding numeric expressions presented by Joana in her answer to the second question in the post-test

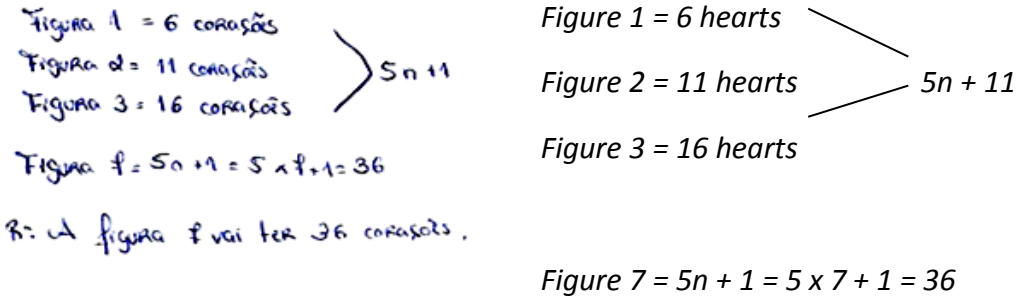
Most visual presentations included symmetry, horizontal, vertical and mixed reading, and rectangular, quadrangular and hexagonal geometrical forms.

In terms of reasoning, the analysis of the answers given to the three questions concerning this aspect in the pre-test and the post-test revealed that there was a positive evolution – from recursive reasoning to functional reasoning – in Manuel and Daniela and especially António. Thus, evolution occurred gradually, as the different tasks proposed were solved. For example, in the resolution of the third task, Joana/António and Margarida/Daniela used alternatively recursive and functional reasoning, while in the fourth task all of them used only functional reasoning.

In figure 6 are presented two examples of the answers given to this question:

"Francisco and Madalena met five years ago… and it was love at first sight. In Valentine's Day, both draw figures made of hearts. (…) In figures 2 and 3, you must draw different ways of seeing the forms they have drawn. Please explain how you can obtain the number of hearts featured in the seventh figure without drawing it, just using these ways of 'seeing' "





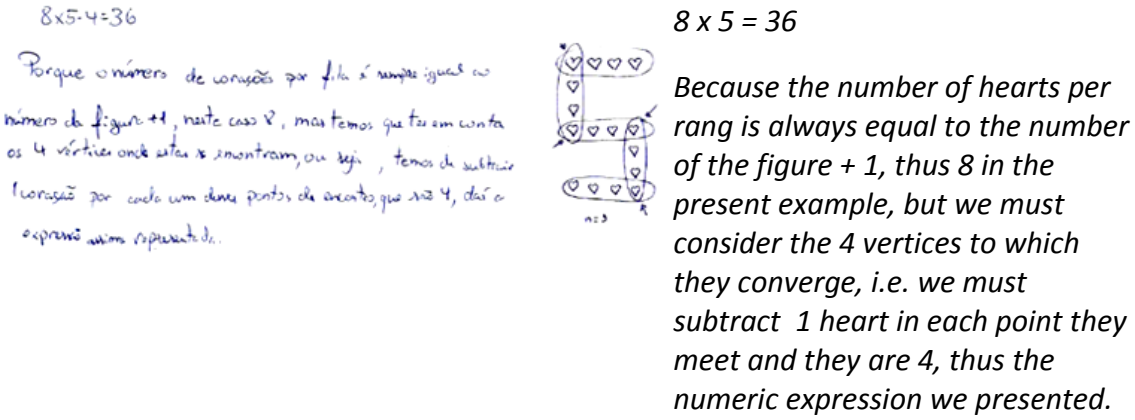


Fig. 6. Examples of answers given to the fourth question in task 4

Final remarks

Our study revealed considerable improvement in what concerned: i) the different dimensions of creativity – fluency, flexibility and originality –; ii) representations on creativity and iii) the use of functional reasoning.

Thus, we conclude that the effect of the implementation of the didactic sequence on "Sequences and regularities" was very positive and we relate this success to the fact that the tasks proposed were focused on visual patterns and also the dynamics developed in the classroom, which included the resolution of the tasks by the students followed by their presentation and discussion and the assessment of the different solutions that had been found.

References

Adams, D. & Hamm, M. (2010). *Demistify Math, Science and Technology: Creativity, Innovation, and Problem Solving*. UK: Rowman & Littlefield Education.

Amit, M. & Neria, D. (2008). "Rising the challenge": using generalization in pattern problems to unearth the algebraic skills of talented pre-algebra students. *ZDM – The International Journal on Mathematics Education*, 40(1), 111-129.

Barbosa, A. (2010). *A resolução de problemas que envolvem a generalização de padrões em contextos visuais: um estudo longitudinal com alunos do 2º ciclo do ensino básico*. Tese de doutoramento. Braga: Universidade do Minho.

Blanton, M. & Kaput, J. (2004). Elementary grades students' capacity for functional thinking. In M. Jonsen Hoines & A. Fuglestad (Eds.), Proceedings of the *28th Conference of the International Group for the Psychology of Mathematics Education* (Vol.2, pp. 135-142). Oslo: PME.

Bogdan, R. & Biklen, S. (1994). *Investigação qualitativa em Educação: uma introdução à teoria e aos métodos*. Porto: Porto Editora.

Conway, K. (1999). Assessing open-ended problems. *Mathematics Teaching in the Middle School, 4*, 8, 510-514.

Davis, P. & Hersh, R. (1995). *A experiência matemática*. Lisboa: Gradiva.

Devlin, K. (2002). *Matemática: a ciência dos padrões*. Porto: Porto Editora.

Doyle, K. (2007). The teacher, the tasks: Their role in students' mathematical literacy.

Em J. Watson & K. Beswick (Eds.), *Proceedings of the 30th Annual Conference ofthe Mathematics Research Group of Australasia*, 1, 246-254.

Lee, L. & Freiman, V. (2006). Developing algebraic thinking through pattern exploration. *Mathematics Teaching in the Middle School*, 11(9), 428-433.

Leikin, R. (2009). Multiple proof tasks: Teacher practice and teacher education. In the *Proceedings of ICMI Study-19: Proofs and proving*.

Levenson, E. (2011). Mathematical creativity in elementary school: is it individual or collective? *Proceedings of CERME 7*, Feb. 2011. University of Rzesków, Poland.

Meissner, H. (2011). Challenges to further creativity in mathematics learning. Em M. Avotina, D. Bonka, H. Meissner, L. Ramana, L. Sheffield & E. Velikova (Eds.), *Proceedings of the 6th International Conference on Creativity in Mathematics Education and the Education of Gifted Students*, 1, 143-148.

Ministério da Educação (2001). *Currículo Nacional do Ensino Básico: Competências Essenciais*. Lisboa: ME/DEB.

National Council of Teachers of Mathematics (2000). Principals and Standards for School Mathematics. Reston: NCTM. [Tradução portuguesa: Princípios e Normas para a Matemática Escolar. Lisboa, APM, 2007.]

Orton, A. & Orton, J. (1999). Pattern and Approach to Algebra. Em A. Orton (Ed.), *Pattern in the Teaching and Learning of Mathematics* (pp. 104-124). Londres: Cassel.

Pehkonen, E. (1997). The State-of-Art in Mathematical Creativity, *ZDM – The International Journal on Mathematics Education, 29*, 3, 63-67.

Ponte, J. P., Serrazina, L., Guimarães, H., Breda, A., Guimarães, F., Sousa, H., Menezes, L., Martins, M. & Oliveira, P. (2007). *Programa de Matemática do Ensino Básico*. Lisboa: ME/DGIDC.

Radford, L. (2008). Iconicity and contraction: A semiotic investigation of forms of algebraic generalizations of patterns in different contexts. *ZDM – The International Journal on Mathematics Education*, 40(1), 83-96.

Rivera, F. (2007). Visualizing as a mathematical way of knowing: understanding figural generalization. *Mathematics Teacher*, 101(1), 69-75.

Rivera, F. & Becker, J. (2005). Teacher to teacher: figural and numerical modes of generalizing in algebra. *Mathematics Teaching in the Middle School, 11(4)*, 198-203.

Rivera, F. & Becker, J. (2008). Middle school children's cognitive perceptions of constructive and deconstructive generalizations involving linear and figural patterns. *ZDM – The International Journal on Mathematics Education*, 40(1), 65-82.

Robinson, K. & Aronica, L. (2009). *The element: How finding your passion changes everything*. New York, NY: Penguin.

Silver, E. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *ZDM – The International Journal on Mathematics Education*, *3*, 75-80.

Stacey, K. (1989). Finding and using patterns in linear generalizing problems. *Educational Studies in Mathematics*, 20(2), 147-164.

Stein, M. K. & Smith, M. S. (2009). Tarefas Matemáticas como quadro para reflexão. *Educação e Matemática, 105,* 22-28.

Sternberg, R. & Lubart, T. (1999). The concept of creativity: Prospects and paradigms. Em R. J. Sternberg (Org.), *Handbook of Creativity* (pp. 3-15). New York: Cambridge University Press.

Tanisli, D. (2011). Functional thinking ways in relation to linear function tables of elementary school students. *Journal of Mathematical Behavior*, 30, 206-223.

Torrance, E. P. (1974). *Torrance tests of creative thinking*. Bensenville, IL: Scholastic Testing Service.

Vale, I. & Cabrita, I. (2008). *Learning through patterns: a powerful approach to algebraic thinking*. In K. Kumpulainen & A. Toom (Eds.), *ETEN 18 - TheProceedings of the 18th Annual Conference of the European Teacher Education Network* (pp.63-69). Liverpool, England, april, 2008. (ISBN: 978-952-10-4951-4).

Vale, I., Barbosa, A., Barbosa, E., Borralho, A., Cabrita, I., Fonseca, L., & Pimentel, T. (2011). *Padrões em Matemática: uma proposta didática no âmbito do Novo Programa para o Ensino Básico*. Lisboa: Texto Editores.

Vale, I., Pimentel, T., Cabrita, I., Barbosa, A., & Fonseca, L. (2012). Pattern Problem Solving Tasks as a Mean to Foster Creativity in Mathematics. In T. Y. Tso (Ed.), *Proceedings of the 36th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 171-178). Taipe, Taiwan, 18-22 july, 2012. (ISSN: 0771-100X).

Warren, E. (2000). Visualisation and development of early understanding in algebra. In T. Nakahara, M. Koyama (Eds.), *Proceedings of the 24th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 273-280). Hiroshima, Japan.

Warren, E. & Cooper, T. (2008). Patterns That Support Early Algebraic Thinking in the Elementary School. In Carole Greenes & Rheta Rubinstein (Eds.), *Algebra and Algebraic Thinking in School Mathematics – Seventieth Yearbook* (pp. 113-126). Reston: NCTM.

Yin, R. (2010). *Estudo de Caso: Planejamento e Métodos*. Porto Alegre: Bookman.

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Challenging and Creative Mathematical Tasks: an exploratory study with elementary pre-service teachers

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Abstract

Challenging tasks, in particular those with multiple solutions and/or multiple resolutions usually require creative thinking and could be a possible way to promote creativity in students, using contexts within and outside mathematics. Creativity plays an important role in mathematics learning so teachers must provide students with appropriate learning opportunities. In this paper some of these ideas will be illustrated using examples of some tasks used during math classes with elementary pre-service teachers.

Keywords: Creativity. Tasks. Problem Solving and Posing. Elementary Pre-service Teachers.

Introduction

Students' mathematical literacy is usually determined by how they use their knowledge, skills and attitudes to solve problems. It is therefore necessary to offer them diverse experiences in order to develop their capacities for problem solving, so they can take advantage of lifelong learning mathematics. In order to deepen students' understanding of mathematics, we need to recognize that the mastery of rules, algorithms, and strategies is not the end goal of mathematics education, instead they should use these procedural tools to explore, test and defend their solutions to meaningful problems.

Creativity plays an important role in mathematics learning, however there is no single description of creativity, but it can be argued that it begins with curiosity and involves students in exploring and experimenting, raising their imagination and originality. So, challenging tasks, in particular those with multiple solutions and/or multiple resolutions usually require creative thinking. Research has shown that problem posing and problem solving in mathematics are closely related to creativity and can be characterized by three dimensions: fluency, flexibility and originality. Thus, learning environments, where tasks give students opportunities to use several strategies to solve and formulate their own math problems, may involve them in rich mathematical explorations, increase their motivation and encourage them to investigate, make decisions, generalize, look for patterns and connections, communicate, discuss ideas and identify alternative paths.

Research has showed that what students learn is largely influenced by the tasks given to them (Doyle, 1988; Stein & Smith, 2009; Vale, 2009). Thus the initial training courses must propose tasks for future teachers to experience and explore deeply so they can use them with their future students.

Mathematics teaching

Nowadays we are experiencing deep changes in different areas of society, in particular in mathematics education. So mathematics educators have a great challenge to face mainly developing higher order thinking skills in students, such as formulating and solving problems, reasoning and

communication. We need as well ~~as~~ to analyze what features of teaching and learning are associated with better performance in mathematics by improving the quality of the main agents of change: teachers. These factors justify innovative strategies to improve teaching and learning, in particular tasks and other instructional materials that call for independent and critical problem solvers, curiosity and creativity in order to develop mathematical knowledge and citizenship.

The teacher unquestionably affects ~~in order unquestionable~~ students learning either with ~~their~~ his knowledge and conceptions on teaching and learning of mathematics, or with ~~the~~ the choices he takes and the actions ~~that~~ he develops in ~~its~~ his practice (Vale, 2009). In the context of school classrooms, teacher, students, and (mathematical) content are linked in a system, which several researchers called "the didatical triangle" (Sträβer, 1994) or the "instructional triangle" (Lampert & Ghousseini, 2012), where teaching depends on the coordination of students' active engagement in meaningful mathematical work, and on the materials that are used to represent the content to be learned in teacher-student interaction. In particular, the teacher's role in this instructional system is to assure that students are engaged with content productively, where we can highlight the role of tasks (Fig.1).

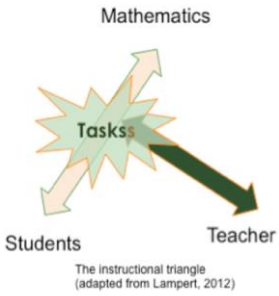


Fig. 1

Mathematics learning is strongly dependent upon the teacher and the tasks that are proposed to students (e.g. Doyle, 1988; Stein & Smith, 2009; Vale, 2009). Many of the fragilities that students have in learning mathematics are due to teachers' conceptions and attitudes, which influence their actions in the classroom, and the interactions with the students, but also to the gaps in mathematical knowledge and in innovative teaching strategies.

The tasks that teachers select for their classes are fundamental and characterize their work (Stein & Smith, 2009). The orientation of inquiry, ~~and~~ discussion and reflection of ideas is critical to student learning and arises only when teachers have a good knowledge of the subject they teach, how they teach it and when to teach it. Thus, it is important that teachers develop certain skills, including creative ones, based on a deep mathematical knowledge and teaching of subjects, allowing them to build, adapt, and exploit good mathematical tasks for the classroom. On the one hand, teachers must propose tasks that help them motivate their students to learn and develop their creative thinking, on the other hand teachers should themselves formulate creative tasks and teaching strategies to offer their students. It is therefore crucial that teachers can take advantage of all the potential contained in a task and, for that, they need opportunities to explore and solve them the same way they think exploring them with their own students. Among the different tasks that we use in mathematics classes, problem solving plays an important role in the learners' competences, involving rich discussions that are cognitively challenging and are the primary mechanism for promoting conceptual understanding of mathematics (Stein & Smith, 2009). Problem solving tasks must be revisited through new approaches, encouraging students to be persistent and look for creative ideas in order to raise flow of mathematical ideas, flexibility of thought and originality in the responses.

An exploratory teaching in which the teacher promotes conditions for students to discover and construct their own knowledge is key to achieving this objective. We pay special attention to work in figurative contexts due to their importance in any mathematical activity, being a learning component with many possibilities and often neglected in the trajectory of pupils. Such importance is the fact that the display is not only related with the mere illustration, but also recognized as a component of thinking deeply involved in the conceptual and not just the perceptual. Students without this visual capacity will have great difficulty in learning to succeed. "-Seeing" is an important component to explore the generalization ability and this can only be developed through experiences that require this type of thinking (e.g. Barbosa, 2011; Rivera & Becker, 2005; Stylianou & Silver, 2004; Vale & Pimentel, 2011).

Recognizing the central role of tasks in the development of mathematical knowledge and abilities of students, it is necessary to involve teachers in their selection and preparation in order to acquire a deeper awareness of their effectiveness and educational value.

Mathematics and creativity

According to Liljedahl and Sriraman (2006) students' ability to present new ideas and / or (re) solutions to problems in mathematics is considered as an indicator of creativity. One of the big questions of creativity is knowing what students can do with what they know. Most of the time we have to encourage them in the pursuit of ideas in unusual places, unlikely to nurture ideas seem absurd, as bridges for efficient and practical ideas. In fact, both teachers and their students need more than only declarative knowledge, certain and solid mathematics to develop creativity in this area (Meissner, 2005). Mathematics is engaging, useful, and creative and challenging tasks usually require creative thinking. Challenge in mathematics requires prior knowledge and is related to solving high-level mathematical tasks where memorization is not enough, and among another things involves the use of procedures with connections.

Environments where students have the opportunity to solve mathematical problems, using diverse strategies, and formulate their own problems, lets them engage in their exploration, increase motivation and encourage them to investigate, to make decisions, to look for patterns and connections, to generalize, to communicate, to discuss ideas and identify alternatives. Problem posing has been a rather neglected component of classroom mathematics, but crucial in the learning of mathematics.

But defining mathematical creativity is a very complex task. It is argued that it begins with curiosity and engages students in exploration and experimentation, involving imagination and originality. As mentioned above, tasks that may contribute to the development of creative mathematical explorations should take the form of that to solve problems and to formulate, especially with multiple (re) solutions. Thus, teachers should provide tasks that raise multiple (re) solutions and to provide the students of the flow of mathematical ideas, flexibility of thought and originality of the responses (Vale, Pimentel, Cabrita, Barbosa & Fonseca, 2012).

Creativity involves divergent thinking contributing to higher order reasoning, which highlights three main dimensions: fluency, flexibility and originality (novelty). Fluency is the ability to generate a large number of different solutions obtained by the student for the same task. The flexibility is the ability to produce a variety of different ideas about the same problem, organized in various categories. Originality is the ability to create ideas that have been identified as unique as compared to students in the same group (e.g. Leikin, 2009; Silver, 1997; Vale et al., 2012).

In this context, formulating and solving problem tasks develops new approaches and creative ideas, as well as provides multiple (re)solutions in order to raise the student flow of mathematical ideas, flexibility of thought and originality in the responses. Teachers must encourage students to create, share and solve (their own) problems, as this is a very rich learning environment for the development of their ability to solve problems as well as their mathematical knowledge. In this way, future teachers should themselves develop these skills and go through the same type of tasks that they will offer their students.

Creativity is a topic that should be part of the mathematics programs at all educational levels, but is still much neglected in math classes, because the teachers are unaware and / or ~~or~~ have not yet realized its importance.

For all these reasons it should be given special attention to training teachers, providing them with experiences that enable (future) teachers to acquire a deep understanding of mathematics teaching and of how to teach.

Methodology

We adopted a qualitative approach to understand in what way an experience, grounded on challenging tasks, that privileged figurative contexts, is a suitable context for promoting creativity and consequently foster mathematical knowledge, identifying potentialities in the used tasks, from the perspectives of elementary pre-service teachers' performance. The didactical experience grounded on theoretical references on creativity, focused in problem solving and formulation, where we used several tasks which require multiple (re)solutions. Each task is not intentionally designed to enhance one specific component of mathematical creativity, although, in some cases, one of the components is more relevant. This didactical experience was developed during classes of two hours, two times a week, during three weeks with twenty elementary mathematics pre-service teachers, in the didactics of mathematics classes of the 1st academic year of the 2nd cycle.

Data was collected in a holistic, descriptive and interpretive way and included classroom observations and written tasks. Data analysis consisted of measuring students' creativity through the three dimensions - fluency, flexibility, originality , following the basic ideas of Conway (1999) and Silver (1997) without assigning a score to each student but analyzing each task globally, identifying the most common and the most original, according to the frequency of the responses.

Some results

Several tasks of different kinds were used during the didactical experience. We present here three of those tasks (Fig.2) that require producing various and different responses. In this paper we shall highlight the creative responses of the group of students involved in the modeling tasks.

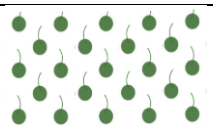
Task 1 - The Cherries    1. Find different ways to count the cherries.   2. Write the numerical expression that translates that way of counting them.
Tasks 2- The dots    1. Imagine that the given figure is the 1st term of growing sequence. Draw the next terms.   2. Write a numerical expression translating a way to calculate the nth number term of the sequence you built.   3. Imagine that the growing sequence you construct began with the 2nd term. Draw the 1st term. Construct as much sequences as you can.
Task 3 - The expression   Suppose that you are an elementary teacher and you intend to propose to your students a problem that can be translated by the numerical expression 3 x 5 + 2. Invent a problem that can be translated by the given expression.

Fig. 2

Task 1. This type of task requires students to see the arrangement in different ways connecting previous knowledge about numeric relationships and their connections with basic geometric concepts. There are different ways to count the arrangement of the cherries and each counting can be respectively written through a numerical expression that translates the students' thinking and seeing. This task ~~gave~~ suggested students many and varied ways of visualizing the counting of cherries. Fig. 3 illustrates the summary of the most common resolutions, with the expressions corresponding to each way of "seeing".

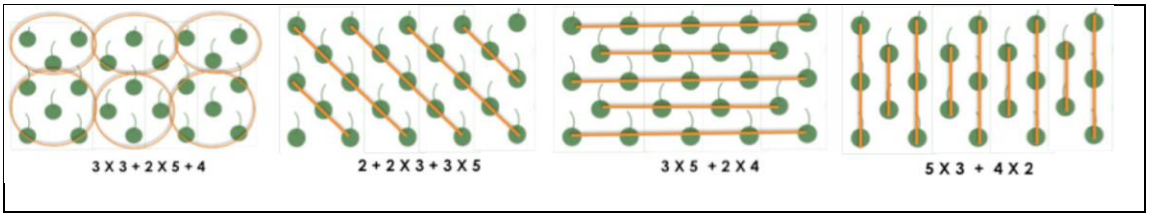


Fig. 3

These expressions must be verbalized for instance as the following: "I see three groups of three cherries each, two groups of five cherries and one group of four cherries" or " I see three horizontal rows with five cherries each and two horizontal rows with four cherries". It is important to discover that each expression illustrates one way of seeing but they are all equivalent and correspond to the same number of cherries, 33. Fig. 4 illustrates the most original responses.

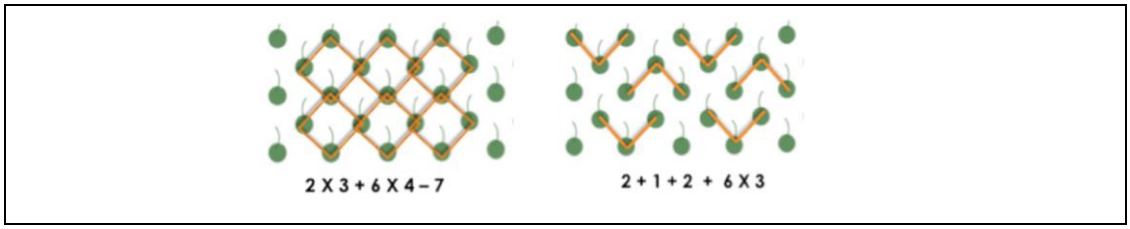


Fig. 4

It is important that future teachers realize that they must encourage their future students to look for many ways of seeing and explain what they see. Teachers should also highlight mathematical concepts involved in each of the tasks proposed to students.

Task 2. We intended that students constructed as much growing pattern sequences as they could and, after looking for the pattern in the figurative sequence, described it, and produce arguments to validate it, using different representations. The previous work with visual counting may help to see a visual arrangement that changes in a predictable form and write numerical expressions translating the way of seeing, in order to make possible the generalization to distant terms. Students used different representations, more or less formal, to solve this task. They achieved a general rule through schemes and drawings or tables, but mainly used functional reasoning that allowed them to accomplish far generalization. We will regard only ~~to~~ the different ways of seeing the pattern to get far generalization, as we are convinced that is the most important aspect of solving these tasks in which students can be creative. Fig. 5 illustrates some different ways of seeing one of the sequences that students built and the respective algebraic expression that generalize that rule.

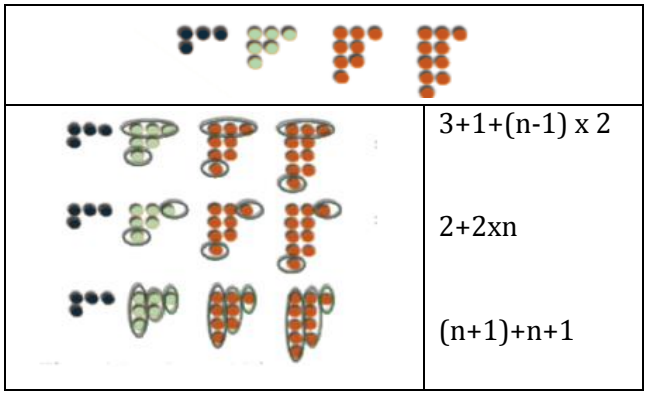
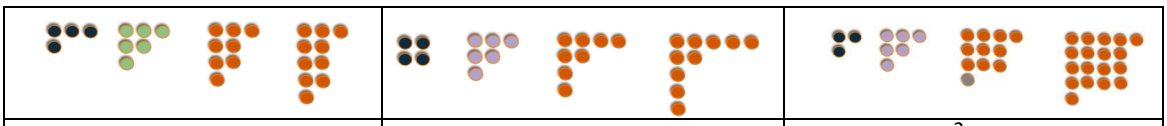


Fig. 5

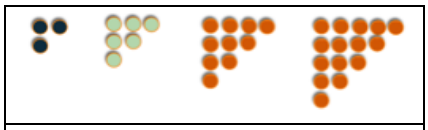
This task had one additional question that was to imagine, for each sequence constructed, that it began with the 2nd term and they had to draw the 1st term. This part of the task wasn't completely solved by all the students. Fig. 6 includes only the most common answers, from the students who

completed the task. It was difficult for them, not to invent the next terms starting from the given term, but to work backwards to discover the new first term. The last solution (Fig.7) was the most original since only one student presented it.



3+1+(n-1) x 2	4+(n-1) x 2	$n^2 + 2$

Fig. 6



(n+1)(n+2)/2

Fig. 7

Task 3. This task, despite not having a visual context, could give the formulation of a problem using the visual contexts. But this just ~~as~~ occurred with one of the students (Fig. 8). It was a unique resolution. The previous work on visual counting, previously developed with these students, must have influenced the choice of this student.

Write a numerical expression for counting the dots quickly.

Fig. 8

The common solutions presented by the students were statements identified as close problems using only the basic arithmetic operations (Fig.9). The proposals were almost all of the same type of Mary's aunt or of António, just varying contexts (e.g. cakes, animals, fruits, shells, CDs, tables, chairs, chocolates, flowers, dots).

António went to the bookstore and bought 3 books to 5 euros each and a pencil for 2 euros. How much António spent?	Mary's aunt gave three euros to each of her three nephews and two euros to Maria. Writes an expression that translates the money spent by Mary's aunt.

Fig. 9

Main Conclusions

The tasks used are problems for solving and posing and were selected to foster creativity of elementary students, beginning with their future teachers. They promote a flexible approach looking for multiple (re)solutions using different representations. They also involve elementary mathematical concepts and can be applied in different contexts of the classroom the 1st and/or 2nd cycles of basic education and recontextualized for different students and other contents, allowing students to explore beyond mathematical concepts and processes. The counting and pattern tasks (tasks 1 & 2) were the ones that led to more resolutions. This result seems to depend of the work done previously on patterns. The problem posing task (task 3) followed the most evident and elementary approach and their proposals weren't different from those obtained by elementary

students. Fluency and flexibility were largely identified mainly in the counting tasks.

Not all students have the same performance on tasks. The discussions raised in the classroom resulted in a better understanding of some of the more confusing aspects of the tasks. Our concern was not to categorize students but to identify potentialities in the tasks to develop creativity in students, detecting their mathematical strengths or weaknesses, and that patterns have potentialities. It can be said that the students were engaged and willing to overcome the barriers they experienced. We concluded that the used tasks have great potential to promote creativity in students, however not all the tasks provide the development of the three dimensions of creativity. Students recognized that both flexibility and originality encourage divergent thinking, which promotes higher-level thinking, so as future teachers they should seek out appropriate curricular materials to develop mathematical creativity with their own students.

The future teachers must become themselves creative thinkers and they must be aware to act in the same way with their own students, encouraging them to seek unusual and original responses. These tasks have been used by different students in different years and the results were very similar, which leads us to infer that the results may depend more on the tasks than on students, but we need to further examine this aspect.

References

Barbosa, A. (2011). Patterning problems: sixth graders' ability to generalize. In M. Pytlak, T. Rowland & E. Swoboda, *Proceedings of the Seventh Congress of the European Society for Research in Mathematics Education*, pp. 420-428. Rzeszow: ERME.

Conway, K. (1999). Assessing open-ended problems. *Mathematics Teaching in the Middle School*, *4*(8), 510-514.

