The Proceedings of the 24th Annual Conference of the European Teacher Education Network

ETEN Proceedings Editors
José Portela & Isabel Vale - Instituto Politécnico de Viana do Castelo, Portugal
Francyne Huckaby - Texas Christian University, USA
George Bieger - Indiana University of Pennsylvania, USA
ETEN 24
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Preface

This publication reports papers presented at the 24th annual ETEN Conference in Leipzig, Germany, which was hosted by the Faculty of Education of the University of Leipzig, in April 2014.

The theme for the conference was The Concept of “Bildung” in Teacher Education.

The keynote speaker, Prof. Dr. Jürgen Oelkers, a German educationalist and Professor Emeritus at the University of Zurich offered an inspirational presentation.

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 translate some of the presentations on the following Thematic Interest Groups (TIG):

- Art Education
- Democracy, Religion and Culture
- Educational Technology
- Internationalisation
- Mathematics Education
- Reflective Practice and Teaching for Thinking
- Science Education
- 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.

José Portela        Isabel Vale        Francyne Huckaby        George Bieger
Instituto Politécnico de Viana do Castelo, Portugal        Texas Christian University, USA        Indiana University of Pennsylvania, USA
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Art Education
The Impact of Music Activities on Foreign Language, English Learning for Young Children

Liza Lee, Shu-Chuan Lin
Chaoyang University of Technology
Taiwan

ABSTRACT

The purpose of the study was to examine the impact of music activities on foreign language, English learning for children at age four. The methodology of the study used a quantitative analysis to measure validity based on assessment scales used in the observation forms by the observers and a qualitative study using interviews with classroom teachers and parents. A group of children at age four was selected by purposive sampling to participate in the study. The duration was 18 weeks with 45-minute instructional sessions twice per week. The teaching content included a Hello Song, Letter Song, Musical Storytelling, Music Appreciation, Musical Movement and Goodbye Song. The study applied the thematic music elements to the teaching content. The results were the following:

1. Based on the comparison of pre- and post-test and observation forms, the quantitative scores for the participants were clearly enhanced.
2. Based on the observation forms, teacher’s observation and parental reports, the use of the music, musical instruments and supplemental materials for the participants’ foreign language, English learning were developed.

Keywords: Music Activities, Foreign Language, English, Young Children

INTRODUCTION

Background

With globalization and global competition, it is clear that education is critically important for the future success of young people in Taiwan. The Ministry of Education and other experts agree that initiatives such as creating an “all-English environment” are necessary to enable Taiwan to participate in the global economy. As anyone who has tried to learn a foreign language will agree, the process can be very difficult and requires that educators find unique ways in which to help their students.
As an educator and researcher in the U.S. and Taiwan, the researcher has found that music – and music education – can play a crucial role in helping children to learn a second language, English. In the United States the researcher created, tested and implemented a music program to help Chinese-American children learn Chinese language and culture. This curriculum, and the dissertation based on it, drew on years of research and work in music education. The key to the program is using music as a means to help children become familiar with a foreign language and culture. The work has been successful as it is based on the leading contemporary research that shows clearly that music is essential to learning in all other areas, and is a huge benefit to aiding children in language learning.

The purpose of the study

The purpose of the study was to examine the impact of music activities on English learning for children at age four. The specific purposes of the study were:

1. Evaluating the use of music activities on promoting English ability of understanding and expression for children at age four.
2. Evaluating the effectiveness of a music curriculum on enhancing foreign language development for children at age four.

Research Questions

According to the purposes of the study, the research questions were:

1. Will the use of music activities promote English ability of understanding and expression for children at age four?
2. What is an effective music curriculum for enhancing foreign language development?

LITERATURE REVIEW
Music offers its own benefits - similar and complimentary to the benefits of learning a second language. Like language, there is documented research (Lathom-Radocy, 2002) that shows early exposure to music can lead to increased brain density and an increased skill in math and logic. However, the music seems to stimulate a different yet complimentary portion of the brain. It is noted that both are important to a child's development and it is crucial to incorporate music as a means of teaching language.

The linkage between music and language learning

Most infants grow fast from crying to babbling, which enables them to consciously experiment with prosodic elements of speech, such as tone, pauses, timbre, and stress. Loewy (2004) states, “This music of speech is the earliest dimension of language that is used and understood by children” (pp. 61). The babble introduces words with consonant – vowel – consonant constructions and semantic placement in musical phrases. Real spoken words and sentences will follow up soon.

Music contains authentic, informal language that is natural to the ear. Songs offer precious resources that develop students’ abilities in listening, speaking, reading and writing (Saricoban et al., 2010). A research from the University of Edinburgh (Ludke, Ferreira, & Overy, 2013) found that adults who sang words or short phrases from a foreign language while learning were twice as good at speaking it later. It is thought that by listening to words that are sung, and by singing them back, the technique takes advantage of the strong links between music and memory. This study provides the first experimental evidence that a listen-and-repeat singing method can support foreign language learning, and opens the door for future research in this area.

The use of music in English as a Foreign Language (EFL) classroom
Lynch (2006) indicated that music can improve listening comprehension skills in EFL learners by exposing them to new vocabulary, expressions, idioms, and accents. Researcher (Mora, 2000) asserts that music and language should both be used in the EFL classroom. She asserts that verbal practice associated to musical information seems to be more memorable, using melody with new phrases lowers the student's anxiety, and foreign sounds paired with music will be stored in long-term musical memory and accessible for mental rehearsal and memorization. In Mora’s study (2000), she states that repetition is one of the basic ways the brain remembers material. She describes why using a melodic approach works: “The musicality of speech has an effect not only on the pronunciation skills of EFL students but also on their entire language acquisition process” (Mora, 2000, pp. 148). Music and the musicality of language teaching provide a rich environment of sound and cuts out other auditory distractions. The musical method enhances the EFL learner's awareness of sounds, rhythms, pauses, and intonations and encourages them develops linguistic fluency through imitation and subvocal rehearsal (Mora, 2000, pp. 152).

The benefits of music for young children’s language learning

Research studies (Daniels, 2003; Hatasa, 2002) have long and consistently proven that early, positive, age appropriate experiences with music have a remarkable impact on children's second language learning, such as pronunciation, vocabulary, comprehension and expression.

Most people learn song lyrics faster than words and melodies tend to store easier in the memory even though the meaning of the words might not be clear. “Through the use of songs, rhymes and music, children are able to retain much larger amounts of information” (Ortis, 2008, p. 207).
Researcher proposes that language should be considered not in a cognitive context, but in a musical one, which she calls the Musical Stages of Speech (Loewy, 2004). Music contains a variety of vocabulary that can easily be adjusted to the appropriate age or level of learning. It is full of phrases and expressions that will prepare children for using genuine language. It teaches grammar and many songs can be used as grammar exercises (Saricoban & Metin, 2010).

Researcher asserts that a child can imitate the rhythm and musical contours of the language long before he can say the words, and caretakers of young children will agree. She says that musical aspects of language, tone, pauses, stress, and timbre are sonorous units into which phonemes, the consonant and vowel sounds of language, are later placed (Mora, 2000).

Methodology

The methodology of the study used a quantitative analysis to measure validity based on assessment scales used with a “1-5” scale structured observation forms by three trained observers and qualitative data using interviews with parents, classroom teachers and anecdotal unstructured observation reports from three trained observers.

The Participant and Setting

Originally there were twenty-three participants, nine boys and fourteen girls, aged four. At the end, one male participant dropped out due to the family reasons. All of the participants had no foreign language experience. They were enrolled in a private kindergarten in Taichung, central Taiwan and selected by purposive sampling to take part in the study.
**Duration**

This was an 18-week study, with 45-minute sessions twice per week of specific, study-focused music activities.

**The Curriculum Design**

The curriculum framework has been tested by the hands-on teaching for 10 years. The curriculum contents included a Hello Song, Letter Song, Musical Storytelling, Music Appreciation, Musical Movement and Goodbye Song.

The curriculum included two thematic topics containing different objects:

<table>
<thead>
<tr>
<th>Themes</th>
<th>Musical Elements</th>
<th>Language Goals</th>
<th>Target Objectives</th>
<th>Description &amp; Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(The Black Witch &amp; White Witch)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Stop &amp; Go</td>
<td></td>
<td></td>
<td>1. Movement Responses</td>
<td>Using facial expressions, gestures, and body language to respond.</td>
</tr>
<tr>
<td>2. Short &amp; Long</td>
<td></td>
<td></td>
<td>2. Follow the instructor’s direction</td>
<td>Following the instructor’s directions to do the proper movements.</td>
</tr>
<tr>
<td>3. Tone Colors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Parts</td>
<td></td>
<td>Language Goals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Where are my Facial features)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Stop &amp; Go</td>
<td></td>
<td>1. Movement Responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. High &amp; Low</td>
<td></td>
<td>2. Follow the instructor’s direction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Loud &amp; Soft</td>
<td></td>
<td>3. Imitation of speaking, chanting or singing</td>
<td></td>
<td>Imitating instructor’s speaking, chanting or singing contents either segment or whole content.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Expressing the musical meaning by playing instruments</td>
<td></td>
<td>Expressing the meaning of the music or songs by playing instruments, changing or singing spontaneously.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Simple answer</td>
<td></td>
<td>Answering the instructor’s questions spontaneously.</td>
</tr>
</tbody>
</table>

11
Assessment

The assessment instruments included pre-test and post-test forms administered by the researcher, semi-structured observation forms to gather data on English abilities of understanding and expression.

For the assessment standard of understanding of English, a score of “1” indicated all the participants had no proficiency across 6 activities, such as the ability to use facial expressions, gestures, and body language to respond to the instructor; imitate the instructor’s speaking or chanting contents either in segments or the whole content. A score of “2” showed the participants had 1%~25% understanding of English by following the instructor’s directions or body language. A score of “3” showed the participants had 26%~50% understanding of English. A score of “4” showed the participants had 51%~90% understanding of English. A score of “5” showed the participant had full, 100% proficiency.

For the assessment standard of English expression, a score of a score of “1” indicated all the participants had no proficiency across 6 categories, such as the ability to use verbal language to respond to the instructor. A score of “2” indicated the participants used verbal language to answer 1%~25% questions. A score of “3” indicated the participants used verbal language to answer 26%~ 50% questions. A score of “4” indicated the participants used verbal language to answer 51%~90% questions. A score of “5” showed all the participants had full ability of English expression and responded to the instructor by verbal language spontaneously.

Social Validity

In order to support objective results, a feedback form was completed by six parents, two kindergarten teachers. 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. There was 28 score of “5” recorded, 12 scores of “4” for progress, and no scores indicating the parent, and teachers felt participants had made fair progress, or had regressed (no “1” to “3” scores).

For the second session, respondents gave a score of “1” if they felt the participant had shown a low level of progress in English ability of understanding and expression or other areas of development; they gave “5” scores if they observed that the participants had made a high level of progress. There was 6 score of “5” recorded, 14 scores of “4” for progress, 4 scores of “3” for no changes, and no scores indicating the parent and teachers felt the participant had made regressed, or had regressed a lot (no “1” to “2” scores).

Table 1 Social Validity

<table>
<thead>
<tr>
<th>Items</th>
<th>Feedback Questions</th>
<th>Strongly Disagreed (1)</th>
<th>Disagreed (2)</th>
<th>No comments (3)</th>
<th>Agreed (4)</th>
<th>Strongly Agreed (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part I Goals</td>
<td>1. The research teaching has a crucial meaning for the children under six.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2. The research goals fit the needs of young children’s English learning.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>3. Music activities have positive effects on the young children’s English learning.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4. Music activities provide a safe, not dangerous learning method and good for young children’s English learning.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5. You accept the use of Music activities to teach young children English</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Total of the percentage</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>30%</td>
<td>70%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items</th>
<th>Feedback Questions</th>
<th>Regressed a lot (1)</th>
<th>Regressed (2)</th>
<th>No changes (3)</th>
<th>Progressed (4)</th>
<th>Progressed a lot (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part II Learning</td>
<td>1. After taking the music class, the participants’ ability of English understanding is</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Changes</td>
<td>Total of the percentage</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>37.5%</td>
<td>62.5%</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>2. After taking the research class, the participants’ ability of English expression is</td>
<td>0 0 2 6 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total of the percentage</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>3. After taking the research class, the participants’ other developments, such as: music, cognition, social interaction, physical movement etc. are</td>
<td>0 0 2 5 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total of the percentage</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>62.5%</td>
<td>12.5%</td>
<td></td>
</tr>
</tbody>
</table>

If you have other thoughts or opinions other than the description above, please write down here:

**RESULTS**

The results were based on the observation forms, interview reports and teaching logs. The comparison of pre-test and post-test is made by the researcher and shown in figure 1. The participants were scored on a “1-5” scale on a range of aspects related to learning changes of English understanding in the activities by the researcher.

Figure 1: Pre-test & Post-test of the participants’ English ability
Figure 1 indicates the comparison of the participants’ English ability between the beginning and the end. The score shows the participants’ progress from the beginning of 1 to the end of 4.

Figure 2: The weekly changes of the participants’ ability of English learning

Participants’ narrative

Figure 2 shows the average of weekly changes of the participants’ English understanding by the observers. The participants’ narrative is based on the observation forms from three observers and interviews with teachers and parents.

Baseline

According to interviews with the kindergarten teachers and parents, this was a brand new learning experience for the children to participate in the study. Especially it was their first school experience. There were only five children, 3 girls and 2 boys attended private music lesson after school. All of the children had no foreign language experience. One parent
is an English teacher at a local junior high school, but never speaks English to her child at home.

Theme I: Colors — “The Black Witch and White Witch”

At week one, the participants were silent most of the time since they could not understand a word during the entire music session. After the instructor sang goodbye to the children, one girl seemed to relieve from her tension by signing out loud and said:

“Whew, time’s up finally.” (OA02182011, OB02182011, OC02182011)

At week two, when the instructor first time introduced the musical story, The Black Witch and White Witch, to the class, the class became more energetic by giggling and started talking to each other. When one youngest boy saw the witches, he started crying. Some older children told him not to be afraid of those fake puppets.

“Don’t cry! They are fake.” (OA02252011, OB02252011)
“Come on, it’s not real.” (OA02252011, OB02252011)
“I am not afraid of Witches.” (OA02252011, OC02252011)

From week three to week five, the children were more used to the learning style. Therefore, there were more children followed the instructions by showing their body responses and playing on an instruments, such as when they heard the music playing, they would be banging on the drums; when they heard the music stopped, few would say “shh” to remind those who were still banging.

“Sh, don’t play!” (OA03042011, OB03112011, OC03182011)
“Be quiet!” (OB03042011, OA03112011, OC03182011)

From week six to week eight, over 4 out of 5 children showed their learning motivation by actively attending each activity. Some children were able to answer simple words in English, such as: yes, no, ok etc. Some children would sing the story songs during the school day.
“2/3 children were able to answer the instructor’s questions by saying yes in English.” (OB03252011, OC03252011)

“Child E sang Put-Away Song before going home.” (TB03172011)

By the end of the theme I, due to the familiarity of the teaching content, all the children were able to respond to the instructor by body language. Although there were some children’s responses made by imitating either from the instructor or peers, it did not affect the result of English learning.

In sum, through the theme I, from week one to nine, all the children became more and more attentive to the class, so the average score went up gradually and stably.

Theme II: Body parts — “Where are my facial features?”

During the second phase, the instructor used a new theme to introduce the body parts. Due to the unfamiliarity, the average score went down at week ten. Most children had no responses to the new vocabulary and activities. There were only few children able to answer yes or no even they did not really understand.

When the instructor asked “Could you show me your eyes?” Children D & F answered “Yes”. But they didn’t follow up to show their eyes. (OA04292011, OB04292011, OC04292011)

Because of the previous learning experience, most children at theme II learned more smoothly and faster than the first stage. The average score at week ten was down to 2.33 due to the new vocabulary and content.

All the children love to play in the class. Some children would play the role in the story during their free time. (TA05022011)

From week 11 to week 15, the average score went up gradually. It indicated the effectiveness of the study. At week 16 the reason made the score went down a bit was due to
the graduation rehearsal on the same day. All the children became excited and distracted from
the event.

All the children were so excited about putting on their costumes and getting on the stage. (TA06102011, TB06102011)

By the end of the study, from week 17 to week 18, all the children showed their stability on their performance of learning English.

Most of the children were able to follow the instructor’s directions even they couldn’t respond in English. (OA06242011, OB06242011, OC06242011)
The combination of singing, movement, games and art make the classes dynamic and fun, and hold the child’s interest. (TA06242011, TB06242011)

Curriculum Analysis

The curriculum analysis was based on the results:

1. Singing activities: Hello Song, Attendant Song, Goodbye Song

Among the teaching activities, songs are found to be the most effective ones to be used for children in the study. Using songs to signal changes helps children understand what is going on and also helps save the instructor’s voice. Moreover songs contain words and expressions of high frequency and offer repetition for young children’s language learning.

Songs are a great way for children to learn English. (TA06242011, PF06242011)
Some children come to class bouncing off the walls, while others are quite reserved. Starting class with an active song allows the higher energy children to move out their energies and the lower energy children to pep up a little. (TA06242011, TB06242011)
While gathering the children, I sand “Come & Follow me”. It’s the most effective way to gather children between every activity. (RL06242011)

2. Musical movement

Most young children love to move. It is a natural way for them to learn. They can make shapes with their fingers, arms, or whole bodies. They can create movements for verbs, or act out nouns or adjectives. Movement can be varied by moving in one place, with a partner, taking turns with a group, or even moving around the classroom.
The combination of music, singing, movement and games make the classes dynamic and fun, and hold the child's interest. (TA06242011, TB06242011)

My child liked to hold my hands to do the movements she learned in Liza’s class at home. Most of the time, she would pretend she was the teacher. I find out that her physical movement is doing better than before. The music class did help my child a lot. I hope Liza will keep the music class for next semester. Not only my child’s wish, also the parents. (PL06272011)

3. Music Appreciation

Using contrastive music pieces is a good way for teaching young children to understand music concepts and verbal language. Music with contrastive elements could motivate young children do movement spontaneously and learn spoken language simultaneously. For example: For “Stop and Go” game, When the music starts, children do the movement the instructor select (such as “jump”) in one place until the music stops and the instructor calls out “stop!” Praise those children who set a good example by stopping after the movement and remaining still.

The CDs Liza provided are fun, so the children tend to listen to them during the school time. (TA06242011, TB06242011)

My child loves Liza’s CDs so much, K would ask for listening to ABC song in the car again and again when we go out. (PK06292011)

4. Musical storytelling

Musical storytelling is an ideal tool for enhancing young children’s language ability and attention span. When a storyteller tends to use more repetition, sounds, music, and gestures than a person merely reading a story, children will be more attentive to the activity. Using instruments to represent each character in the story is also a fun way to get children’s attention.

Child T is very shy and quiet all the time. After attending Liza’s music class, he would repeat the song and chanting in the story all the time. He couldn’t go to sleep without telling the story to us at night. (PK06292011)

The most miracle thing for the children in the class is Liza’s Musical Storytelling Time. We reviewed some part of the story activities during the school time. Children became more energetic and enthusiastic by saying “I know it, I know it” “Ooh yeh, I am right!” (TA06242011, TB06242011)

In summary, music is an effective tool for teaching English, especially to young children as long as it is fun and interesting. Music and songs are useful venue and bounce around in
children's head long after the lesson is over. Young children pick up vocabulary, sentence structures, and the rhythm of the language simply by doing what they already love to do.

CONCLUSIONS AND RECOMMENDATIONS

The results of the study provide support for the effectiveness of music activities in enhancing young children’s English ability. It is clear to researchers, educators and parents that music is a crucial tool for enabling the language learning process and will give children a boost in language development. Other than language benefits music is:

1. Music is a non-threatening way to make learning English more fun. In this way, children’s learning motivation will be enhanced.
2. Music offers shy or introverted children more frequent and varied ways to participate.
3. Music and playing instruments can be used to reinforce children’s attention span.
4. Music, action songs and playing instruments help children develop gross and fine motor skills that are associated with learning to read.

In summary, children are natural music lovers. There is no need to convince them that it will help them learn.

Recommendations

Music is a very effective tool that should play a larger role in the foreign language classroom because it offers a great variety that appeal to children. Most children enjoy music and therefore it should increase their interest in learning a new language in a very entertaining way. Educators need to be willing to incorporate music in their lessons in order to better enhance their students’ learning.
Music can be used to remove language barriers. More music in every language classroom will inspire more children to become creative and independent. Music will allow educators and their students to understand each other and connect in a new way.

Music is a valuable teaching tool. It makes complex concepts more accessible and enjoyable. It facilitates language learning.

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Democracy, Religion and Culture
Religion, Worldview, and Values in an International Class

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ABSTRACT:

Students attending an international course, “Multicultural Identity” (MCI), in Oslo, come from many different European countries, some also from Asia, Africa, Latin-America or the USA. They meet and mingle daily and learn cultural codes and values from each other, in classes of 24-32 students. During the course, they are challenged to present their own culture, with its values and norms, to their fellow-students, an eye-opener toward traits and values of their own culture. They are, furthermore, exposed to their own stereotypes and identity-markers, giving reason to think through their own attitudes toward peoples and cultures with different characteristics and values. Many of the students come from a secularized modern society in Europe, and in this encounter discover some deep structures in their own society, becoming more conscious of the religious roots and framework. Class-discussions go high under topics such as Cultural Identity and Cultural Awareness, Alternative Value Dimensions, Culture and Religion, Multicultural Competence, and Culture and Ethical Challenges. The students are also exposed to the multicultural environment of the city of Oslo, with more than 25% immigrant population, and schools and kindergartens in some areas of the town with as many as 80-90% of minority-background.

Through an extensive questionnaire and interviews, to the classes of 2005-12, supplemented by impressions from class-discussions, we analyze the attitudes to Religion, Worldview and Values, as related to their home-culture, as well as the culture of the place of study.

Keywords: Cultural awareness, Cultural codes, Worldview, Religion in Culture, Multicultural Identity.

1.0. Introduction

Why do students go abroad on exchange-programs? How do they react to the new environment, to the international setting? How do they respond to different cultural codes and worldview among their new classmates? We address some of these issues, basing this article on an extensive questionnaire and interviews to the first 8 classes of a course on multicultural issues (hereafter called MCI) in Oslo, Norway, from 2005 to 2012. We challenge the students to express how their attitudes, values, and convictions have been influenced by the course. The main issues mentioned are discussed in relation to theory, both the required readings of the course, as well as supplementary literature of
the multicultural field in general.

1.1. The MCI-course

The “Multicultural Identity in a Global World” (MCI) is a one-term course of 30 ECTS credits. The classes have varied from 24 to 32 students from 12-16 different countries, mainly Europe, including the Eastern part, but also 2-5 students in each class from other parts of the world, as well as a few national students. The MCI-students in the period of 2005-2012 total 215, and have come from 36 countries. The reasons for joining the course are quite varied. Some of the students focus on the content of the course, the main concepts of culture and identity. They are concerned with how they can make a positive contribution in the multicultural society, how they can make a difference for children growing up in today’s globalized world. Others just want to go abroad.

There are two main focal concepts of the course, that of “culture” and “identity”, both with reference to childhood and education. Some of the sub-themes are cultural identity and cultural awareness, alternative value dimensions, culture and religion, multicultural competence, and culture and ethical challenges. The cultural background of each participant is a vital resource in the discussions, and the city of Oslo, increasingly multicultural, is an important arena for contextualization. The course offers fieldwork in schools and kindergartens, which becomes an important basis for their reports, often in comparison with experiences from their own background. Most of the students are midway in their teacher education, either for primary school or for kindergarten.

1.2 Materials and Methods

Of all the 158 students who attended the MCI-course during the first research period of 2005-2010, 129 (82%) responded to the 66 questions, of which 10 were open-spaced for personal comments. Later, 3 students from each class were chosen for an in-depth qualitative survey, with 20 open questions (see Hoaas 2010, and samples below).

The questionnaire asked for feedback on both structure of the course, practical issues, topics treated, teaching methods, class-management, relations to teachers and fellow-students, the requirements, the form of the exams, their own input, the relevance
of the course for themselves, and finally, how the course had any influence on their attitudes toward other cultures. The students for the qualitative survey were chosen both to give a broad range of countries as well as diverse educational background. The total material is therefore partially quantitative and partially qualitative. However, this article is mainly based on the open questions in the questionnaire and on the in-depth survey of the selected students, as these questions more specifically relates to our present research question. Methodological and ethical aspects are treated in line with Kvale and Brinkmann’s principles, and the interviews, including those from the classes of 2011 and 2012, have focused on the understanding of concepts rather than of facts and practical issues, as well as having observed also the main elements of discoursive interviews (see chaps. 4 and 8; cf. Hammersley & Atkinson).

In addition to these questionnaires and interviews, the article also incorporates impressions from class-work and on-going communication with the students during their 4 month period of study. Thus, the author is also a participant observer to the process as the curriculum of the course becomes a natural outline for most of the topics for discussion (Hammersley & Atkinson, chaps 4 and 5). Some introductory questions have already been mentioned, but our main point of research is as follows: “How are the values and worldview of exchange-students influenced by their attendance in an international course, being exposed to the multicultural issues treated?”

1.3 Background of the MCI-Students.

The exchange-students come from a variety of backgrounds. Even though they are mostly from within Europe, their cultural context, including political climate, is widely differing. Some come from countries with dramatic events in the recent past, such as the Baltics, Hungary, and the Czech Republic. Others have experienced severe struggles as to the position of their own language. For both Belgian, Swiss, and Catalan students their mother-tongue as their identity-marker was considered very important. For others their cultural identity seemed rather vague, at least at the outset.

Culture presentations from every country represented in the class, is part of the syllabus. The students are free to focus on whatever they choose, in the overall framework of identity and education. It may be surprising that these young students in
their early twenties very often focus primarily on traditional aspects of their culture, such as major festivals, nature, architecture, costumes, food, drinks, and music. History, religion and traditional values are in the fore, rather than raising recent critical and sensitive issues in their home-society. Major symbols are presented such as the flag, colors, buildings, as well as music, arts, and sports, also focusing on famous people, including the royal families and top politicians.

As for the religious context, the variety among the students was even greater. Some of the them would seem rather “secularized”, such as many of the Germans and the Nordic students, and had only a distant notion of the place of religion in society. Others are brought up in strong religious traditions in their previous schooling, such as some of the Dutch and Belgian students. Still others are brought up in a society dominated and partly controlled by the religious establishment, which caused some of these students to react against that kind of religious guardianship. This could be true of the Spanish or Italian students. Still others are brought up in a society, which for half a century has been characterized by the atheistic values of the state, but where people now again may freely engage in religious activities, such as in Hungary, the Czech Republic, and the Baltics. For this last group it becomes almost a paradox that in the previous Christian Western Europe, the religious values have become almost invisible.

2. Encountering Norwegian Schools and kindergartens

In their fieldwork, the MCI-students visit schools and kindergartens also in parts of the city where there are large concentrations of immigrants. Some of the students live in student hostels in such areas, and are surprised to see many more mosques than churches. Even students from the Netherlands and Germany, who actually have large immigrant groups, are somewhat surprised that so many ethnic groups and languages are present in the same school or kindergarten, even in the same classes. They are more used to seeing the different ethnic groups clustered in different parts of the big cities, and therefore belonging to different schools. The exposure to the local multicultural environment is therefore a surprise for many, unexpected in a Nordic country, especially for the students from East-Europe, since their immigrant population is still rather limited.
2.1 Religion, Culture and Tradition.

In the schools and the kindergartens they encounter also some of the values and subjects treated there which causes further surprise. The Value-clauses of both schools and kindergartens are explicit in underlining the humanistic and Christian heritage, as we see from the following Value-clause in school:

*Education and training shall be based on fundamental values in Christian and humanist heritage and traditions, such as respect for human dignity and nature, on intellectual freedom, charity, forgiveness, equality and solidarity, values that also appear in different religions and beliefs and are rooted in human rights.*

*Education and training shall help increase the knowledge and understanding of the national cultural heritage and our common international cultural traditions.* (Education Act, 2008)

They furthermore encounter a subject unfamiliar to most of the MCI-students, the RLE-subject (Religion, Philosophy of Life, Ethics). The Subject came into being in 1967 as KRL (Christianity, Religion, Philosophy of Life), as a more inclusive subject than the previous subject of Christianity. It became a much debated subject, and went through a number of reforms, presently as RLE, a compulsory subject for all pupils in Norwegian elementary school. The focus is now on plurality of faiths and life-view, with a strong emphasis on common ethical values. And yet, also in this subject, the above mentioned cultural values are very evident, underlining Christianity as cultural heritage in the Norwegian society. The subject is introduced as follows:

“*Knowledge of religions and philosophies of life is important for human beings to understand their existence and to gain an understanding of cultures within one's own society and in societies around the world. Children and adolescents of today encounter an overwhelming amount of cultural influence and traditional values. The Christian faith and traditions have characterised European and Norwegian culture for centuries. At the same time, traditional humanistic values have brought to western cultural heritage a wider scope of understanding. Religious and ethical diversity are becoming more and more important in society in general. Familiarising oneself with different religions, philosophies of life, ethics and philosophies is an important precondition for understanding and interpreting our lives, and for gaining ethical awareness and understanding across religious faiths and cultural borders.”* (RLE-Curriculum, 2011)

The Value-clause for Norwegian kindergartens is quite similar as in the Kindergarten Act:

“... The Kindergarten shall be based on fundamental values in the Christian and humanist heritage and tradition, such as respect for human dignity and nature, on intellectual freedom, charity, forgiveness, equality and solidarity, values that also appear in different
religions and beliefs and are rooted in human rights... Kindergartens shall promote equality and work against all forms of discrimination.” (Kindergarten Act, 2005).