Doyle, W. (1988). Work in mathematics classes: The context of students' thinking during instruction. *Educational Psycologist, 23*, 167-80.

Lampert, M. & Ghousseini, H. (2012). Situating mathematics teaching practices in a practice of ambitious mathematics teaching. In A. P. Canavarro, L. Santos, A. M. Boavida, H. Oliveira, L. Menezes & S. Carreira (Eds.), *Investigação em Educação Matemática 2012: Práticas de ensino da matemática,* pp. 5-29 Portalegre: SPIEM.

Leikin, R. (2009). Exploring mathematical creativity using multiple solution tasks. In R. Leikin, A. Berman and B. Koichu (Eds.), *Creativity in mathematics and the education of gifted students.* (pp. 129-145). Rotterdam, Netherlands: Sense Publishers.

Liljedahl, P. & Sriraman, B. (2006). Musings on mathematical creativity. *For The Learning of Mathematics, 26*(1), 20-23.

Rivera, F. & Becker, J. (2005) Figural and numerical modes of generalization in Algebra, *Mathematics Teaching in the middle school*, *11*(4), 198-203.

Silver, E. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. ZDM, *3*, 75-80.

Stein, M., & Smith, M. (2009). Tarefas Matemáticas como quadro para a reflexão. *Educação e Matemática*, *105,* 22-28.

Stylianou, D.A., & Silver, E.A. (2004). The role of visual representations in advanced mathematical problem solving: An examination of expert-novice similarities and differences. Mathematical Thinking and Learning, *6*(4), 353-387.

Vale, I., Pimentel, T., Cabrita, I., Barbosa, A. & Fonseca, L. (2012). Pattern problem solving tasks as a mean to foster creativity in mathematics. Tso, T. Y. (Ed), Opportunities to learn in mathematics education, Proceedings of the 36th Conference of the International Group for the Psychology of Mathematics Education, vol. 4, pp. 171-178. Taipei, Taiwan: PME.

Vale, I. & Pimentel, T. (2011). Mathematical challenging tasks in elementary grades, In M. Pytlak, T. Rowland & E. Swoboda, *Proceedings of the Seventh Congress of the European Society for Research in Mathematics Education*, pp. 1154-1164. Rzeszow: ERME

Vale, I. (2009). Das tarefas com padrões visuais à generalização. XX SIEM. In J. Fernandes, H. Martinho & F. Viseu (Orgs.), *Actas do Seminário de Investigação em Educação Matemática* (pp. 35-63). Viana do Castelo: APM.

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Early mathematical experiences: the importance of curricular integration

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Abstract

In this paper we explore the implications of some tasks that promote integrated activities in a preschool context. In early years education, children should have meaningful experiences, involving discovery experimenting and solving challenging problems, based on their interests. All of this should be regarded in an articulated way, intertwining contents, knowledge and processes from different areas. Our main goal is to explore the potential of this approach from were mathematics stands, perceiving the kind of mathematics preschoolers should learn, operationalizing it through different types of connections.

Keywords: Preschool Education, Mathematics, Connections

Introduction

Much of our world can be better understood through a mathematical lens, and preschool is a good time for children to become interested in exploring phenomena that leads them to counting, sorting, measuring, building and describing shapes, finding patterns, estimating, among other experiences (Clements, 2001). Mathematics is an everyday activity for young children, emerging naturally from day to day problems, and teachers just have to make the most of them, building on children's spontaneous discoveries and on their prior knowledge to deepen the understanding of mathematical concepts.

Working in teacher training, especially pre-service teacher training, related to the teaching of Mathematics in the early years, there are some questions that normally arise, either from students that attend these courses, but sometimes also from in-service teachers in preschool contexts, like:

(1) What kind of mathematics is to be expected in preschool?
(2) How and when should mathematics be explored in this educational context?
(3) What is the impact of curricular integration in the learning of mathematics at this level? And how can it be operationalized?

Taking these perspectives into account, this study will address the previous questions, with the purpose of exploring preschool children's mathematical knowledge, through tasks that emerge from daily experiences and problematic situations, considering possible connections between mathematics and other curricular areas.

Curricular guidelines for preschool education

In order to contextualize the work developed in preschool education in Portugal, it's pertinent to start by highlighting the main curricular guidelines. The Portuguese preschool curriculum (DEB, 1997) is organized in three content areas. They contemplate different

kinds of learning experiences and goals. The *Personal & Social Education* area has to do with the way the child relates with her self, with the others and with the world, and implies the development of attitudes and values, focusing the importance of social interactions. The *Expression and Communication* area covers psychomotor and symbolic development, determining comprehension and progressive grasp of several forms of language. This particular area is differentiated in several domains: language, mathematics and expressions (motor, drama, arts, music). Finally, the area of *Knowlege of the World* relates to the natural curiosity of children and their need for knowledge, making sense of the world around them, relating to the beginning of learning in natural and human sciences. In spite of having these distinct content areas to approach, the teacher must articulate and contextualize them in a specific educational environment. This contributes to the achievement of a flexible process of learning, following the educational goals determined, hence making sense for each child (DEB, 1997).

These aspects take into consideration how children learn. For instance, they have a fundamental role in the construction of their own knowledge. Children are continually acting on and organizing experiences mentally, either of social or physical nature. Knowledge emerges through repeated experiences involving interaction with people and objects (Piaget, 1952), as a result of dynamic interactions between the child and the physical and social environments. As said, social interaction is necessary for intellectual development, but it also has impact in developing social competence and self-esteem. Another important feature teachers in preschool have to consider is that children learn by doing, by experimenting, by choosing and discussing (Jones, 1989). The relations they discover through these processes and their thinking about the consequences of their actions, enlarge their knowledge and refines their reasoning. The day-to-day play also provides opportunities for children to practice naturally, in a variety of situations, the newly acquired skills or knowledge. In these contexts they are spontaneously motivated in participating, questioning, being active, which will deepen their understanding of concepts.

One of the most fundamental demands for preschool teachers is the need to identify contents and themes that intrigue children and stimulate their curiosity to figure something out (DeVries & Kohlberg, 1990). Activities that are based on children's interests provide intrinsic motivation for learning. Curriculum that is based on children's interests and internal motivation to understand fosters desirable attitudes, such as initiative, curiosity and attention.

Mathematics in preschool: general ideas

The foundation for children’s mathematical development is established in the earliest years and many mathematics concepts start to develop before formal teaching. Young children possess powerful beginnings of mathematical ideas, using them to make sense of their everyday activities. So, it must be stated that, mathematical thinking starts long before entering school, through the interaction with the environment and through everyday experiences (e.g. DEB, 1997; NCTM, 2000). In this sense, traditional teaching approaches don’t tend to promote an adequate construction of mathematical knowledge (Baroody, 2000). Teachers have to consider what children already know, be alert and open to their interests, create an environment that promotes self confidence to share ideas and foster children’s natural curiosity. These aspects should not be neglected in favor of a traditional

approach (Clements, 2001). The most powerful mathematics for a preschooler is usually not acquired while sitting down in a group lesson but brought forward by the teacher from the child's own self-directed, intrinsically motivated activity (e.g. Clements & Sarama, 2009; DEB, 1997; NCTM, 2000). These perspectives suggest that preschoolers can and should engage in an effective mathematical thinking.

The Portuguese curricular guidelines for preschool mathematics (DEB, 1997) suggest that children gradually construct mathematical ideas through daily experiences, being up to the teacher to use quotidian situations as a starting point. The teacher must also take into account what children already know, what may be called informal knowledge, to diversify experiences and support children's reflections, in order to develop mathematical thinking, contemplating moments of consolidation and systematization of mathematical concepts. The privileged methodology in this educational level should be based on problem solving. Preschool teachers must promote problem solving and allow children to find their own solutions and discuss them, enhancing communication, reasoning and the development of critical sense. More recently the learning goals for Preschool Mathematics were organized into 3 main themes: Numbers and Operations; Geometry and Measurement; Organization of data and data treatment (ME-DGIDC, 2010). This document lists a set of goals, related to the mentioned mathematical themes, that children are expected to achieve at the end of preschool education, however it also considers abilities like problem solving, reasoning and communication as being transversal to all of them.

Appropriate mathematical experiences should challenge young children to explore ideas related to patterns, shapes, numbers, measurement and space, with increasing sophistication and in a meaningful way (DEB, 1997; NCTM, 2000). But, as important as mathematical contents are, equally fundamental are general mathematical processes like problem solving, reasoning, communication, connections, and representation, as well as specific mathematical processes such as organizing information, patterning, and habits of mind, like curiosity, imagination, inventiveness, persistence, willingness to experiment (Clements & Sarama, 2009). In general, teachers should focus on meaningful mathematics tasks, develop rich environments, create opportunities for children to collaborate and encourage them to talk and write about the mathematics learned (Van de Walle, 2004), having an active role in the learning process.

The importance of establishing connections

The different curricular areas, stated for preschool education, should not be perceived separately. One of the main reasons is because young children do not perceive the world as if it were divided into separate cubbyholes. Knowledge should be constructed through the articulation of the different curricular areas, interpreting them in a globalizing and integrated way, and promoting proper and meaningful connections (DEB, 1997).

Considering the particular case of Mathematics, in the first years, this domain comes alive for children through tasks that reflect significant contexts and the integration of contents (Schwartz, 1995). An effective teaching practice should not limit mathematics to a specific period of the day, rather it should be explored throughout the day and across the curriculum, according to the opportunities that arise. This approach should involve tasks that implicate previous experiences of children, their interests or daily problematic situations, thus stating the importance of mathematics and the way it is linked to quotidian.

It's also important to consider the possible connections between mathematics and other curricular areas, perceiving knowledge as a whole, connecting concepts and events (Boavida, Cebola, Paiva, Pimentel & Vale, 2008). The opportunity for students to experience mathematics in a context is important, once they may apply and deepen contents and processes, through an interplay where mathematics illuminates a situation and the situation illuminates mathematics (NCTM, 2000).

Children's everyday activities and routines in preschool contexts can be used to introduce and develop important mathematical ideas. Also important is weaving mathematics into children's experiences with other areas, like literature, language, science, social studies, art, movement, music, and all parts of the classroom environment (e.g. DEB, 1997; NCTM, 2000). In this sense, it's relevant to consider that helping children connect mathematics to other subjects, develops knowledge of both subjects, as well as knowledge of the wide applicability of mathematics (NAEYC, 2002). This approach facilitates the comprehension of the usefulness of mathematics and contributes to a positive attitude towards this content area.

Methodology

Given the nature of this study, we adopted a qualitative approach (Erickson, 1986) to address the questions stated initially. The study implicated 22 preschool children (5-6 years old) and was developed within the context of pre-service teacher training. Throughout 4 months, pre-service preschool teachers, from the course of Preschool Education, were supervised while working with their class. For this study we chose the context attributed to one of the pairs of preschool teachers we accompanied in the area of Mathematics. To understand the potential of curricular integration in early mathematical experiences, the participants explored several tasks, in whole or small groups, emerging from children's interests or intentionally proposed to highlight connections between mathematics and other areas.

The data collected was essentially descriptive in nature, resulting from three fundamental sources: observation, audio/video recordings and document analysis. All the sessions corresponding to the implementation of each task were observed and videotaped, for later viewing and analysis. The document analysis was based on all the registers produced by the children involved, on biographical records related to the educational background, and field notes written by the researcher throughout the study.

The data analysis process followed the model proposed by Miles and Huberman (1994). Data resulting from observing each session, from the audio and video recordings, as well as the registers produced by the students, were reduced in order to identify regularities for further interpretation.

Results from some tasks

During the semester, corresponding to the pre-service teaching experience, several tasks of different nature were used. In this paper, we present four of those tasks, highlighting curricular integration and, naturally, the links to mathematics.

Wrapping paper for Mother's day

With Mother's day approaching, the group decided to build their own wrapping paper, to wrap the gift each child would give to their mother. This task promoted clear connections between plastic expression and Mathematics, since they used different techniques of artistic expression, working with diverse materials, that lead to the exploration, search and creation of patterns.

Children where divided in small groups to analyze and discuss properties of wrapping paper, so they could build their own later. One of the most common conclusions was "all the papers have patterns". Since the papers analyzed were different (Figure 1), a whole group discussion was promoted in order to share some of the findings. Children described several repetition patterns (e.g. orange dots, pink dots, pink square, orange dots, pink dots, pink square; white column, green column, white column, green column; bird to the right, bird to the left, bird to the right, bird to the left) and perceived the idea of cyclical repetition of the unit, saying things like "and then we repeat it" or "the other line has a flower, pink square, another flower, dots, and then the same".

Figure 1: Wrapping papers analysed by children

After the initial exploration, each child created a project of what their wrapping paper would look like. For this work, they used sponge stamps with different shapes, brushes and watercolors. As we can see in figure 2, mainly, children created AB and ABC patterns. Some of the patterns formulated reflected the use of different elements throughout the lines, maintaining the structure, like they had observed in some of the wrapping papers. In particular cases, the need to shift to another line provoked a conflict in their reasoning, leading them to break the sequence and reinitiate it.

Figure 2: Projects of the wrapping papers

After concluding and presenting their projects, explaining the content, children copied the structure created to the recycled paper the group had made along the week, presenting no type of difficulties in this activity.

The recipe

Children manifested interest in making chocolate cupcakes after reading a story that mentioned it. So, it was considered an interest problem that they would have to deduce all the process of making the cupcakes, deciding all the necessary phases. This task promoted

connections between everyday knowledge, related to children's day to day experiences, and Mathematics. They needed to decide all the ingredients, materials and procedures they would have to use to do the cupcakes, evidencing measurement skills.

The group started by discussing and deducing what they would need to make the chocolate cupcakes. They remembered some ingredients (e.g. eggs, flour, sugar), some utensils (e.g. bowl, oven), and also identified the need to follow a recipe, claiming they had "to use the right amount". This lead to the presentation of a pictogram (Figure 3) that represented the recipe.

Figure 3: Recipe for the cupcakes

Following the initial discussion, the focus was on exploring and interpreting the content of the pictogram. Along the group discussion, children revealed and applied knowledge related to their daily experiences, identifying the ingredients, the materials and the measures. Even some of the conventional measures were recognized, like 500g of flour, saying that it was "half a package" because they saw their "mother do it". This example states the importance of informal knowledge and its consideration in school activities. After interpreting the pictogram, children went on to the procedures. They had a measuring box in the classroom containing a diversity of materials, like common objects (e.g. ping pong balls, pens, clips, squared cards, cubes) and measuring instruments (e.g. scale, measuring cup, ruler, measuring tape). They knew that in measuring situations the box was a possible resource they had at their disposal. They were able to make adequate measurements according to the magnitudes involved. Despite having some difficulties with the magnitude of some numbers, like 500g or 400ml, they were able to make generalizations from the numbers they already knew, like 5 or 4. They also used non-standardized units, as the recipe suggested, using counting skills

Reflection

While freely exploring the areas of the classroom, some children made pertinent assumptions and questions about their reflection on a mirror. Thus the reason of proposing this task: *What can we see in a mirror? Lets experiment and see what happens.* It promoted connections between children's literature and Sciences and obviously Mathematic, highlighting the concept of symmetry.

The teacher started by reading a story that focused the idea of reflection, *The reflection of Lola in the mirror*. Lola had never seen her reflection and as she was confronted with a

mirror, she discovered what happened as she made several movements and expressions. Children had the opportunity to do the same as the character in the story. Individually, they experimented different actions in front of the mirror in the classroom, making predictions and discussing what they saw: raising a hand, walking towards the mirror or stepping back, making funny faces. After the group discussion, children individually explored a mirror in some images (e.g. half a heart, half a pizza, boy smiling, sad boy), verbalizing their findings in each step. It was considered pertinent, as the group was so interested in experimenting, to explore what would happen when using 2 mirrors in different positions, making the respective registers (Figure 4).

Figure 4: Registers of the reflection task

Children concluded that the position of the mirrors would influence the reflection and that as they reduced the angle between the mirrors, the number of objects reflected increased. The most complex situation emerged when the mirrors were on a parallel position, however they had the notion that there were "to many".

The number of paws

One of the parallel projects developed with this group of children was *The animals*. To obtain and confirm information, children consulted books, searched the internet, questioned family members and went on field study visits. At certain point the discussion focused on the animals found on the sea or near the sea (e.g. types, number of paws, covering, feeding). In this context the following problem was proposed: *Simon went to the beach and saw 2 types of animals: seagulls and turtles. He spotted 8 paws. Which animals could it be?* This task hence promoted connections between the area of knowledge of the world and Mathematics. Considering the knowledge of children about animals and its features, connections were established to mathematics through problem solving.

After the presentation of the problem, children had access to cards with the animals, to facilitate reasoning about the conditions proposed. They manipulated the cards freely, discussing about the content, the animals and their features (Figure 5). Then they tried to find solutions using the cards as resource to facilitate trial and error.

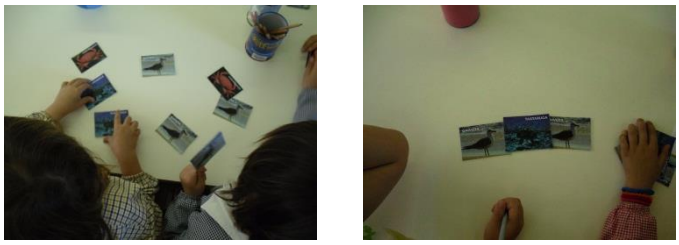

Figure 5: Manipulation of the cards to solve the problem

After manipulating the cards and finding different solutions, children made the respective representations by drawing them. Those who had difficulties with drawing used images of the animals and pasted them in the register sheet (Figure 6).

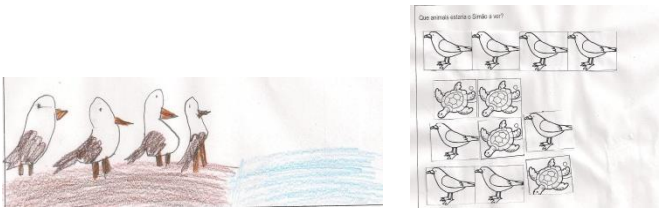

Figure 6: Register of the solutions

Discussion

It's evident that tasks contemplating curricular integration constitute more effective and natural learning experiences, especially in these educational levels. Knowledge is perceived as a whole and concepts of specific areas are intertwined in order to produce a sequence of common benchmarks.

Focusing on the examples presented we can say that: (a) Many natural connections arise between art (plastic expression) and mathematics, mainly because there is a visual component that facilitates the exploration of geometric shapes, patterns, colours, geometric transformations; (b) Daily activities (e.g. cooking/recipes, snack time, daily routine) constitute privileged contexts to develop measurement skills, like learning about standard and non standard units, and also aspects of number sense; (c) Science and nature turn the focus to the environment and to the comprehension of phenomena, which leads to predicting, observing, comparing, measuring, classifying, looking for patterns (including symmetry); (d) Reading books can also enhance mathematical experiences, since many of the children's literature have good story elements that focus on subject areas, such as mathematics.

The approach intended and proposed, in this case focusing on mathematics, tends to encourage children's curiosity, leading them to make connections, and to build their confidence. These connections help them make sense of the world, understanding facts, events and concepts in a more meaningful way fostering even more their curiosity.

References

Baroody, A. (2000). Does mathematics instruction for three to five year olds really make sense? *Young Children, 7*(4)*,* 61-67.

Boavida, A., Cebola, G., Paiva, A., Pimentel, T., & Vale, I. (2008). A Experiência Matemática no Ensino Básico - Programa de Formação Contínua em Matemática dos 1º e 2º Ciclos do Ensino Básico. Lisboa: Direcção Geral de Inovação e de Desenvolvimento Curricular.

Clements, D. (2001). Mathematics in the Preschool. *Teaching Children Mathematics, 7*, 270-275.

Clements, D., & Sarama, J. (2009). *Learning and teaching early math: The learning trajectories approach*. New York: Routledge.

DEB (1997). *Orientações Curriculares para a Educação Pré-escolar.* Lisboa: Departamento de Educação Básica.

DeVries, R., & Kohlberg, L. (1990). *Constructivist early education: Overview and comparison with other programs.* Washington, DC: NAEYC.

Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (Ed.) *Handbook of research on teaching* (pp. 119-161). New York: Macmillan.

Jones, E. (1989). *Emergent curriculum: Planning and letting go.* Unpublished paper. Pasadena, CA: Pacific Oaks College.

ME-DGIDC (2010). *Metas de Aprendizagem para a Educação Pré-escolar.* Retrieved from http://metasdeaprendizagem.dge.mec.pt/educacao-pre-escolar/metas-de-aprendizagem/

Miles, M. B., & Huberman, M. A. (1994). *Qualitative data analysis.* Thousand Oaks, CA: Sage.

NAEYC (2002). *Early Childhood Mathematics: Promoting good beginnings.* Retrieved from http://www.naeyc.org/files/naeyc/file/positions/psmath.pdf

NCTM (2000). *Principles and Standards for School Mathematics.* Reston, VA: National Council of Teachers of Mathematics.

Piaget, J. (1952). *The origins of intelligence in children.* New York: International Universities Press.

Van de Walle, J. (2004). *Elementary and Middle School Mathematics: Teaching Developmentally* (5th Edition). Boston: Pearson Education Inc.

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Reflective Practice

The reflection quadrant. A way to guide reflection

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Anything you do is an interaction between you and the society you live in. You are a product of your own society and always will function from that point of origin. Social context differs between countries, but also within countries and even within cities or towns. And even than it is not constant. The last years has seen major changes in school context due to the development of digital media. The teacher must be able to constantly follow these technological and any social changes and adapt his/her teaching. To be abele to change you should be socially and professionally flexible. You can do that passively, slowly changing with the flow but it is much more effective to react to the changes in an active manner. The reflection quadrant can help you with that.

In this workshop we explored the potential effectiveness of the reflection quadrant by first organising a learning and a teaching experience for each participant in the TIG. The TIG was divided into two equal groups and given the task of teaching a specific experiment with a balloon to the other group. The first group was taught to sit on a balloon; the whole body should be leaning on the balloon. Normally anybody can sit on an inflated balloon, it does however take some convincing that you can do this. The second group learned how to float a negatively charged ring of plastic bag above a negatively charged inflated balloon. This activity has a scientific component that looks like magic. This will invite the 'students' to ask questions about the underlying physics.

After both groups had decided how they would teach their recently acquired skills the groups were mixed, pairs were made and the tricks with the balloons were taught to each other. This way each TIG participant had a learning experience and a teaching experience, which were reflected upon using the reflection quadrant.

Evaluation

Reflection on your own behaviour is not the same as evaluating. At an evaluation you look objectively to you goals and the process that should have resulted in obtaining your goals. Typical remarks about a lesson in an evaluation are:

- The students worked hard.
- The lesson was orderly
- At the end of the lesson all students new how to write the letter k.

This is an excellent start of an reflection, for: was it your accomplishment that the students worked hard? What did you do to maintain order? How did you design the instruction of the letter k? This is the start of reflection.

The reflection quadrant

ME

The model always starts with a concrete experience from the field of education you yourself experienced. Something happened and you reacted to it. You did something to achieve some kind of goal. You saw something of importance. Than you ask yourself questions like

- What happened?
- What do I feel?
- What do I think?
- What did I do?

Use objective and subjective questions. Describe the situation and couple your insights to your own learning goals.

Them -> ME

In education you are never alone. There is always someone looking and watching you. When you are a pre-service teacher that may by your supervisor but there are always students in the classroom that constantly form opinions about you and judge you. These others may help you but also interfere with your own ideas. Ask yourself questions like:

- Did they help or interfere?
- How did that feel?
- What was the effect on your?

It does not just concern your supervisor but also parents, friend, lecturers or even politicians. Their influence is not always direct but also often indirect. Just the presence of a supervisor or anybody else looking at you during your lessons may have a strong influence on your functioning. What was that influence? Was it positive or negative?

How did the class influence you? The composition of the class, their background, and your connection with them influences how you act in the classroom. What was it like in this occasion?

ME -> Them

Eventually you have influence on others. Not just active but also passive. Your presence alone has influence whether you want it or not. In education having an influence on students is the goal, you teach, you educate, you coach children. You have specific goals to reach with every activity you do. Next to these short term goals you also have long term goals for the whole class and for individual (or even all) students. The goals are linked to student needs and school wide gaols a benchmarks.

Next to students you will influence your supervisor, colleagues, parents, school management and supervisors from the school of education. You are a part of an much larger structure called ‘School’

From all these perspectives you should ask yourself questions like:

- How did you influence the other?
- Did you help them or interfere?
- Did you accomplish your goals?

Them

Every experience involving other people shapes your opinion of the other people, 'them'. But also institutions can be 'them'. Schools have their own culture and separate goals. What do you think of them? In the case of your students: Are they adorable? Cute? Is your supervisor wonderful or a witch? Do you agree with the pedagogical climate in the classroom or school? Your opinion has no meaning on the larger scale of thinks but when argue correctly can shape your own teaching. Valid arguments can refer to scientific theory but also emotions can play a important role. Something might just not 'feel right'. That is often a sign that something is 'rotten in paradise'.

Your opinion of 'them' also reflects on the goals you formulate for 'them'.

Those other also form an opinion about you. 'That is a good student!' 'This one should never get a degree!' 'Organizes her/his work nice but…' This could be grounded opinion but also just bullshit. Anyway you leave an impression on the other. What would that be? How do you want to be remembered by children, parents, or colleagues?

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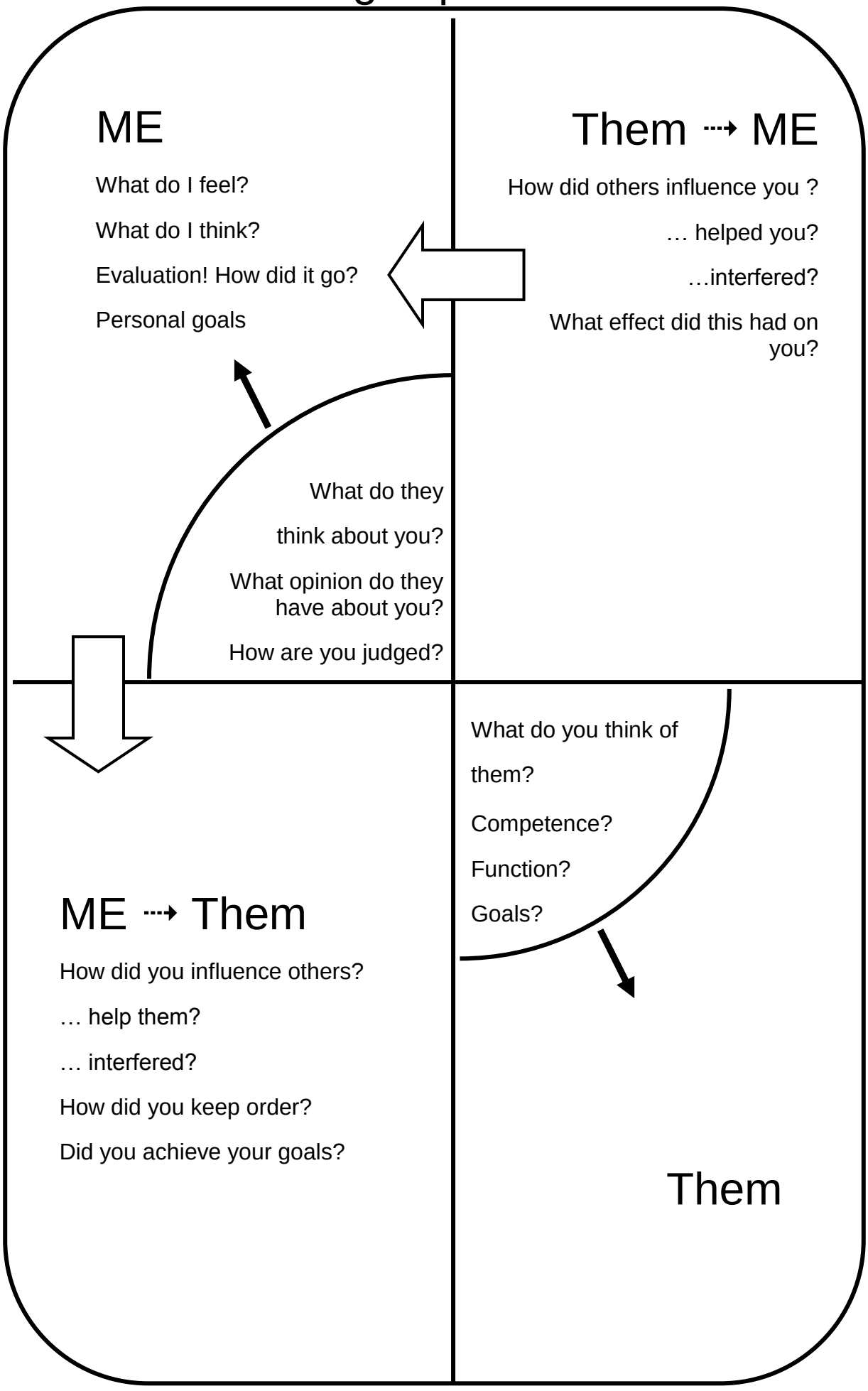
Teaching experience



Reflection in developing speech production skills

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Introduction

In modern society, a great emphasis is laid on reflective practice as the key quality of a practitioner. This article concentrates on the role of reflection for intending ESL teachers, its integration in the process of teaching English to them and the technology of implementing this approach.