The MCI-students have met the above principles and in their Fieldwork (visiting schools and kgs.), in their daily activities and subjects, including the RLE subject. The seasonal activities became an integrated part of the education, such as preparing for Easter with crafts, stories, and dramas. Or visiting the local church for input by the minister, through songs, music or art. The MCI-students also visited an exhibition called «Holy Rooms» at the International Culture Center and Museum, where the major religions exhibited a Church, Mosque, Synagogue, Gurdwara, Hindu and Buddhist temple, in a minimized format. This was also an exhibition common for classes in elementary school, in an effort of relating religious values in a very concrete fashion.

2.2 Nordic «Child-centered Pedagogy»

Several of the MCI-students have their Fieldwork in local kindergartens. They are prepared through studies of the above Value-clause and the pedagogical principles underlined both in the so-called Kindergarten Act, as well as in the more practical Framework-plan which all kindergartens are obliged to follow. Most representative are the two following phrases in the Kindergarten Act:

Care, upbringing and learning in kindergartens shall promote human dignity, equality, intellectual freedom, tolerance, health and an appreciation of sustainable development.
Kindergartens shall impart values and culture, provide room for children’s own cultural creativity and help to ensure that all children experience happiness and ability to cope in a social and cultural community. (Kindergarten Act, 2005, Section 2, Content of kindergartens)

The following ethical values are underlined: “Friendship, Helpfulness, Respect, Tolerance, Solidarity, and Empathy. The Pedagogical principles for reaching these goals are the concepts of Recognition, Acceptance, Mutuality, and Dialogue. The lingering question is of course, “How do we teach small children these values?” Also in the Convention of the Rights of the Child (CRC), we encounter fundamental values, such as the “3 P’s”, that of Provision, Protection and Participation. The issues are debated in the MCI, particularly Participation, as that is specified in the Kindergarten Act:

- Children in kindergartens shall have the right to express their views on the day-to-day activities of the kindergarten.
- Children shall regularly be given the opportunity to take active part in planning and assessing the activities of the kindergarten.
- Children’s views shall be given due weight according to their age and maturity.

(Kindergarten Act, 2005, Section 3, Children’s right to participation)

This is a clear expression of a strong emphasis in Nordic Pedagogy, the children’s right to participate in all matters of relevance to the well-being of the child, and expresses explicitly what democracy is all about also in early childhood.

3. Findings and Topics for Discussion.

We will single out those topics most relevant to our research question, also including some issues visualizing a broader context. Some student-quotations illustrate the themes in question.

3.1 Perception of Culture

There are many definitions of culture. Clifford Geertz, (1973, p.89), describes culture as “a system of inherited conceptions expressed in symbolic forms by means of which people communicate, perpetuate, and develop their knowledge about and attitudes toward life”. Crucial expressions here are “inherited conceptions” and “perpetuate and develop”, combining both the unchanging aspect, often derogatory called essentialism, with the dynamic and always evolving element. Samovar (2010, p.22) maintains that “Culture is a way of organizing the world, offering a group-worldview, a framework, allowing the members to make sense of themselves and of the world”. Culture teaches the child how to behave in an acceptable way, and protects people from the unknown, and covers according to Hofstede the main elements found in all cultures, such as history, religion, values, social organization, and language.

This analysis has given reason for the students to focus with fresh eyes on the values of their own culture, often in a critical way. It would also be fitting to refer to Kluckhohn and Strodtbeck’s analysis, with their focus on “value-orientation”, claiming that everybody turn to their cultures for answers to the fundamental questions, concerning human nature, nature, time, activity, and behavior.

Present trends to disassociate culture from national or ethnic connotations, such as Holliday, Piller, Parekh, May, and Scollon, focusing rather on characteristic traits of
human behavior and interest crossing borders, are present among some of our students, but only to a certain degree. On the contrary, national and ethnic peculiarities seem to catch the attention of the students, not the least to see their own culture both as unique as well as in a broader geographic context, for example that of Europe, as in Burgess. Many students protest the notion that this is a prejudice, or “neo-essentialism” or “chauvinism”, as in Piller (2011, p.15), and are a bit surprised that there should be a contradiction between Hofstede’s categories on the one hand, and the more trendy expression of “global cosmopolitanism” on the other, as in Holliday (2011, p.11). May not the two be interrelated and complementary? This question is related to elements in the debate on “Acculturation”, focusing on both the psychological aspects as well as the variety of perception within the concept of acculturation, as by Sam & Berry (2006). The MCI-course gives space to such a discussion, also that of critical multiculturalism, as in May (1999) and Baumann (1999).

The MCI-students are required to present their own culture to the class, which is to a large degree delivered within a national and ethnic framework. They find it interesting to listen to what their peer-students have to say about their own culture (89% in the questionnaire), but it’s also challenging to think through what values in their own culture they would like to relate to the class (90%). S-05 (student of 2005-class): “I understood that behind a behavior there is a complex system of symbols, meanings, both personal and cultural. Identity and need for identity is flexible and changing and very often the differences are in the level of form not in concept”.

S-07: “Since I have been brought up within three completely different cultures, it gave me an exceptional insight to understand many things about myself better...When I ‘flex’ between different cultures, I am now much more aware of my own behavior”.

It becomes evident that educational systems are indeed culturally dependent and have roots and inherent values that cannot be overlooked, well underlined by Sonia Nieto (in May 1999, chap.8, and in Banks, 2009, chap.5). Why is it natural in some countries to have religious symbols in the classroom, such as in Italy, while it is unthinkable in others? Why is the national flag used frequently in some countries, while very seldom in others? Some of the students, especially those from Southern Europe, are very critical of the ruling political establishment in their home-countries, they would rather identify with protest-movements, with humanistic and international ideals.
Through the MCI-course the students become even more aware of this dilemma, and even though it may be a kind of adventure-trip, they discover deeper aspects of other cultures through their personal contacts in the course. Some of the students comment on their cultural identity:

S-08: “I was born in a mixed family so I always had contact with different cultures simultaneously, but never with so many at once. I believe that the MCI-course made me more conscious both of my personal values and cultural identity as well as of my ‘global’ identity”.

S-05: “I have always hated my country, but when I felt down, maybe missing friends or family, I discovered how I loved some ‘normal’ [home country] attitudes”.

3.2 Cultural Awareness and Stereotypes

In the first class-session of the MCI-course, the students are confronted with stereotypes and prejudices, in the topics of “Cultural Identity” and “Cultural Awareness”. The students have barely become acquainted with each-other and are challenged to write down what stereotypes/biases/ prejudices they might have toward each-other. Sometimes, this exercise starts with a great degree of caution, so as not to offend any of the newly acquired friends, already on the first day. However, usually someone breaks the ice with a direct characteristic of another country, and others follow suit. It could be how Southern Europeans view the Germans, the Northern Europeans toward the Italians, the English toward the French or vice versa, but probably the most common one is the attitude of many Europeans toward the Americans, with strong stereotypes. Several of the students are willing to be quite frank about their prejudices, and even if this exercise is somewhat sensitive, it ends in a friendly and pleasant atmosphere.

This focus on stereotypes and prejudices is dealt with in many of the different sections of the MCI-course, both in the sociological parts on anti-racism and globalization, as by Donnelly and Giddens (cf. Beck, and Steger), and within the topics on culture and religion, especially by McGuire and Woodhead, as well as the pedagogical topics of identity-construction, as related by Gundara and Kjørholt. The students are also much concerned about this issue during their fieldwork in kindergartens and schools. They are reminded that knowledge and education is the key to liberate oneself from prejudices.
Stereotypes can often be complicated. You sometimes see what you want to see, or as Gudykunst (p.140) expresses it: “Stereotypes can create self-fulfilling prophecies. Individuals tend to see behavior that confirms their expectations, even when it is absent”. To discover such mechanisms is vital, and also part of the objective of the MCI-course. Several of the students gave feedback to that effect. It was frightening to discover that stereotypes so easily colored one’s attitudes, but also liberating to become aware of this process, not the least in relation to the cultural interaction as in Spencer-Oatey, as well as in the thorough treatment of culture-shock in Ward.

With increased knowledge and awareness of stereotypes in general, the students usually become more critical of issues in their home-country, issues they didn’t feel strongly about previously. For some, it was also an eye-opener for several positive aspects of their own culture.
S-06: “It was interesting to be in such an international class, where almost everybody was very proud of their countries and it did make me reflect on my own national identity and my relationship with it”, referring to herself as a Third Culture Kid, an expression from Pollock & Van Reken.
S-08: “As a result of my work, I try and advocate for refugees and migrants whenever I face prejudice, when I feel I can do something about it”.
S-10: “I guess what surprised me is that there still are so many stereotypes in the world and that even people my age, even fellow MCI-students, who have unlimited access to information and live in a free world, consider them as the truth”.

3.3 Children and Identity. Challenges in the Multicultural Kindergarten/school

An important topic in the MCI-course is “Childhood and Identity Construction”, where articles such as Kjørholt “The Participating Child”, and Jans “Children as citizens” are in focus. As we saw from the Kindergarten Act, the principle of children’s participation is fundamental in Nordic pedagogy, and even though this aspect is not unknown in other European countries, the impact seems less obvious. What is the content of “the competent child”? What do we mean by saying that a child is a resource or subject? In what way is democracy being taught and practiced in the kindergarten? Such questions are raised and discussed in the MCI-course, and it is surprising to many of
the students that children’s perspectives are given such weight. This is thoroughly treated by Berit Bae, in her article “Qualitative Aspects of Dialogue between Children and Adults in Pre-school Institutions”. Similarly, Eide and Winger focus on the reciprocity in the communication between adults and children in their research on interviewing children. Here we encounter some of the most characteristic elements of Nordic Early Childhood pedagogy, expounding the concept of mutual recognition. Many of the MCI-students find this emphasis both surprising and interesting, not the least when related to the multicultural kindergartens and schools they become acquainted with.

The MCI-students see classes with fewer children per adult than they are used to, and even sometimes an assistant for only one particular child, which would never happen in their home-country. They also sometimes meet mother-tongue-assistants, especially in the kindergartens, and realize that they can be of valuable help for some of the children. They find that inclusion may function, although at different levels. They are also surprised to see how the RLE-subject works (Religion, Life-View and Ethics), being compulsory for all pupils in school. Here the children learn about each-others’ festivals, religious traditions and stories, and can thereby understand better what is important for the identity of each child. Knowledge creates understanding, and understanding in turn creates a more tolerant and open atmosphere. It is a cornerstone in building democracy.

3.4 Culture and Worldview, Culture and Religion

These topics are treated in the MCI-course, under such sub-headings as “The Deep Structures of Culture”, and “Worldview: Cultural Explanations of Life and Death”. Samovar (p.98), holds that “worldview is at the core of human behaviour since it helps define perceptions of reality and instructs the individual on how to function effectively within their perceived reality”. Thus, the worldview helps people to make sense out of reality, and is an overarching set of values, which most people within a culture adhere to.

A definition of religion is appropriate at this point, “Religion can be understood as a system of conceptions of faith, which gives direction and content to the thinking of the individuals, their way of evaluation and action”, (Dahl, p.132, my translation). We distinguish some of the elements that all science of religion must have in mind, as expressed in Ninian Smart’s 7 Dimensions of religion: the dogmatic, ethic, mythical,
rituals, experiences, social, and material dimension. These dimensions give meaning to the MCI-students, as verbalized in class-discussions. Their fragmented impressions of the place of religion in society become clearer, and so does their own relation to religion, seeing which elements of religion that are meaningful to them.

Adhering to McGuire’s approach, one does not primarily ask what the religion teaches, but what religion does for the individual. Religion expounds the unknown, personifies the ideals, integrates culture, legitimates the social system and interprets human existence. As religion for many brings meaning into their experiences, people will therefore choose meaning from a greater system, from a worldview. Meaning becomes acquired. Clifford Geertz holds to a functional perception of religion, and sees religion as “a template for meaning, [which] not only interprets reality but also shapes it” (Geertz 1966, p.40), and that “people interpret events and experiences as meaningful by linking them with a larger sense of order” (p.12).

McGuire, referring to Berger, claims that a system of meaning demands a “social basis”, a “plausibility structure”, that will give social support to its members. That gives a strong sense of belonging for the majority, and likewise a strong desire among minorities to mark their own belonging, sometimes legitimizing the creation of ghettos, or cultural and ethnic enclaves, where the religious belonging, a kind of “collective representation”, becomes a vital characteristic trait. Many MCI-students on their daily trip to the university through some parts of the city, claim to see such enclaves, a kind of visible “social basis”, especially around the mosques in the area. The reasoning behind such ghettos may well be the desire to preserve their faith and tradition, but also to protect against undesired influences from the majority society, especially as to the moral standards of the secularized Nordic country.

The discussions in the MCI-class will therefore often deal with the place of religion within the scope of cultural identity. For some, this is less important, while for others, quite fundamental, as their religious belief is not just a cultural trait, but a personal conviction. Many will discover, without regard of their own personal attitudes and experiences, that their own culture is highly influenced by religion, be it in language, symbols, different rituals, structures, and not the least, in art. They realize that religion often legitimates and justifies social actions. Religion has a place in all societies, as a kind of collective representation, sometimes very visible, at other times more behind the
scene. Some MCI-students comment on these issues, primarily in relation to values.

S-07: “I was surprised to listen to children of different faiths tell about their festivals in such an open manner, and even sing one their religious songs. I was not used to that. They did not seem embarrassed and the others did not make fun of them.”

S-09: “[The MCI-course] provided me a means to understand my own cultural values in a theoretical framework. Also, it boosted my ethical values by helping me being more tolerant to other cultures, respecting the dignity of each culture”.

S-11: “The MCI-course helped me redefine my own world-view, and I became more conscious of my values”. S-12: “In my work as a kindergarten teacher, as a parent and a friend, I think it is important to further pass on values, such as was discussed in the course, and to act by them”.

4. Concluding Remarks

When asked about the most valuable experiences resulting from this period abroad, the most prevalent answers are: lasting cross-cultural friendships, becoming more self-confident and independent, and having been able to adapt to a foreign environment. The MCI-course had furthermore opened up for dialogue on issues sometimes considered personal and difficult to discuss, such as faith and world-view. They found that topics of religion and faith are not topics of a special realm for special people, but an area of thinking and experience that is most fundamental for achieving a friendly and open communication between people of differing backgrounds.

At the outset we asked why students go on exchange-programs. We also asked how their attitudes, values, and convictions have been influenced through the MCI-course. We have not answered that in full, but we have commented on some relevant issues in relation to basic theory. As active citizens in a multicultural society, they claim that their level of consciousness related to these issues has been raised, considering themselves as representatives of the new global cosmopolitanism, that Holliday speaks of. Yet, at the same time, they also underline the characteristic traits of their own ethnic or national background. Both perspectives are significant elements of the topics treated in the MCI-course, and are also noted as partial answers to our initial research questions. Many of the MCI-students have a desire “to make a difference”. They are genuinely
concerned about how they can change the world, in their immediate society, in school and kindergarten, in social work, and youth-institutions. Their responses confirm that they have acquired at least a partial “Multicultural Competence”, which they were not very conscious of in advance, but now see as a valuable tool for their coming profession.

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Educational Technology
EduTab – facilitating ICT integration through continuous support and Design Based Research

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Abstract
Digital devices and media have become commonplace in the hands of teachers and students alike, while it’s still seldom encountered in instructional settings in schools in Germany. Taking a closer look at the barriers and constraints of ICT use and integration while referring to preliminary results of an active research project, this papers aim is to propose an alternative way of supporting teachers and schools. Building on the principles of Design Based Research (DBR) institutes of teacher education currently have a rare opportunity to not just embrace a new methodology, but a chance to actively change the use of ICT in schools.

Key words: Information and Communication Technology (ICT), Design-based research (DBR), Learning Management Systems (LMS), Open Educational Resources (OER)

On the way into school – reasons for an integration of ICT

Information and Communication Technology (ICT) used to be a fringe topic of schools and educational science alike. While strong research efforts were directed at a micro didactical level, investigating the use of different ICTs and their respective effects and impacts on students and lessons, rather little was done on the integration and sustainability of ICT initiatives. Positive effects on the student, class and school level have changed this focus somewhat on the challenge of sustainable ICT integration for educational research and teacher education (Eickelmann, 2013; Tulodziecki & Grafe, 2011).

ICT enable a higher flexibility of learning processes, leaving students to individually decide the time, place and topic of their work. Technologies such as learning management systems (LMS) provide working materials at any time and can easily be updated and adapted to new findings (Koldeová, 2013). Concerning the quality of teaching, ICT can enhance innovative teaching and learning methods due to materials, authentic information and a different approach to the engagement of the students (Pineida, 2011).
Although a significant body of literature comes to the conclusion, that ICT in classroom might not work miracles, but can easily improve the quality of learning and teaching (Haddad & Jurich, 2002), the question arises, why so many teachers are still hesitant to engage.

**Explaining the gap – barriers of ICT use in school**

Obstacles for the integration of ICT by teachers into their classrooms have been divided by Ertmer (1999; Bingimlas, 2009; Donnelly, McGarr, & O’Reilly, 2011) into first and second order barriers. First order barriers consist mainly of “those obstacles that are extrinsic to teachers” (Ertmer, 1999, p. 50) and usually mean the lack of adequate hard- and software. It is rather an economical, than pedagogical problem, that was repeatedly used in the past as the main explanation for a still technological free classroom. But the ongoing proliferation of digital devices and the now ubiquitous present of tablets, laptops and smartphones among teachers and students alike, seem to contradict this already (Kerres, Heinen, & Stratmann, 2012).

It is therefore interesting to take a closer look at those second order barriers, which Ertmer defined as “rooted in teachers' underlying beliefs about teaching and learning and […] that interfere with or impede fundamental change” (1999, p. 51). This intrinsic dimension can be divided into (at least) the three different areas of knowledge, (pedagogical) belief systems and cultural dependencies (Ertmer & Ottenbreit-Leftwich 2010).

Knowledge in this context means more than just how to use specific hard- and software, but rather a specific pedagogical knowledge of how to address students' needs with the aid of technology. Koehler and Mishra (2009) described this problem in their TPACK framework, which emphasizes the need to combine general pedagogical skills, with the ability to use technology and the specific content of their respective subjects. While first order barriers left teachers without a choice, the idea behind TPACK is to empower “teachers to be competent to teach with technology in the classroom [and] make sensible choices in their uses of technology when teaching specific content to a specific target group” (Tondeur et al., 2012, p. 135).
It is obvious that this must intersect with teachers' beliefs and it has been shown, that a more constructivist belief correlates with stronger integration of technology (Ertmer & Ottenbreit-Leftwich, 2010, p. 262), yet beliefs are more persistent than misconceptions or a lack of knowledge.

The cultural dimension shows the individual path dependencies of past decisions and is mostly a structural problem, as the single teacher has just limited influence on the “interlocking cultural, social, and organizational contexts in which they live and work” (Somekh, 2008, p. 450).

So it is not surprising that schools still “struggle to optimize use of the technology, due to a lack of appropriate professional development, [...] the ongoing costs and [...] organizational challenges, such as lack of personal to manage community access” (Usun, 2009, p. 332). Bofinger (2007), who conducted two surveys with Bavarian teachers in 2002 and 2006 respectively, came to the conclusion, that the discussion about new media had changed from one about ‘extra burden for teachers’ to one of ‘a lack of competencies’.

**EduTab – Tablets in school and how to get started**

The Sixth Progress Report of the Enquete Commission on "Internet and Digital Society" formulated the far reaching recommendations to equip every high-school student with a mobile computer and to accompany this with appropriate educational concepts and a change in teacher education (Bundestag, 2013). This – if taken serious – would mean a leap from a student/computer ratio of 6:1\(^1\) to a 1:1 setting, which hardly a few teachers in Saxony have ever encountered.

For this reason the State Ministry for Science and Art together with the European Social Fund (ESF) founded the project `EduTab - technology tailored for educational needs` in 2013 at the Center of Teacher Education and School Research (CTS) at the University of Leipzig. As part of the project two high-schools with different profiles were asked to take part in a field experiment of ICT integration. One of those had already established itself as an institution with a firm stance on project based learning, but had barely any use of ICT, while the other

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\(^1\) This ratio includes computer in teacher rooms, libraries and other sources, who are not accessible by students and was given on an informal inquiry. The last public available estimate is from 2008 an 10:1 (KMK, 2008).
just recently had invested in technological equipment (IWB, server, Wifi), but had yet to introduce this into its curriculum and everyday use. A school-wide systematic use of ICT was hindered in both cases by the lack of a sustainable strategy. As part of the cooperation we offered interested teachers a set of tablet-PCs and technical support, while letting the teacher decide when and how to use them.

**Preliminary results of the project and methodological questions**

The main focus of EduTab is the collaboration between teachers and researchers on behalf of the implementation of ICT in the cooperating schools. Starting from the methodological background of Design Based Research (DBR) the project is based on an active exchange and close contact between teachers and researchers.

DBR has had a strong influence of the educational research of the last decade by becoming an ever stronger desiderata of a ‘grounded research’ that is addressing teachers needs and getting them involved, instead of treating them as a research subject (Anderson & Shattuck, 2012). DBR has been defined “as a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories” (Wang & Hannafin, 2005, p. 7).

Given the “constraints of classroom settings, real world data collection is challenging [while] laboratory experiments are also difficult to conduct due to lack of equipment and safety issues” (Dede et al. 2004: 158). DBR owns its recent ‘success’ to the fact that while its reducing costs for experimental designs, “the resulting principles are perceived as having greater external validity than those developed in laboratory settings” (Wang & Hannafin, 2005, p. 9).

Furthermore it fosters the participation of teachers, by changing their role from a research subject to an active stakeholder. Especially when dealing with the integration of new media, it is mandatory that schools and research project work on par together. As part of the research method of DBR, school and researchers can be flexible and spontaneous working on the issues that arise only during the integration of new media in school.
But efforts to evaluate the activities in the project – both of teachers and pupils – have let to the difficult methodological question on how digital media can be explored (Bachmair, 2013), which seems to have no easy answer. Participant observations of the ‘tablet lessons’ and interviews with the students, teachers and the technical support help us to learn more on how tablets are being implemented in school and how teachers and students learn to cope with this new learning situation (Coleman, 2010). Another, yet rarely used source of information are the process-produced data, which can – to the least – produce a measure of engagement.

For the purpose of this paper two preliminary results shall be emphasized:

**1. Barriers and chances of ICT**

The implementation of tablets in the two different schools diverged strongly, but generally confirmed the impact of the already known barriers of ICT integration. Of the eight teachers involved not one changed its general lessons outlay and so the ‘success’ of those lessons varied strongly. While some teacher (already) focused on a student-centered project-based learning, in which task and topics could be chosen by the students, they were able to enrich the lesson, yet others had a strong teacher-centered approach and became quickly frustrated by the new source of distraction.

The focus on active and collaborative practice of ICT use in class is recently an emerging branch in educational research and until now mainly studied in the field of higher education (Pinheiro & Simões, 2012). Our chosen focus on the practice of ICT use in class is the question of self-regulation. This goal becomes more important in the light of the digital society and its endless access to information and the resulting risk of it distraction. “Self-regulated learning is an active, constructive process whereby learners set goals for their learning and attempt to monitor, regulate and control their cognition, motivation, and behavior, guided and constrained by their goals and contextual features on the environment” (Saks & Leijen, 2014, p. 191).

Observing and assisting the students and teachers first contact with ICT enriched learning settings was both demanding and encouraging. Particularly striking was the character of self-regulation in the project-based learning. Even though the students in the fifth grade
(between nine and ten years old) had never studied with tablets before, their first contact was almost natural. We assume, that the students did so well, because they are used to working in self-regulated settings. As mentioned earlier and seeming tautological, it is the style of teaching (and learning) which seems to be the single strongest predictor of a successful integration of ICT. Furthermore learning with the aid of a digital device demands an individual scope for each learner within the learning setting. Participant observations within the project EduTab showed how self-evident students used this freedom and participated actively on their individual learning goals, while they worked on different subjects with different equipment at different places. This interpretation refers to our first research findings that we will deepen in the course of the project.

**2. Access and management of learning materials**

Interviews with the teachers however underlined a common problem that all teacher faced: a lack of adequate materials. While the literature on ICT barriers mainly focuses on hard- and software (or the lack thereof) the existence of content that is compatible with the specific technology (Tablets, IWB, different OS, etc.) and the specific curriculum seems to be taken for granted (Clements & Pawlowski, 2012).

Teachers reported repeatedly that in preparation of their lessons they've spend significantly more time on the search and examination of materials, while being frustrated by the results. Moreover, it turned out that, although they had a sketchy idea what were allowed and what wasn’t according to copyright laws, so far none of them had ever reflected on their own usage of copyrighted material. After just a couple of lessons it became obvious for them, that their policy of ‘use what you can find’ was in a gray zone at best.

Our experience in a parallel pre-service teacher seminar on new media in school corroborated this realization, as none of the master students had a concrete idea of what they were allowed to use and how to distinguish between different licenses.

Hence the use of Open Educational Resources (OER), the creation and dissemination of own materials and the restriction due to ownership and copyright laws is a pivot and therefore

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2 The seminar took place at the university of Leipzig and was held by Hagen von Hermanni and Karla Müller with the title: „ICT in school“ in 2013 and 2014.
crucial to levy ICT use in Saxony. Any future attempts of establishing a sustainable use of ICT in (high) schools should address the creation of materials and their dissemination among teachers (i.e. Professional Development).

Future prospects of the project: A joint platform for education and research

The technological progress of the past fifteen years has left institutions of teacher education outrun, like the usage of technology by students has outrun teacher’s ICT- implementations in lessons. In the curricula of pre-service teacher education in Germany (especially Saxony) topics like ICT and TPACK, copyright law and OER are still underrepresented and discussed theoretically (if at all), rather than tried practically.

It is an aged wisdom that “traditional technology-training programs do not help teachers acquire the skills needed to use technology in ways that facilitate fundamental, qualitative changes in the nature of teaching and learning” (Shaw et al. 1997: 33; taken here from Ertmer 1999: 58)

Building on the advice of Dede (2008) and MacDonald (2008) we are therefore suggesting a combined approach of DBR and ICT-PD (ICT-professional development) using a joint platform for researchers and teachers, which offers the latter three complementary features:

1. A free-to-use LMS that is hosted on university servers and allows teachers to prepare lessons and engage students. While this will be of little help for those who teach at school which have neither (sufficient) internet nor Wi-Fi, it offers others a secure space, which can be used with clear conscience concerning privacy and child protective laws. The alternative would be either employing a software as a service (SaaS) from a third party, including all the above mentioned legal problems, or a school hosted solution, which would require the school to have a leased line to enable students using the LMS from home.

2. A platform for OER, which content will be provided by researchers, pre-service teachers and teachers alike and be compatible with the LMS. The content will be guided towards local curricula and created by teacher educators and pre-service teacher students, as part of their studies.

3. An online platform for PD seminars, which enable teachers to partake at their own pace and a time of their choosing. “An obvious challenge for all professional development programs is
to prepare in-service teachers in ways and at times that meet their schedules, locations, and support mechanisms. With respect to the emergence and application of technologies in education, more and more professional development programs must focus on guiding teachers to teach from an integrated knowledge structure of teaching their content with technology” (Niess, Lee, Sadri, & Suharwoto, 2006).

We cannot expect teachers to develop a comprehensive understanding of the workings and usage of ICT if we do not let them assume a student’s perspective. It is therefore essential that PD seminars utilize the same concepts and technologies which are to be taught.

Although there are already several platforms offering similar features, the combination of guided instruction, open materials and the technical means are seldom3 and in the local context nonexistent. This arrangements will further allow us to get pre-service teachers involved in the design and revision of OER materials, which in light of the still evolving ICT solutions, will be an essential 21. Century teacher skill.

Wang & Hannafin (2005) postulated a set of principles which DBR should follow and described a workflow that starts with a specific design and (should) end with the validation of “the Generalizability of the Design” (Wang & Hannafin 2005: 19). As Macdonald has noted: “To begin with someone else’s plan, without providing ownership to participants over the research process, will be less likely lead to success for the participants and researchers [...] both researchers and teachers should explicitly articulate their own goals and collaboratively assess their possible alignment before proceeding with the research” (Macdonald, 2008).

Facilitating these ‘alignments’ presupposes a “community of practice” (Macdonald, 2008) to give teachers a backchannel through which they can give input on future research topics and report on their experiences.

The proposed platform would offer involved teachers lessons plans and materials (delivering instructions per online seminars, if required) and an opportunity to try them out, while asking for their feedback and a permit for evaluation (done by the researchers and pre-service teachers).

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3 One example is the non-profit organization CK-12, which offers online services as well as curriculum tailored OER materials.
A typical project lifecycle would therefore start with specific problem (Popper, 1962), brought forward by a teacher asking for help and voted on by other community members for prioritization. After deliberation the mandate for a specific design would be given to a group of pre-service teacher students from one of the perpetually running ICT seminars. They would collaborate with the teacher, conceive an initial design and evaluation strategy and document the practical lessons, provided their semester plans permit to do so. We had similar arrangements in the past with considerable results and are therefore confident about its feasibility (Müller, Spendrin, & Hermanni, 2013). Resulting resources, instructions and the (anonymous) evaluation results will be recorded on the OER platform and contribute to an ever growing repository of free-to-use teaching materials.

The PD-platform will help to disseminate general principles and applications of ICT⁴, while cross-referencing said materials and encourage the use of the LMS.

The LMS on the other hand is more than just an altruistic offer, but together with the PD-platform, a means to realize “Research methodologies that do not simply replicate methods used in studying face-to-face professional development but instead take advantage of the unique data collection possible in online programs” (Dede et al. 2008: 16). A research design which does not take advantage of user generated data seems unfit for exploring virtual classrooms. But as long as universities do not offer such virtual working spaces, teachers will have to rely on third party solutions, which not only means, that this kind of data is not available for research, but also slipped from the control of their teachers.