Context

The role of reflection in education was grounded in the first half of the 20th century by John Dewey (1933, p.17) who distinguished between routine and reflective actions. He argued that routine actions are unsystematic and habitual, whereas reflection "enables us to direct our activities with foresight and to plan according to ends-in-view […], to act in deliberate and intentional fashion, to know what we are about when we act".

The scientist's ideas were developed in the early 1980s by Donald Schon (1983) who concentrated on the meaning of reflection for teaching process. Schon maintains that a teacher should be a reflective practitioner who continually learns from their experience with the help of reflection. The scientist singles out three types of it: reflection-in-action, reflection-on-action and reflection-for-action. Reflection-in-action, according to Schon (1983), is about the practitioner being aware of what they are doing while they are doing it. As Farrell notices this simultaneous thinking about the action causes reshaping of what the person is doing (2003). Reflection-on-action is concerned with our looking back on what we have done to analyze how it could have been improved (Schon, 1983). Reflection-for-action is proactive in nature (Farrell, 2003); it guides the practitioner's future actions based on the results gained from the other two types of reflection.

The term "reflection" is traditionally used for questioning one's beliefs, assumptions and values rather than one's actions while the term "reflective practice" is focused on the doer's activity. Barbara Larrivee states that the term "reflective practice" is the culmination of all

other forms of reflection as it is "undertaken not solely to revisit the past but to guide future action" (2006, p.6). We, however, are inclined to consider these two terms (reflection and reflective practice) interchangeable as we view reflection as the practitioner's active inquiry into their knowledge and actions that lead to self-improvement. As Killon and Todnew (1991, p.15) maintain: "We undertake reflection not so much to revisit the past or to become more aware of the metacognitive process one is experiencing (both noble reasons in themselves) but to guide future action (the more practical purpose)".

The significance of reflective practice for teachers is beyond denial. Due to this fact a great attention is paid by researchers to the ways of introducing and maintaining reflective practice in the classroom. At the same time other ways to intensify this process are sought. We are of the opinion that a rather logical solution to this problem might be including reflection in the course of study for intending teachers. Thus when they graduate this complicated psychological mechanism will be highly developed and will constitute one of their personal traits. As a result the graduates will have no difficulty in transferring reflection onto any sphere of their personal and professional life.

Reflection in teachers-training universities

One of the ways of introducing reflective practice into intending teachers' studies is integrating it into the subjects on the curriculum. In this research an attempt was made to integrate reflection into will-be teachers' learning a second language. Yet, applying reflective practice to the whole process of learning English as a Second Language is quite an ambitious enterprise due to its (the process') complexity and diversity. So it was decided to introduce reflective component into the process of teaching speech-production (monolog) as one of the aspects of communication learning (though it can be done in relation to any component of communicative competence). One of the reasons for choosing this aspect of teaching a second language is the fact that students have much difficulty when speaking on their own, without apparent interaction. Another reason lies in the relative independence of the speaker performing this type of activity who completely controls the talk.

The research focuses on teaching students speech production on the basis of reflective practice. As a result of this, speech production skills are efficiently improved and concurrently the students' ability to reflect on their speech (and then on their actions) is being developed. Reflection plays an essential role in the speech production process; it prompts

students' analysis of their actions and encourages their self-control and self-assessment, which make up essential psychological mechanisms of an active and self-critical person.

The objects of reflection

The implementation of this technology was made possible by first singling out the objects of reflection in the process of first-year students' speech production. These objects also serve as the criteria of assessment and self-assessment of students' speaking skills.

To fulfill this task and define the objects of reflection in speech production it was essential to turn to the linguistic research of discourse, its characteristics and its types. These issues form the first-year objectives in ESL teacher training universities in terms of speech production.

The most common understanding of discourse is "language in use" (Fasold, 1990, Brown & Yule, 1983, van Dijk, 1980, etc.), for example Candlin views discourse as "language in use, as a process which is socially situated" (1997, p. ix).

This correlates with Deborrah Schiffrin's understanding of discourse as 'text used in context'. She distinguishes between the term "text" (linguistic material) and "context" (the environment in which linguistic productions occur). "In terms of utterances, then, "text" is the linguistic content […] Context is thus a world filled with people producing utterances: people who have social, cultural, and personal identities, knowledge, beliefs, goals and wants, and who interact with one another in various socially and culturally defined situations" (1994, p.363).

This understanding of discourse made it possible for us to single out the criteria for speech production assessment based on discourse characteristics. Following Tischer et al. (2000) we distinguish text-internal and text-external criteria of discourse.

To text-internal criteria belong:

- Cohesion, which is formal connectedness of a text. A great significance for teaching cohesive speech belongs to discourse markers, which are understood as "a class of short, recurrent linguistic items that generally have little lexical import but serve significant pragmatic functions in conversation," (Andersen, 2001, p. 39). In this research a great

importance is attached to the fact that different discourse markers are used in descriptive, narrative and argumentative discourse..

- Coherence, which is understood as the wholeness of a text that conveys its meaning.
- Completeness of an utterance is understood as its finality, which is seen by the speaker. It is measured by the abundance of the expression of the speaker's thought.
- Type of speech. There are three main types of speech: description, narration and argumentation. This classification is based upon the objective relations between the phenomena in real life: a person perceives objective forms of matter existence in time (narration), space (description) and the cause-effect relations between notions (argumentation).

To text-external factors we refer the following:

- Addressee account, which implies direct influence of the addressee on the speaker's selection of lexical and grammar structures and their speech strategy. As Mikhail Bakhtin (1984) pointed out any utterance including a monolog is built upon dialogic relationships.
- Situationality, (which means the situation in which the discourse is produced) plays a crucial role in the production and perception of the message. In our research a great emphasis is laid on the situation as social relationship between the interlocutors, their intentions, status and personal characteristics. All these factors influence the lexical and grammatical constructions the speaker uses and the style of the discourse.
- Intentionality, which relates to the aim of the speaker and, most importantly, its realization in the discourse.

The study of the text-internal and text-external discourse characteristics distinguished above allowed us to single out the objects of reflection. These objects guide the process of learning to produce monologs. In the table below there is an illustration of the objects of reflection for argumentation. In the right column there are objects, which are common for all the speech types; in the left column, the objects typical of argumentation are presented. There we included the most important characteristic of this speech type.

Table 1: Objects of reflection on argumentation

Common objects	Specific objects of argumentation
• Cohesion	• Right wording of the thesis
• Coherence	• Logical structure (thesis-arguments-conclusion)
• Completeness	• The arguments are sufficient and adequate
• Type of speech	• The connectors are adequate for argumentation
• Addressee account	
• Situationality	
• Intentionality	

The technology of developing speech production on the basis of reflection

The selected objects of reflection enabled us to develop the technology of teaching speech production on the basis of reflection. The proposed technology is based on Galperin's Theory of Stage-by-Stage Formation of Mental Activity (Galperin, 1969), which in its turn is grounded on the ideas of Vygotsky's scientific school. The technology is aimed at the students' speech production skills development on the basis of reflection. This aim is achieved through the implementation of the system of exercises of a concurrent and stage-by-stage development of reflection and speech production skills.

As it was mentioned above the technology is built upon Galperin's Theory of Stage-by-Stage Formation of Mental Activity, which states that human mental activity is formed out of the transformation of external ("materialized") activity. Pyotr Y. Galperin proved that mental activity reflects materialized activity and that the former includes all the components of the latter with the difference that external activity operates material objects whereas mental activity deals with ideal ones. The scientist distinguished five stages of the idealization of an external action, which are analyzed in relation to teaching argumentation to students below.

1st stage. According to Galperin, the aim of this stage is to form the orienting basis of an action (OBA), which is understood as "the whole set of orienting elements by which the student is guided towards the successful execution of an action" (Ramirez, 2012, p.5). During theteaching of speech-production on the basis of reflection the teacher motivates the students to study and provides them with the information on discourse (its characteristics, types of speech and their qualities) and reflection (its significance in the educational process). With

the help of exercises students learn to analyze the structure of argumentation and single out discourse characteristics.

Reflection is integrated into speech-production starting from the very first stage of this technology. The first task to the students is to reflect on their existing level of speech and juxtapose it with the requirements to it being logical, cohesive, coherent and linguistically adequate. Besides reflection-for-action helps the students predict the possible applications of the gained knowledge and their probable difficulties.

These goals are achieved through the set of preparatory exercises whose main function is to form the cognitive basis for further activity: 1) exercises that form knowledge of 'discourse'; 2) exercises that ensure analysis and recognition of the text-internal and text-external characteristics; 3) exercises that prompt students' singling out the specific qualities of argumentation; 4) exercises that provide the analysis of the model discourse.

2nd stage. Galperin maintained that the second stage of the formation of mental activity is all about material activity, in which learners manipulate real objects: models, schemes, diagrams and drawings. In this technology the second stage is aimed at creating the scheme of the orienting basis of the action. At this stage students' knowledge of discourse features are improved, external speech support is created and the lexical and grammatical skills adequate for argumentation are formed.

The following students' abilities are developed: the ability of self-analysis and self-regulation, the abilities to work in a team, to synthesize the gained information, to use adequate connectors, the abilities to logically build argumentation and to prove their point of view. Moreover, the activity facilitates students' respectful attitude to the interlocutor and self-critical attitude.

At this stage students are engaged in reflection through their analysis and comprehension of the theory on argumentative discourse and their control of its practical application in speech-production. Reflection-in-action corresponds with students' self-control and self-regulation while speaking whereas reflection-on-action is carried out in a loud form during the students' retrospective analysis of their group mates' talks and later during the students' self-analysis of their own utterances.

The above-mentioned goals are realized by the set of training exercises: 1) exercises that train the features of argumentation; 2) exercises that train students in using adequate connectors; 3) exercises on retelling the model discourse.

3rd stage. According to Galperin the third stage of mental formation is aimed at verbalization when students repeat the operations aloud without the material support. The aim of the third stage of the current technology is to improve speech-production skills without the external support. The following abilities are developed: the ability of self-analysis and self-regulation, the abilities to work in a team, to use adequate connectors, to produce an addressed, logical, completed, cohesive and coherent talk that corresponds with the communicative situation, and the ability to prove the main idea by connected and adequate arguments. Moreover the activity forms students' respectful attitude to the interlocutor as well as self-critical attitude.

At this stage, reflection-for-action helps anticipate possible difficulties. Reflection-in-action helps realize all the requirements during speech production process. Reflection-on-action is verbalized in a loud form and carried out individually.

This stage includes: 1) preparatory exercises: a brief analysis of model discourse, 2) exercises training the adequate use of connectors, 3) exercises on retelling of the model of discourse with modifications.

4th stage. In Galperin's theory the fourth stage plays an important role as it provides gradual movement of the action from the outside to the inside. The action at this stage is carried out at the inner level but it still can be verbalized if needed. This stage of the current technology is aimed at speech production with the subsequent inward reflection. The following abilities are developed: the abilities of self-analysis and self-regulation, of working in a team, of speaking in front of the audience, the abilities to produce an addressed, logical, completed, cohesive and coherent talk that corresponds with the communicative situation, and the ability to prove the main idea by connected and adequate arguments. The activity facilitates students' respectful attitude to the interlocutor, self-critical attitude and the ability to speak naturally and with conviction.

All the kinds of reflection (reflection-in-action, reflection-on-action and reflection-for-action) are essential at this stage and are carried out inwardly. The students are conscious of each operation and are able to expand the process of reflection when required (when they make a mistake, the teacher asks to comment on the necessary feature of discourse).

This stage consists of: 1) preparatory exercises: a brief analysis of model discourse, 2) exercises on retelling of the model discourse with modifications, 3) speech-productive exercises (in the frames of one speech type, i.e. argumentation).

5th stage of Galperin's theory is characterized by fulfilling the activity at the wholly inner level. In this technology it is aimed at the development of speech-production skills of mixed speech types with reflection carried out at the inner level. The following abilities are developed: the ability of speaking in front of the audience, the ability to produce an addressed, logical, completed, cohesive and coherent talk that corresponds with the communicative situation, the ability to prove the main idea by connected and adequate arguments, to express opinion on the topic of argumentation and to choose the type of speech according with the communicative purpose. The activity forms students' experience of creative activity, their willingness to participate in interpersonal communication, the ability to speak naturally and with conviction and students' willingness to assess their level of speech-production skills.

At the final stage reflection consists of the students' informed assessment of their level of argumentation skills and their realizing the ways of its further development. The goals of this stage are realized through speech-productive exercises that are directed at production of natural monologs of one and more speech types: argumentation and description/narration.

All in all this technology guarantees both speech-production skills improvement and the parallel development of the students' reflection. This will encourage the transfer of the psychological mechanism of reflection to other types of the students' activity and thus it will become their essential personal quality.

Conclusion

Integrating reflective practice into the course of study for intending teachers will make the learning process far more efficient by enabling students to make informed decisions

concerning their learning strategies and acquired skills. At the same time this approach will facilitate and develop students' mechanism of reflection that they will apply first to the process of studying and later on to their professional activity.

References

Andersen, G. (2001). *Pragmatic markers of sociolinguistic variation: a relevance-theoretic approach to the language of adolescents*. Amsterdam: John Benjamins.

Bakhtin, M.M. (1984). *Problems of Dostoevsky's poetics*. In C. Emerson (Ed.). Minneapolis, MN: University of Minnesota Press.

Brown, G. & G. Yule. (1983). *Discourse analysis*. Cambridge: Cambridge University Press.

Candlin, C.N. (1997). General Editor's Preface. In Gunnarsson, B.-L., Linell, P. and Nordberg, B. (Eds.). *The construction of professional discourse* (pp. ix-xiv). London: Longman.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Chicago, IL: Henry Regnery Company.

Dijk van, T. (1980). *Discourse studies and education*. Amsterdam: University of Amsterdam.

Farrell, T. (2003). Reflective teaching: The principles and practices. In: *English Teaching Forum*, October 2003 (pp. 14-21).

Fasold, R. (1990). *Sociolinguistics of language*. Oxford: Blackwell.

Galperin, P. (1969). Stages in the development of mental acts. In: Cole. M and Maltzman M. (Eds). *A handbook of contemporary Soviet psychology*. (pp. 249-273). New York: Basic Books.

Killon, J. and Todnew. G. (1991). A process of personal theory building. *Educational Leadership*, 48, 6, 14-16.

Larrivee, B. & Cooper, J.M. (2006). *An Educator's guide to teacher reflection*. Boston: Houghton Mifflin Company.

Ramirez, J.L., Juarez M. & Remesal A. (2012). Activity Theory and e-Course Design: An Experience in Discrete Mathematics for Computer Science. In: "Mathematical e-learning" [online dossier]. *Universities and Knowledge Society Journal (RUSC)*. Vol. 9 No 1. Pp. 320-339 UOC. [Accessed: 15/03/2013].

Schiffrin, D. (1994). *Approaches to Discourse*. Oxford: Basil Blackwell.

Schon, D.A. (1983). *The reflective practitioner*. New York: Basic Books.

Tischer, S.M., R. Meyer, R. Wodak & E. Vetter. (2000). *Methods of Text and Discourse Analysis*. London: Sage.

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Crisis Preparedness: A Multifaceted Approach

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Abstract

Disruptive student behavior is a global concern. Campus communities are expected to be safe havens for learning. Realistic threats to safety require a proactive institutional-wide approach to crisis prevention and preparedness. The Assessment-Intervention of Student Problems (AISP) is a model to evaluate student behavior and to foster effective strategies (Delworth, 1999). A review of current literature surrounding behavior management indicates a team approach is invaluable as "dangerous people rarely show all of their symptoms to just one department or group on campus" (Lake, 2007). Protocols empower campus leaders, faculty, and staff to create safe environments where students can thrive, develop to their fullest potential, and become global citizens. Therefore, it is important for university faculty and staff to work together to develop protocols that create such safe environments.

Introduction

Prevention and preparedness for crisis situations requires an increased awareness across the field of higher education as university presidents, administrators, faculty, and staff are called to action and mobilized to respond to concerns of violence and safety. Emergency management experts warn that if your campus has recently averted a crisis, then your institution is much closer to the next as, "the further you are from your last emergency…the closer you are to your next emergency" (Bookser, 2013, February). Campus crisis prevention and preparedness is threat or behavioral assessment in its purest form and is based upon sound guidance from experts such as the US Secret Service, the US Department of Education and the Federal Bureau of Investigation (2008). Institutions of higher education must deepen their knowledge of violence prevention, assess the campus climate, strengthen lines of communication, identify safety concerns, implement a threat assessment process, and utilize effective case management to respond to individuals who present with potential harm to self or others. According to Deisinger and Randazzo, universities must develop an orderly process that "enables centralized awareness of developing concerns through an active outreach program and consultative process" (December, 2012).

Campus safety and threat assessment require all members of the campus community to respond to this call to action as a means to prevent, avert, or minimize potentially dangerous or harmful events. The World Health Organization defined violence as: "The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, mal-development or deprivation" (Krug, et al, 2002). Global statistics reveal that every minute nine people die from unintentional or violence related injuries (World Health Organization, 2010). Specifically, acts of violence may include campus shootings, homicidal and suicidal acts, physical and sexual assaults, acts of bullying and hate crimes due to gender, race, ethnicity, and sexual orientation.

The importance of threat assessment

Worldwide, the acts and threat of school violence across universities and colleges has reached epidemic proportions. Colleges and universities first recognized the need to implement a process of threat assessment following the 1999 massacre at Columbine High School outside of Denver, Colorado in the United States. School officials, law enforcement, and the general public became shockingly aware that signs and information of this impending tragedy were known by many but shared by none. The disheartening awareness that perhaps the lives of individual teachers and students could have been spared at Columbine and the paralleled realization of the Virginia Tech tragedy caused the field of higher education to search for preventative approaches to enhance campus safety and minimize harm (Leavitt, Spellings & Gonzales, 2007). The reaction and desire to raise awareness and insure safety across campus environments is noted by the Commonwealth of Virginia's response and 2008 enactment of legislation mandating colleges and universities to establish threat assessment teams.

Threat assessment models may differ from campus to campus but each share the singular goal of preventing campus harm through a simple but effective means to collect information, assess the presenting concern, and provide assistance to those who may be distressed. The nature of the threat assessment process balances a sense of support and concern for the individual who may be distressed against the safety of the campus community at large. Members of Crisis Response teams include university counselors, police, housing staff and other student affairs personnel who are professionals charged with promptly responding to information provided by faculty, staff, and students regarding a concern for the health and safety of the campus.

Institutional responsibility

The university has a responsibility to establish a process for effective reporting of concerns and strategies to eradicate any threat to the safety of an individual or the campus community (Carr & Ward, 2006). Threat assessment and response is vital as a means to prevent crisis events and is legally mandated in the United States as Jain v. State of Iowa determined that institutions have a "duty to provide reasonable supervision of students…and take reasonable steps to protect students" (Lake, p. 138). The Court found that colleges and universities must take action to implement steps and to insure that every reasonable action has been taken to protect the campus community. Such legislation should serve to raise awareness and reach beyond the U.S. territories, alerting all institutions of their responsibility to recognize and respond.

The threat assessment process is a vital mechanism that can help the university to meet this fundamental obligation. Threat assessment models include the essential elements of education and communication encompassing all members of the campus community. University administrators must mandate that workshops and educational outreach be developed as a method to raise campus awareness surrounding impending acts of violence. Campus-wide educational programs must articulate both the University's responsibility to ensure student safety, and educate the faculty, staff, and students of the warning signs surrounding violence, the importance of sharing information and the preferred reporting process. This objective is clearly stipulated by the American College Health Association goal statement that urges colleges and universities to take action to reduce injury, acts of violence,

and related deaths through education, reporting, and the implementation of best practices to prevent violence and enhance safety (2005).

Members of the campus community must understand that safety is everyone's concern and responsibility. According to Deisinger (December 4, 2012), reports of concerns should contain the critical elements of the case beginning with the identification of the subject who may take violent action; the identified target of the action; the environment where the action may occur; and any identified precipitating events or potential triggers of the action. All information, regardless of severity from the smallest concern to an eminent crisis, must be viewed as serious and in turn shared with campus administrators who are responsible for the safety and well-being of the campus community.

A simple, yet a highly effective reporting system is the university-wide CARE reporting system implemented by the University of Pittsburgh at Johnstown (www.upj.pitt.edu/602/). Such an online system establishes a centralized reporting process and encourages all members of the campus community to submit non-emergency concerns regarding any aspect surrounding campus safety and security. The effectiveness of this process hinges on the campus community's willingness to communicate and share information through the CARE reporting system. The value of communication cannot be overstated and is critical in building a campus-wide safety net, as communication is the first step to activate the crisis response process.

CARE reporters are guided to contact campus police rather than submit a CARE report for concerns requiring immediate emergency response. All other concerns can be reported through the online CARE report system that is managed across various departments within the Division of Student Affairs. Once a report is submitted, the nature of the report directs the response. Cases of limited threat are assigned to specific support staff members who reach out to the student and offer services. Concerns of a serious level are managed through the collaborative efforts of the Threat Assessment Team that include counseling service, campus police, student services, housing, administrators and others across the campus community that work together to gather the facts, draw conclusions, and implement case management.

Effective case management interventions incorporate techniques to de-escalate the subject who may take violent action; decrease the susceptibilities of the target; modify the environment to decrease potential escalation; work to de-escalate or contain the subject who may take violent action; and prepare to moderate any events that may trigger any negative reactions (Dunkle, Silverstein & Warner, 2008). Individuals who present as an immediate danger to self or others are guided towards treatment and often separated from the institution until they receive documented clearance to reenter the community.

Identifying students of concern

De Becker (1997) in his book *The Gift of Fear,* describes over sixty signals noting universal body movements and gestures first identified by Morris (1995) that are behavioral indicators and predictors of violence. Some of these "signals" include nostrils flaring with a sharp indrawn breath indicating anger or a jutting chin demonstrating aggression. Building on this research surrounding body language De Becker developed the JACA Model (Justification, Alternatives, Consequences and Ability) that has been found to be predictive of impending acts of violence. Perceived *justification* can be identified as being actually provoked, an imagined slight or an angry response only peripherally related to the issue at hand. Perceived

alternatives refers to the options the actor believes are viable. The more limited the alternatives appear, the more likely the individual will turn to violence. Perceived *consequences* can be weighed in order to determine if the act will justify the likely penalties. Likely this explains why many perpetrators of campus shootings have ended their actions by committing suicide. They simply see no other acceptable consequence. Perceived *ability* refers to whether the individual believes they can successfully follow through on their plan to completion. Thus, many actors will plan their violence in great detail, even acting out some of the events in a rehearsal.

The work of Borum, Fein, Vossekuil, and Berglund (1999) further expanded the field of study through the identification of specific acts of targeted violence. Targeted violence is defined as violent behavior in which the victim and the offender are identifiable prior to the act of aggression (Borum, et al, 1999). Tarasoff v. Regents of the University of California (Borum & Reddy, 2001) case is the most noted example of targeted violence on record where an individual of concern shared in a counseling session his intention to harm his girlfriend. The therapist negated the professional responsibility to alert the identified victim of her potential endangerment, which the court found, contributed to her death. This landmark case is often referred to as "duty to warn" noting a professional's obligation to warn potential victims of specific acts of targeted violence.

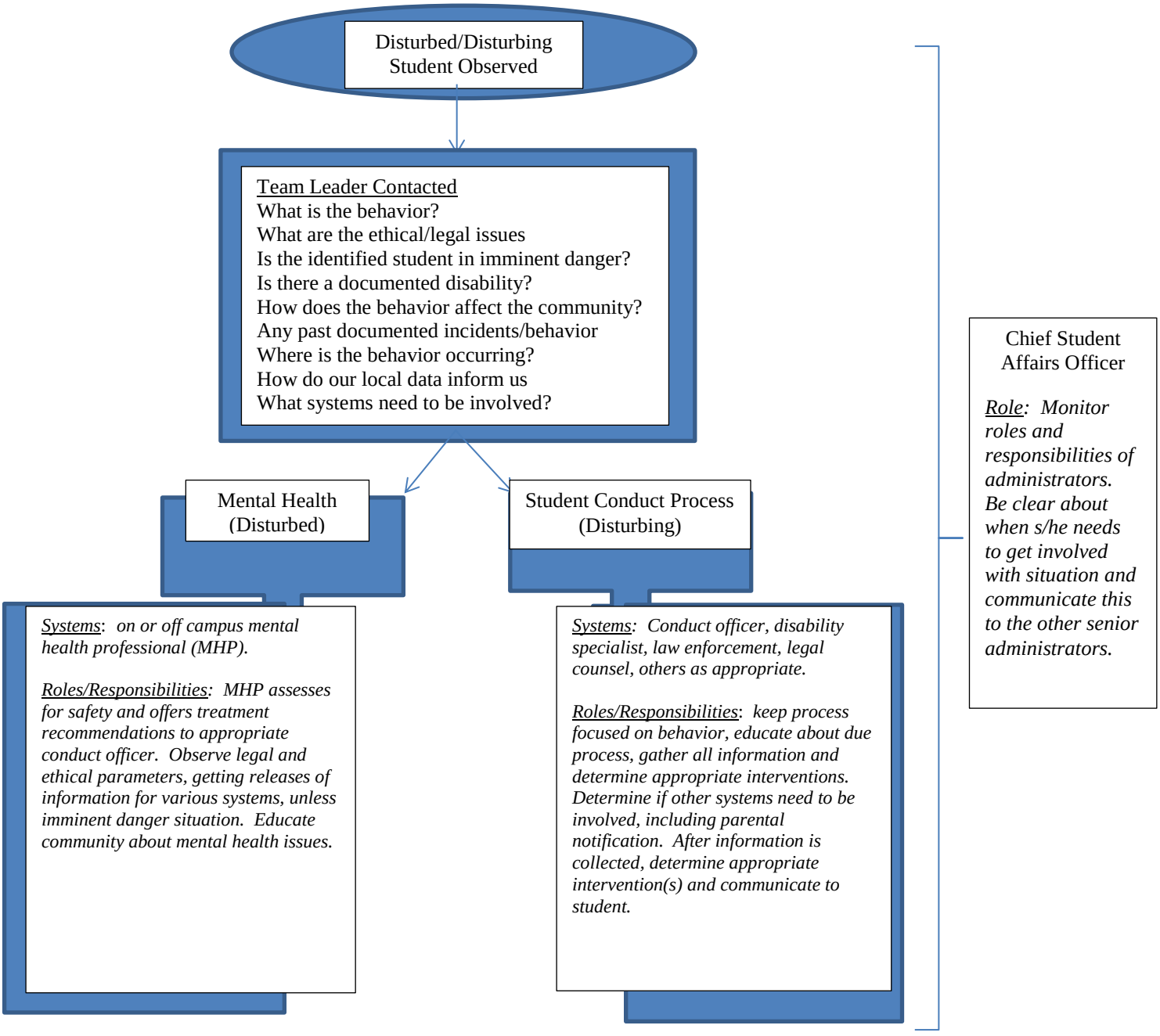
Meloy, Hoffman, Guldimann, and James (2011) provided a third theoretical approach which defined "warning behaviors" as a measure of an individual's ability to potentially complete a violent act. These seven warning behaviors include: *identification warning behavior* where the subject presents with an unusual fixation with weapons, attackers or assassins; *last resort warning behavior* communicates that there are no other solutions except for violence; *pathway warning behavior* speaks to any activity that serves as preparation or implementation of an attack; *fixation warning behavior* is evidenced through an increased preoccupation with a victim; *energy burst warning behavior* is observed through an increased activity level pertaining surrounding the target; *leakage warning behavior* is communication to a third party of intent to harm and *directly communicated threat warning behavior* is a direct threat to harm the target or law enforcement (p. 265-66). The research validates the significance of these warning behaviors and notes that *leakage warning behavior* is frequently indicative of a violent act. Additionally, *directly communicated threats* often fail to be fulfilled possibly due to the advance notification of the event (Meloy & O'Toole, 2011).

Crisis response protocol

The assessment

The university has the obligation to warn individuals who may be at risk for harm and simultaneously to maintain safety and security across the campus community. The Assessment-Intervention of Student Problems (AISP) model, introduced by Ursula Delworth (2009), is a tool to assist universities in the classification, management and behavioral assessment of the at-risk college student. The AISP model serves to identify students of concern as falling into one of three categories. (See Diagram 1).

Diagram 1



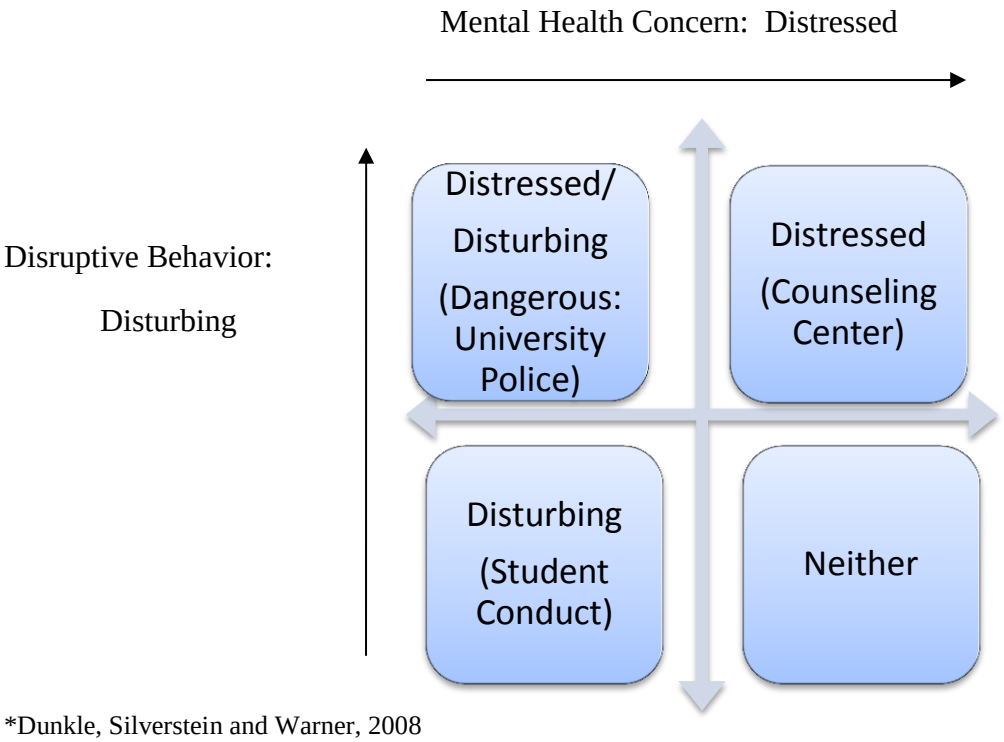
(Dunkle, Silverstein & Warner, 2008, p.635)

Delworth (2009), describes the *disturbing* student as lacking "skills in establishing close, age appropriate relationships, very self-centered but wants to establish relationships" (p. 13). The next category, the *disturbed* or distressed student expresses "specific behavior[s] that are out of sync with other students; often marked patterns of moving away from or against others…seems angry and destructive toward self or others" (p.13). The final category is the *disturbed/disturbing* student. This student expresses characteristics of being both *disturbing and disturbed*. An example of this is a student who has a roommate conflict that escalates beyond the issue at hand, becomes destructive and disrupts the entire community (disturbing) while later seeming to have no recollection as to what provoked the behavior (disturbed).

Dunkle, Silverstein & Warner (2008) further extended Delworth's theory of assessing students of concern with the addition of the terms "distressed" and "dangerous".

Diagram 2

Disturbed/Disturbing Matrix



*Dunkle, Silverstein and Warner, 2008

The response

There simply is no single best response. In a campus environment, the sharing of information is the key. Typically, responses fall into one of two best practices: either Behavioral Intervention or Threat Assessment (Sokolow & Lewis, 2009). Many campuses have both.

The Behavioral Intervention Team is often made up of a variety of campus faculty and administrators. At Indiana University of Pennsylvania, this team is referred to as CART (Concern and Response Team) and its standing membership includes academic deans, the director of University Police, the chair of the counseling center, the executive director for the center for health and well-being, the executive director for housing, residential living and dining, the director of student life and the director of residential living. The group is convened by the Vice- President of Student Affairs on a biweekly basis (http://www.iup.edu/page.aspx?id=66653). The campus community can report students of concern through a variety of methods including anonymous reporting, faculty or staff consultations with their deans or supervisors and reports that come through the Campus Officials Reporting (COR) structure. COR is a method of documenting and following up on alleged crimes that have not been reported to the authorities (www.iup.edu/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=133135). While the Behavioral Intervention Team (BIT) and COR groups are standing multi-disciplinary groups,

a Threat Assessment Team (TAT) is a more specialized ad hoc committee that commences to address very specific situations.

Often the Threat Assessment Team is made up of a subset of the behavioral intervention group and may pull in other areas such as specific faculty, disability services and other faculty and staff who have specific knowledge of the situation or student of concern. Many campuses have teams that include human resources and leadership from collective bargaining units if their team, in addition to working with student issues, also works with faculty and staff issues (Deisinger, Randazzo, O'Neill & Savage, 2008).

The intervention

The intervention with the student varies depending on the severity of the problem, the information at hand, the accessibility of the student and the options. Most campuses have guiding documents that should be reviewed with their institutional attorney. It may be helpful to review the student discipline policy, the academic integrity policy, the involuntary withdrawal policy, the emergency campus notification tool (such as a text notification system or a campus alarm), leave of absence protocols that include an individualized plan for re-entry to the community, a knowledge of disability law, a policy regarding mandated assessment and/or treatment, to name but a few. Once a policy is developed, adopted and published, it is imperative that it be consistently followed.

It is also important for institutions to identify community resources. An institution of higher education should have a memorandum of understanding (MOU) with local hospitals, law enforcement and health agencies to define the parameters of a collaborative relationship. All such resources should be clearly communicated to faculty, staff, students and parents (The Jed Foundation, 2008).

Campus readiness

It is irrefutable that colleges and universities must continually seek resources to keep their campuses safe. No one likes to think about threats of violence and in fact, personal fables cause us to believe that "it" cannot happen to us, our campus or our community. It is therefore critical to educate and mentally prepare a campus wide team that understands that successful crisis management is dependent upon all team members and their ability to respond appropriately in time of crisis.

Programs that enhance communication across the campus community help to increase the institutions level of success in averting a crisis and responding to signs of concerns. Activities surrounding reflective practice that include ongoing and frequent workshops, tabletop drills, and assessment activities can serve to sensitize the team, ready the team for action, and ultimately increase the effectiveness of the team during periods of crisis.

Summary

Campus safety is everyone's concern. Best practices across the field of higher education require colleges and universities to provide a standard of care that strives to insure the safety of all students. Delworth (1989) and colleagues have advocated a modern approach to threat assessment having designed best practice models of intervention to assess behavior and the risk of threat since the 1980s.

Threat assessment teams are one effective means of early intervention to prevent, avert, or prepare for a potential crisis. It is a moral imperative to alert your campus leaders of the university's responsibility to implement a campus wide reporting system, to designate a threat assessment team and to ultimately build a campus wide safety net for the benefit of students, faculty and staff.

References

ACHA Standards of Practice for Health Promotion in Higher Education Committee. Vision into action: Tools for professional and program development. Based on the *Standards and Practice for Health Promotion in Higher Education*. Baltimore, MD: May 2005.

Bookser, M. (2013, February). Emergency preparedness. In M. Masiello (Chair), *School and community safety forum.* Symposium conducted at the meeting of Center for Safe Schools, Windber Research Institute, Windber, Pennsylvania.

Borum, R. & Reddy, M. (2001). Assessing violence risk in Tarasoff situations: A fact-based model of inquiry. *Behavioral Sciences and the Law, 19,* 375-385.

Borum, R., Fein, R., Vossekuil, B., & Berglund, J. (1999). Threat assessment: Defining an approach for evaluating risk of targeted violence. *Behavioral Sciences and the Law, 17,* 323-337.

Carr, J. L., & Ward, R. L. (2006). ACHA campus violence white paper. *NASPA Journal, 43*(3), 380-409.

De Becker, G. (1997). *The gift of fear and other survival signals that protect us from violence.* New York: Dell Publishing.

Deisinger, G. & Randazzo, M. (2012, December). *Mitigating institutional risk while managing threats.* Presented by Dr. Deisinger at Executive Briefing for Indiana University of Pennsylvania, Indiana, PA.

Deisinger, G., Randazzo, M., O'Neill, D., & Savage, J., (2008). *The handbook for campus threat assessment & management teams*. Massachusetts: Applied Risk Management, LLC.

Delworth, U. (2009). The AISP model: Assessment-intervention of student problems. *New Directions for Student Services, 128* (Winter 2009), 11-21.

Delworth, U. (1989). Dealing with the behavioral and psychological problems of students. *New Directions in Higher Eucation, 45*. San Francisco: Jossey-Bass, Inc.

Dunkle, J. H., Silverstein, Z. B., Warner, S. (2008). Managing violent and other troubling students: The role of threat assessment teams on campus. *The Journal of College and University Law, 34*(3), 585-636.

Hollingsworth, K. R., Dunkle, J. H. & Douce, L. (2009). The high risk (disturbed and disturbing) college student. *New Directions for Student Services, 128* (Winter 2009), 37-54.

The Jed Foundation (2008). *Student mental health and the law: A resource for institutions of higher education.* Retrieved from https://www.jedfoundation.org/assets/Programs/Program_downloads/StudentMentalHealth_Law_2008.pdf

Kolb D.A. (1984). *Experiential Learning experience as a source of learning and development*, New Jersey: Prentice Hall - See more at: http://www.simplypsychology.org/learning-kolb.html#sthash.EiAlk75i.dpuf

Krug, E.G., Dahlberg, L.L., Mercy, J.A., Zwi, A.B., & Lozano, R. (Eds.) (2002). *World report on violence and health.* Geneva, Switzerland: World Health Organization.

Lake, P. F. (2007). Higher education called to account. *The Chronicle of Higher Education, 53*(43), B6.

Lake, P. F. (2011). *Foundations of higher education law & policy: Basic legal rules, concepts, and principles for student affairs.* Washington, D. C.: NASPA.

Leavitt, M. O., Spellings, M., & Gonzales, A. R. (2007). *Report to the President on Issues raised by the Virginia Tech tragedy*. Retreived from U.S. Department of Health and Human Services websight at http://www.hhs.gov/

Meloy, J. R. & O'Toole,M. E. (2011). The concept of leakage in threat assessment. *Behavioral Sciences and the Law, 29,* 513-527.

Meloy, J.R., Hoffman, J., Guldimann, A. & James, D. (2012). The role of warning behaviors in threat assessment: An exploration and suggested typology. *Behavioral Sciences and the Law, 30:* 256-279.

Morris, Desmond (1995). *Bodytalk: The meaning of human gestures.* New York: Crown.

Sokolow, B. & Lewis, S. (2009). *2nd Generation behavioral intervention best practices.* NCHERM. Retrieved from http://ncherm.org/pdfs/2009NCHERMwhitepaper.pdf

U. S. Secret Service and U. S. Department of Education (2008). *Prior knowledge of potential school-based violence: information students learn may prevent a targeted attack*. Retrieved from http://www.secretservice.govntac/bystander_study.pdf

World Health Organization (2010). *Injuries and violence: The facts*. Geneva, Switzerland: World Health Organization. Retrieved from http://www.who.int/violence_injury_prevention/key_facts/en/index.html

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Reflective Practice in American and Taiwanese Classrooms

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Many scholars have written about the importance of reflective practice in American education. I believe that it is not only important in American education but also in Taiwanese education because the focus in Taiwanese classrooms has changed from teacher-centered to student-centered. In student-centered classroom practice teachers reduce lecture time and avoid concentrating only on grades, shifting the focus to student interests and meeting student needs in their classrooms. Hence, expectations of teachers are increasing. Students desire to learn more and better; administrators want teachers to be good directors to help students; parents hope teachers can help their children reach their goals; and teachers want to become experts in their craft in order to help more students. Because of these factors "educators must continually study their practices if they are to grow. They need to concentrate on developing those practices that help them deliver their best work" (Adler, 1991). In fact, the notion of the reflective practitioner in education has been widely known since John Dewey formulated his theory in the 1910s, and thousands of books and articles point out the importance of the reflective practitioner in American education. Stanley (1998) said, "Reflective practice is an evolving concept. In the 1930s, John Dewey defined reflection as a proactive, ongoing examination of beliefs and practices, their origins, and their impacts". In this report, the researcher will present four main categories of reflective practice: (a) reflective practice in the traditions of curriculum and teaching studies, (b) reflective practice in foundational literature on American pragmatism, (c) reflective practice in interpretations of John Dewey's work, and (d) reflective practice as it can inform EFL teaching in Taiwan.

Reflective Practice in the Traditions of Curriculum and Teaching Studies

The Reflective Practice in the Traditions of Curriculum

Many educators have critiqued American education. For example, Henderson and Hawthorne (2000) stated, "Too many children are schooled, not educated, and too many school systems focus on organizational goals, economies, and efficiencies rather than

meaningful student learning" (p. 1). Apple (2001) said, "Public institutions such as schools are 'black holes' into which money is poured—and then seemingly disappears—but which do not provide anywhere near adequate results" (p. 38).

I wonder what problems exist in American and Taiwanese education. Why do some students fail to achieve in schools? Why the meaning of student learning has been ignored in classrooms? Why have schools taken better care of organizational goals and economics than of student learning? Perhaps teachers and educators as reflective practitioners can help alleviate the problems?

In fact, the problems in American traditional education are fairly similar to the problems in Taiwanese education right now. Because of exam-centered theory, Taiwanese teachers and students must concentrate on serious preparation in order for students to achieve high scores on exams. Similarly, the traditions of curriculum in American education have demonstrated the same problem. Henderson and Hawthorne (2000) pointed out the mainstream curriculum philosophy (MCP) is predetermined skill-based and content-based subject learning. The reliance of MCP is placed on standardized tests, and learning obedience to authority in MCP is important. Briefly, teachers in mainstream curriculum could not teach differently and creatively even if they wanted to do so (i.e., different approaches, materials, or evaluations) because they must focus on students' scores on the tests, complete official paperwork, and follow traditional rules in schools. Henderson and Hawthorne (2000) said some teachers in mainstream curriculum might always follow the rules: "Do not argue; obey. Do not try to understand; believe. Do not rebel; adjust. Do not stand out; belong" (p. 23).

Sadly, many educators face this situation, and it is particularly problematic for those enthusiastic teachers who dream about helping every single student. I believe many educators have seen these puzzles in American education and have tried so hard to change this situation. Dewey pointed out that reflective practice might be useful for teachers to help students achieve, and many scholars have advocated this approach. Dewey (1910) promoted the importance of reflective reaching in his book How We Think, organizing his thoughts around the concept of reflective action. He said, "Teachers reflect because they face a surprise, problem, dilemma, or puzzle that calls into question something they thought

they already knew". At the same time, he also argued that when teachers reflect on their work, they should carefully consider the beliefs that underlie their practices as well as the results of their instructional efforts. Dewey called reflection the "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (p. 6). From my perspective once educators want to become reflective practitioners, they must have really thought about how to take responsibility for educating students. The goal of reflective practice is to help students achieve, and I believe this should be the purpose of education.

Donahue (2004) supported Dewey's idea: "When you [teachers] reflect on your own teaching, ask whether the thinking you call reflection is active, persistent, and careful". He said educators should challenge their core beliefs and question what they know; they should examine the assumptions on which their beliefs rest, and educators should be willing to change those beliefs and the teaching practices if those assumptions turn out to be unwarranted. He said that when educators are open to such questions and change in their practice, then their thinking can be called reflection. This point of view reminds teachers to be open-minded and student-oriented in their teaching. They should not teach like the "teaching robots," following the teacher's guide and rules, caring little about students' reactions; but the most important thing in teaching should be full reflection upon students' learning.

In addition, Zeichner and Liston (1996) identified five traditions of reflection: (a) academic, (b) social efficiency, (c) developmentalist, (d) social reconstructionist, and (e) generic—each with a different purpose and focus. The academic tradition emphasizes teacher thinking about subject matter and is concerned with student learning. This point is the most important of all, and many scholars have mentioned it. The social efficiency tradition stresses reflection on the extent to which one's teaching aligns with research findings and ways in which those findings can be put to use in the classroom. The developmentalist tradition focuses teachers' reflection on students' thinking and understanding. The social reconstructionist tradition assumes teaching is a political act, and reflection focuses on social conditions and teaching as a political act aiming toward a more just society. Unlike these other traditions, the generic tradition, the most recent one to

emerge, argues for the benefits of teacher reflection without specific concern for the topic of teachers' reflection.

The Reflective Practice in Teaching Studies

Florez (2001) pointed out the following steps as integral to the reflective process in the adult ESL setting: (a) collect descriptive data, (b) analyze data, (c) consider how the situation or activity could have been different, and (d) create a plan that incorporates new insights.

Collect descriptive data. First of all, Florez (2001) proposed the collection of descriptive data as the first process in teaching. She said, "Reflective practitioners need detail and breadth of perspective as they gather information on what is happening in the classroom. They can achieve this through the data-collection tools they select" (p. 145). She believed collecting descriptive data is the fundamental step in reflective teaching. Teachers could observe students' learning, interactive reaction in class, and scores of the exams, to realize the students' achievement in class. Brookfield (1995) suggested using four possible "lenses" to create a balanced picture of practice: (a) practitioners' own writings about their experiences as learners and teachers (autobiographies), (b) learners' eyes, (c) colleagues' eyes and experiences, and (d) existing theoretical literature (p. 29). I believe these four perspectives could make teachers powerful in their teaching, and also achieve students' learning in the classroom.

Analyze data. "After data have been collected, the data can be analyzed in terms of the attitudes, assumptions, beliefs, goals, power relations, and consequences that they reveal" (Florez, 2001, p. 148). Teachers might ask several questions after they collected their data, for example, the following: What happened that was unexpected or surprising? What theories about teaching or personal experiences with learning were revealed in the data? How do these theories relate to the practitioner's stated beliefs and attitudes? What relationships are revealed among the participants? What are the consequences of the practitioner's actions? (Crandall, 2000; Gebhard, 1996; Stanley, 1998).

Consider how the situation or activity could have been different. Whenever looking at the data in the moment or in retrospect, practitioners need to examine alternatives to the choices they have made as well as the beliefs behind them (Stanley, 1998). Considering how other practitioners address similar situations, generating alternatives, and asking "what if"

questions push practitioners to broaden their reflection beyond the data they have collected (Gebhard, 1996).

Create a plan that incorporates new insights. Because reflection is conducted not for its own sake but to improve instructional practice, practitioners must link information and insights gained from the reflective process to changes they make in the classroom (Farrell, 1998). The changes need not be massive—small changes can have an impact on teaching and learning (Gebhard, 1996). The important thing is that practitioners incorporate their new insights in their ongoing planning and decision making, observe the impact, and continue the reflective cycle.

Obviously, Florez pointed out some good points in reflective teaching. I think teachers could easily become reflective practitioners by following these four steps; however, some researchers have argued a lack of clarity about the definition of the reflective practitioner. Donahue (2004) said, "As you read the literature on learning to teach, you will find widespread support for the notion of teacher reflection. You will also find that educators mean different things when they refer to reflection". He said the collection of definitions can seem confusing and even contradictory. Some teachers conceive reflection as any thinking by a teacher, arguing that it is impossible to teach without thinking, and, therefore, it is impossible to be an unreflective teacher. Some teachers equate reflection with research, whether positivist, university-based investigations, or teacher-action research. No matter what reflective practice means to teachers, I think if students can learn what they want, achieve their goals, be happy to be in class, and interact well in the classroom, then these teachers deserve to be called reflective practitioners. The reflective practice should focus on students' performance, and teachers should be the best helpers in students' learning.

Many scholars have emphasized the importance of reflective teaching. Henderson and Hawthorne (2000) said, "Reflective teaching is a major focus of curriculum work in both schools and colleges of education. It is an umbrella term, covering related ideas such as thoughtful instruction, teacher research, teacher narrative, and teacher empowerment" (p. 38). Donahue (2004) said, "Reflection changes the nature of relationships between teachers and students. In reflective teachers' classrooms, students are not the only ones gaining

knowledge. Instead, students and teachers together create new knowledge about what, how, and why students learn. . . .Reflection allows teachers to become theory builders".

Moll and Greeberg (1990) described reflective learning as a "fund of knowledge" in which no one member of a community knows everything, each member [teacher or student] needs what others know, and each member contributes to the development of others' new knowledge. In the reflective learning environment, teachers should create an open environment for each member to learn. Teachers are not the leaders in classrooms but the helpers and good friends of students.

Donahue (2004) said:

Although reflection is important to sustaining thoughtful teachers, it is no panacea. For reflection to nurture the intellectual side of teaching, foster a sense of democracy in the classroom, and provide a sense of hope, teachers' inquiry must be based on important questions, questions where knowing the answer would make a real difference in what, how, or why you teach.

He pointed out that teachers should be very careful in teaching and designing the questions that they would teach in the class. The best questions focus on student learning, not teaching practice. For example, "How do students learn how to pronounce the new English vocabulary?" is a better question than "How I should teach students to pass the vocabulary test?" I think the student-oriented questions could focus on students' learning, and teachers could also discover the best teaching theory for students at different levels to meet their needs. Donahue (2004) said:

As you [teachers] formulate your questions to focus on specific students and their thinking, learning, experiences, and beliefs, you will find yourself moving from a teacher-centered way of thinking about a classroom to a student-centered one. . . . Reflective teachers think critically about pedagogy, subject matter, and the needs and backgrounds of all students.

Accordingly, they choose appropriate content and adapt their teaching approaches as needed, while maintaining high standards. Successful teachers are committed students of the disciplines they teach. They remain current with professional ideas and use these to guide instructional decisions and are constantly assessing their instructional effectiveness.

Reflective Practice in the Foundational Literature on American Pragmatism

Since the 1930s, reflective practice has been influenced by various philosophical and pedagogical theories. Four main theories have affected American education. One influence is constructivism, in which learning is viewed as an active process where learners reflect on their current and past knowledge and experiences to generate new ideas. A humanistic element of reflective practice is its concern with personal growth and its goal of liberation from values that can limit growth (Kullman, 1998). Critical pedagogy, espousing the examination of underlying power bases and struggles, and American pragmatism, emphasizing active implementation, testing, and refining of ideas through experience, have also shaped the concepts of reflective practice, particularly in the United States (Brookfield, 1995). Pragmatism, however, has been the most influential philosophy in the American education.

What defines the notion of American pragmatism? Menand said:

> If we strain out the differences, personal and philosophical, they [the pragmatists] had with one another, we can say what [they] had in common was not a group of ideas, but a single idea—an idea about ideas. They all believed that ideas are not 'out there' waiting to be discovered, but are tools—like forks and knives and microchips—that people devise to cope with the world in which they find themselves. . . . They [the pragmatists] believed that ideas are produced not by individuals, but by groups of individuals—that ideas are social. They believed that ideas do not develop according to some inner logic of their own, but are entirely dependent, like germs, on their human carriers and the environment. And they believed that since ideas are provisional responses to particular and unreproducible circumstances, their survival depends not on their immutability but on their adaptability.

The notion of reflective practice is, therefore, based on the fundamental of American pragmatism because the ideas of pragmatism are to be discovered and social. I think teachers as reflective practitioners should find out how to teach well from students' reflection and communicate with them in the classrooms. From the view of American pragmatism, teachers might recognize the importance of student–teacher interaction and collaboration in the classrooms; and this notion is very different from the traditional teacher-centered theory.

Pragmatism is a philosophical movement, which developed in the United States and holds that both the meaning and the truth of any idea is a function of its practical outcome.

Fundamental to pragmatism is a strong antiabsolutism: the conviction that all principles are to be regarded as working hypotheses rather than as metaphysically binding axioms. A modern expression of empiricism, pragmatism was highly influential in America in the first quarter of the 20th century. Pragmatism has tended to criticize traditional philosophical outlooks in the light of scientific and social developments. Three philosophers in particular have always been considered icons of early American pragmatism: C. S. Peirce (1839-1914), William James (1842-1910), and John Dewey (1869-1952).

Charles Sanders Peirce (1839-1914)

Considered the founder of pragmatism, Charles Sanders Peirce developed it as a theory of meaning in the 1870s, holding that an intrinsic connection exists between meaning and action—that the meaning of an idea is to be found in its "conceivable sensible effects" and that humans generate belief through their "habits of action." In a paper entitled "How to Make Your Ideas Clear," contributed to the Popular Science Monthly in 1878, Charles Sanders Peirce first used the word pragmatism to designate "a principle put forward by him as a rule for guiding the scientist and the mathematician." Peirce considered pragmatism as a method of clarifying conceptions. His basic principle is that the meaning of ideas is best discovered by putting them to an experimental test and then observing the consequences.

Williams James (1842-1910)

Williams James gave a further direction to pragmatism, developing it as a theory of truth. True ideas, according to James, are useful "leading"; they lead through experience in ways that provide consistency, orderliness, and predictability. William James is generally considered not only the most influential of all American philosophers but the very representative of American thought.

In his famous work The Principles of Psychology **(**1890), he developed the view, in opposition to the more traditional associationism, that consciousness functions in an active, purposeful way to relate and organize thoughts, giving them a streamlike continuity. I think this might be the beginning of the reflective practice. In the history of psychology, James' theory of mind is called functionalism. James elaborated his theory of pragmatism in works

such as Pragmatism: A New Name for Some Old Ways of Thinking (1907) and The Meaning of Truth: A Sequel to Pragmatism (1909). He considered pragmatism to be both a method for analyzing philosophic problems and a theory of truth. Therefore, he developed the notion of truth as "leading" that is useful: it can change as human experience changes. I think he also believed that if teachers would change their approach from traditional teacher-centered to reflective student-centered, then students might learn more and better. He tried to explain that tradition does not always represent the truth, and people should experience more to find out the best way to live.

James believed that knowledge is an instrument existing for the sake of life, existing as practical utility. True ideas are those we can assimilate, validate, corroborate, and verify. "Truth is, therefore, useful because it is true; it is true because it is useful." James' empiricism opposes classical rationalism and traditional empiricism. He denied that whatever is rational is real. I think this is very useful to address the notion of reflective practice. On the one hand, because of the changed society teachers should not necessarily believe that the traditional approach is suitable to teach their students right now. Although it might have worked in the past and it seems rational to follow traditions to teach, the traditional approach might be inappropriate. Students need to do more than simply earn higher grades on exams, and teachers should try the various teaching approaches to meeting different students' needs. On the other hand, teachers actually should not fully trust what scores mean to students' achievement. The emphasis in traditional education has been placed on the importance of scores in students' learning; however, students should be taught that they are active interpretive agents, not obedient followers of authority (Palmer, 1998). Independent critical thinking is much more important than achieving on exams, and students and teachers should realize that different students have talents in different fields.

John Dewey (1859-1952)

John Dewey is the most distinguished representative of modern American pragmatism. Contributing two additional factors in pragmatism—the psychological and the logical—Dewey strongly emphasized the social aspects of his philosophy. Throughout his long life he tried not only to apply his experimental methods to social philosophy, but he also actively participated in disputes and struggles of political, social, and cultural relevance.

Political, social, cultural, and theoretical motives enhanced Dewey's interest in education. He recognized the important role education plays in the survival of democracy, and the importance of democratic thought and action in the improvement of education.

After World War I, pragmatism grew into a social philosophy. Pragmatists have applied their doctrine to every phase of social theory. Dewey equated theory and living, applying his philosophy to economic, political, and pedagogical questions. Reality is declared to be changing, growing, and developing in things. A real philosophy, according to Dewey, must abandon absolute origins and finalities and explore specific values in practical, moral, and social life. He believed "man continues to change his ideas until they work" (Dewey, 1938). I think this view of Dewey is similar to James' notion of truth.

Dewey maintained a leadership in American education, bringing increased human interest into school life and work, encouraging pupil initiative and responsibility.

I think Peirce, James, and Dewey all argued about the traditional identification of Truth. People tend to believe traditions because they do not want to change or they are afraid to change. These pragmatists reminded all the educators that change would be a good thing in teaching. In fact, the successful reflective practitioner should always contemplate change, how to improve, and how to enhance their teaching. I strongly believe American pragmatism deeply affected the nature of reflective practice.

Reflective Practice in Interpretations of John Dewey's Work

John Dewey maintained that reflection is an important aspect of teaching and learning from experience. He wrote in Experience and Education (1938) that reflective thinking leads educators to act in a "deliberate and intentional fashion" rather than in a "blind and impulsive" manner. Dewey emphasized the importance of reflecting on practices and integrating observations into emerging theories of teaching and learning, believing that this helps educators become both the producers and consumers of knowledge about educational practices.

Historically, Dewey, who himself drew on the ideas of many earlier educators, such as Plato, Aristotle, Confucius, Lao Tzu, Solomon and Buddha (Houston, 1988), is acknowledged as a key originator in the 20th century of the concept of reflection. Dewey's theory actually

derived from ideas of Western and Eastern philosophers. He considered reflection to be a special form of problem solving: thinking to resolve an issue that involved active chaining and a careful ordering of ideas linking each with its predecessors (Adler, 1991; Cutler, Cook & Young, 1989; Calderhead, 1989). His basic ideas indicated that reflection may be seen as an active and deliberative cognitive process, involving sequences of interconnected ideas that take account of underlying beliefs and knowledge. Reflective thinking generally addresses practical problems, allowing for doubt and perplexity before possible solutions are reached.

Dewey believed in "no such things as pure ideas or pure reason. Every living thought represents a gesture made towards the world, an attitude taken to some practical situation in which we are implicated" (Dewey, 1933). I think that is why the student-oriented approach might be better in students' learning: the student-centered theory could completely reflect what students find necessary and difficult in learing. For example, the low learning aspiration of students might show teachers' incapability, inpatience, or unwillingness in teaching.

Dewey (1910) identified the reason for reflection in puzzles and predicaments, and those problems became not only the motivation, but also the content for reflection. The problem may be located in a teacher's current practice, in past experience, or in future concerns. Undoubtedly, reflective practitioners face and struggle with many problems in their teaching, and they must solve those problems from different perspectives. I think this view of Dewey encourages teachers to do research and find the best solutions by themselves, and I believe training to do so is very useful for reflective practitioners.

Based on Dewey's ideas, Schon (1983) asserted that all educators engage in a developmental process as "reflective practitioners." In his book, Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions, Schon explained that reflective practitioners use the knowledge they gain through continual inquiry and analysis to refine instruction. He clearly wrote about reflection that is intimately bound up with action. He stated that professionals should learn to frame and reframe the often complex and ambiguous problems they are facing, test out various interpretations, and then modify their actions as a result.