Summary and prospect

Carlson & Gladio’s reminder that “educational technology is not, and never will be, transformative on its own [...] computers cannot replace teachers - teachers are the key to whether technology is used appropriately and effectively” (2002, p. 119), might be more than 10 years old, but is still unrefuted.

While there is an ongoing discussion about the role of teachers in the 21. Century, few, if any, question the role university will have to play. This paper – and the proposed platform –

⁴ We are currently preparing the first three online PD seminars, which will cover the handling of Moodle (a LMS), Mahara (a ePortfolio application) and basics of OER. We consider these three topics as – among others – common ground in the use of ICT.
are supposed to give an outlook on the challenges ahead and how a ‘grass root’ organization could change our access to research and the dissemination of its results. It is also a direct call to consider the yet unexplored research data, which Dede reminds mean “diversifying the number of outcome measures to offer higher degrees of validity to authentic practice [and] extending the analysis of outcome measures across time to allow measurement of different stages of teacher change/learning and impact on students” (2008, p. 19).

**Literature**


Internationalization
The Internet & Internationalization in Primary through Secondary Schools

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Abstract

The purpose of this paper is to provide examples of ways in which the Internet can be used to connect primary through secondary school-age students with people around the world for virtual learning exchanges. In fewer than three years our school has used the Internet to link our students with people in 19 schools in 11 countries on five continents. Student ages range from 5 to 18 years old, and they communicate mainly through blogs/discussion boards, Skype, and videos. Through these mediums and others, students have shared information about their local cultures, histories, and geographies, discussed U.S. civil rights issues, climate change, poetry, chemistry, and mathematics, and they played chess matches and debated contemporary global issues. Using the Internet to connect students develops 21st century communication and collaboration skills, teaches students about various parts of the world, and provides students with different perspectives on life. In this paper, I highlight several examples of these exchanges to help other educators prepare their students to internationalize their classrooms in educational, fun, interactive, and meaningful ways.

Key Words: Blogs, Internet, Internationalization, Virtual Learning

Internationalizing, or globalizing, our classrooms has become a driving force in 21st century education. Government agencies, schools, private corporations, and individual educators recognize the value of an international education starting at a young age, and there is a—seemingly—limitless host of resources available online and in print for that purpose. Although most people who play a role in a school’s, community’s, or country’s education system agree in the importance of internationalization in the classroom, few understand how to integrate it into the current curriculum without detracting too much from other educational goals. The potential for additional financial, personnel, and other resources also complicates the smooth creation of a globalized classroom. Further, because internationalization in the classroom is a fairly recent addition for most schools, there is a lack of consensus over what that looks like at the applied level. We have an idea of what internationalization, or globalization, means, but what does a “global” or “international” classroom look like, and what are students learning in such an educational environment?
The implementation of a global education is not new. Indeed, works published in 1979 by Anderson and Becker are perfect examples of the academic attention this topic was receiving in some circles over 30 years ago, indicating that internationalization in the classroom was already taking place in some parts of the world. More recently, education scholars have provided 21st century research using samples from various parts of the world about how and why to globalize education (see e.g., DeHaan 2014, Gaudelli 2003, Ortloff et al. 2013, Reimers 2010, Sato 2013, Sparapani et al. 2014, Yemini 2014). Beyond academic examples, influential public and not-for-profit organizations have also published global education checklists (Czarra 2012), defined “global competence” (Asia Society 2014), and offered specific “strategies” to improve education and prioritize international goals (U.S. Department of Education 2012).

This paper is a case study, summarizing the results of one school’s attempt to build an international program using virtual and in-person exchanges between students, faculty, and others from different parts of the globe. While the examples for this paper focus on this school’s experiences, the resources discussed are applicable in many educational institutions, and it is hoped that by sharing the successes and weaknesses of this school’s program, many other institutions worldwide will be able to internationalize their primary through secondary classrooms in educational, fun, interactive, and meaningful ways.

For the purposes of this study, a “global” or “internationalized” classroom refers to an educational setting (not, necessarily, a traditional “classroom” with desks, chairs, students, and a teacher) in which students and teachers are learning about and connecting with (directly or indirectly, in person or virtually) a variety of cultures and people. It is a setting in which an objective is to help students view the world through a variety of lenses. Based on this understanding, any subject (e.g., mathematics, hard sciences, social studies, language (national and world languages), literature, physical education, etc.) can be enhanced by adding lessons, units, or examples from other cultures—thus creating an internationalized classroom.
A brief case study description

The case study for this paper is a private school\(^2\) (not-for-profit and independent of state or federal funding) in the southern U.S.A. with students ages 5-18. Acceptance to the school is based on quantitative testing and in-person interviews. Typical of many similar private college preparatory schools in the U.S.A., most students pay tuition to attend (approximately US$18,000-20,000 annually, or €13,225-14,700—US$1 = € 0.73); however, many students receive some level of need-based financial aid. With just over 50 years of history, the school has grown from a handful of high school boys to a school of approximately 950 boys and girls.

In 2011, with the assistance of a generous private donor, the school decided to establish a full-time position to make internationalization a school priority. The mission of the program is to “connect [their] students with, and educate them about, people from different cultures around the world.” Because the school aims to fulfill this mission for all students, the program has relied heavily on the Internet as a way to create these exchanges for entire grades of students—not just individuals or classes. To-date, they have connected with people in 11 countries by using blogs, discussion boards, Skype, video conferencing, online gaming, email, and videos posted on YouTube, Vimeo, and shared in Dropbox. In short, the Internet has enabled the school to internationalize most primary level classes and several secondary subjects in a short amount of time.

Virtual learning: Using the Internet for internationalization

“Virtual learning” (a.k.a. “online learning”) can refer to any form of learning that uses the Internet, rather than face-to-face or in-person, for learning exchanges. In this paper, I focus on blogs/discussion boards because of our successes with those platforms and the flexibility they offer educators.

Blogs and discussion boards

Blogs (an abbreviation for “weblogs”) are Web sites that provide “a means for presenting introspective thinking, a record of daily events, a tool for political mobilization, a journalists project, an open-ended literary experiment, a constant exhibition of images and videos, and in many cases, a combination of all the above” (Siles 2011:737-738). Discussion boards also
allow for sharing of ideas in this manner, except that discussion boards tend to be look and operate more like a specific program or software (e.g., Blackboard, Blogger, or Edmodo\textsuperscript{3}), rather than a Web site. Simply stated, to access a blog only requires an Internet connection. A discussion board, on the other hand, requires access to the Internet \textit{and} a school’s membership with a specific program (e.g., Blackboard) \textit{or} each teacher and student must join the specific group and create an ID (e.g., Blogger or Edmodo).

Briefly, a few other distinctions between blogs and discussion boards revolve around cost, design/layout, and student online safety preferences. Some frequently used \textit{free} blog sites, where you build your own site (with the help of their templates and online training), are Edublogs, Weebly, and Wordpress. There are many others, but I recommend trying at least one of those based on their price, general ease of use, customer support, design flexibility, the ability to add multimedia, and positive experiences that I and other educators I know have had with them.

In terms of cost, all three offer free versions. However, free options have limitations, such as fewer templates and design options, the inability to embed directly videos on the blog (but you can post links to videos), and advertisements. Of those three, perhaps the most frustrating may be advertisements. In an educational setting, we often want to control—or at least limit—our students’ online experiences, and we cannot control what ads pop up on our blogs\textsuperscript{4}. For a fee, it is possible to improve your blogging experience and eliminate ads from your site, and it is nice to know that there is an option. Traditional online discussion boards are not free and may cost your school tens of thousands of dollars. Therefore, if virtual learning is new for your school and cost is an important factor, consider using Edublogs, Weebly, or Wordpress. If you are looking for low cost but do not want much flexibility in terms of design and layout, Blogger and Edmodo are good discussion board alternatives.

In terms of flexibility, blogs tend to offer more variety for layout or design and the ability to add pictures and videos or video links. If you have the time, desire, and energy, you can create a visually pleasing blog that is attractive for your students and others who you allow to view it. Discussion boards, on the other hand, tend to be text heavy and—unlike Edublogs, Weebly, or Wordpress, for example—are not designed to look like Web sites.
Though they are often much less flexible in terms of design, they do provide a basic platform for student discussions.

Most educators want to create a safe learning environment in which students feel cared for, protected, and challenged. We should do the same with virtual learning. Edublogs, Weebly, and Word press all allow the creator (“administrator”) to change the settings to limit who can view or comment on the blog. In other words, if the participating schools have strict policies on the visibility of and participation in an online discussion, these blogs offer controls for that. Further, if both schools agree to allow for open visibility but closed participation—that is, anyone can view the students’ comments, but only the students in the classes and the teachers can make comments—such restrictions are possible. Additionally, each comment can be automatically sent to a teacher for approval before being posted, preventing irresponsible students from posting inappropriate or irrelevant comments. At our school, we require this setup for all comments, but whether a blog is visible by anyone online depends on all participating schools’ technology policy restrictions and varies per exchange.

In the three years that I have been administering international blogs at my school, there have only been two to three instances of misuse by students (in two separate cases, two students tried to post comments posing as other students without realizing that I was able to see who they really were), and we have deleted only about 3-5% of all comments submitted (mostly because the students wrote silly comments that did not reflect the more formal exchange we were trying to establish—e.g., writing in “texting” language or trying to post smiley faces and no text). A simple reminder to the students about the importance of making positive impressions on our international friends and to take the exchange seriously typically corrects these behaviors. As far as student security and privacy are concerned, I feel that we have had great success with blogs.

Discussion boards also offer security and privacy because they are for internal viewing and commenting only. Whether you use a school’s program such as Blackboard or a free online program, only the participants invited by the administrator can view or participate in the discussion. This internal conversation protects the students from outside advertisements and the threat of unrelated people trying to make comments or learn about the students.
On the other hand, parents and other school faculty or administrators are unable to see what students are writing unless they are permitted to create IDs and, thereby, gain access.

Ultimately, when selecting between blogs and discussion boards, an educator needs to decide on his or her priorities and defer to her or his school or district policies: design freedom with the flexibility of different levels of security and accessibility (blogs) or simple format with similar degrees of security but with no option for open access or visibility (discussion boards).

**Some general pros and cons of using blogs or discussion boards for internationalization in the classroom**

There are a number of advantages to using a blog or discussion board for internationalization in the classroom. In general, an online discussion between students from different parts of the world extends a classroom conversation beyond the walls of their schools. This enables students to learn from different perspectives and ways of thinking and learning otherwise not experienced in a single classroom with students from the same country.

More specifically, blogs/discussion boards also allow for conversations between students that are not limited by specific times, and—unlike emails or letters—many students can view them simultaneously. Because comments can be posted and written at any time of the day and students don’t all have to be commenting at the same time, each school’s time zone does not matter—this is important when connecting schools from opposite sides of the globe. Also, one advantage they have over email or letters, for example, is that they are accessible to more people at once. A better virtual learning exchange seeks to engage as much of the class as possible in open, interactive dialogues, and blogs and discussion boards provide such learning spaces.

One important disadvantage of blogs/discussion boards, however, is the potential for language barriers. If your students speak English and the other school is in China, the students will not be able to communicate unless one group is studying the others’ language, and the level of conversation is limited by the ability of each group of student’s command of the shared language. On the other hand, if each group of students is studying the other
group’s language, that language “barrier” can become a perfect language practice opportunity. Students studying Mandarin can write in Chinese, and the Chinese students studying English can write in English. The discussion may be limited, but the blog can become a fun way to practice the other language and for students to recognize that it’s possible to communicate in another language without mastering it.

**Three examples of blog/discussion boards in primary and secondary education**

In three years, our school has coordinated almost 20 blogs/discussion board exchanges with students ranging in ages 5 to 18. Below are brief descriptions of three of those exchanges: two blogs and one discussion board.

In the spring of 2012, our third grade students (ages 8-9) began a blog exchange with students in Bali, Indonesia. We continued the relationship in 2013 with a new group of third graders, and in 2014, we added a school in London, England to the exchange. I created blogs each year using Edublogs. First, I coordinated with the teachers at both schools the general timeframe (at least 4-6 weeks is recommended) and the main topics. We have learned that it’s best to give 1-2 weeks at the start for everyone (including teachers) to get comfortable with posting, editing, or administering comments (only teachers administer). The first step is to talk with your students about the exchange to get them excited and to discuss your expectations about content and language. Second, start the blog by allowing the students to get to know each other. This works well if you give them general guidelines (e.g., write 50-100 words about yourself—this should be altered based on skill levels, use your first name only, check your comment for grammatical errors, etc.). Third, once the teachers at both schools have agreed on (a) theme or discussion topic(s), invite the students to respond to a prompt or question you discuss in class and list on the blog. In the case of the Indonesia, UK, USA exchange, the students commented about something they were assigned to study about their own countries. Next, they were asked to read comments from the students in the other countries. In this way, the students became teachers and pupils, and the interactive nature of the blog allowed students the chance to ask more questions and learn more than they would have learned from only a book, for example. Perhaps most
importantly, students become intrinsically motivated to learn more on their own—creating a perfect learning environment that internationalizes the classroom.

Similarly, I created a blog using Wordpress for secondary students (ages 16-18) in an Environmental Science class. We coordinated with a school in Argentina, and it was agreed that they would mostly communicate in English (though, some U.S. students chose to comment in Spanish as well). Like the blog mentioned above, students began with self-introductions; however, each student also wrote an “ecosophy”, or ecology philosophy. After getting to know each other, the students posted comments about water, water pollution, and desertification in their countries. Again, students were the educators and the learners, and they posted comments throughout the day during the short 3-week exchange.

As a final example, our school has also been conducting discussion board exchanges with students at a school in Scotland for three years. The first year, we used their Virtual Learning Environment (VLE), a school-managed program for virtual exchanges. Our exchange was one of the first times for them to use the VLE with an outside school. For the past two years, however, we decided to use Edmodo because the VLE was not as user friendly. Switching to Edmodo allowed us to keep students in groups—an important management tool for conversations (otherwise, you will have all the students commenting on the same page, making it very difficult to follow), and because its structure is more similar to blogs, students were able to engage in discussions more easily.

The success of these exchanges has varied each time, but some of the key factors in terms of content learning, participation, and skills acquisition include: advanced organization/coordination between teachers, allowing for an adequate time frame for the comments and replies to other students (four or more weeks, ideally), providing time in the lessons (as classwork or homework) to post comments and replies, and discussions beforehand to help students understand what appropriate and effective comments look like and how to deal with intercultural differences that could be construed as rude or inappropriate. Ideally, an exchange will also begin and end with pre- and post-tests to assess what your students learned in terms of content, about the other culture(s), and about working and communicating with people in another country.

Does using a blog or discussion board to internationalize your classroom take time and energy? Yes. However, I would argue that the benefits of a successful multicultural blog
exchange far outweigh any loss of time or content covered. An effective virtual exchange (which might be your second or third attempt) will provide a learning environment that encourages student ownership in learning and teaching, students will practice communicating and coordinating with people from diverse backgrounds, and because most students find an international exchange exciting, they will be motivated to learn and share on their own—with or without extrinsic rewards such as grades. Further, because students can ask questions and get (relatively) quick responses, it allows students to learn more, and more deeply, about topics in which they are naturally interested. Thus, internationalizing a classroom via blogs and discussion boards does much more than just teach them about, and connect them with, people of other cultures. It helps prepare them for the 21st century and fosters intrinsic learning experiences.