Dewey's conception of reflective practice was highly significant in American education. Based on this theory, teachers know how to enhance their teaching, communicate with pupils, and help students achieve their goals. Dewey encouraged teachers to observe things from different perspectives, not merely follow traditions. He believed teachers' teaching deeply affects student learning, and teachers should realize they may have to solve many puzzles before they become successful reflective practitioners. I cannot agree with Dewey's theory more. I believe being a teacher is difficult, and being a reflective practitioner is even more difficult; however, some strategies could help teachers become involved in reflective practice. Dewey's reflective practice gave teachers a hint of how to play their roles in classrooms, and this would be a path leading teachers to becoming reflective practitioners successfully.

How to Inform Reflective Practice in Taiwan EFL Teaching

In Taiwan, many scholars have discussed Dewey's theories—especially reflective practice. Every Taiwanese teacher knows that "Learning by doing" is Dewey's main contribution to education. Dewey described the importance of experiences in students' learning and teachers' teaching, and this view has deeply affected the curriculum reforms in education in Taiwan. In transforming the English curriculum, educators in Taiwan have added some activities and discussions to every lesson. Because of this I think they want students to experience more than just memorizing everything. Obviously, reflective practice has played an important role in English education in recent years. Educators in Taiwan realized that the exam-centered approach in teaching English could not effectively improve Taiwanese students' English ability, especially in listening and speaking; therefore, they have applied the student-centered approach, interactive activities, and subject matter for daily use in current EFL teaching in Taiwan (Wang, 1999).

In my opinion, the notion of reflective practice is practicable and impracticable in some parts in Taiwan EFL education. Because of cultural differences between American and Taiwanese education, I do not think Taiwanese EFL education should copy America's entire teaching and thinking mode. I will definitely suggest that Taiwanese teachers acquire some skills of reflective practice. I think Florez' theory (2001) might be useful. She mentioned four steps to the reflective process: (a) collect descriptive data, (b) analyze data, (c) consider how

the situation or activity could have been different, and (d) create a plan that incorporates new insights. With this step-by-step approach, I think both experienced and inexperienced Taiwanese teachers could easily implement reflective teaching.

The academic issue in Taiwan EFL education is that students have low proficiency in spoken English. I think the reflective practice would absolutely improve this situation. Through reflective teaching in English class students have more chances to practice oral English with classmates and teachers. At the same time, students can also learn listening, thinking, grammar, and sentence-construction skills in a reflective English-learning environment; therefore, I suggest that English teachers use reflective practice theory to teach English in listening and communication classes. By teaching speaking and listening reflectively, the relationship between students and teachers might also be strengthened.

I do not think, however, that the theory of reflective teaching can apply to all English classes in Taiwan. From my point of view, the classroom culture is still traditional in some schools, especially ones located in the countryside. The traditions of classroom culture in Taiwan demand that students respect teachers, that teachers know everything correctly, and that teachers cannot be criticized. Although the traditions have been changed to some degree and are more similar to western educational principles right now, most Taiwanese teachers still think they should hold the power in the classrooms, and they believe the teacher-centered approach is more useful and necessary in English class (Wang, 1999). In fact, Taiwanese students always remain quiet because they are trained to follow every rule from their earliest days in school. Taiwanese students barely discuss issues with teachers, even if they do not agree with what the teacher said. Taiwanese students also believe whatever appears in a textbook is the absolute truth. Because of different learning and cognitive styles of Taiwanese students, I think reflective practice may not be completely practicable in grammar and reading classes. We all know the exam-centered approach in teaching is still necessary in Taiwan, and teachers have to teach students effectively in a limited time, especially in grammar and reading classes. Because of the time issue the responsibility of teachers is to teach students some strategies to choose the correct answers in the shortest time. Sometimes teachers simply ask students to memorize everything without question. Although there is no reflection in the exam-centered teaching, this approach works pretty well to help students to succeed in the NJEE (National Joint Entrance

Examination). The two important parts of NJEE are grammar and reading comprehension tests, and students have to answer 60 to 70 questions in 70 minutes. Consequently, the exam-centered approach to teaching students in grammar and reading classes will remain a necessity. Students must memorize grammar rules and vocabulary; then they can achieve high marks on the rigorous examinations.

Many scholars have suggested that teachers become reflective practitioners in order to enhance students' learning; however, I would like to advocate that Taiwanese students become reflective practitioners as well. Henderson and Hawthorne (2000) pointed out the three Ss of learning: subject, self, and social in progressive education (p. 4). In self-learning, students will become cognitively, emotionally, physically, aesthetically, and spiritually attuned to themselves (Henderson & Hawthorne). I strongly believe self-learning is very important for Taiwanese students in studying English. Because of traditional classroom culture, Taiwanese students are passive in learning English; they do not express their opinions, they do not question, and they do not argue in class. Consequently, even if teachers want to create a reflective English-learning environment, sometimes students will not engage. I think Taiwanese students should be active and passionate in learning English, and the reflective practice is perhaps the best method for students to use in their English learning. By learning as reflective practitioners, students would think about what they have learned, what is useful for them, how to apply English in dialy life, and how they can learn effectively in both preparing the exam and practicing the conversation skills. It might be difficult to change the tradition in the beginning, but I believe that once we educate students about the notion of reflective practice, they may change their learning attitudes and cognitive styles in learning English. After that, the goal of improving Taiwanese students' English ability will be easier to reach.

References

Adler, S. (1991). The reflective practitioner and the curriculum of teacher education. Journal of Education for Teaching 17(2), 139–150.

Apple, M. (2001). Educating the "right" way. New York: Routledge Falmer.

Brookfield, S. (1995). Becoming a critically reflective teacher. San Francisco: Jossey-Bass.

Crandall, J. (2000). Language teacher education. Annual Review of Applied Linguistics, 20, 34–55.

Cutler, B., Cook, P. & Young, J. (1989, February). The empowerment of preservice teachers through reflective teaching. Paper presented at the Annual Meeting of the Association of Teacher Educators, St. Louis, MO.

Calderhead, J. (1989). Reflective teaching and teacher education. Teaching and Teacher Education, 5(1), 43–51.

Dewey, J. (1910). How we think. New York: Heath.

Dewey, J. (1933). How we think: A restatement of the relation of reflective thinking to the educative process. Boston: Heath.

Dewey, J. (1938). Experience and education.. NY: The Macmillan Company.

Donahue, D.M. (2004). Preparing and supporting the reflective practitioner. Teaching as Principled Practice, 3, 35–56.

Farrell, T. (1998). Reflective teaching: The principles and practices. Forum, 36(4), 10–17.

Florez, M.C. (2001). Reflective Teaching Practice in Adult ESL Setting. National center for ESL Literacy Education. Washington, DC: ERIC/NCLE Digests.

Gebhard, J.G. (1996). Teaching English as a foreign or second language. Ann Arbor: University of Michigan Press.

Henderson, G. H., & Hawthorne, R. H. (2000). Transformative Curriculum Leadership. NJ: Prentice-Hall, Inc.

Houston, W. (1988). Reflecting on reflection in teacher education. In H. Waxman et al. (Eds.), Images of Reflection in Teacher Education (pp. 7–9). City: VA: ATE.

Kullman, J.G. (1998). Mentoring and the development of reflective practice: Concepts and context. System, 26 (4). 471—484.

Menand, L. (2002). The Metaphysical Club—A story of Ideas in America. NY: Farrar, Straus and Giroux

Moll, L., & Greenberg, J. (1990). Creating zones of possibilities: Combining social contexts for instruction. In L. Moll (Ed.), Vygotsky and education (pp. 319–348). Cambridge, UK: Cambridge University Press.

Palmer, P. J. (1998). The courage to teach: Exploring the inner landscape of a teachers' life. San Francisco: Jossey-Bass.

Stanley, C. (1998). A framework for teacher reflectivity. TESOL Quarterly, 32(3), 584–591.

Schon, D. (1983). The reflective practitioner: How professionals think in action. New York: Basic.

Wang, P. Y. (1999). Effects of a modified English listening comprehension curriculum on students' achievement in English listening comprehension Tamshi Oxford University College in Taiwan. MI: UMI company.

Zeichner, K., & Liston, D. (1996). Reflective teaching: An introduction. Mahwah, NJ: Erlbaum.

<TOC<

Science Education

Truthfulness in science teachers' bodily and verbal actions

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Abstract

A dramaturgical approach to teacher's personal bodily and verbal actions is applied through the vocabulary of truthfulness. Bodily and verbal actions have been investigated among Danish primary and lower secondary school science teachers based on their narratives and observations of their classroom actions. The analysis shows how science teachers engage truthfully in pupil relations through an effort of applying classroom management, among other things. In all, this indicates that if science education research wants to understand science teachers' personal relations to teaching science it could be beneficial to address the truthfulness of science teachers' narratives and actions.

Introduction

Teachers work mostly consists of teaching and communicating with students and colleagues. In this communication teachers use voice, gestures and other bodily communications (Hwang & Roth, 2011). This means that teachers' voices and other communicative actions are fundamental in understanding teacher practice in their classrooms. Wertsch (1991) uses Habermas (1984) and Popper (Keuth, 2000) to develop sociological approaches to actions and relations between actor and environment. Habermas helps Wertsch to develop two approaches to understanding action: a teleological and a dramaturgical. The teleological approach is concerned with bringing about a desired state by choosing means that can be successful, meaning that the relation between actor and world is judged in terms of truth, efficacy and intention. The dramaturgical approach is concerned with a presentation of self that is in accordance with the personal feelings and desires, meaning that the relation between actor and world is judged in terms of sincerity, authenticity and truthfulness. Habermas (1984) further develops the communicative intents in the speech actions of a speaker:

> We can identify these intuitively if we keep in mind that in communicative action a speaker selects comprehensible linguistic expression only in order to come to an understanding with a hearer about something and thereby to make himself understandable. It belongs to the communicative intent of the speaker (a) that he perform a speech act that is right in respect to the given normative context, so that between him and the hearer an inter-subjective relation will come about which is recognized as legitimate; (b) that he make a true statement (or correct existential presuppositions), so that the hearer will accept and share the knowledge of the speaker; and (c) that he express truthfully his beliefs, intentions, feelings, desires and the like, so that the hearer will give credence to what is said. (1984, vol. 1 s. 307-308).

Wertsch accentuates that he adds Leont'ev's (1978) notion on activity to avoid assuming "that the appropriate focus of analysis is the solitary actor or that there is a neat separation between ends and means" (1991, p. 12). Thereby Wertsch subscribes to a sociocultural approach in his study of mind and voice. He is however primarily interested in goal-directed actions and a teleological analysis of them. This line of research has been extensively pursued since Wertsch wrote his book within among other things teacher credibility (McCroskey, 1999; Zhang & Sapp, 2013) and efficacy (Brígido, Borrachero, Bermejo, & Mellado, 2013; Finn et al., 2009).

In the present study I will take up the dramaturgical approach presented by Wertsch to understand teachers' actions and voices. This line of research is not as extensive in teacher research as the teleological approach, though studies are coming out on the significance of embodiment (Hwang & Roth, 2011). Wertsch (1991) use Habermas to point out that the dramaturgical approach can be engaged by addressing truthfulness and sincerity. Truthfulness is a virtue, which acknowledge, that it is possible to understand statements of teachers as being based on their truly believed reasonable grounds even though these may later turn out to be false (Cooper, 2008, p. 82). Cooper builds his understanding of truthfulness on Williams (2002):

> *… truthfulness devolves into two dispositions, 'Accuracy' and 'Sincerity'. These are the dispositions, roughly, to take due care that one's beliefs are warranted, and 'to come out with what one believes' (Williams 2002, p. 45). The former requires honesty, objectivity and effort when forming one's beliefs; the latter, a determination to communicate what one believes and, more generally, to be trustworthy communicators who do not mislead. (Cooper, 2008, p. 81)*

Sincerity has to do with the trustworthiness in the speech acts, meaning a disposition to make sure that one's assertions expresses what one actually believes. Accuracy is a more complex virtue, its basis is the effort we put into acquiring information about a certain subject matter. This informed accuracy will support a more authentic, objective and honest addressing of audiences (Williams, 2002). Cooper elaborates on William's notion of truthfulness and adds fidelity that Cooper defines as "truthfulness in discussing some topic may require 'Fidelity' to the topic - an approach to it that does not belie what one takes to be the salient, important aspects of the topic". Furthermore he adds transparency meaning that truthful communication "has no 'agenda' hidden from its audience" (Cooper, 2008, p.81). In order to make communication truthful it must be accurate and transparent and furthermore demonstrate fidelity and sincerity in dealing with its topic. Truthfulness is a characteristic for communicative actions in the subjective world (Habermas, 1984). This indicates that truthfulness is a way to address science teachers' personal and subjective experience of the complex of aims and expectations in contemporary science teaching. Wertsch (1991) accentuates the importance of an awareness of mind as mental actions that though they are carried out by individuals are inherently social in certain respects especially in their use of language and other means of communication. I will apply such a sociocultural understanding of verbal and bodily actions in my approach as well. Hwang and Roth (2011) understand mind by addressing the living body as a necessary condition for knowing and representation – "body and mind are two manifestation of the same thing: the flesh" (p. 4). In their quest to research the significance of the body in learning science and mathematics, they focus on how the body is integral to sense making in their analysis of bodily communication between teachers and students.

Taking the lead from the above cited research I will in the present paper address science teachers' bodily and verbal actions in science teaching from a dramaturgical approach. I will apply Cooper's vocabulary of truthfulness to analyse teachers' verbal and bodily actions. Similarly Wertsch (1991) put human action as his central analytical element.

> When action is given analytical priority, human beings are viewed as coming into contact with, and creating, their surroundings as well as themselves through the actions in which they engage. Thus action, rather than human beings or the

> environment considered in isolation, provides the entry point into the analysis. (Wertsch, 1991, p. 8).

In my approach I will add that it is important to keep in mind that actions here are to be understood as bodily as well as mental actions. Hwang and Roth (2011) use Vygotsky to stress the point that mental actions like language are copied from the social world. In reverse, the way that we can learn about other persons' mental actions is through their narratives. Narratives (i.e. verbal communication) are the best way to bring forward significant past and present experiences (Clandinin & Connelly, 1994, 2000). In order to investigate the personal aspects of teachers work you need to apply a method that is sensitive to the personal idiosyncrasies of the individual teachers. Goodson (2008, 2011) is mostly concerned with the individual teacher's relation to her own personal life and professional work. In one of his early writings he proclaimed his quest to address the teaching profession from the personal perspective: "*In understanding something so intensely personal as teaching it is critical we know about the person the teacher is.* Our paucity of knowledge in this area is a manifest indictment of the range of our sociological imagination." (Goodson, 1980). Interviews, observations and contextual data regarding the school and local area where teachers live and work all inform research about the teacher's past and present personal life and work experiences (Goodson, 1992). Furthermore it is important to observe the teachers' actual teaching, to saturate your understanding of the teachers' narratives (Traianou, 2007). Such a methodological approach has been tried out by Goodson and Norrie (2011) and Brickhouse and Bodner (1992).

The applied method

The present study is conducted with Danish primary and lower secondary school science teachers. The teachers were participants in a study on the relation between life and work of science teachers that I made as my PhD study. The teachers and I made introductory semi-structured life history interviews followed by observations of each teacher for 2-4 workdays at their schools or during field trips to saturate and enable a thick description (Denzin, 2001). The observations were documented through handwritten logbook notes. Along with interaction with teachers some of their own produced teaching material such as pupil worksheets, curricula, etc. was collected. A second interview was based on themes and questions that appeared from the preliminary analysis of the first interview, the observations and the collected material. All data was collected from February 2009 to November 2011. The coding is performed using the Nvivo8 qualitative analysis software. The coding framework is constructed in accordance with the recommendations by Saldaña (2009) and Richards (2008) using a mixture of free nodes and tree nodes in Nvivo8. The structure of tree nodes was developed from a pilot study (Daugbjerg, 2010). The free nodes appeared during the analysis when a theme presented itself in the interviews or observations.

In my research I have the teacher voices – verbal actions - in their classroom dialogue and in the life history narratives. I have their bodily actions in their bodily communications in the classrooms, in the school corridors, in the staff room and during field trips with their pupils. I have selected cases that illustrate how the relation between verbal and bodily communication can be read as signs of truthfulness. I will ascribe it as a sign of accuracy if the teacher expresses and shows effort, authenticity or honesty in their verbal and bodily communications. I will ascribe it as a sign of sincerity if the teacher expresses and shows trustworthiness in their verbal and bodily communication. I will ascribe it as a sign of fidelity if the teacher expresses a full account in their verbal and bodily communication. I will ascribe

it as a sign of transparency if the teacher shows no signs of hidden agendas. I have to stress here that I'm not judging the teachers general personal character. I am specifically analysing the actions in the presented cases and how they can be read for signs of truthfulness. For this reason each case is presented as a teacher and his or her handling of a school element to stress the point from Wertsch above that actions are the entry point of the analysis.

Diana dealing with classroom management

Diana is very reflective in her approach to dealing with a problem of classroom management in her Physics/Chemistry teaching:

> During the last years I have read a lot on classroom management. I think I have some specific tools for what you do, and what works, and what does not work in relation to quieting things down; or in relation to conflicts, how can I de-escalate rather than escalate it. Because I felt that I kept running into, and couldn't understand, there was no experience that could solve that problem.
> …
> The most important thing for me is that the pupils function socially in relation to each other and function in relation to the conditions we have here. They can relate well with one another; but when I give some conditions or other do it, then they suddenly do not function (...) and that I think it is the biggest task to make them function here and make them function with the other pupils. (Diana is 39 years old and has been a Physics/Chemistry teacher for 13 years).

Diana's follow up on acknowledging this problem is that she puts effort into gathering knowledge through literature on how a classroom dialogue can be managed. Her next action is to implement what she has read in her own classroom dialogue. I have seen how Diana instructs the pupils, she uses the blackboard to present the agenda for the lesson and for structuring the classroom dialogue.She uses the interactive whiteboard for presenting exercises and worksheets that the pupils can download from the school intranet to their own laptops or borrowed school-laptops. She instructs the pupils that if they have problems they first read the worksheets once again if that doesn't clarify their problem then they ask their classmates. Only if their classmates can't help them then they ask Diana. Telling the pupils to use their classmates forces the pupils explicate their problem and to relate to their classmates as potential sources of learning. This also diminishes her own number of pupil interactions giving her more time to talk to pupils with significant problems learning the subject matter at hand.

I see her actions as signs of accuracy as she honestly puts effort into acquiring knowledge on how to handle classroom management but she is also authentic as she addresses the problem in a way that communicates well with the pupils. She signals a very sincere and trustworthy follow up on her recognition of a problem instead of belying it.

Jane teaching outdoor

Jane has taken a primary science teaching module from the teacher education. As her exam project she investigated a pond and a forest near her school and made plans how to restore them and improve the education value of them. She followed up on these plans and pushed the municipality to restore the lake and the forest. The lake has been restored. The bottom mud has been dug up. The forest is being thinned, so that the remaining trees have a better chance for growing into healthy natural looking trees.

> It is such a beautiful little place.. It is so full of opportunities. I even stayed overnight up there with a group of pupils once. We had wonderful evening, a clear sky and lots

> of stars. Children nowadays don't see stars; they don't sleep in the wild. It is a shame. (Jane is 56 years old, and has been a primary science teacher for 32 years).

The in-service training has reaffirmed that her approach to teaching about science and nature is constructive and beneficial for the children. Jane's actions in the classroom - and other educational settings - reflects a continued relation of her 32 years of experience of teaching, and her devotion to communicating nature and natural phenomena to children, and her recent in-service education. She is and has constantly been involved in local nature conservation projects; Jane is - in spite of her seniority - still developing her own teaching. She is still engaged in social activities with the pupils such as spending the night under open air.

I see Jane's commitment to outdoor teaching as signs of accuracy as she puts a lot of effort into activating her new competencies from her primary science teaching education into her own primary science teaching. Jane's long-lasting and continued emotional relation to natural settings such as forest and ponds was founded when she was young:

> We went swimming in the creek near my uncle's farm when I was girl. I remember one evening we were going home and the sun was setting, this red evening sun and there came a bumblebee very quiet (.) and the smell of bugs, these leaf bugs, who were hanging up in the trees, this sharp smell, no really (...) such an experience stands very strong for me (..).

The way that Jane gives this type of experienceed voice in her life story narratives adds a lot of authenticity to her commitment to teaching enthusiasm for nature to the children using a series of bodily communicative actions and experiences. I followed Jane on a field trip, where the pupils collected insect galls from oak trees. She enthusiastically praised the pupils when one of them found a new type of galls.

In all, I see signs of accuracy in Jane's effort in restoring the pond and signs of sincerity in her trustworthy use of the pond in her primary science teaching. Furthermore I see signs of fidelity and honesty in the fact that Jane, based on her own emotional childhood experience, applies an experience-based approach in her teaching of nature and natural phenomenon to children.

Simon supporting his colleagues

Simon has taken a one year diploma education as science education guide. Today he functions as such and he heads the science teacher team at his school. He furthermore has been attached to a nature school where he functions as a guide. Simon has taken his new competencies and used them for the development of a local primary science curriculum. Simon's interest is to empower his colleagues in their work and teaching of primary science.

> ... last year we said in our science teacher team that Natur/teknik [primary science] was our focus and what we did actually, that there was to be something related to the curricular aims and that was really it and then people should help collect materials. I had taught something about it - that is me and a colleague - it was on how we used some material in our teaching. And this year we really have thought that it would be Physics/chemistry that needs a boost. (Simon is 39 years old, and has been a science teacher 9 years).

Simon uses his newly acquired competencies to guide his colleagues in their joint work with establishing a resource bank and database on teaching materials for primary science. Simon

has presented the material database to me and shown the teaching materials in it. Simon was able to get his colleagues involved, as his talk of "we" and "team" illustrates but also as the joint ownership to the database of materials that supplement the curriculum illustrates.

I see signs of sincerity in the way that Simon wants the colleagues to take ownership to the joint development of the local primary science material database. The way that Simon open communicates the agenda of the database and the science team work in general signals transparency. Simon bases his colleague including approach on his science teaching guide education, where he was educated to work systematically with including his colleagues to secure their ownership of the development of primary science teaching. A choice that signals the he objectively finds this a fruitful way to include his colleagues.

Truthfulness in science teachers bodily and verbal actions

I set out to investigate the relation between science teachers' bodily and verbal actions using a dramaturgical approach and chose to use the vocabulary of truthfulness to analyse the verbal and bodily actions of the participating teachers. The above cases present how teachers' bodily and verbal actions can be ascribed with truthful dispositions of accuracy, sincerity, transparency and fidelity in their relations to their work and pupils as suggested by Cooper (2008). The presented examples relate to diverse school activities such as teacher pupil relations, outdoor teaching, and colleague support. In the presented cases it is especially sincerity, effort, authenticity, accuracy and trustworthiness that stand out as visible signs of truthfulness.

The vocabulary of truthfulness enriches the description of science teachers' more personal aspects of verbal and bodily actions in their teaching science and handling the complex demands of contemporary teacher work – e.g. classroom management, outdoor teaching, and colleague guidance. This indicates that if science teacher research wants to understand the person in the professional science teacher it could be beneficial to address the truthfulness of science teachers' voices, narratives and actions. Within science learning research there seems to be a movement to broaden the understanding of conditions for learning science.

> A recognition now emerges that being human means being in the flesh, acting in the world with feelings, emotion and corporeal forms of knowing. The classical theory of reason, which explains learning as the product of the conscious (rational) mind configuring itself, does not fully explain how real people learn by means of sense experiences, affect, and uncertainties. (Hwang & Roth, 2011).

Research within teacher emotions is an emerging field (Day & Lee, 2011), that also broaden the understanding of the conditions for teaching. The vocabulary of truthfulness can contribute to this movement by offering a language that brings personal aspects of teaching forward in the analysis of professional bodily and verbal communication.

References

Brickhouse, N., & Bodner, G. M. (1992). The beginning science teacher: Classroom narratives of convictions and constraints. *Journal of Research in Science Teaching, 29*(5), 471-485.

Brígido, M., Borrachero, A. B., Bermejo, M. L., & Mellado, V. (2013). Prospective primary teachers' self-efficacy and emotions in science teaching. *European Journal of Teacher Education, 36*(2), 200-217. doi:10.1080/02619768.2012.686993

Clandinin, D. J., & Connelly, F. M. (1994). Personal experience methods. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (first ed., pp. 413-427). California: Sage Publications.
Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research*. San Francisco: Jossey-Bass Publishers.
Cooper, D. E. (2008). Teaching and truthfulness. *Studies in Philosophy and Education, 27*(2), 9.
Daugbjerg, P. S. (2010). Understanding teacher practice using their own narratives. *Socio-Cultural and Human Values in Science and Technology Education,* Bled, Slovenia. 332-342.
Day, C., & Lee, J. C. (2011). *New understandings of teacher's work: Emotions and educational change*. Dordrecht: Springer.
Denzin, N. K. (2001). *Interpretive interactionism* (2. ed. ed.). Thousand Oaks, Calif.: Sage Publications.
Finn, A. N., Schrodt, P., Witt, P. L., Elledge, N., Jernberg, K. A., & Larson, L. M. (2009). A meta-analytical review of teacher credibility and its associations with teacher behaviors and student outcomes. *Communication Education, 58*(4), 516-537. doi:10.1080/03634520903131154
Goodson, I. (1980). Life histories and the study of schooling. *Interchange on Educational Policy, 11*(4), 62-76.
Goodson, I. F. (1992). *Studying teachers' lives*. London: Routledge.
Goodson, I. F. (2008). *Investigating the teacher's life and work*. Rotterdam: Sense Publisher.
Goodson, I. F. (2011). *Life politics*. Rotterdam: Sense Publishers.
Habermas, J. (1984). *The theory of communicative action*. London: Polity Press.
Hwang, S., & Roth, W. (2011). *Scientific and mathematical bodies*. Rotterdam: Sense Publishers.
Keuth, H. (2000). *Die Philosophie Karl Poppers*. Tübingen: Mohr Siebeck.
Leont'ev, A. (1978). *Activity, consciousness, and personality*. London: Prentice-Hall.
McCroskey, J. C. T., & Jason J. (1999). Goodwill: A reexamination of the construct and its measurement. *Communication Monographs, 66*(1), 90.
Norrie, C., & Goodson, I. F. (2011). We've come full circle. In I. F. Goodson, & S. Lindblad (Eds.), *Professional knowledge and educational restructuring in Europe* (First ed., pp. 11-24). Rotterdam: Sense Publisher.
Richards, L. (2008). *Teach-yourself NVivo 8: The introductory tutorial*. Melbourne: Lyn Richards.
Saldaña, J. (2009). *The coding manual for qualitative researchers*. Los Angeles: Sage.
Traianou, A. (2007). *Understanding teacher expertise in primary science. a sociocultural approach*. Rotterdam: Sense Publishers.
Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. London: Harvester Wheatsheaf.
Zhang, Q., & Sapp, D. A. (2013). Psychological reactance and resistance intention in the classroom: Effects of perceived request politeness and legitimacy, relationship distance, and teacher credibility. *Communication Education, 62*(1), 1-25. doi:10.1080/03634523.2012.727008

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Why go to a Museum?

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Abstract

Visiting a museum with primary school students can be a strong learning experience for the students. This study investigates the declarative knowledge attained by a visit to the science museum Boerhaave in Leiden, The Netherlands. Comparing the effect of a history lesson in school to that of visiting the museum showed that the latter has a stronger effect on the declarative knowledge. Although the sample sizes are small the effect is significant. The results are discussed in relation to function and use of museum visits during the primary school period.

Introduction

Every year hundreds of thousands of Dutch primary school students visit hundreds of different kinds of museums ranging from art to science museums. Although this sounds like a large number, in general a class of school children visits a museum only once per year (Geukema *et al*. 2011). A visit to a museum is not just 'fun' but can be an elaborate learning experience having long-term effects (Henrikson & Jorde, 2001, Morentin & Guisasola, 2011). Comparing a pre-test on the topic 'forces' with a post-test, Morintin and Guesasola (2011) found an increase in correct answers from 7.9% to 30.5% after a visit to a Science Centre. This science centre, like many, focuses on explaining science by intensive interaction of the visitor with materials and experimental set ups.

A visit to a museum is a school activity that may be classified as Real Life Learning, learning about real life things in the actual environment (Slikke *et al*., 2010). Often such activities are regarded as fun and not as a learning experience for the children (Morintin and Guesasola 2010) or teachers focus too much on the organisation part of the activity (McLoughlin, 2004). Museums for their part provide all kinds of learning materials for children and/or groups of children in order to make the visit a meaningful experience for the students. Visiting school children are not often allowed to explore the museum by themselves. An expert usually guides the group of students through the collection. The guide tells stories at a selection of the collection to explain the importance and meaning of the object to the listeners. Sometimes there is some interaction. The quality of such a guided tour depends strongly on the knowledge and communication skills of the guide. An alternative way to an expert guide is to give the children a paper exploration guide. In groups they can discover and explore the museum on the basis of questions in the paper guide.

Travelling to and from the museum uses valuable teaching time. In the Netherlands, museums tend to be situated in cities. Therefore classes from outside the city travel much

longer. So what could be arguments to go to a museum instead of using the museum and travel time for regular education? Hooper-Greenhill (2001) argues from a constructionist point of view that museum objects obtain meaning by the prior knowledge of the beholder combined with his attitudes and beliefes toward the objects. The reverse can be argued too: museum objects provide meaning to an otherwise meaningless knowledge base that often quickly is forgotten.

The Museum Boerhaave in Leiden (the Netherlands) is the Dutch National Museum for the History of Science and Medicine of the last four and a half centuries. It exhibits unique scientific and medical equipment used in ground breaking research. The museum provides expert guided tours for school classes but also paper exploration guide booklets for groups of school children.

Method and Materials

An 8th grade class with children between 11 and 13 years of age was divided into three experimental groups of 9-10 studentsto test the knowledge of the subjects of medical science and history; the history of botanical science and; scientific history of the seventeenth,eighteenth, and nineteenth centuries. Before the intervention and afterwards, a 22 multiple-choice question test on the subjects was produced.

Group A (10 students) was presented with a standard history lesson about the above mentioned subjects. During the lesson only pictures were presented to the students about objects in Museum Boerhaave. Group B (9 students) was offered a guided tour through three exhibition rooms of the Museum Boerhaave on the three subjects. Group C (9 students) explored the same three rooms like group B with a paper exploration guided booklet. All groups were tested on their knowledge of the subjects with the post-test a week after the history lesson or the museum visit. The total number of correct answers was used as a measure for the level of declarable knowledge about the subjects.

Results

Before the intervention the 28 participating students scored an average of 7.4 points (sd=3.34, n=28) for the pre-test with a minimum of 2 points and a maximum of 14. After the intervention the students scored on average better on the post-test averaging 16.6 points (table 1) with a lowest score of 9 points and a highest score of 22 points. Table 1 shows the absolute scores of the three groups in the post-test. Figure 1 shows the score of the post-test compared to the pre-test combined with the standard deviation bars. It is clear that all groups score more points on the post-test but groups B and C both score significantly higher than group A ($F_{2,25}$=34.3, P<0,05).

Table 1: The scores of the post-test of the three groups: group A (history lesson in the school); group B (guided tour in the Museum Boerhaave); and group C (exploration tour). Maximum number of correct answers = 22.

	N	Average	Standard Deviation	Minimum	Maximum
Group A	10	12.5	2.12	9	16
Group B	9	17.3	2.29	15	21
Group C	9	20.1	1.62	17	22
Total	28	16.6	2.01	9	22

Discussion

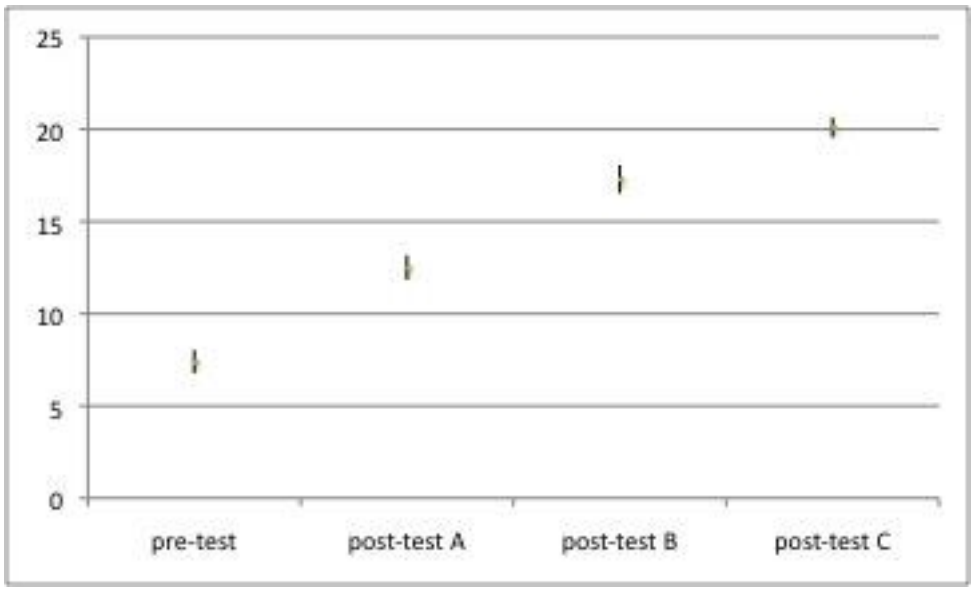
This study shows that a visit to a museum can have a significant contribution to the declarative knowledge of primary school students. The effect is so strong that it can be shown using a limited number of students. The results concur with the findings of Morintin and Guesasola (2011) who also found a significant effect on the declarative knowledge after the visit to a science centre. They, however, used the active learning system of experiential learning (Kolb, 1984) while we used a more static and less 'hands on' learning style.

A museum visit requires more school time compared to a standard lesson about a similar subject. In total, the visit to Boerhaave museum took at least a full morning and comprises: gathering at the school, transport by bicycle to the museum, cloakroom and waiting, guided tour or self-exploration tour, cloakroom and waiting again, transport by bicycle to the school; and time to settle again in the classroom. Compared to a history lesson of 60 minutes, the museum visit took four times longer to realize. One can argue that four hours of history lessons would have a stronger effect on declarative knowledge than a four-hour visit to a museum, which only includes one hour of actual museum work. Any teacher would however disagree with this argument but would have hard time explaining why the argument is not true. It does make a good research question for further research.

Falk and Dierking (2000) formulated a model for learning in a museum setting. The Contextual Model of Learning describes eight factors that may influence the learning experience in a museum: 1. Motivation and expectations. 2. Prior knowledge, interest, and beliefs. 3. Choice and control. 4. Within-group socio-cultural mediation. 5. Mediation facilitated by others. 6. Advance organizers and orientation. 7. Exhibit design. 8. Reinforcing events and experiences outside the museum.

The success of the museum visit in the current study can be contributed to several of these factors. The 'special' environment in which the learning took place may have stimulated active learning. Furthermore, especially in the self-exploratory group, students had much choice and control over their learning experience. In the guided tour group there was little control and choice but the 'mediation facilitated by others' possibly had a strong effect. The other factors probably did not play an important role in the learning experience.

Figure 1: The number of correct answers of the pre-test (n=28) and post-test of group A (history lesson in the school. n=10); group B (guided tour in the Museum Boerhaave. n=9); and group C (exploration tour. n=9). Maximum number of correct answers = 22. Bars indicate standard errors of mean.



Hooper-Greenhill (1999) argues that the experience a person has with the exhibited article shapes the persons understanding of the article. The museum creates the opportunity to interact with the exhibited articles in a way pictures cannot facilitate. According to Hooper-Greenhill a dialogue can take place between the observer and the article where any question posed by the observer can be answered by a closer inspection of the object. If such a dialogue indeed did take place it might have contributed to the learning experience of the students.

After organizing the trip to the museum, most teachers look forward to a nice museum visit with their students. Most teachers tend to think of museum visits as leisure time and seldom relate such a school trip to the school curriculum (Guisasola and Morentin, 2010). During the field trip teachers tend to be passive and not engaged with the learning of the students (Offsted, 2004). Anderson *et al*. (2003) argue that an active involvement of the teacher is essential to the student learning. Not just during the visit but also before and after the visit. Adding extra supplementary lessons before and after the planned visit may enhance the learning effect of the museum visit (Henrikson and Jorde, 2001; McLoughlin, 2004). To embed the visit in the curriculum might work even better in order to gain the highest learning experience for the students (Martin, 2001; Anderson, *et al.,* 2003).

How to visit a museum

During the ETEN annual conference 2013 Hasselt (Belgium) the tasks of the teacher before, during and after a museum visit was discussed. Together with the literature and the findings of this study, a picture of a 'perfect' museum visit can be painted. A good museum visit starts with a learning goal for the students (Martin, 2001). From there, the visit can be planned in relation to the curriculum.

Before the visit

Educational decisions. The teacher decides what subject must be taught and in what context. Depending on the function of the museum visit in the planned lessons, the visit is positioned in the time line of the lessons. More to the front if it is an introduction to the lessons, more to the back if the subject is closed with the visit, more to the middle if the visit is the key component of the learning experience. The educational goals of the visit should be clear to the teacher but also for the students. Any visit to a museum should be introduced by either a simple organisational introduction or, preferably, an introduction lesson where the learning goals of the visit are conveyed and a start of the learning experience is made.

Students. Students have prior knowledge on the subject of the museum and may even have prior experiences in the planned museum or in similar museums. This knowledge and experience should be made clear and expectations should be set. When the learning goals of the museum visit are clear to the student, they will experience the visit in a different way especially if they have an inquisitive an exploratory research mind set.

Logistics. The teacher should call the museum and find out what the exact content of the exhibition is and if any supplementary lessons are available. If a guide supervises the visit, the teacher should confer with the guide to discuss his own role during the visit. Transport and supervision should be arranged.

During the visit

Interaction. The teacher and other supervisors stay involved with the learning process of the students during the museum visit. Instead of having a cup of coffee, supervisors help students answering questions and especially asking questions about the exhibited objects. Asking questions about the object facilitated the dialog between the observer and the observed resulting in a deeper understanding of the object and a stronger relation (Hooper-Greenhill, 2001). Students should be challenged, encouraged and stimulated to engage in a more meaningful way with the objects in the museum. This can be done by helping the students but also by asking additional questions or point out details. Furthermore, the teacher should be a model for the students and display a curious mind himself.

Observe. Observations made during the visit can facilitate interaction during the museum visit but also after the visit back in school. Photographs or video can be used for feedback to parents but also as visual memory to be used in the post-visit lessons.

Educational decisions. The exhibited objects and the special environment of the museum itself appear to contribute to the learning experience. It is important to show the students how to behave in a museum and that it is a learning environment, which is not very different from school. The activity in the museum should be full of context and experiences that aim to couple the personal experience of the student to the potential knowledge in order to obtain the learning goals. In that sense the student becomes a part of the exhibition and the exhibition part of the student.

After the visit

Educational decisions. After the visit the experience can be made explicit by asking questions about the content of the exhibition, the experience of the exhibited objects, the cooperation with fellow students and the learning process itself. The experience should be discussed and reflected upon. Following the evaluation, the learning process can be continued by follow up lessons where the knowledge and experience can be deepened by making an exhibition or museum with the students

Sharing. The museum experience should be shared between the students but also with parents or even students from other classes. This can be done via the above-mentioned activities or by making a site or report for the school.

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Literature

Anderson, D.; Lucas, K.B. & Ginns, I.S. (2003) Theoretical perspectives on learning in an informal setting. *Journal on research in Science Teaching*. vol.40, no 2, 177-199

Falk, J.H. & Dierking, L.D. (2000). *Learning from museums: Visitors experiences and their making of meaning.* Walnut Creek, CA: Altamira Press.

Geukema, R.; A. Notenboom; R. Goudriaan & P. Postma (2011) *Stimulering van museumbezoek door kinderen, Resultaten en verantwoording van de experimenten*. **A**artsDeJongWilmsGoudriaan**P**ublic**E**conomicsbv(APE)en **P**aul **P**ostma **M**arketing **C**onsultancy bv (PPMC)

Guisasola, J. & Morentin, M. (2010) Concepciones del profesorado sobre visitas escolares a museos de ciencia. *Enseñanza de las Ciencias* 28 (1), 127-140.

Henriksen, E.K. & D. Jorde, (2001) High School students' understanding of radiation and the environment: can museum play a role? *Science Education* 85, 189-206.

Hooper-Greenhill, E. (1999). Learning in art museums: Strategies of interpretation. In E. Hooper-Greenhill (Ed.), *The educational role of the museum* (2nd ed.) (pp. 44–52).

Kolb, D. (1984). *Experiential Learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

McLoughlin, A. (2004). Engineering active and effective field trips. *Clearing House: A journal of educational strategies, issues and ideas,* 4, 160-163.

Morentin, M, & J. Guisasola (2011) Training elementary school teachers for the use of science museum field trips in early education. *The ESERA Book Series. Science Education Research Series. Strand 12: PRE-SERVICE SCIENCE TEACHER EDUCATION*. Pp 132-138
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Does integrated science education improve scientific literacy?[7]

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1. Introduction

1.1. Science for all and scientific literacy

When talking about education designed for all, a central issue is how science education should be organized to provide the necessary background, tools and attitudes to the future citizen, and at the same time to inspire and prepare the future scientist and technician for further studies and career (Eurydice, 2011).

'Science for all' is often associated with 'scientific literacy,' meaning, according to the PISA 2003 definition:

the capacity to use scientific knowledge

- *to identify questions and*
- *to draw evidence-based conclusions*

in order to understand and help make decisions about the natural world and the changes made to it through human activity (OECD, 2003)*.*

Achievement of scientific literacy for all pupils is the major goal of a 'Science for all' curriculum. However, a science curriculum designed for the future scientist and technician should also achieve the scientific literacy of pupils, together with the suitable conceptual and technical depth needed for further scientific studies and career.

1.2. Structure and recent changes in the Flemish Science Curriculum

In the following, we give an overview of the science curriculum in Flemish schools (Eurydice). In the last years, some changes have been implemented in the Flemish science

[7] *The results presented in this paper have been obtained in the framework of the Flemish project* ***P-Review: Practice-oriented reviews of research in subject matter teaching,*** *supported by School of Education, Association KU Leuven.*
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curriculum. In particular, in some non-technical-scientific specialisations in secondary education, the separate scientific subjects chemistry, physics and biology have been replaced with one 'integrated science' subject.

1.2.1. Primary Education

In elementary school, the so-called subject "Wereldoriëntatie" is an integration of science, history and geography. This subject approaches science by working with *specific examples*. The 'amount' of science pupils are exposed to in elementary school is in fact strongly dependent on the choices and the background of their teacher. The results of this approach to science in elementary school in Flanders are currently rather poor, according to the results of the Trends in International Mathematics and Science Study assessment 2011 (TIMSS & PIRLS International Study Center, 2011). The government is now trying to attack this problem. Introducing a specialized science and technology teacher at primary school level is an option.

1.2.2. Secondary Education

In the first two years of secondary education, "Natuurwetenschappen" as a subject for integrated science, has been introduced in 2010. "Natuurwetenschappen" (translated 'natural sciences') includes, together with biological topics, some *elements of physics and chemistry*. Before, most pupils found only biology on their school programme.

In higher secondary education, the Flemish science curriculum has been structured according to the two possible trajectories: 'science for all' and 'science for the future scientist and technician'.

In the 3rd and 4th year of secondary school, the integrated 'science for all' subject 'natural sciences' has been gradually introduced starting in 2007 in some specialisations in technical schools, instead of the three separate subjects physics, chemistry and biology. For some of these technical schools the total number of science classes per week has simultaneously been *reduced* from 3 to 2.

Pupils in general schools and in some specialisations of technical schools

still get the three separate subjects physics, chemistry and biology during 3rd and 4th year.

In the 5th and 6th year of secondary school, the integrated 'science for all' subject 'natural sciences' has been introduced in 2004, also in general schools, for pupils who do not explicitly choose to major in science. The number of science classes per week has also in this case been reduced from 3 to 2.

This means that general school pupils who have followed the three separate subjects physics, chemistry and biology in 3rd and 4th year, but have not chosen for a science specialisation in 5th and 6th year, go back to integrated science with very little science hours. Quite surprisingly, this happens also to general school pupils who choose to major, for instance, in *mathematics* and latin.

Secondary school pupils in Flanders score quite high in the PISA scientific literacy assessment (OECD, 2011).

1.3. Are the recent changes in the Flemish Science Curriculum evidence-based?

As described above, Flanders has recently changed its secondary school curriculum by replacing the separate subjects chemistry, physics and biology with one 'integrated' science subject for pupils who have chosen for non technical-scientific specialisations.

Underlying this decision, we see the *implicit assumption* that *integrated instruction in science has a positive effect on scientific literacy*, considered to be the major goal of a 'science for all' school trajectory. But is this assumption supported by facts?

These days, with the increasing pressure by our knowledge society to base *any decision* on *scientific evidence*, also in an educational context, we would expect that such curriculum changes implemented by the government, with consequences not only for pupils but also for teachers and for the general school organisation, were also supported by scientific evidence and were not based on ideology or current trends in pedagogy.

Considering that we are talking about curriculum changes concerning the improvement of scientific literacy, and that *drawing conclusions based on scientific evidence* is the central element of the already mentioned PISA 2003 definition of scientific literacy, it would be particularly striking if the decision to implement these changes had not been based on scientific evidence.

This reflection has inspired us to start a systematic search for scientific evidence of the effects of integrated instruction in science for the scientific literacy of pupils. More specifically, our review addresses the specific question:

Is there scientific evidence that integration of biology, chemistry and physics to one school subject, natural sciences, improves *student results* for scientific literacy in secondary education?

1.4. The project P-review

Our work has been performed in the framework of the Flemish project P-Review - Practice-oriented reviews of research in subject matter teaching, supported by School of Education, Association KU Leuven (Project P-review, School of Education - Association KU Leuven, 2013).

The goal of this project is to *bridge the gap between teachers and research in subject matter teaching*.

Research in subject matter teaching can only have an impact on the society if research results reach school teachers, who can then take them into account in their school practice. Unfortunately, teachers have little time to search for academic literature relevant for their teaching activity.

The project P-review makes relevant international research results accessible to Flemish teachers by producing 6 practice oriented reviews of research in subject matter teaching for the school subjects: natural sciences (review presented in this paper), history, biology in secondary education; “wereldoriëntatie” (integration of science, history and geography), physical education, mother language in primary education.

The general project framework refers to the concept of systematic review.

The material presented in the P-reviews must be collected by a *systematic procedure*, the details of which are presented in a *transparent* way in the text, so that the whole process is in principle *reproducible*.

The research question addressed by the review must be chosen in advance, before knowing which relevant results are available in the literature. This implies that an ‘empty’ review is also meaningful in this approach, because it proves that for the chosen question no research results have been published yet and the problem is still open.

The P-reviews, in Dutch, are written in a style and with a terminology suitable for the target group of teachers, teacher students and teacher educators.

2. International debate on integration in (science) education

2.1. Semantic confusion

We have been talking about the school subjects natural sciences in secondary school and “wereldoriëntatie” in primary school as ‘integrated’, meaning that they are a form of *clustering* of different disciplines, such as biology, chemistry, physics, history, geography, in one school subject.

In the international literature, several authors point out that the integration of different subjects to one cluster subject can be organized in different ways. In fact, more than one classification exists of the possible integration structures, but a generally accepted *definition of integration* does not actually exist. Different authors, curriculum developers, policy makers, schools directors and teachers use the term integration with a different meaning.

Therefore, *semantic confusion* can arise, in particular for teachers, who are normally not familiar with the academic literature on integration, when the terminology used in a certain context is not properly defined.

A simple and practice oriented classification defines three categories or approaches to integration (Lederman, 1997), that we here apply to the case of natural sciences as a clustering of physics, chemistry and biology:

- The *integrated* approach is based on real-world problems. The three disciplines physics, chemistry and biology are not recognizable anymore. This approach can be compared to tomato soup, where the different ingredients are not visible anymore.

- The *interdisciplinary* approach uses the insights of the three separate disciplines, that are mentioned and recognizable, and applies them to the investigation of a

natural science topic or problem. Basic knowledge in the three disciplines is needed. This approach improves the understanding in the separate disciplines, by investigation of a topic, and can be compared to chicken-noodle soup. The different ingredients are recognizable and all contribute to the preparation, which, however, has also its identity has a whole.

- The *thematic* approach is similar to the integrated approach, but is organized around broad themes relevant for the society, like for instance energy, instead of starting from many real world problems. The different disciplines are also in this approach not recognizable.

2.2. Arguments for and against integration

In the ongoing international debate on integration, we can identify a set of typical arguments for and against integrated/thematic instruction, see for instance (Czerniak, 2007).

The most common arguments in support of integrated instruction are:

- Reality is not organized in separate subjects.
- Pupils see the big picture instead of fragmented knowledge.
- Integrated instruction increases student motivation.
- Relevance: the content is organised around real-world problems and socially relevant themes.
- Connection with the pedagogical theory of social constructivism: more attention for relations among ideas.

Most common arguments against integrated instruction:

- Almost no research results support the superiority of integrated instruction.
- There is no consistent definition of integrated instruction.
- Practical problems in the school practice arise...
- ... together with problems in the education and training of teachers!

3. Relevant empirical studies

Our systematic search for scientific evidence of the effects of integration of biology, chemistry and physics on the student results for scientific literacy, has brought us to the conclusion that *surprisingly few empirical studies* have been published on the subject. This is in striking contrast to the huge amount of literature on the topic, mostly providing arguments based on *filosofical or ideological assumptions*.

We have identified only two empirical studies relevant for our research question.

These are Swedish studies based on the PISA results of 2003 with 1867 participating pupils (Åström, Integrated and subject specific. An empirical exploration in Swedish compulsory

schools, 2007), and of 2006 with 4140 participating pupils (Åström, Defining integrated science education and putting it to test, 2008).

It is important to stress here that the PISA assessment for science is designed to test scientific literacy and not scientific knowledge and technical skills.

The authors have first determined which schools had followed an integrated, mixed or traditional curriculum in science. The statistical correlation between this information and the results of the corresponding pupils in the PISA-tests has been studied, together with the influence of other parameters such as gender, socio-economical status of the family and the language spoken at home.

The very special situation in Swedish schools in those years have made this study possible. Swedish schools *could choose* to follow an integrated, mixed or traditional, i.e. with separate subjects, science curriculum. The way final grade(s) for science were given, one grade or three, could be used as a cross-check of the declared school choice. In Flanders a similar study would not be possible, since schools cannot choose.

The results of the two PISA-based studies differ. The first study, based on the PISA 2003 data, finds *no difference* in student achievement among different science curricula. The second study, based on the PISA 2006 data, finds a *small difference* in the student achievement among different curricula, *but only for girls*, and partly correlated to differences in socio-economical situation and home language.

To summarize, only two extensive *quantitative* studies have been found. They do not agree, since the second study sees a small statistically significant difference, *only for girls*, while the first one sees no difference**.**

It is therefore not possible to conclude, based on the currently existing empirical studies, that integration in science has an effect on student achievement for scientific literacy.

If we look back at the question addressed by our review, namely 'is there scientific evidence that integration of biology, chemistry and physics

in the subject natural sciences improves student results for scientific literacy?', we see that the answer obtained in the framework of our systematic review is 'No'.

Therefore, offering an integrated subject natural sciences instead of the three separate subjects physics, chemistry and biology to pupils, does not *automatically* improve their scientific literacy.

This of course does not mean that integration in science education is 'bad'. A teacher who believes in the integrated approach and who can work well in an integrated, thematic or interdisciplinary way in the class, has still all the rights to do it.

We personally believe that the commitment, love for the subject and experience of the teacher have a bigger effect on the student performance than the degree of integration in the science curriculum.

The result of the PISA 2006 based study, revealing a *gender-based effect,* is very interesting and deserves further investigation.

This result is maybe not so surprising, though, considering that *context-based* approaches in science are well-known to have a positive effect on motivation and results for girls, see for instance the case of physics (P. Murphy, 2006). It is possible that teachers working in an integrated way in the classroom have given more attention to contexts than in the often more abstract or technically oriented traditional approach with three different subjects.

Another interesting consideration is related to the general discussion around performance vs. motivation in education.

The focus of our review is the effect of integration on *student results* in scientific literacy and not on the *student motivation*. An increase of student motivation is however often mentioned in the literature as a positive effect of integration (Czerniak, 2007).

This stimulates a reflection on the meaning of the term 'motivation' and leads us to another example of semantic confusion in education, also well-known in the literature (Abrahams, 2010).

We would expect that, when students are more motivated, their performance should also improve. The kind of motivation we have in mind here can be identified by the fact that the student is engaged with the subject and is willing to make more efforts. In the literature, we find a classification with different degrees of motivation. The one just mentioned is the highest one in the ranking.

The lowest one is *situational interest*, meaning that the student likes a certain activity more than other activities in the class, but with *no durable effects* after the end of the class.

Therefore, situational interest has no effect on the learning process and on student achievement, but only on the atmosphere in the class. We suspect it is this kind of 'motivation' that is increased by integration in science education.

4. Implications and suggestions for teacher education

The debate around integration in science education is currently of ideological and philosophical nature and not based on results of empirical research studies.

This lack of scientific evidence for the effectiveness of integration implies *intellectual freedom* for teachers and teacher educators on how to give the subject natural sciences. Multidiscipinary, interdiscipinary, thematic or integrated instruction are all possible options, among which the teacher should be free to choose.

We believe that good teacher education in science should also educate future teachers to make their *own choices* for their school practice in science education.

We find it important to make our students aware of the international debate concerning integration in science education and to stimulate them to develop their *own opinion* about it.

We are aware that some colleagues consider this kind of issue too philosophical for our students. We often hear that teacher students need clear instructions and should only be *trained* to execute a certain set of practical tasks in a professional way.

We find this mentality dangerous, considering that the 'tasks' teachers are supposed to execute, and the set of topics they will have to present to their pupils in the classroom, will change several times during their teaching career.

Reflection on and participation inthe debate on science education in relation to one's own school practice should, according to us, also be considered an important element of teacher education in science.

In the following, we would like to give some suggestions on how a teacher educator could integrate the discussion on science integration in the teacher training.

In the framework of a subject matter teaching course, of student projects or of a bachelor thesis, it is possible to let students explore the different possibilities for integration in the subject natural sciences.

The different categories and levels of integration can be presented during the lectures. Several practice-oriented exercises for teacher students are possible based on these topics, for instance:

1. Browse several natural sciences textbooks and classify them according to the type and level of integration.
2. Discuss in groups the positive and negative aspects of integration. The issues raised by the different groups can be summarized and compared with what mentioned in the literature, see for instance (Czerniak, 2007).
3. What could be good topics for working in an integrated way in the science class? The topics found by the students can be compared with the official list of topics for the subject natural sciences.

This way of working with teacher students also automatically exposes them to *research in science education*.

Another possible discussion and reflection topic for science teacher students is the existence and role of the subject natural sciences in the general school curriculum.

Students can for instance analyze the structure of science education in their country and discuss this in the context of the international debate on integration in science education.

In Flanders, teacher students who specialize in one of the three scientific subjects physics, chemistry or biology, are automatically allowed to teach the integrated subject natural sciences. Without considering the problems these students face, due to the lack of specific knowledge and possibly also a lack of interest in the other scientific subjects, one should consider that a 'science for all' integrated subject has a different goal, namely achieving the scientific literacy of all pupils.

But do science teacher students know what scientific literacy means? And do they know how they can work in the class to achieve it?

We think it is definitely possible and relevant to discuss scientific literacy with science teacher students. Some suggestions are: discussing the PISA definition(s) of scientific literacy during the lectures, letting students solve PISA sample questions in teams and let

them reflect on these questions: why is this question actually a test of scientific literacy? PISA sample questions are freely available on the internet (OECD).

5. Conclusion

The scientific conclusion of our review is that **there is currently no empirical evidence that the integration of biology, chemistry and physics**

in one school subject, natural sciences, has any effect on student results for scientific literacy in secondary education.

Our practice-oriented conclusion, meant for teachers, future teachers and teacher educators, is that **intellectual freedom** remains for the teacher and teacher educator on how to approach the clustering of physics, chemistry and biology in one school subject. Multidisciplinary, interdisciplinary, integrated or thematic approach are all possible and the teacher should make an **informed choice** for its own school practice.

We would like to conclude with a message for (future) science teachers:

- *Be aware* of the ongoing debate on integration in science education.
- Form your own *opinion* on integration.
- *Choose with this in mind* among the textbooks for natural sciences and for your own class practice.
- *Contextualising* has a well-known positive effect on the motivation of *girls,* and you can do this in the subject natural sciences as well as in the separate subjects physics, chemistry and biology.
- The world of scientific research becomes more *interdisciplinary* with fields like nanoscience and nanotechnology: try to open this fascinating world for your pupils.
- *Participate* to scientific studies on integration and interdisciplinarity in science education with your class when this possibility is offered to you, even if this might be slightly inconvenient for your class practice.

Bibliography

Åström, M. (2008). *Defining integrated science education and putting it to test.* PhD Thesis, Linköping University, Sweden, Faculty of Educational Sciences.

Åström, M. (2007). *Integrated and subject specific. An empirical exploration in Swedish compulsory schools.* Licentiate of Philosophy Thesis, Linköping University, Sweden, Faculty of Educational Sciences.

Abrahams, I. a. (2010). Untangling what teachers mean by the motivational value of practical work. *School Science Review , 92*, 111-115.

Czerniak, C. (2007). Interdisciplinary science teaching. In S. a. Abell, *Handbook of research on science education* (pp. 537-560).

Eurydice. (n.d.). *Belgium (Flemish Community)*. Retrieved June 30, 2012, from Eurypedia: webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Belgium-Flemish-Community:Overview

Eurydice. (2011). Science education in Europe: National policies, practices and research.

Lederman, N. a. (1997, February). Integrated, interdisciplinary, or thematic Instruction? Is this a question or is it questionable semantics? *School Science and Mathematics* .

OECD. (2011). Retrieved from http://www.oecd.org/pisa/

OECD. (n.d.). *PISA sample questions.* Retrieved from http://pisa-sq.acer.edu.au/

OECD. (2003). *Scientific Literacy. Retrieved from The PISA 2003 assessment framework - Mathematics, Reading, Science and Problem Solving Knowledge and Skills.* From http://www.oecd.org/dataoecd/38/29/33707226.pdf

P. Murphy, E. W. (2006). *Girls in the Physics Classroom - A Review of the Research on the Participation of Girls in Physics.* Institute of Physics, The Open University. Institute of Physics.