**Other options for internationalizing the classroom**

In addition to blogs and discussion boards, our school has exchanged videos and used Skype to connect visually. Videos can be shared via YouTube or Vimeo, for example, or they can be uploaded to a Dropbox or Copy folder—two kinds of free online storage options, and that folder can be shared by teachers (and students). Once the file has been downloaded to a computer, the user can watch the video without Internet connection. Another advantage to sharing videos is that language barriers can be overcome. For two years, our school has shared almost 20 videos with a primary school in Japan. Our students do not speak Japanese, and theirs are only beginning to learn English. Thus, we rely on images and action to tell a story and to teach. Students have thoroughly enjoyed learning about “lunch at school”, “favorite sports”, “holidays/festivals”, and other topics that we have shared as video files downloaded from Dropbox.

Another tool worth investigating is Skype. The advantage of Skype, like video conferencing, FaceTime, and other similar video chat options, is that students can have conversations in real time. They can ask questions and get immediate answers, they can see each other’s reactions, and they can learn about different culturally specific mannerisms—all qualities that blogs/discussion boards, emails, letters, etc. lack. The greatest drawback to Skype is time. School-to-school exchanges in real time are limited to schools that are close in time zones (depending on the school day, that limit is typically eight hours of difference).
In very recent years, Skype has developed an education platform ("Skype for Education") that allows teachers who want to internationalize their classrooms to post ideas for exchanges and seek partner schools around the world. Additionally, this site offers teachers opportunities to link their students with various experts. Teachers have used this resource to connect their students with people in dozens of countries and hundreds of students, teachers, and experts around the world.

The Internet has opened the doors to countless forms of communication between students and educators. Creating a global classroom is easier now than ever—educators just need to know where to start. The examples shared here are not at all exhaustive, but it is hoped that this paper provides relevant advice and examples for teachers who seek to open their classrooms to topics and skillsets necessary for students in the 21st century.

Endnotes
1. I use the terms “internationalization” and “globalization” interchangeably in this paper. In much of Europe, the former term is more common, and the latter is more commonly used the U.S.A.
2. During the blind review process, I have removed the name of this school for anonymity. I intend to be less vague and use the school’s name if this paper is accepted for publication.
4. In five years of using Weebly, Wordpress, Edublogs, I have not received a complaint about the kinds of ads that appear on the sites that I have built for classes.

References


Associates.


Mathematics Education
Isometries – a creative approach with Geogebra and iTALC

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Abstract

Creativity is recognized as a basic skill but the educational system has not known, wanted or achieved foster their development. Conceptual renewal on isometries requires new approaches based on mathematically significant task sequences. The use of Dynamic Geometry Environments (DGE) can contribute that Mathematics is considered less hostile and to the development of geometrical competences. These "technological environments" are enhanced by the use of Classroom Management Systems. In this context, a qualitative case study has been developed. We concluded that a complementary technological approach seems to develop geometrical knowledge and skills and an "atmosphere" of cooperation and sharing enhance creativity.

Keywords: Mathematics, Isometries, CMS, Creativity, GeoGebra

Introduction

Creativity is seen as a key to a profitable future. Thus, creative thinking is one of the basic skills, transversal to all areas of knowledge, required for this century (Cropley, 2003). It is therefore essential that Education promotes its development in their students (Adams & Hamm, 2010). However, this is not happening (Robinson & Aronica, 2009).

Several studies (Hiebert 2003; Lu, 2008; Ponte & Serrazina, 2004; Ruthven, 2008) point out that Mathematics remains a subject taught in routinely way. Moreover, some content should be recast. In Portugal, different initiatives tried to reform the curricula. The Basic Education Mathematics Program⁵ - PMEB (Ponte et al., 2007) advocates changes in what and how we learn and teach this subject. In Geometry, which achieves greater importance in the curricula, geometric transformations deserve a central place that also calls for different approach that involves new understandings about isometries and symmetry.

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⁵ Although this program has already been repealed in 2013, this research was based on it as it was the official document at the date of completion of the empirical work.
Methodological guidelines of PMEB (Ponte et al., 2007) suggest the use of computer technologies. In fact, learning Geometry using DGE, such as GeoGebra, is quite different from doing so only with traditional instruments in a paper and pencil environment. DGE free their users from mechanical and routine tasks such as measurement and calculations and construction procedures, leaving room for a more active and fruitful work in Geometry.

The construction of learning "technological environments" capable of keeping students engaged on tasks, characterized by being truly collaborative and cooperative is greatly facilitated by the use of Classroom Management Systems - CMS. However, despite all institutional efforts to widespread use of computers, particularly in Mathematics, the use of these tools in our schools remain inadequate with limited impact in the classroom.

Creativity and the use of technological tools, including DGE framed by a CMS, were the main area that leads to this study, oriented by the main question: "In which level the appropriate use of technological tools favors: a stronger ownership of the geometric concepts and skills involved and the development of creativity?"

**Theoretical Framework**

Creativity is a prerequisite for a high level of development in the new (current) global information society (Adams and Hamm, 2010) and studies on creativity reveal that all individuals are creative (Alencar, 2007). The same author states that a significant factor that interferes with their creative potential is education. However, its development implies deep and extended educational changes (Cropley, 2003). In fact, education has numerous flaws and distortions where "place for exploration, for discovery, for creative thought is reduced and sometimes nonexistent" (Alencar, 2007: 9). Therefore, education should implement favorable practices improve it in their students (Fleith & Alencar, 2005).

Zamir and Leikin (2011) argue that teaching creatively and for creativity can enhance the learning process. Ponte (2005:1) suggests the creation of tasks able to involve students in "mathematically rich and productive activities". These should be challenging: resolution and problem formulation, mathematical explorations and investigations (Vale et al., 2011). This author also states that confronting students with various resolutions, especially from their own colleagues, develops some dimensions of creativity. According to Berger (2012),
mathematical tasks that require "complex and not algorithmic thinking" where students have to determine their own path through the problem, demand students to engage in their exploration using various mathematical concepts, relationships and processes. Computers can free students so they can focus on task conceptual aspects.

The term creativity has a wide variety of definitions but emerges a common idea: the potential to generate original ideas, and therefore unique, as well as useful (Sternberg & Lubart, 1999). In this study, we adopt the definition presented by Torrance (1974), which includes the concepts:

- **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;
- **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;
- **Originality** - is the ability to create unique, unusual, totally new or extremely different ideas or products. Concerning 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).

In this perspective, creativity is likely to be assessed. Fluency can be measured by the number of correct responses, solutions, proposed by the student during the same task (Silver, 1997; Conway, 1999). Flexibility can be measured by the number of different categories of solutions that students’ can produce. Originality 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.

Mathematics occupies a central role in most advanced societies and in the curricula. Within Mathematics, Geometry has gained further importance (Matos, 2001; NCTM, 2000). Then, emerges in the PMEB (Ponte et al., 2007) as the main purpose for basic education, "Developing students' spatial sense, with emphasis on visualization and understanding of the properties of geometric shapes in plane and space, the comprehension of geometric quantities and their measurement processes, and the use of such knowledge and skills in solving problems in different contexts" (p.36). One of the most significant changes is related to the early introduction of isometric transformations, with a special focus on the concept
of symmetry. This document also suggests that Geometry approach should be based in tasks that provide opportunities to observe, analyze, relate and construct geometric figures and work with them. Open and complex tasks involving isometries should deserve special attention in 5-6th grades, especially those related to reflections and rotations.

But we must attend that difficulties may arise related with some particular transformation. Several studies have concluded that these difficulties decrease in tasks involving rotation with respect to reflection (Jacobson & Lehrer, 2000). Others found that students’ performance was superior in tasks involving translation regarding rotation (Clements et al., 1996). However, some studies on children’s perceptions (Shah, 1969; Moyer, 1978) showed that they considered translation, particularly horizontal, simpler than reflection, which was easier than rotation. Kucheman (1981) found that students considered harder to make rotations when its centre was outside the figure and that the inclination of the axis of reflection constitute a difficulty as well. Schultz and Austin (1983) stated that students seem to have difficulties when the reflection is underpinned by an oblique axis. The complexity of objects also appears to influence negatively the results. According to Clements (2003), children have early notions on symmetry, thus, an approach to this concept should start from their previous experiences. Schattschneider (2009) states that students begin by learning to recognize symmetry by observing various figures, exploring them with mirrors, folding them, turning them and overlapping them. However, there are some variables that interfere with the ability to perceive symmetry of figures (Hershkowitz, 1990): the orientation of the axis of symmetry, the respective position of different parts of the geometric shape and axis (prototypes phenomenon), and age of the students. Gerkins (1975), cited by Clements (2003), considers that the vertical bilateral symmetry is more easily understood than one with a horizontal axis and argues that conceptualisation of symmetry even does not occur in a solid way before 12 years of age.

The tasks proposed must be solved using measuring and drawing instruments, DGE programs and applets, witch promote the understanding of geometric concepts and relationships (Ponte et al., 2007). According to NCTM (2008), the use of technology, particularly computers and DGE, is one of the principles for teaching Mathematics that promotes active and meaningful learning by students. But this does not necessarily imply the marginalization of paper and pencil even because the exams are usually held in this
environment (Laborde, 2001). Therefore, it seems to emerge the need of combining the two approaches, exploiting the advantages of each and minimize their disadvantages.

A computer use that promotes powerful learning environments where students can build their knowledge interacting with objects, with each other and with the world will be much richer and more valuable, passing from an instructional perspective to a constructivist one (Valente, 2001). Regarding DGE, NCTM (2000) states that they “[...] can allow experimentation with families of geometric objects, with an explicit focus on geometric transformations. [...] the boundaries of the mathematical landscape are being transformed.” (p.27). The most commonly used DGE have been Cabri-Géomètre and Geometer's Sketchpad. More recently came out GeoGebra, which is an added value when compared with those applications, as it combines graphical manipulations with their correspondent algebraic representations and calculus (Mehanovic, 2009; Misfeldt, 2009).

Despite obvious benefits, using computerized technology and respective applications can disrupt teaching and learning process (Berliner & Calfee, 1996; Brophy and Good, 1986; Galluch & Thatcher, 2011). Nowadays, many classes take place in ICT rooms. Failure to use a system to manage all activities in the room, for example, block access to websites, restrict use of certain applications or closely follow students’ work can negatively affect their progress. A CMS application could be the answer. The CMS should not only be used to monitor students’ work but as a catalytic tool: (i) increasing student task engagement; (ii) increasing collaboration, cooperation and sharing; (iii) keeping students focused on the task (especially important for students in the early grades); (iv) allowing easily work supervising (Joyce & Schmidl, 2008). There are several commercial solutions on the market. We opted for an open source alternative, the iTALC.

The iTALC (intelligent Teaching and Learning with Computers) allows the teacher to monitor and remotely control any workstation in his class; show a demo - the teacher’s screen is shown on all students’ computers in real time; lock workstations; send text messages; and home schooling.
Method

Within a constructivist paradigm, we selected a qualitative case study (Bogdan & Biklen, 1994), focused around three groups of twelve (the privileged way of working in the classroom) of students of the 5th grade. They were selected because they had different school performances and expectations regarding Mathematics and they were present in every moment of the instructional sequence. At the end of the study, they were eleven years old and had no retentions. The group G1 was comprised of a single female member, appointed by Catarina; G2 by Tiago and Luísa and G3 comprising Gabriela and Francisca.

The development of this study involved structuring an instructional exploratory task sequence (Ponte, 2005; Stein & Smith, 2009), on "reflection, rotation and translation" topic, in the "Geometry" theme. The teacher/researcher took an active part in this study, as he planned and led all the events resulting from this research.

To collect the data were used: i) participant observation by the teacher/researcher, supported by field notes and Logbook; ii) inquiry, through questionnaires and interviews with the case students and iii) a documentary analysis of a variety of documents - students’ tasks resolutions, Initial and Final tests and some official documents produced by the school.

To begin with, we passed an Initial Questionnaire (IQ) to obtain information mainly about their habits and some basic knowledge of computer use, including DGE. Then, we implemented a small test on technological skills, which the results served afterwards to make adjustments in the structure of the didactic intervention. It follows an Initial Test (IT), solved in paper and pencil and with GeoGebra, which was intended to analyze the knowledge that students held on the topic, even if constructed beyond the formal context. Such a review could advise changes to planning and task structure. Subsequently, it facilitated the analysis of the evolution of student performance when compared with the same Final Test (FT) at the very end of the didactic intervention.

Then, in eight sessions, we implemented the didactic intervention consisting in a sequence of seven adapted tasks (Coelho, 2013), with increasing complexity, whether mathematical or technical, previously validated and presented (Cabrita et al., 2011).

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6 These are fictional names to preserve students’ true identity.
The first task was set to remind some concepts related with isometric transformations discussed in earlier grades and provide the students with an informal exploration on reflections, rotations and translations. Traditional materials and instrumentation in paper and pencil and DGE environments were used.

The second task focused on reflection. It was designed to evolve from a more informal approach, with traditional materials and instrumentation in a paper and pencil environment, to another, yet informal, with GeoGebra, ending again with paper and pencil in a more formal way.

Task III pursued a different approach. Centered in the rotation, it was intended that students address the concept through GeoGebra and evolve to a paper and pencil environment with increased formal requirements.

The fourth task focused on translation, called for the use of traditional instruments in a paper and pencil environment in a more formal way. A final open-ended task, using GeoGebra, invited them to freely create and show their creativity.

Sliding reflection, approached in the fifth task, was an unknown concept to the students. It consisted in an open-ended task, allowing multiple solutions and introducing a slightly more formal notion on composition of isometries.

Tasks VI and VII (adapted from Cabrita et al., 2011) were related to the concept of symmetry which all students misunderstood with reflection. In these tasks, they evolve from a pencil and paper environment, exploring several images, to a computer assisted one to support their earlier conclusions (see figure 1).

The classroom environment was mediated by a CMS, which was installed by the teacher/researcher in the ICT room. The teacher’s workstation desktop screen,
contained the "Master", was constantly been shown in the interactive whiteboard which everyone could see, in real time, what was happening in all computers (see figure 2).

**Fig. 2-** iTALC “Master” application is teacher’s desktop

In the selection/creation process we aim to find exploratory activities, with several open-ended tasks, whose implementation was arranged in four different phases (Stein et al., 2008). In the first phase, the task was presented orally and some aspects, to be considered relevant or by direct request from the students, were clarified by the teacher. In the next phase, all groups solve their tasks autonomously but under teacher’s supervision, through the CMS when tasks were performed in the computer. In the third phase, the working groups presented their results, either in terms of processes or solutions. Likewise, in computer assisted tasks, they use CMS features to show their own desktop in the interactive whiteboard. Finally, in the fourth phase, conclusions were established yielding small written reports on daily notebook. Students had to present their solutions and the underlying strategies were discussed, in order that everybody reflected on the work done by each pair. The main ideas were registered. By the end of each session, 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 were analyzed before the following session, so that the plan could be changed, if necessary.
After the didactic intervention, we passed the FT and the FQ. This questionnaire was intended, essentially, to gather data on their opinions about the approach on this topic. The IT and FT had double aims: the initial one gave us an image on the knowledge and skills pupils had before the didactic intervention and the final one allowed us to assess what they had learned concerning isometric transformations and symmetry.