Project P-review, School of Education - Association KU Leuven. (2013). *P-reviews - Onderzoek koppelen aan je vak.* Retrieved from http://www.p-reviews.be/

TIMSS & PIRLS International Study Center. (2011). Retrieved from http://www.timss.org/

<TOC<

Special Needs

Evaluating the Use of Music with Teaching Aids in a Multi-sensory Environment on Developing Children with Disabilities Positive Emotions and Communication Skills

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Abstract

Music activities in multisensory environments have provided support and proven potential benefits for children with disabilities. Through a number of studies, the effects of music activities in multisensory environments have been examined for children with profound multiple disabilities. The purpose of the study was to explore the use of the multisensory environment teaching approach with music and teaching aids on the development of positive emotions and communication skills for children with disabilities. Three 3-4 year-old children with disabilities were selected by purposive sampling to participate in the study. The duration was 16 weeks with 50-minute instructional sessions once per week. Both qualitative and quantitative methods were used to obtain the results. The results showed the effectiveness of using music with teaching aids on increasing positive emotions and developing communication skills for the participants in the multisensory environment. Furthermore, the young children's cognitive development and level of intelligence were improved through the assessment of the research sessions.

Keywords: Music, Teaching Aids, Children with Disabilities, Emotions, Communication, Multi-sensory Environment

INTRODUCTION

Background

For children with mental or physical disabilities, there can be many challenges throughout their life. While there are psychological and cognitive health issues to be addressed, many children with disabilities also experience different areas of impairment.

For children with disabilities, music contributes to cognition development, feelings and response, personal fulfillment, language skill, the promotion of communication, attention span, motor control and physical well-being, positive learning motivation, socializing and pleasurable experiences with others in a group.

Motivation of the study

As a music educator for years, the researcher always tries to find the learning venues for children with disabilities. For therapeutic purposes, music is a means for developing children

with disabilities non-music areas, but the most important purpose is for them to apply the improvement from the music sessions to their daily life.

The use of multisensory environments (MSEs) for educating children with learning disabilities has gained widespread acceptance in recent years. However, scientific research studies on the use of MSEs are limited. Therefore, the motivation of the study was to build up more reliability and credibility through music teaching with teaching aids in a multi-sensory environment.

The purpose of the study

The purpose of the study was to exam the use of music with teaching aids in a multi-sensory environment on developing positive emotions and communication skills for children with disabilities. The specific purposes of the study were:

1. Evaluating the use of music with teaching aids in a multi-sensory environment on increasing positive emotions for children with disabilities.

2. Evaluating the effectiveness of music with teaching aids in a multi-sensory environment on enhancing children with disabilities communication skills.

Research questions

According to the purposes of the study, the research questions were:

1. Will the use of music with teaching aids in a multi-sensory environment be effective on increasing positive emotions for children with disabilities?

2. Will the use of music with teaching aids in a multi-sensory environment be helpful on enhancing children with disabilities communication skills?

LITERATURE REVIEW

Children with disability who have complex communication needs and emotional problems often experience challenges, when making the transition to intentional communication and from early intentional forms of communication to more formal means of communication. These difficulties involve the interaction of these children's physical, intellectual, and sensory/perceptual impairments and their affect on the motivation and ability to communicate with both communication partners.

Music can be a transformative intervention for children with disabilities building connections and fostering development. Researches support the use and benefit of music therapy and multi-sensory environments for a variety of populations.

The Benefits of Music for Children with Disabilities

Music therapy has been widely reported to play an important role in stimulating and facilitating learning and development of young children with disabilities (Bunt, 2006; Schwartz, 2008). Researchers state that music therapy has been a popular and immediately valued area of work for children because of their positive and enjoyable experience of music (Wigram, Pedersen & Bonde, 2002). It is also believed that children are motivated to learn through music because it offers an easier way of communication than spoken language (Boxill & Chase, 2007; Oldfield, 2006). Integrating music in early intervention programs has been suggested to be effective in enhancing various areas of child development (Kern & Wolery, 2001).

Music for children's emotional development

Music is a medium for young children's expression of feelings and emotions. Many children respond positively to music which encourages the experience of positive emotions such as happiness, joy and security. Music also allows them to express negative emotions, such as anger, frustration and sadness which may otherwise be suppressed in everyday life (Wigram et al., 2002). Research showed that music encourages self-expression for children who are non-verbal, limited in speech/language or emotionally disturbed (Boxill & Chase, 2007). Children with disabilities may experience frustration and difficulties when trying to express their emotions. This may be due to their language impairment, lack of communication skills and poor social skills. When children cannot meet the expectations set by others they may experience rejection, which can manifest itself in behavioral disturbances (Aldridge, 1996). Music therapy can provide opportunities for self-expression through instrument playing, singing familiar songs and song writing. 'However primitive or restrictive they may be in response, it is one of the first objectives to equip a person with some facility for self-expression and some outlet for emotional discharge' (Wigram, 1986, p. 4). Frustration and anger may be expressed in a safe way in the music therapy space through playing instruments or singing about the issue. Children and adults with severe delays can also express themselves through musical experiences.

Music for children's communication and language development

Literature showed that music has meaningful effects in helping young children with speech/language delays to increase their language skills (Oldfield, 2006; Adamek & Darrow, 2005). Music provides a non-verbal way of communication when it used therapeutically (Boxill & Chase, 2007; Klein & Winkelstein, 1996). For children who are at a pre-verbal stage, music can help increase their auditory awareness when they listen to different musical instruments and different vocal sounds (Adamek & Darrow, 2005).

Multi-sensory Environments

Multi-sensory environments (MSEs) are rooms or spaces containing equipment that is designed to provide sensory stimulation and relaxation, learning and/or therapy to the users. The goal is to allow instructors, therapists, professionals and parents who work with children with disabilities to use MSE to maximum effect (Hong, 2004). The sensory experiences provided are tailored to the perceived needs of the user (Fowler, 2008). The equipment typically includes items such as projectors and effect wheels, bubble tubes, music equipment, fiber optics, vibrating devices, aroma diffusers and sound equipment (Fowler, 2008; Lancioni, Cuvo, & O'Reilly, 2002).

The use of a multi-sensory environment (MSE) or Snoezelen stemmed from the concern that "people with severe and multiple handicaps often experience very limited psychological and sensory stimulation, particularly in institutionalized care, and have a limited degree of control and choice in all aspects of their lives"(Baillon, van Diepen, & Prettyman, 2002, p. 445). The word Snoelezen is a combination of the two Dutch words meaning to sniff and to doze and describes the use of a sensory rich atmosphere to simultaneously stimulate the senses and motor responses of people with multiple disabilities (Cadwell, 1991). The concept is based on the belief that there are basic human needs which include the need to seek sensory stimulation, the need to make sense of the world, the need for relaxation and the need for enjoyment.

The positive effects of multi-sensory rooms for those who are neurologically involved have widely been reported. Time spent in a sensory room has been shown to increase concentration, alertness, calmness, and general awareness of the surrounding world. Individuals appear happier while in a sensory room and tend to vocalize more and stay on task. For those with self-injurious behaviors or autistic behaviors, the gentle stimulation has a

soothing effect and helps relieve agitation and promotes relaxation. Finally, individuals with perceptual difficulties appear to gain pleasure for the visual, auditory, and tactile experiences.

Multi-sensory Environments for Children with Disabilities

A study used a single-system ABAB design to examine the behavioral states of individual children for evidence of responsiveness within and without a multisensory environment. Three children in the age range of 3-10 years with severe multiple disabilities participated in the study. The results showed two participants had no change in their behavioral states with or without the MSE, suggesting that the environment did not have an effect on their responsiveness. One participant demonstrated a decrease in self-directed movement and an increase in visual attention with movement toward the MSE suggesting a more interactive shift in this participant's response to the environment (Tunson & Candler, 2010).

A survey was conducted of special schools enrolling children with severe disabilities in New South Wales, Australia. More than half of the 36 responding schools reported having an MSE installed. The results showed the wide range of uses and benefits. There was a widespread acceptance of the inherent value of sensory stimulation (Carter & Stephenson, 2012).

METHODOLOGY

The methodology of the study used a quantitative analysis to measure validity based on assessment scales useing a “1-5” scale observation form by three observers and qualitative data using interviews with parents, classroom teachers and anecdotal observation reports from three observers.

Participants and Setting

The participants were three 3-4 year-old children who had received a clinical diagnosis of having developmental disabilities. They were enrolled in a non-profit early intervention center in Taichung, Taiwan, and were selected by purposive sampling to participate in the study. The criteria of participants included: aged from 3-4 years old, diagnosed disabilities by a medical doctor and enrolled in the research place. The description of the participants are as follows:

Information / Participants	Age	Sex	Syndrome Diagnosis
A	3	Male	Visual impairment with developmental delay
B	4	Male	Autism and multiple disabilities
C	4	Female	Visual impairment with cerebral palsy

Duration

This was a 16-week study, with 50-minute sessions once per week of specific, study-focused music activities. Prior to the formal teaching, two observations were taken by the researcher and three observers to obtain the participants' condition.

Research Design

In the last two decades, researches have provided ample evidence of the physiological benefits of positive emotion for children's development and learning. Communication is fundamental to children's development. Children need to be able to understand and be understood. Communication is also the foundation of relationships and is essential for learning, play and social interaction. Therefore, the goal of the first stage was aimed to improve the participants' positive emotions using music activities with various teaching aids in a multi-sensory room. The goal of the second stage was to continue improving the participants' positive emotions and enhancing their communication skills.

All observations of the participant undertaken during all sessions were recorded on videotape.

The Curriculum Design

The curriculum framework has been tested by the researcher's hands-on teaching for 10 years. The curriculum contents included a Hello Song, Attendance Song, Musical Movement, Music Appreciation, Musical Storytelling, Relaxation Time and a Goodbye Song.

Assessment

The assessment instruments included the participants' information from the early intervention center; semi-structured observation forms to gather data on the development of emotional responses and communication skills from the parents and three observers who were trained graduate students; interview reports from the teacher at the early intervention center and the parents at home; and teaching logs from the researcher.

In assessing the participants' initial behavior, prior to the formal teaching, two observations were taken to obtain the participants' condition. The baseline observations concluded when the observers were in agreement about the specific nature of the participant's behavioral and developmental challenges.

All intervention sessions were recorded on video and these were viewed and scored by three observers. At the end of the study, six social reliability assessment reports were completed by three parents and three observers. In the observation form of assessing the participant's emotions, it was scored on a "1-5" scale on a range of aspects related to emotion responses. For the assessment standard of emotion responses, a score of "1" indicated the participants had 100% negative responses, such as screaming, crying and aggressive behaviors, such as hitting, self-injury, biting and kicking etc. A score of "5" showed the participants had full positive responses throughout the therapeutic session, such as showing their happiness by smiling or laughing.

For the assessment standard of communication, a score of "1" indicated the participants had no understanding of spoken language, such as no ability to follow the instructions by spoken language or physical reactions. A score of "5" showed the participants had full understanding of the instructions and responded by spoken language or / and physical reactions.

RESULTS

The study was implemented through 16 sessions of using music activities with teaching aids in a multi-sensory room. The results were based on a "1-5" scale observation form, interview reports and teaching logs.

Compared to the baseline, the results showed a positive development in the study group after receiving music activities with teaching aids in the multisensory room. Both positive

emotions and the participants' communication development increased under treatment, as well as their cognitive structures, and level of intelligence. Throughout the study period, even slowly, developmental age converged with their biological age. Ratings according to the observation forms showed positive changes in the participants.

The Changes of the Participants' Emotion Statuses and Behaviors

The comparison of the participants' emotion statuses and behaviors between the baseline at the beginning and the intervention at the end are shown in Table 1. Each participant's narrative is based on the observation forms from three observers, teaching log, interviews with parents and teachers as well as parental reports.

Prior to the formal teaching, two observations were taken. Three participants showed negative emotions, especially Participant C who showed more aggressive behaviors all the time both during the session and at home.

Table 1. The comparison of the participants' emotion status and behaviors

Participants' emotion Status / Description of the participants	Baseline Session (beginning)		Intervention Session (the end)	
	Negative emotions & Behaviors	Positive emotions & Behaviors	Negative emotions & Behaviors	Positive emotions & Behaviors
Participant A: 3 years old; Male; Visual impairment with developmental delay	Angry, Crying, Clamoring, Squirming, Weepy	Would calm when the teacher companied him	No negative emotions	Calm, Cheerful & Happy: Smiling, Laughing
Participant B: 4 years old; Male; Autism with multiple disabilities	Rage, Crying, Clamoring, Hyperactive, Self-injury, Screaming, Aggressive behaviors: kicking, hitting, biting	No positive emotions at all	Clamoring, Crying, Screaming	Calm, Laughing

Participant C: 4 years old; Female; Visual impairment with cerebral palsy	Angry, Crying, Clamoring, Screaming, Weepy	Would clam & smile only when she saw her mother	Weepy, Clamoring,	Calm, Cheerful & Happy: Smiling, Laughing

Research indicates that young children who are emotionally well adjusted have a significantly greater chance of early school success, while children who experience serious emotional difficulty face grave risks of early school difficulty. According to researchers (Gaulin et al., 2003) emotion is associated with mood, temperament, personality, disposition, and motivation. When emotions provide the affective component to motivation, positive or negative, motivations direct and energize behavior. Therefore, the first goal of the study was to enhance three participants' positive emotions.

Figure 1 shows the 16-week process of the participants' changes of emotion statuses scored by 3 observers. The average sore from one at the beginning to 2.6 at the end indicates the results had an effective impact for three participants on developing positive emotions and behaviors.

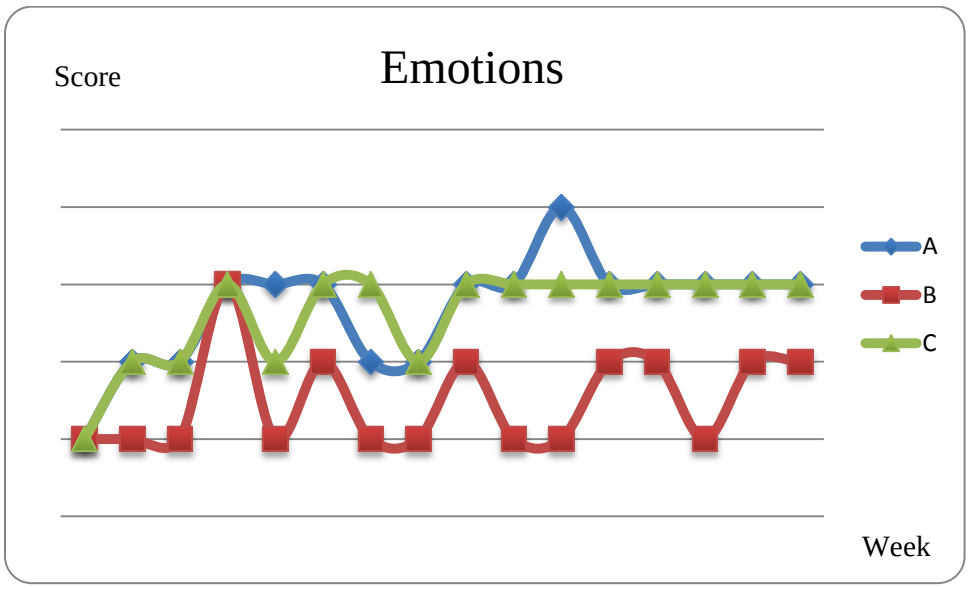

Figure 1. The process of three participants' changes of emotion statuses

Narratives of three participants

Due to the individual differences among the participants as well as to provide a clear understanding and perspective of each participant, a case study narrative on each child will be presented below. Each participant's narrative is based on the observation forms, teaching logs, interviews with the teacher and parents as well as parental reports.

The Baseline

Three participants were diagnosed by medical doctors at a local hospital. Participant A was a 3-year-old boy with developmental delay. Participant B was a 4-year-old boy with autism and multiple disabilities. Participant C was a 4-year-old girl with cerebral palsy.

Prior to the formal teaching, Participant A performed very negative emotions and behaviors, such as: angry, crying, clamoring, squirming and weeping. He only would calm when the teacher accompanied him; Participant B showed his negative emotions and aggressive behaviors, such as: kicking, hitting, biting persisted throughout the observation session and self-injury sometimes. According to the parental observation forms, Participant B did not show positive emotions during this stage at home either; Participant C would clam and smile only when she saw her mother. The rest of the time at this stage she would be angry, crying, clamoring, screaming and weepy during the school time.

The Intervention Session

Participant A

At beginning, he showed his unstable emotions throughout the intervention session. It might be due to the anxiety of experiencing the new learning environment including the teaching style and the instructor. It led participant A showed his negative emotions at the first time. It was improved at the second session when the instructor used the combination of music with tactile material before the hello song time. There was an obvious difference at week four. When the instructor changed the lighting stimulation mode, Participant A became more focused on the environment and more calm. It lasted for three weeks. At week seven, when the instructor added a new activity to improve his fine motor skills, Participant A started showing his negative emotions slightly. It continued for two weeks. At week 11, Participant A made the biggest progress on developing his positive emotions by smiling, laughing and humming. According to the observers, Participant A showed obvious preference

of the musical elements, stop and go. When the music stopped, he would stop to observe the environment including the instruments, lights and teaching materials; when the music started again, he would be excited playing with the teaching materials and instruments. It was noted that his favorite teaching material was a big blue scarf. At the end of the intervention, Participant A performed stably throughout the intervention session by showing his calmness, happiness, smile and laughter. According to the parent interviews, Participant A would ask for playing the musical game of stop and go at home. He liked to play this game with his sheet. Both parents agreed that some teaching aids and multi-sensory room improved Participant A's positive emotions.

Participant B

Even Participant B had the learning experience with the instructor for 2 semesters. He still showed an extremely unstable condition during the first three weeks. The assumption is for a child with autism and multiple disabilities, the development of emotions might be effected by more uncontrolled factors, such as: cognitive and physical impairment as well as a language barrier. These factors might cause his conflict of inner behaviors and lead into his unstable emotions.

At home, both parents indicated that Participant B has no specific musical preferences and that they encourage him to listen to children's songs and to other songs. He responds positively to that. However, at that time, there were no musical instruments at home. This explains that he hardly responded spontaneously to instruments and music heard on CD's at school.

At week four, Participant B was scored the highest points of 3 by three observers. Initially he was crying while entering the multi-sensory room. After the instructor switched the lights on and off a few times, Participant B became quiet and focused on the lighting stimulations on the ceiling. During the intervention session, he enjoyed music for a longer period of time when it was accompanied by lighting stimulation and contrastive music (especially stop and go). He was able to calm and showed more positive emotions. At week five and six, due to the sickness, his scores went down to the lowest points. Even the curve of Participant B's emotional status went up and down. He was able to stay more stable at the end of the intervention session.

Since the implantation, Participant B's mother has been playing contrastive and relaxation music with some teaching aids at home. Both parents indicated Participant B sometimes responded happily but sometimes lost interest quickly. "The more positive emotions, the less self-injury would be made" said the parents. Even his emotional status is still an unstable condition. Both parents support the positive effect of using music and teaching aids in the multi-sensory room for Participant B.

Participant C

Participant C had the same response as Participant A and B at the beginning. She showed her anger and anxiety throughout week one by crying, clamoring and screaming. At week two, Participant C's attention was captured by the changing stimulation. Therefore, her scores went up to two. Except for the sickness at week five and eight, Participant C showed more positive emotions during the intervention sessions in comparison to Participants A and B. After her return from the hospital at week nine, Participant C developed more stable and positive emotions throughout the intervention session.

According to the teacher, after the implementation of the research teaching at school, Participant C's frequency of asking for her mother was less. The parents indicated Participant C had positive emotions more at home. Especially when playing with her favorite instrument, hand bells with fast music, Participant C's positive emotions will be elicited.

While using music with teaching aids in the multi-sensory, three participants made progress on their positive emotion expressions. Three participants were attracted to different lights, music and teaching aids. Even the curves went up and down. Overall. three participants' emotion statuses and behaviors presented more positive at the end.

The Changes of the Participants' Communication Skills

Communication is a vital and continuing process for all of us. It is the means by which all humans make contact, share experiences, understand their world and find their place within it. We all use communication to express ourselves and our interests, our dislikes or desires and what we need. Children with sensory and other impairments can often be isolated from their community and environment because their communication goes unrecognized. Therefore, the second goal of the study was to enhance three participants' communication skills in understanding instructions, responding to instructions by physical responses and/or spoken language.

Table 2. The comparison of the participants' communication skills

Participants' communication status / Description of the participants	Baseline Sessions (beginning)			Intervention Sessions (the end)		
	No understanding (0% of understanding)	Understand by physical responses	Understand by spoken language	No understanding (0% of understanding)	Understand by physical responses	Understand by spoken language
Participant A (male): 3-year-old developmental delay	Most of the time (Over 90% of understanding)	Passive responses: nodding & shaking head, standing up & sit down, raising hand	Single words with assistance: yes, no, bye, want, good	Understood the instruction most of the time (Over 90% of understanding)	Spontaneous responses: nodding & shaking head, standing up & sit down, raising hand	Spoke words spontaneously: His name, here I am, red, green, number 1~6
Participant B (male): 4-year-old autism and multiple disabilities	Most of the time (Over 90% of understanding)	Passive responses: nodding & shaking head, standing up & sit down, raising hand	No spoken language	Sometimes (10~50% of the time)	Spontaneous responses: nodding head, Responded with assistance: standing up & sit down, raising hand	Imitated single word with assistance: Yes, no, bye, his name, number 1~5
Participant C (female): 4-year-old cerebral palsy	Most of the time (Over 90% of understanding)	Passive responses: nodding & shaking head, raising hand	Simple words with assistance: yes, no, bye	Sometimes (10~50% of the time)	Spontaneous responses: nodding & shaking head, standing up & sit down, raising hand	Spoke words spontaneously: Her name, here I am, red, number 1~5

The comparison of the participants' communication skills between the baseline at the beginning and the intervention at the end are shown in Table 1. Each participant's narrative is based on the observation forms from three observers, teaching log from the researcher, interviews with parents and teachers as well as parental reports.

Prior to the formal teaching, 2 observations were taken. Three participants showed less competence of communication skills including understanding and expressive language, especially Participant C showed no understanding of spoken language all the time during the session.

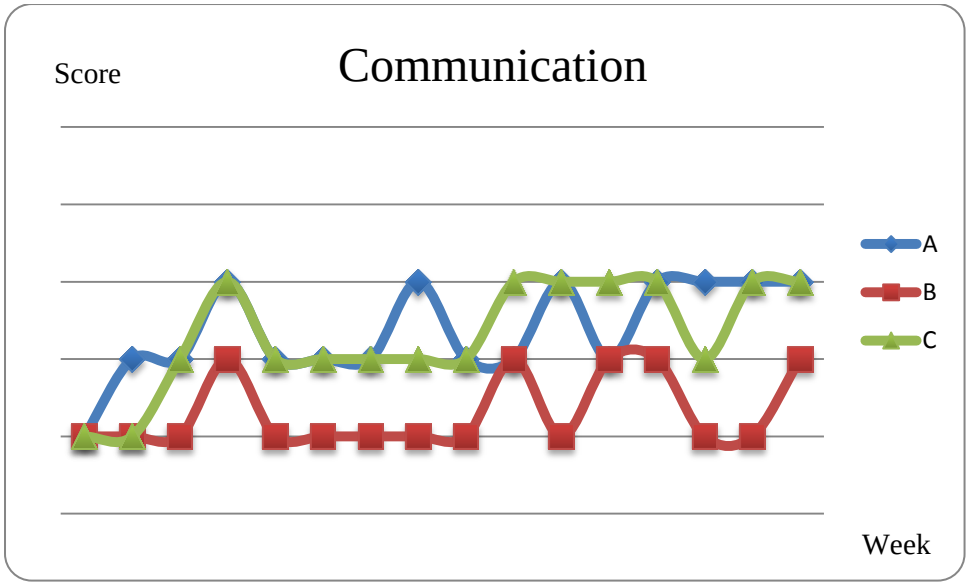

Figure 2. The process of three participants' changes of communication skills

Figure 2 shows three participants' communication skills from the lowest score of 1 at week one to the average score of 2.6 at the end. Even the curves show up and down, they still indicate the level of progress on three participants' communication development.

Narratives of three participants

The baseline

Prior to the formal teaching, 3 participants had no understanding most of the time. They had difficulty following instructions by physical responses and spoken language in the classroom. With assistance, Participants A and C could respond to the instructor by passive physical responses and spoken language. According to the teacher, Participant B almost had no spoken language during the school time but sometimes he would make nonsense sounds during the play time. It might be due to his severe syndrome of autism.

The Intervention Session

Participant A

Initially, Participant A did not respond to the instructor at all throughout the intervention session. According to the teacher and his parents, Participant A's learning performance depends on his emotion status both at school and at home. "He would learn better when he was calm or happy" said the teacher. It only took a week for Participant A to adjust the new learning environment and style. With his stable emotional status, his communication ability

made improvement at week two and three. At week four, he reached the highest score when the instructor used more sensorial stimulations with contrastive music and teaching aids, such as handmade instruments with various textures. At week five, his score went down to two. It might be because he was distracted by more assistance in the class. Since then his performance on communication skills was between two and three. Basically, his learning was progressive and more stable at the final stage.

According to parental reports, Participant A needed less assistance with spoken language at home. "He would respond to me by saying '*here I am*' when I take attendance in the class" said Participant A's teacher. From the researcher and three observers' observation, the sensorial stimulations and contrastive music drew more attention for Participant A's learning than regular class learning. It was noted that three types of musical elements, stop and go, fast and slow, loud and soft were the most effective music for Participant A's learning.

Participant B

At first week, Participant B was mute most of the time; therefore, at this session he did not make any improvement. The instructor tried to motivate his spoken language by singing the vowel sounds with sound effects, such as using sound effect instruments, string instruments, but he only screamed along with disruptive behaviors throughout the first three weeks. At week four, he made the first progress by playing the drum with correct timing when the instructor played musical elements of stop and go. When playing the drum, Participant B could play right on the beat with music. When music stopped, he would lean against wall. It was the first time that Participant B did not need assistance with the directions and understood the meaning of stop and go. From week five to week nine, Participant A showed the regression by doing nothing, so his score went back to one. According to observation reports, neither lighting stimulations, nor teaching aids and instruments, it seemed nothing could capture or motive his attention for learning. Even Participant B's learning was unstable. It was still obvious that when his emotional status was more positive, his communication skills would be improved more.

Participant C

According to the interviews with the teacher and parents, Participant C used to respond to music by clapping when she listened to music at school and at home. She also used to point at the CD player so that her mother would turn it on for her. Initially,

Participant C was anxious and would look for her mother all the time during the intervention session. At week three, Participant C could respond to the instructor by physical responses and spoken language. At week four, she reached the highest score by both physical responses and spoken language, sometimes with assistance and sometimes spontaneously. From week five to nine, Participant C was learning numbers and attendance song by saying "here I am". Due to her physical limitation, she did less response to the instructor than week four during this stage. Other than week 14, Participant C's communication skill made stable progress.

From the interview at the end with Participant C's mother, she said that many of her expectations regarding this study were fulfilled because Participant C loves music and feels connected to music. She prefers listening to specific songs and likes to play musical instruments. By reviewing Participant C's video examples, both parents think the research study contributed a lot to Participant C and themselves. Both parents are willing to apply music experiences that they saw in the video examples. Participant C's parents want to invest in buying 'real' musical instruments because they are aware of the great enjoyment and enthusiasm that Participant C has from playing them, especially the hand bells and hand drums.

Social Validity

In order to cross-check the results, a feedback form was used by 3 parents, and 3 observers. All respondents gave positive support for the study, and scored various aspects on a 1-5 scale. A score of "1" for questions in the "goals" section indicate that the respondent strongly disagreed with whether a goal of the study had been met; a score of "5" showed that they strongly agreed that a goal had been met. A score of "1" for questions in the "Emotions & Communication skills" section of the feedback form indicate that the respondents agreed the participants regressed a lot; a score of "5" showed that they agreed that the participants progressed a lot.

Table 1 Social Validity

Items	Feedback Questions	Strongly Disagreed (1)	Disagreed (2)	No comments (3)	Agreed (4)	Strongly Agreed (5)
Part I Goals	1. The research teaching has a crucial meaning for young children with disabilities.	0	0	0	0	6
	2. The research goals fit the needs of young children with disabilities.	0	0	0	2	4
	3. Music and teaching aids in the multisensory environment have positive effects on young children with disabilities.	0	0	0	2	4
	4. Music and teaching aids in the multisensory environment provide a safe, not dangerous learning method and good for young children with disabilities.	0	0	0	2	4
	5. You accept the use of Music and teaching aids in the multisensory environment to teach young children with disabilities.	0	0	0	1	5
	Total of the percentage	0%	0%	0%	23.33%	76.66%
Items	Feedback Questions	Regressed a lot (1)	Regressed (2)	No progress (3)	Progressed (4)	Progressed a lot (5)
Part II The effective-ness of the study	1. After taking the research class, the participants' positive emotions are	0	0	1	2	3
	Total of the percentage	0%	0%	16.66%	33.33%	50%
	2. After taking the research class, the participants' communication skills are	0	0	2	3	1
	Total of the percentage	0%	0%	33.33%	50%	16.66%
If you have other thoughts or opinions other than the description above, please write down here:						

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of the study provide support for the effectiveness of music activities with teaching aids in the multi-sensory room on developing three participants' positive emotions and communication skills. This study suggests that music activities with teaching aids in the multi-sensory room may have a measurable effect on the development of children through the treatment's interactions with fundamental aspects of positive emotional status and communication development, including the ability to form and maintain relationships and language abilities. Thus, music activities with teaching aids in the multi-sensory room may provide a basic and supportive method for children with disabilities. Further studies should be conducted to investigate the mechanisms of these interactions in greater depth.