All collected data was object of content analysis using categories related to: i) Geometry - isometries and symmetry and ii) dimensions of Creativity – fluency, flexibility and originality.

**Results**

Direct observation and the analysis of students’ answers to the FQ showed the importance they give to the high technological approach on the topic, as well as nature of tasks and how they were addressed and discussed and their contribution in the development of their creativity.

As suggested by Stein and Smith (2009), teaching for creativity must be, at same time, creative, where the challenging nature of the tasks, based on the formulation and problem solving, exploration and research, can promote creative thinking (Vale et al., 2012).

One variable that assumed great preponderance in this study which seems to play a decisive role was the construction of a classroom “atmosphere” that allowed truly exploratory activities with open-ended tasks and where students feel "safe" from destructive criticism (Fleith & Alencar, 2005).

Using iTALC on an ICT room seems to help build this environment. The main goal was to promote sharing and collaboration among the different actors, holding proper control of a room full of computers connected to de Internet.

In what concerns to the influence in the development of creativity of this approach on the topic using GeoGebra in a CMS monitored environment, is important to note that classroom “atmosphere” had the same features above described. Students actively shared their knowledge and findings. Discussion moments seemed to trigger new motivations and, consequently, new strategies and productions.

The five students also declared in the FQ that observing other students work (most creative ones) motivated themselves to be more creative, although Catarina said that, despite having felt this necessity, could not be more creative. Although, her productions were quite original both in solutions and in adopted strategies (see figure 3).
Also Tiago and Luísa and Francisca and Gabriela reacted in a similar way, predisposing themselves to reassess their approaches. In this cases, and in contrast with Catarina, feedback from colleagues was seriously taken into account, which led them to incorporate often new elements that were absent in their original ideas (see figure 4).

Hence, more original "constructions" progressively arose. This seems to confirm the idea formulated by Levenson (2011) that creativity can be built collectively, while being individually developed. The ability to share, at any time, any approach, process or solution on a computer was provided by iTALC.

Concerning colour, in strictly mathematical terms, the construction should be monochromatic. Attending that it is a student's construction of an early educational level its use was accepted in all cases.
Productions of the three selected groups show unique and distinctive features, therefore great originality (see figure 5).

**Fig. 5 - Creative students' productions in different tasks of the didactic intervention**

It was also seen that G2 and G3 tended to have a higher number of more elaborate and original answers when resorted to GeoGebra to solve the tasks. In these cases, use of "paper and pencil" (including traditional instrumentation and manipulatives) seemed to "soak" students in a whirlwind of technical procedures that somehow seemed to prevent them from exploring alternative strategies, thus, limiting their ability to adapt processes. This aspect, very pronounced in G2 and also noticeable in G3, seemed irrelevant for Catarina (G1). This student often used "paper and pencil" in early attempts to rehearse procedures for resolving tasks (see figure 6).

**Fig. 6 – Not requested initial attempt on “pencil and paper” environment**

Concerning fluency, it could be observed in several tasks, that all three groups developed several approaches to the same problem, which, in a likely manifestation of flexibility, they adapted to achieve the desired "effects". There seemed to be improvements in three considered dimensions of creativity.
Concerning the impact of this approach developing a stronger ownership of geometric concepts and their application, it could also be seen, earlier in this empirical study, that the three cases showed a very superficial knowledge (or even null), and often conceptual errors on isometries and symmetry. Their final results in the FT were very encouraging.

It seems clear that, facing the results students had achieved at the end of the study, the use of this software is valuable, establishing itself as a powerful tool in the graphical problem solving that allows multiple approaches and solutions (Bardini, Pierce & Stacey, 2004).

Analysis of further responses to the FQ revealed a high degree of agreement on the benefits of using GeoGebra. Any negative aspect wasn’t pointed out. Concerning how the topic had been implemented, some students reported that the program helped them to understand isometries, making Geometry less complex and more fun.

Use of DGE seemed to play an important role, especially in relation to students who had greater difficulties. It was observed that success in solving a task in GeoGebra not always ensured a similar success when it was held on "paper and pencil" environment (see figure 7).

**Fig. 7** – Group 2 difficulties when evolving from DGE to “paper and pencil” environment (task III)

Evolving from "paper" to DGE posed no problem. The reverse was not true. In particular, G2 felt some difficulties making this transition.

All students expressed their agreement or strong agreement when asked if they had considered important to have worked with "paper and pencil" and have used instruments for measuring and drawing. These findings suggest the importance of a complementary approach (Laborde, 2001; Ponte, 2005; Ponte et al, 2007).
Final remarks

The research undertaken suggests that the appropriate use of CMS in highly technological approaches seems to contribute positively to improve teaching and learning of Mathematics. These applications allow students to keep more focused on their tasks and contribute decisively to build a learning environment where cooperation, collaboration and sharing between all actors in the classroom are indeed possible.

Further deeper and extended studies should be performed to better understand the benefits of its use. Variations in age, topics or themes should be introduced. Knowing CMS’ potential for E-learning (when the student can not attend school) also constitutes an unexplored field. To understand in which context in it could be detrimental is another one.

This study also follows the perception that the creation of a "social atmosphere" seems to elicit increases in dimensions of creativity. However, the limitations of this study, relating primarily to its short period of implementation and the extraordinary complexity the phenomenon, do not allow more ambitious conclusions.

Also regarding creativity, the use of DGE, seems to promote the emergence of more creative productions in Geometry. More studies are needed in both range and depth.

If using DGE appears to have a major influence in some dimensions of creativity when working in Geometry, the development of geometric knowledge and skills seems to benefit more from a complementary approach, which combines DGE with "paper and pencil” environments.

Some of these aspects should be, as suggested, target of much more extensive and detailed studies. Their relevant role in teaching and learning Mathematics should have implications in teacher training.

References


Visualization in pattern generalization: Potential and Challenges

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Abstract: With this study we try to understand how pre-service teachers, from basic education, solve problems involving the generalization of visual patterns, identifying: the strategies used; the difficulties they present; the role of visualization in their reasoning; and the factors that influence their generalizations. We followed a qualitative methodology. The participants were 80 pre-service teachers. During the classes of a Didactics of Mathematics unit course, these students solved a sequence of tasks involving growing visual patterns. Results showed that students were able to use different types of strategies, but also that some dimensions of the tasks can have impact in their reasoning, provoking, sometimes, a shift on the strategies used and the emergence of difficulties of different kind.

Key words: Visualization, Patterns, Generalization, Functional reasoning.

Introduction

Algebra is often considered an essential bridge to access higher order mathematics. However, the difficulties highlighted by many students in this area are evident. Kaput (2008) and Mason (1996) point the abrupt transition from arithmetic to algebra as one of the reasons for this failure. It is therefore essential to reflect on how this transition takes place and how we can contribute to the development of functional reasoning in students. Pattern exploration allows the formulation and justification of generalizations and the use of these relations to make predictions, facilitating, in a more natural way, the transition to traditional Algebra, by establishing relations of functional type (Lannin, 2005; Zazkis & Liljedahl, 2002). There are also advantages in the use of visual skills in solving problems in Algebra. Generalizations based on the study of visual patterns allow students to contact with the dynamic component need to know mathematics in order to teach it well. In this sense, the learning of mathematics is strongly dependent on the teacher. Pre-service teachers need to learn both mathematics and also how to teach it. It is necessary, thus, to offer them diverse experiences to extend their mathematical content and didactical knowledge. In this context,
we considered pertinent to understand how pre-service teachers, from basic education (3-12 years old), solve problems involving the generalization of patterns in visual contexts, defining the following research questions: (1) How can we characterize the generalization strategies used?; (2) What difficulties can be identified?; (3) What is the role of visualization in their reasoning?; (4) What factors influence their reasoning when formulating generalizations?

**From patterns to generalization**

Generalization plays a crucial role in the activity of any mathematician, being considered an inherent ability to mathematical thinking in general. Focusing on the educational context, it can also be said that it’s a key goal in the learning of mathematics. The search for patterns has been associated with generalization, considering that could naturally lead to the expression of generality (e.g. Mason, Johnston-Wilder & Graham, 2005; Orton & Orton, 1999). These type of tasks can be a powerful vehicle for understanding relationships between quantities that underlie mathematical functions, thus contributing to the establishment of relations of functional type (Blanton & Kaput, 2005; Warren, 2008). On the other hand, they constitute a concrete and transparent way for students to begin to deal with the notions of generalization and abstraction, since the elementary years. It is also expected that, through this approach, students are able to more easily assign meaning to the language and symbolism used in algebra and the corresponding representational systems, such as graphs and tables.

Traditionally, the bridge between arithmetic and algebra is achieved through growing patterns. All types of patterns are necessary for the development of mathematical reasoning, but growing patterns lead, more naturally, to the discovery of a relationship between two variable quantities, thus facilitating functional reasoning (Lee & Freiman, 2006; Rivera & Becker, 2008). When exploring this type of patterns, it is requested that students find a relationship between elements of the pattern and its position and that they use this generalization to generate elements in other positions. They are thus motivated to think in growing patterns as functions instead of focusing only on the variation of the variables.
The role of visual patterns in discovering functional relations

The importance given to visualization in the learning of mathematics is based on the fact that it’s not confined to mere illustration of ideas, but it’s also recognized as a component of reasoning (Vale, Pimentel, Cabrita, Barbosa & Fonseca, 2012). Although it’s not an easy task, the integration of visual approaches is suggested in the mathematical experiences provided to students (NCTM, 2000). There are two major challenges in this situation: most students associate mathematics to the manipulation of numbers, numeric expressions and algorithms, which can contribute to the devaluation of visualization; on the other hand, teachers should take into consideration that there are many ways of seeing (Duval, 1998). Visual features can be grasped in two ways: perceptually and discursively. The perceptual apprehension of figures occurs when these are seen as a whole. Discursive apprehension implies the identification of the spatial arrangement of the elements that make up the figure, either individually or in relation to each other, as a configuration of objects that are related through an invariant attribute or property.

Tasks that involve the study of patterns can be proposed in various contexts, visual and non-visual, and give rise to different approaches. However, literature indicates that the use of a visual aid in presenting problems involving the search for patterns can lead to the application of different approaches to achieve generalization, either of visual or non-visual nature (e.g. Barbosa, Vale & Palhares, 2012; Stacey, 1989; Swafford & Langrall, 2000). Seeing a pattern is necessarily the first step in searching for a regularity, however students should have perceptual agility to see the pattern in several ways, allowing them abandon those who are not useful. With this support, it will be easier, for the student that explores the pattern, to produce a general law that mathematically translates the underlying model structure (Vale & Pimentel, 2013). We can say that visual patterns may contribute to generate different rules that enhance: connections between arithmetic and geometric relationships; assigning meaning to the formulated rules; the need to formulate and validate conjectures. Thus, working with functional relationships through visual growing patterns can raise the attribution of meaning to the operations that transform the independent variable on the dependent variable. Usually there are different ways of expressing the relationship between two variables in such tasks, which makes them privileged contexts to discuss multiple strategies and generalization rules, as well as to exploit equivalent expressions,
which contributes to a more flexible reasoning (Barbosa, 2011). In this sense, visual patterns may be a facilitating context to functional reasoning, promoting different ways of seeing and generalizing (Becker & Rivera, 2005; Lannin, Barker & Townsend, 2006).

In the context of visual patterns, students that are able to analyse figures discursively, can do it in different ways: identify disjoint sets of elements that are combined to build the initial figure, using a constructive generalization (Rivera & Becker, 2008); observe the existence of overlapping subsets, counting certain elements more than once that are subsequently subtracted, which means that the generalization is formulated in a deconstructive way (Rivera & Becker, 2008). Several studies have concluded that students tend to use more frequently constructive generalizations than deconstructive ones (e.g. Barbosa, 2011; Rivera & Becker, 2008), since the latter category involves a higher cognitive level regarding visualization.

**Generalization strategies used with visual patterns**

The generalization of a pattern involves the use of a strategy, however there is a great diversity of approaches that enable students to generalize. Several studies have been carried out in order to understand and categorize the strategies evidenced by students of different levels, as they solve pattern problems in different contexts. The analysis of the categories proposed by some researchers (e.g. Lannin et al., 2006; Orton & Orton, 1999; Rivera & Becker, 2008; Stacey, 1989) led to the construction of the categorization presented in Table 1 (Barbosa, 2010; Barbosa et al., 2012).

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Nature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counting (C)</td>
<td>Visual</td>
<td>Drawing a figure and counting its’ elements.</td>
</tr>
<tr>
<td>Whole-object (no adjustment) (WO$_1$)</td>
<td>Non visual</td>
<td>Considering a term of the sequence as unit and using multiples of that unit.</td>
</tr>
<tr>
<td>Whole-object w/ visual adjustment (WO$_2$)</td>
<td>Visual</td>
<td>Considering a term of the sequence as unit and using multiples of that unit. A final adjustment is made based on the context of the problem.</td>
</tr>
<tr>
<td>Whole-object w/ numeric Non visual</td>
<td></td>
<td>Considering a term of the sequence as unit and using multiples of that unit. A final adjustment is made based on the context of the problem.</td>
</tr>
<tr>
<td>Adjustment (WO)</td>
<td>Recursive (R)</td>
<td>Recursive (R)</td>
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<tr>
<td>----------------</td>
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<tr>
<td></td>
<td>Non visual</td>
<td>Visual</td>
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In this categorization several generalization strategies are identified, based on the exploration of visual patterns. Considering each case, we can distinguish differences in their nature, being either visual or non-visual strategies. In some cases the figures play an essential role in the discovery of the invariant (C, WO₂, R₂, D₂, E₂) and, in others, the work is developed in a numeric context (WO₃, WO₃, R₃, E₃, GC). It can be highlighted that different strategies may be used in solving the same problem but, depending on the characteristics of the situations presented, it is essential that students understand the strengths and limitations of each strategy.

**Factors that may influence pattern generalization**

There are some factors that may have an impact on the choice of strategies used to generalize patterns, regardless of their adequacy. The identification of obstacles to the generalization process, and the reasons that may underlie them, is essential so that the teacher can promote the development of the students' ability to generalize.

Lannin et al. (2006) identified a number of factors that can influence the use of generalization strategies, organizing them into three categories: (1) social, factors resulting
from interactions of the students with their peers and with the teacher, since they can have implications on students' thinking; (2) **cognitive factors**, associated with mental structures that the student has developed; and (3) factors associated with the **structure of the task**, like the type of pattern, the values attributed to the independent variable or even the ability to see. In general, Lannin et al. (2006) concluded that when the starting values are close, students tend to use recursive rules, regardless of the type of pattern and the visual component of the task. Although also referring that the visual analysis of the situation often leads to a different perspective on the recursive relationship, promoting the association between the proposed rule and characteristics of the context. On the other hand, students who base their reasoning only on numeric values usually have little idea about the relationship between the rule found and the context of the problem. When the starting values are multiples of known terms of the sequence, students tend to apply the whole-object strategy, with no adjustment. They also indicate that students with difficulties in seeing the pattern incorrectly apply the whole-object strategy, while those who show greater visual capabilities recognize the need to adjust the strategy if the context does not reflect a model of direct proportionality. The use of distant values, as starting point, may encourage the application of the explicit strategy.