Findings

The findings indicate that music activities, as implemented in this study were beneficial for these children. The findings also support the premise that music activities would have a positive effect on developing positive emotions and enhancing communication outcomes when integrated with teaching aids in the multi-sensory room for young children with disabilities like Participants A and C. To realize these benefits, parents and educators need to be given concrete recommendations regarding the exposure of children with music activities and the use of music with teaching aids for positive emotions and communication.

Limitations and Recommendations

The most limitation in this study is its sample size. Three children were excluded from the clinical trials and only three finally participated. Obviously, a sample of three children, who were not randomly chosen, does not represent the population of children with disabilities, and thus, the results cannot be generalized and the findings relate specifically to this sample only.

Since the results for the three children in this study were encouraging, establishing conclusive evidence of the effect of music activities with teaching aids in the multi-sensory room on developing positive emotions and communication skills of children with disabilities requires a replication of this study with a larger sample.

References

Adamek, M. S. & Darrow, A. (2005). *Music in special education*. Silver Spring, MD: The American Music Therapy Association.

Aldridge, D. (1996). *Music Therapy Research and Practice in Medicine*. London: Jessica Kingsley Publishers.

Baillon, S., Van Diepen, E., & Prettyman, R. (2002, March). Multi-sensory therapy in psychiatric care. *Advances in Psychiatric Treatment, 8*(1), pp. 444-452.

Boxill, E. H. & Chase, K. M. (2007). *Music therapy for developmental disabilities*. (2nd ed.), Austin, Texas: Pro-Ed.

Bunt, L. (2006). Music therapy for children. In G. McPherson (Ed.), *The child as musician: a handbook of musical development* (pp. 273-288). Oxford; New York: Oxford University Press.

Cadwell, P. (1991, June). Stimulating people with profound handicaps. *British Journal of Mental Subnormality*, 37(2), pp. 92-100.

Campos, J. (2006). Prelude to a theme on emotion and gratitude. *Journal of Personality, 74* (1), pp. 3-8.

Carter, M. & Stephenson, J. (2012). The use of multi-sensory environments in schoold servicing children with severe disabilities. *Journal of Developmental and Physical Disabilities, 24* (1), pp. 95-109.

Fowler, S. (2008). *Multisensory rooms and environments: Controlled sensory experiences for people with profound and multiple disabilities*. London, UK: Jessica Kingsley.

Gaulin, S. J. C. & McBurney, D. (2003). *Evolutionary Psychology*. Prentice Hall, pp. 121-142.

Hong, C.S. (2004). Helping children with learning disabilities: making sense of multisensory environments. *Journal of Family Health Care, 14*(2), pp. 35-38.

Kern, P. & Wolery, M. (2001). Participation of a preschooler with visual impairments on the playground: effects of musical adaptions and staff development. *Journal of Music Therapy, 38* (2), 249-164.

Klein, S. A., & Winkelstein, M. L. (1996). Enhancing pediatric health care with music. *Journal of Pediatric Health Care, 10*, 74-81.

Lancioni, G. E., Cuvo, A. J., & O'Reilly, M. F. (2002). Snoezelen: An overview of research with people with developmental disabilities and dementia. *Disability and Rehabilitation, 24*, 175–184.

Oldfield, A. (2006). *Interactive music therapy-a positive approach: music therapy at a child development centre*. London: Jessica Kingsly Publishers.

Tunson, J. & Candler, C. (2010). Behavioral states of children with severe disabilities in the multisensory environment. *Journal of Family Health Care, 30*(2), pp.101-110.

Schwartz, E. (2008). *Music, therapy, and early childhood: a developmental approach*. Gilsum, NH: Barcelona Publishers.

Wigram, T. (1986). A therapy approach with severely disturbed and aggressive mentally handicapped people. *Australian Music Therapy Association Bulletin, 9*, (1), 2-7.

Wigram, T., Pederson, I. N., & Bonde, L. O. (2002). *A comprehensive guide to music* therapy. Theory, *clinical practice, research and training*. London: Jessica Kingsley Publishers.

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Technology, Teaching and Learning

Digital worlds revolutionizes today education and school requires the use of digital tools an altered teacher role in schools and universities?

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Background

What distinguishes digital capabilities to handle text, images and other types of information from the sources we are accustomed to the traditional use of writing or reading? The way to acquire new and relevant knowledge today is quite different than just a decade ago. The effect on the schoolwork and other settings are noticeable. At the same time are the questions about the school's role in this fast growing development. Teachers need to know more about how students develop skills that help them understand and evaluate what they encounter through digital media and other resources.

"*Issues of lack of skills in managing technology resources will soon have the same weight as traditional questions of literacy and other basic skills. Being computer literate will be as important at it once was to read and manage paper and pencil"* (Säljö,2010)

Today´s students have grown up in a digital media landscape which looks radically different from what their teachers grew up in. The pupils have their own experiences, often formed from outside the school, about how the information from digital tools are created, published, organized and found. These experiences provide expectations for teaching in school that not always is in compliance with their teachers. How can the teachers meet up to these expectations? How does the classroom situation today look using digital tools?

Problem

How can digital tools be used in higher education, using a digital learning platform? What are the differences using a digital platform based on education as a learning tool in campus based courses contra distance based courses in practical group tasks?

Which differences and similarities are there between a campus-based course and distance – based course in terms of design and developing learning situations, activities, examinations, opportunities and support for learning in different study cultures and teaching approach (distance, flexible, campus located) in connection with the following: production and use of digital content in educational situations? It is interesting to analyze the communication via digital media between teachers and students and between students.

Gothenburg University has more and more distance courses in our technology courses in the teaching programs where we teach in laboratory subjects. It is interesting to develop a group project in which students collaborate better virtually. Since we have more and more distance courses where we teach in laboratory subjects, it is interesting to develop a group project in which students collaborates better virtually. Now that it is becoming normal for more courses to be provided at a distance, it is important for us to obtain an assessment task group that acts as a group task, where not all students are dividing the tasks among them. My questions are

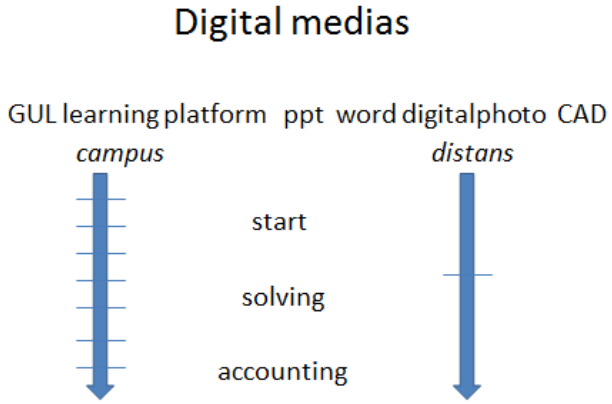
about the need to formulate and test an assessment task that currently is used. In our courses we can develop "an educational development project where you develop something that you have in your teaching practice."

The courses will continue in spring 2013 so it would be interesting to see if the example from ongoing courses can be used to develop a better task. I compared the same task comparing a distance based course with a campus-based course and compare how the virtual learning platform was handled by the students.

The information was presented at our learning platform. The task that was divided into three parts, all initiated digitally for both courses. It includes work with a diary, photo, digital documentation, drawing, discussions using the learning platform and a technical report. In addition, it is a part of the task to discuss solutions during a campus meeting. The task was finally presented with a powerpoint, technical report digitally and then discussed at the learning platform. My purpose is to create a task that has to be solved digitally and the students really have to collaborate via learning platform.

Results

I choose to focus on analyzing how students solved the practical group task, in terms of cooperation, assessment and evaluation. Characteristic was that the students who were campus-based collaborated and discussed the task more among themselves but the students studying remotely chose to divide the task and solve individual parts individually.



References

Säljö, Roger. (2010). Digital tools and challenges to institutional traditions of learning: technologies, social memory and the performative nature of learning. Article first published online: 12 JAN 2010

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Urban Education

Teaching and Learning to Teach with Recursive Mediated Learning Experiences

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Introduction – the educational landscape

In the United States, a child's home zip code, an indication of socioeconomic status, remains one of the strongest predictors of academic success and college completion. Disproportionality and relative risk ratio (National Education Association, 2007) for low SES, African American and Latino students as well as English Language Learners are evident (Kauchak and Eggen, 2008, National Center for Education Statistics, 2011a, National Center for Education Statistics, 2011b).

While inequities abound, the teaching task force remains somewhat of a "revolving door" with half of all new teachers leaving the profession within five years. Moreover, it is the nation's most impoverished, under-resourced urban districts that experience the highest attrition rates. (National Commission on Teaching and America's Future, 1996).

There is an alarming crisis in public education, especially for poor children, non-whites and English Language Learners. Meanwhile, with forty percent minority students but only five percent minority teachers, persistent, pervasive demographic dissonance diminishes positive relationships and effective communication between teachers and culturally and linguistically diverse students. (National Collaborative on Diversity in the Teaching Force, 2004).

Our charge

Given this crisis and dissonance, those responsible for preparing the next generation of educators need to identify innovative ways to confront bias, assumptions, pseudo-concepts, "status quo", to reject complicity, to help prospective teachers realize and move beyond their "situatedness", to foster a sense of social justice as well as a disposition toward resiliency and a spirit of relentlessness.

Recursive mediated learning experiences

Inspired by the work of Vygotsky and of Feuerstein and as a result of on-going action research that we are conducting in the teacher preparation program at our university, we propose recursive mediated learning experiences to strengthen the teaching and learning to teach curriculum and, ultimately, to nurture a more success-oriented schooling environment for all. We describe the intent and power behind educative tasks utilized in courses on campus and during student teaching, designed to draw future teachers "under the hood" and to lead them to fuse relevant theory and practice.

How one of the authors came to see with blindfolds on

Years ago, one of the authors volunteered for a community outreach program that paired university students with children given up by their families, confined to a state-run institution, children who were blind in addition to suffering from hearing loss and developmental delays.

Before meeting the children, volunteers had an hour-long orientation session where we were blind-folded. Instead of talking about handicapping conditions, instead of providing volunteers with a list of do's and don'ts, the trainers provided us with a learning task and an opportunity to put ourselves "in the shoes" of those with whom we would be working. In so doing, trainers empowered and guided us to see with blindfolds on, not only to approach our impending work as volunteers with empathy and insight but also to carry this knowledge forward for individual applications in subsequent work in other settings. This was truly a transformative experience, remembered vividly despite the more than forty years that separate the author from the event.

From blindfolds to other recursive mediated learning experiences

As teacher educators, we are intentionally designing robust experiences for our prospective teachers comparable to this blindfolding. We find activities by, in and through which they will also develop empathy and insight as they prepare to face daunting challenges that await them in P-12 schools.

Mediation

The concept of mediation, of coming between, as described by Vygotsky (Kozulin, 1998), provides us with an underlying theoretical framework. For Vygotsky, cognitive development is viewed from a sociocultural perspective. Mental processes humans use in thinking and solving problems are a consequence of psychological tools developed through mediational agents and in interaction with the culture in which they are immersed.

Feuerstein elaborates upon the essential characteristics of mediated learning experiences (Feuerstein et al, 2010). Mediators abandon the notion of limitedness, of intelligence as a fixed, immutable entity. Instead, mediators see intelligence as incremental, recognizing the potential within each of us for cognitive modifiability. As mediators in the context of a teacher education program, we seek to understand and focus upon prospective teacher needs and begin with where they are. We stand beside them as they confront deliberately chosen stimuli – learning tasks – and beside them as they respond to these stimuli. During the mediated learning experiences, we attend to and value prospective teacher responses, abandon a transmission model with pre-determined "correct" answers, allow for risk-taking in a safe, supportive setting and, in so doing, continue our own journeys as learners, expecting the unpredictable, ready to travel with our students into uncharted territories.

Through the mediational process, prospective teacher personal narratives and situatedness evolve, enabling generalization and transfer of knowledge gained from learning tasks, building bridges from these tasks to new situations and developing general strategies rather than narrow skills. As mediators, we help prospective teachers interpret what they accomplish. Although the mediated learning experiences are always relevant, they are also springboards to transcend tasks at hand.

Recursion

There are two ways for something to re-occur. "Iteration", doing the same process repeatedly, describes one form of recurrence. It is a linear process managed by a counter and involves identical replication. Iteration is involved in the transmission model of training. The trainer models and the trainees repeat exactly the same way or at least that is the goal. "Recursion", on the other hand, is a more subtle recurrence that involves fractalized, non-linear, self-similar growth through self-reference. Recursive systems transform through levels of self-similarity. Recurrence is everywhere because a recursive system is self composed, not simply repeated. Iteration copies past practices through outside agency. Recursion arises anew from within the essence of the requirements and enables significant transcendence. This distinction is at the heart of our success with recursive mediated learning experiences. The mediational tasks are significant transformative agents in our teaching and learning to teach curriculum. Each involves infinite self composition of socially appropriated, individually enacted pedagogy.

Recursion allows teacher educators, prospective teachers and, in turn, their future students, to continually zoom in on an infinite number of "small-scale" learning tasks that are self-similar and self-composed yet incredibly complex in fact, infinitely complex. Within each learning task lies opportunity to explore, to extract meaning, to discard pseudo, "unscientific" concepts (Smagorinsky et al, 2003) and to think in new ways. The recursive nature of each task makes more likely the appropriation of the very mediational process being used. Agency awaits and spurs prospective teachers onward toward increasing self-regulation and self-assurance.

A visual model

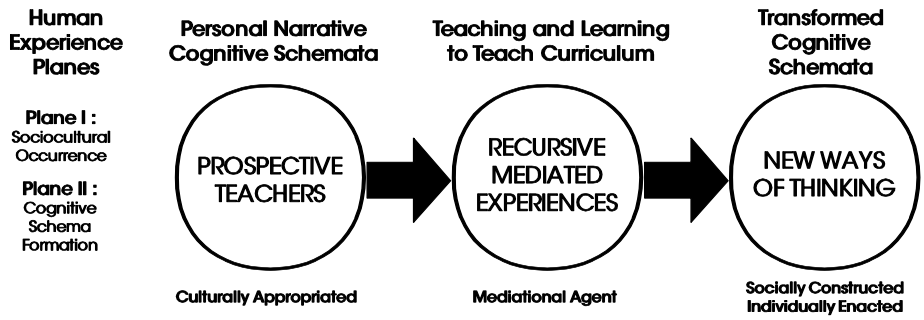

Figure 1: Recursive mediational dynamics of teaching and learning to teach.

(Adapted from an unpublished paper by J. Vagliardo, 2004)

While the explanatory visual model of the recursive mediational dynamics of teaching and learning to teach presented above may appear linear, it is not. Recursive layers abound within designed tasks and by means of interactions among all involved. Figure 1 provides a view of prospective teacher cognitive development promoted by recursive mediational means. Recursive mediated experiences – thoughtfully designed, self-composed learning tasks that comprise the focus of a reconstituted teaching and learning to teach curriculum –

lie between the prospective teachers and new ways of thinking. Teaching and learning to teach tasks are mediational agents that provide immersion in a problem setting and problem solving culture where extant cognitive schemata are intentionally unsettled and continuously transformed. The cognitive schemata appropriated by means of personal histories and experiences are challenged and evolve as a result of learning tasks designed and provided by university faculty, "more capable others" (Vygotsky, 1986).

Teaching and learning to teach begin with external manifestations of mental processes eventually internalized, becoming new forms of inner speech and cognition. Seen through the lens of Vygotsky and of Feuerstein, an appropriation of meaning occurs through the engagement of prospective teachers in a very different representational form of intellectual activity. Teaching and learning to teach in this way create in prospective teachers a repertoire of thinking tools that can be used to continuously engage in the quest for solutions to the most complex classroom problems. Additionally, the recursive nature of the engagement situates prospective teachers as partners with their mediators. That is to say, we, as teacher educators, engage simultaneously in the very transformative processes that we mediate with our students. Success ultimately changes the way in which meaning is made during consideration of each problem. Prospective teachers gain self-confidence as they learn to think differently in a larger set of didactic situations. Faculty likewise experience continuous growth by the mediational tasks that they have designed and implemented.

The learning context and examples of recursive mediated learning experiences

Our prospective teachers mirror national trends for U.S. public school teachers—the overwhelming majority of whom are white, female, have grown up in suburban or rural areas, and have little if any experience with cultural, racial or language difference. The design and success of specific mediated learning experiences are influenced by these demographics.

Several examples of recursive mediated learning experiences that we have used with our prospective teachers will be discussed. These tasks have exercised a profound impact upon prospective teacher cognitive development and upon acquisition of the tools necessary to become "more capable others" for their own students.

Example one: school ratings and inequities

Instead of "telling" prospective teachers about national concerns related to the quality of American schools and talking to them about issues of inequity in educational opportunities from one school and district to another (Boykin and Noguera, 2011), they are asked to provide personal empirical evidence. Instead of *covering* this content, prospective teachers are led to *uncover* it. (Wiggins and McTighe, 2005) They are asked to write down an overall rating of their school experience on a scale of 1 to 10, 1 signifying the lowest rating and 10 signifying highest. Then, they consider the following questions:

What rating did you give your school?

What factors led you to this rating?

What influence did academic rigor, personal relevance, interpersonal relationships or learning outcomes and performance have upon your rating?

Prospective teachers share their responses in pairs and whole class forums, identifying commonalities and differences. Next, they examine prior and current class aggregate data. Finally, based upon data displays, they consider the following questions:

What does the mean score tell you about your collective school experience?

What does the range reveal about variation from one school and district to another?

What are the factors that may be contributing to the difference in ratings?

How do your class ratings compare with the ratings of prior course sections?

How is analyzing classroom data different from analyzing data from national surveys?

What comparable activities might you use with your own students in your future classrooms to engage them in self-study?

Reflective writing prompts include:

(a) Looking at school ratings has led me to consider…; and

(b) Based upon consideration of the mean and range of school rating scores, as a future teacher, I …

Data drawn from prospective teacher experiences interpreted with guiding questions from the teacher educator allow personal narratives and cognitive schemata to intersect and engender new ways of thinking about what is going on in present-day schools.

Example two: campus map-making and diversity

Instead of telling our prospective teachers about diverse learner characteristics, we prompt them to explore their own diverse characteristics when asked to generate a map of our university campus completely from memory and then to compare and contrast what they have drawn (Singelis, 1998 and M. Vagliardo, 2008). Through this task, a "dominant" world view and "other" views are discovered. Student analyses of their own maps and the maps drawn by classmates lead them to conclude that they do not see the campus as it "really is" but rather they see the campus as "they are". They recognize their own "situatedness" and the "situatedness" of others. This perspective taking is vital to effective pedagogy in general but especially important in culturally and linguistically diverse settings. The more general principle – "We do not see the world the way it is, we see the world the way we are." – constitutes a significant new way of thinking that has been socially constructed and individually enacted. (See Figure 1.)

Example three: the French class and submersion

Many of our prospective teachers are English-only speakers who have never considered what life is like for an English Language Learner in an English-only classroom. Instead of "explaining" the difference between submersion and immersion, instead of telling them

about the importance of making content comprehensible, of lightening the linguistic load, of lowering children's affective filter and of respecting the silent period, an in-class simulation leads to personal, deep and lasting understanding, emotionally and intellectually. Again, instead of *covering* course content, prospective teachers are led to *uncover* it.

To introduce instructional do's and don'ts when working with English Language Learners, one of the authors teaches a fifteen minute class entirely in French to a group of prospective teachers in the class who have never studied the language. Following this submersion activity, "students" and "observers" consider questions and writing prompts individually, in pairs and then in a whole class de-briefing.

Students

How did you feel in a classroom where a language that you did not understand or speak was the language of instruction?

What was the gist of the lesson?

How did you know?

What else might have helped you better understand the content?

How else might you have been able to demonstrate your understanding?

Reflective writing prompts include:

(a) As a student in a French-language class, I…; and

(b) Based upon participation as a student in this submersion experience, as a future teacher of English Language Learners, I…

Observers

How did the students respond to the lesson?

Was there variation in response? If so, what accounts for this?

How did the teacher assist students in understanding content?

What else should the teacher have done to ensure student comprehension?

What else should the teacher have done so that students could demonstrate their learning?

Reflective writing prompts include:

(a) As an observer of non French-speaking students in a French-language class, I…; and

(b) Based upon my observation of this submersion simulation, as a future teacher of English Language Learners, I…

Subsequent reflections by students bear evidence of new ways of thinking. Karleigh B. captures the visceral impact and recursive nature of her learning:

"I won't soon forget the experience of sitting in class as a student participant in a French classroom. I was forced to reflect upon instructional strategies and the affective filter….It made me think about my own students when they don't understand….That feeling of

submersion and having literally no clue what was going on placed me in the shoes of the students that I pass every day in the hallway and teach in my classroom."

Example four: using the other hand

Will future teachers be flexible in pedagogical approach based upon the learning context after completing teacher education requirements and obtaining their certifications? Instead of presenting information about Universal Design for Learning, instead of telling teacher education candidates that they must educate all students and that it is their responsibility to design multiple means for presentation of content, student engagement and expression of learning (Gargiulo and Metcalf, 2010), an in-class experience leads to internalization of these critical understandings.

As part of a simulated geography lesson, prospective teachers draw an outline map of the continental U.S. and then cut out the outline map that they have traced. To trace and cut, they must *use their left hand if they are right-handed and their right hand if they are left-handed*.

Afterwards, students consider the following questions:

What was the impact on student engagement by having to trace and cut with the other hand?

Was the activity fair?

Did it yield an accurate snapshot of knowledge and skill?

What if right-handed students were permitted to use their dominant hands and only left-handed students had to use their right hands?

What other insights do you have based upon this experience related to accessibility, fairness and disabling vs. enabling curriculum?

In what ways does this experience demonstrate the principles and the importance of Universal Design for Learning?

In a recursive fashion, Amy E., for a subsequent project focusing upon accommodations and adaptations for students with special needs, writes:

"Every student has a different way of learning, even two students with the same disability. Creating projects that cannot be completed by certain students as in the example of asking right-handed students to write with their left hands, alienates them. Students feel as though there is something irreversibly wrong with them and cannot complete assignments."

Example five: who is the president?

Instead of telling prospective teachers about culturally responsive pedagogy, an in-class learning task uncovers assumptions about what constitutes common knowledge and again

leads prospective to a deeper understanding of situatedness. Prospective teachers are asked to answer the following six questions:

Who is the president?

When does the presidential term begin?

How long is the presidential term?

Can a first-time president be immediately re-elected?

Who is the country's most famous person?

What is the country's most famous landmark?

Responses are shared. Then, prospective teachers are told that the fact checks were for the Dominican Republic, not for the U.S.A. as they had all assumed.

Reflective writing prompts include:

(a) As a "student" responding to the fact check, I…

(b) Based upon my participation as a student in this fact check exercise, as a future teacher, I …

Working through this task, prospective teachers come to grips with consequences of unconscious, contextual, cultural assumptions rooted in personal narratives. Tim M. reflects:

"I never thought to consider countries other than my own. I was thrown into a situation where I could easily put my ELL students. Without qualifiers, questions can easily be misunderstood. This, in turn, sets students up for failure."

Example six: through the looking glass and preparing for student teaching

Instead of talking to pre-student teachers about the challenges of student teaching or to student teachers about their experiences in P-12 classrooms, both groups meet for an on-campus workshop dedicated to student teaching and what to expect. Visiting student teachers sit at different "stations" in the classroom talking with pre-student teaching students about what they wanted to know prior to student teaching, what they learned, what they still need and hope to learn as well as anything else that they want to share related to student teaching. Pre-student teachers assume the role of newspaper reporters recording student teacher remarks with the goal of writing articles for a class newspaper. Reporters move in small groups from one student teacher to another, learning about and from off-campus field experiences. These experiences are utilized as a platform for thinking about the teaching profession. All participants, including faculty, "relive", summarize, analyze, synthesize and evaluate as they communicate experiences with one another within a recursive context that enables transformative opportunities on multiple levels.

Analysis and conclusions

Focus upon recursive mediated learning experiences such as those described above has led us to rethink the teaching and learning to teach curriculum. The recursive nature of the

mediation has effects beyond those of a more linear approach. The "school ratings" activity, for example, allows prospective teachers to be in the very analysis they construct. Conversely, the "campus maps" sequence aims to relocate prospective teachers outside themselves, providing a broadened vision of their teaching responsibilities to include those students currently invisible as a consequence of being outside the dominant culture. The "French submersion" and "using the other hand" recursive tasks require prospective teachers to feel what English Language Learners feel and to experience what students with handicapping conditions experience. Recursive mediation promotes metacognition in the "who is the president?" activity, challenging assumptions of geopolitical context as well as self-imposed limitations on context in general. The final example, "through the looking glass", capitalizes on recursion to mediate the notion of professionalism on multiple levels simultaneously. By means of these interactions, prospective teachers learn to individually negotiate the uneven, fractalized space inherent in all professional conversation focused on teaching and learning. This sociocultural construction is enhanced by careful design and implementation of each activity. Intent for subgroups in the event is dually defined and functions on both external sociocultural and internal cognitive schema planes (See Figure 1.)

Development and refinement of activities that exploit the power of recursive mediated learning suggest a means of transforming our teaching and learning to teach curriculum from linear to non-linear. This transformation has many attributes, including the following:

1. Guiding but not dominating, moving away from a scripted transmission model into an asset-focused one
2. Encouraging new ways of thinking, student voice, agency and the subordination of teaching to learning exemplified by questions such as "What do you think about that?"
3. Honoring all participants, offering choice as well as empowering, allowing for the unpredictable, drawing out rather than pouring in
4. Enabling the appropriation of process as well as outcome.
5. Recognizing that tasks are self-similar and self-composed, that by its recursive nature, mediation educates all involved
6. Exploring the essence of issues, seeking to understand the deep core relational context involved, never exhausting the possibility for further insight or discovery, unendingly meaningful

It is through recursive mediated learning experiences that we immerse ourselves in the psychological space where teacher educators and prospective teachers share knowledge and understanding, where we seize opportunities to learn from one another. In this space, prospective teachers can shed past culturally appropriated blindfolds, take risks, rise up upon our shoulders and reach toward new ways of thinking.

References

Boykin, A. and Noguera, P. (2011). *Creating the Opportunity to Learn*. Alexandria, VA: Association for Supervision and Curriculum Development.

Feuerstein, R., Feuerstein, R. and Falik, L. (2010). *Mediated Learning and the Brain's Capacity for Change*. New York: NY: Teachers College Press.

Gargiulo, R. and Metcalf, D. (2010). *Teaching in today's inclusive classrooms: a Universal Design for Learning approach*. Belmont, CA: Wadsworth, Cengage Learning.

Kauchak, D. and Eggen, P. (2008) *Introduction to Teaching: Becoming a Professional*. Upper Saddle River, New Jersey: Pearson Education, Inc.

Kozulin, A. (1998). *Psychological Tools: A sociocultural approach to education*. Cambridge, MA: Harvard University Press.

National Center for Education Statistics (2011a). *Achievement Gaps*. Retrieved January 31, 2013 from:

http://nces.ed.gov/nationsreportcard/studies/gaps/ .

National Center for Education Statistics (2011b). *Trends in High School Drop Out Rates*.

Retrieved January 31, 2013 from:

http://nces.ed.gov/pubs2011/dropout08/glossary.asp .

National Collaborative on Diversity in the Teaching Force (2004). *Assessment of Diversity in America's Teaching Force: A Call to Action*. Retrieved January 31, 2013 from:

http://www.ate1.org/pubs/uploads/diversityreport.pdf .

National Commission on Teaching and America's Future (1996). *What Matters Most: Teaching for America's Future*. Retrieved January 31, 2013 from:

http://nctaf.org/wp-content/uploads/2012/01/WhatMattersMost.pdf .

National Education Association (2007). *Truth in Labeling: Disproportionality in Special Education*. Retrieved January 31, 2013 from:

http://www.nea.org/assets/docs/HE/EW-TruthInLabeling.pdf .

Singelis, T. M. (Editor) (1998). *Teaching about culture, ethnicity and diversity*. Thousand Oaks, CA: Sage Publications.

Smagorinsky, P., Cook L., and Johnson, T. (2003). *The Twisting Path of Concept Development in Learning to Teach*. Retrieved January 31, 2013 from:

http://www.albany.edu/cela/reports/smagtwisting16002.pdf .

Vagliardo, J. (2004). *Mediating Cognitive Development in Heuristic Problem Solving: Curriculum Qualities and Dimensions*. Unpublished manuscript.

Vagliardo, M. (2008). Exploring the Efficacy of Vygotsky's Theories in Urban Field Experiences in Bao, J. Vold, L. and Tidwell, M. (Editors). *Preparing Urban Teachers Collaboratively in Philadelphia: Practices, Research and Reflection*. El Cajon, CA: National Social Science Press, pp. 36-53.

Vygotsky, L. S. (1986). *Thought and Language*. Cambridge, MA: MIT Press.

Wiggins, G. and McTighe, J. (2005). *Understanding by Design, Expanded Second Edition*, Alexandria, VA: Association for Supervision and Curriculum Development.

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