The improper application of direct proportion, particularly in the exploration of linear patterns, has been mentioned in several studies (e.g. Becker & Rivera, 2005; Lannin et al, 2006; Sasman, Olivier & Linchevski, 1999; Stacey, 1989). A thorough analysis of this phenomenon points to two situations that can be the basis of such reasoning: On one hand the use of a strictly numerical reasoning, implying the meaningless manipulation of variables. Another factor relates to the proposed generalization for “appealing numbers” (Sasman et al., 1999, p. 5), from a multiplicative point of view. In this sense, Sasman et al. (1999) stressed the importance of the tasks contemplating also non-appealing numbers, as a way to circumvent the tendency to use direct proportionality.

The focus on numerical aspects of the pattern, even when it’s presented in a visual context, is often an obstacle to generalization (Noss, Healy & Hoyles, 1997). Mason (1996) notes that there is a tendency to construct tables of values from which is derived a rule, not always correct, based on the analysis of one or two particular cases. This author suggests that
opportunities should be given to students to explore different types of patterns, in which they can apply visualization and manipulate figures, to facilitate generalization.

In the context of visual patterns, even when students are able to grasp figures discursively, it’s necessary to take into account their complexity, a factor that can condition the establishment of generalization. Sasman et al. (1999) distinguish between transparent and non-transparent figures. In the first case, the rule which underlies the pattern is featured in the structure of the figures, situation that does not occur with non-transparent figures in which the rule is not easily discovered by simply observing the figures in the sequence. In these cases it’s appropriate to think of strategies that can help students identify the pattern visually and generalize. Rivera (2007) suggests that students are encouraged to manipulate and transform the figures into simpler forms and then easier to recognize. Another strategy suggested by Rivera (2007) involves a symmetric counting process. Students should be able to identify symmetry in the figures presented and subsequently focus on only one part of the figure, applying the same action to the parts of the figure that show the same characteristics.

Some authors present suggestions that can help students overcome or minimize these difficulties. Noss et al. (1997) identified that the establishment of a connection of visual nature between the context of the problem and the corresponding symbolic representation is a determining factor in assigning meaning to rules of explicit type. Similarly, for Swafford and Langrall (2000) and Zazkis and Liljedahl (2002), asking students to analyse different values for the independent variable, may promote the use of explicit reasoning. Stacey and MacGregor (1995) also stressed the importance of using tasks that reduce the emphasis on recursive relations, trying to get students to identify the connection between the independent and dependent variables, with the purpose of contacting with explicit relations.

Summarizing, it’s pertinent that teachers reflect on the structuring and implementation of tasks to better promote the development of functional reasoning in students.
**Method**

Given the nature of the problem and the research questions, this study follows a qualitative approach, in the form of an exploratory design (Yin, 2012). We developed a didactical experience with 80 future basic education teachers (3-12 years old), that took place during the classes of the subject Didactics of Mathematics. Throughout 9 hours of this unit course, students solved seven tasks, focused on visual patterns, and, for each task the following phases were accomplished: task introduction; individual resolution; and whole group discussion. The tasks had some features in common like: being proposed in a visual context, asking for near and far generalization, and promoting reverse thinking. The diversity was on the type of pattern (linear and non linear) and on the nature of the figures (transparent and non transparent).

Data was collected in a holistic, descriptive and interpretive way, including classroom observations, methodological notes and productions of the students to the tasks. To analyse the data we focused on the identification of categories related to generalization strategies used by students and difficulties emerging from their work.

**Discussion of some results**

We present some results, related to the research questions, focusing on generalization strategies and on difficulties presented by the students, trying also to understand the role of visualization and the influence of some factors in their reasoning. Rather than presenting the results task by task, we chose to reflect on certain aspects that emerged throughout the study, highlighting three different tasks: *Squares in crosses* (Appendix A), that includes a linear pattern and transparent figures; *Figures with squares* (Appendix B), that includes a non linear pattern and transparent figures; and *Intertwined rectangles* (Appendix C), that includes a non linear pattern and non transparent figures.

Throughout the tasks, students used a variety of generalization strategies, either of visual or non-visual nature. This fact was related to the context of the problems, since they could chose to work with figures or with numbers. The frequency of use of each strategy depended on different aspects that will be further developed in the following sections.
**Near and Far generalization**

When confronted with near generalization students used one of these strategies: counting, recursive (non visual), recursive (visual), explicit (non-visual) and explicit (visual). Analysing each one of these cases, we concluded that counting was applied by a reduced number of students, that resorted to a drawing of the term of the sequence asked, in order to determine the number of elements (Figure 1).

**Figure 1.** Task “Figures with squares” – Question 2

Recursive reasoning was also featured in the work presented by these students, mainly the non-visual type (Figure 2). In these cases, figures were converted into numbers and students discovered the variation from one term to the next. However, some of them recognized the structural growth of the patterns, based on the observation of the figures in the sequence: “From figure to figure we add four squares in relation to the previous figure. In each extremity we add a square” (Task “Squares in crosses”, question 1).

**Figure 2.** Task “Squares in crosses” – Question 1

While confronted with near generalization, some students were able to deduce immediately a rule relating the two variables, using an explicit reasoning. But, we also found differences in these cases. Some students deduced the rule from features found on the figures, discovering the structure of the pattern this way: “We have a square in the middle and in each arm of the X we have the same numbers of squares as the order of the figure, so it’s
1+4x199” (Task “Squares in crosses”, question 2). Others deduced the rule based on the study of numerical relations on a table of values (Figure 3).

**Figure 3.** Task “Squares in crosses” – Question 2

Concerning far generalization, the following strategies were applied: difference rate with adjustment, guess and check, whole-object (no adjustment), explicit (non-visual and visual). The two later cases have already been approached above, with the difference of now being the most used strategies. A few students, that had already identified the common difference between consecutive terms using visualization, managed to perceive that they could use that as a multiplying factor adjusting the result based on the context of the problem: “We take figure 1 with 5 squares, thus figure 2 will have the number of squares as figure 1 plus 4 squares from the extremities. So we have 5+4x(n-1)” (Task “Squares in crosses”, question 4). The guess and check strategy was mainly used to address questions requiring reverse thinking, situation that we will analyse in the next section. The whole object strategy with no adjustment was used in rare cases, reflecting that the majority of the students perceived that it was not adequate to solve these tasks, as they didn’t involve direct proportion. One of the tasks where it emerged was “Intertwined rectangles”, particularly to solve the second question, since it involved appealing numbers: “If 5 unit rectangles give place to 15 rectangles of any size, than 10 unit rectangles give place to 30 rectangles of any size”.

*Reverse thinking*

Questions involving reverse thinking proved to be complex for some of these students. To overcome some of the difficulties in finding a rule, most of them recurred to guess and check (Figure 4).

**Figure 4.** Task “Squares in crosses” – Question 3
In some cases the option was the explicit strategy, either using a non-visual approach or a visual one. The first situation was illustrated by solving an equation, finding directly the order of the figure with a certain number of elements. The later situation was based on the visual structure of the pattern: “If we have 973 squares we subtract the one in the middle. Then we divide 972 by 4 because of the four arms in the X. Hence it will be the 243° X” (Task “Squares in crosses”, question 3).

**Transparent and non transparent figures**

As expected, students were more successful in dealing with transparent than non-transparent figures, having sometimes trouble in deducing a rule in these problematic situations. Analysing the tasks with non-transparent figures they used strategies like counting, recursive (non visual), explicit (non visual and visual), privileging the first three approaches. Concerning counting, when the order was near it may be considered an efficient strategy, but, as the order got far, it was very difficult to apply it in a successful way, resulting in confusing diagrams (Figure 5).

**Figure 5.** Task “Intertwined rectangles” – Question 2

Recursive reasoning was also an alternative to solving these tasks, but only efficient for near generalization (Figure 6). Transforming the figures into numbers made it easier for students to find relations between terms and even attempt to find a rule.

**Figure 6.** Task “Intertwined rectangles” – Question 2
It’s relevant to state that, when working with non-transparent figures, most students weren’t able to reach far generalization and find a rule for the pattern, presenting difficulties related to the complexity of visual transformations or the complexity of numerical relations.

**Interpreting the meaning of an expression**

Some of the tasks included a question where students had to interpret the meaning of an algebraic expression in the context of the problem. Only a few students were able to do it, by giving significance to the numbers and variables: “Saw 4 sets. In each set there is one more element than the number of the figure, however, as only one of the sets has always one more element than the number of the figure, we have to subtract the 3 unit added” (Task “Squares in crosses”, question 5). In alternative, the majority of the students verified if the given expression was equivalent to the one they had found. Others used the guess and check strategy, testing the expression for a few particular cases, making generalizations based on this reasoning.

**Concluding remarks**

As shown by the results presented, tasks that involve the exploration of visual patterns promote the emergence of multiple generalization strategies, enhancing the development of a more flexible reasoning (e.g. Lannin et al., 2006; Rivera & Becker, 2008; Sasman et al, 1999). Although assigning a greater emphasis on visual representations, these tasks allow the implementation of strategies of different nature. However, in addition to expecting that students are able to apply and adapt different strategies in the process of generalization, it is equally important to understand the advantages and limitations of each approach.

For example, the counting and recursive strategies are useful in discovering near terms in a sequence, but it’s proven that are difficult to apply in far generalization, as some students revealed. Counting led almost always to correct answers, but there were situations in which this strategy was not applied properly. Trying to solve far generalization questions through counting is an exhaustive process and can result in disorganized and complex representations, being an obstacle to perceiving the structure of the pattern. It was also noticeable that when counting was made based on the perceptual apprehension of the
figures, it did not contribute to finding the rule, but the discursive apprehension allowed students to identify the invariant (Duval, 1998). The explicit strategy was recognized as a process that allows for more expeditious generalizations, being valued by students in far generalization. It was noted that in questions that had underlying the use of reverse thinking, guess and check was an efficient alternative to the explicit strategy, since most of the students showed difficulties with this type of questions. Whole-object was used in very few cases as it was inadequate in the proposed problems. This situation relates to working strictly in numerical contexts that prevents students from understanding the misuse of proportional reasoning (e.g. Becker & Rivera, 2005; Lannin et al, 2006; Sasman et al, 1999; Stacey, 1989) since none of the presented patterns suited to the direct proportion model.

Depending on how students see a particular pattern, the visual approaches used can generate different expressions to represent it (e.g. Rivera & Becker, 2008; Vale et al, 2012). This enables the teacher to exploit the notion of equivalence, a crucial concept in algebraic thinking, while also preventing students to conclude that everyone should converge to the same solution. By analysing how students viewed the presented patterns and the nature of generalization established, it was found that they mainly formulated constructive generalizations, being more evident for them the identification of disjoint subsets in figures (Rivera & Becker, 2008).

Reflecting on possible factors that may have influenced students’ reasoning, we highlight aspects mainly related to the structure of the tasks: (1) All tasks included questions centred on near and far generalization. The magnitude of the values assigned to variables influenced the type of strategies applied, and, in general, students used different strategies in addressing these situations (Lannin et al, 2006; Stacey, 1989); (2) In some tasks we presented questions promoting reverse thinking. In these cases, many students showed difficulties and were not always able to use the inverse operations, applying alternative strategies such as guess and check; (3) Figures representing the patterns may be transparent or non-transparent. The majority of students showed difficulties deducing a rule for non-transparent figures, presenting a tendency for numerical approaches and for recursive strategies. They were rarely successful in the attempt to identify a rule directly from the figures, since the apprehension was compromised (Duval, 1998; Rivera, 2007); (4) The structure of the pattern is also a factor to consider in the choice of generalization
strategies, since, for example, the recursive relationship in non-linear patterns is not as obvious as in linear patterns, implying that students seek to focus the functional relationship.

When formulating/selecting tasks related to visual patterns, teachers should take into consideration a wide variety of factors that may influence the development of functional reasoning of students, including all these aspects when planning the work in the classroom. It’s important to select proposals that enable the implementation of different strategies and promote a dynamic perspective of the possible approaches, so that students can understand and establish parallels between visual and non-visual strategies. The discussion about the potential and limitations of each approach can be an important contribution to develop a more flexible reasoning, fluency in communication and increase their repertoire of representations.

References


Appendix A

Squares in crosses

Consider the first four figures of a given sequence:

1. How many squares will have the 8th figure?
2. How many squares will have the 199th figure?
3. Is it possible to find a figure in this sequence with 973 squares? If it’s possible, determine the position of that figure in the sequence.
4. Formulate a general expression for this sequence.
5. John presented the following algebraic expression to determine the number of squares of figure n: 4(n+1)-3
   Is the expression correct?

Appendix B

Squares in crosses

Consider the first four figures of a given sequence:

1. Draw the next figure.
2. How many squares will have the 7th figure?
3. And the 53rd figure?
4. Is it possible to find a figure in this sequence with 8558 squares? If it’s possible, determine the position of that figure in the sequence.
5. Formulate a general expression for this sequence.
6. Daniel presented the following algebraic expression to determine the number of squares of figure n: (n-1)^2+(n-1)+2
   Is the expression correct?
Appendix C

*Intertwined rectangles*

In this figure you can count three rectangles:

Now consider a figure constituted by five unit rectangles:

1. How many rectangles, of any size, can you count?
2. What if the figure had 10 unit rectangles? How many rectangles of any size could you count?
3. Determine an algebraic expression that represents the number of rectangles of any size in a figure with $n$ unit rectangles.
Developing flexible-adaptive reasoning and computing: 
Pedro’s understanding of the task “prawn skewers”

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Portugal

Introduction

Acquiring proficiency with whole numbers, fractions and decimals is one of the main goals in the reform curriculum (Kilpatrick, Swafford, & Findell, 2001). In this perspective, researchers focus on what Hatano and Inagaki (1986) called “adaptive expertise”. In Hatano’s (2003) words, the general question from this perspective is how students can be taught so that they learn to use what they have learned and invent effective procedures to solve new problems. Specifically, we have to identify: i) first the conceptual knowledge underlying procedures (‘operating knowledge’, Thompson & Saldanha, 2003), and ii) second, how students do construct it. A lot of researchers as Baroody (2003) and Thompson & Saldanha (2003) assume that adaptive expertise depends on conceptual understanding (well-connected knowledge) and its integration with procedural knowledge.

In this presentation we focus the understanding of “multiplication and the flexible and adaptive use of “products” as one aspect of ‘multiplicative reasoning’ that children have to develop along primary education. We illustrate how the research team of the project ‘Numerical thinking and flexible calculation: critical issues’ tries to identify and describe students’ conceptual knowledge associated with the different levels of understanding of numbers and multiplication/division and analyze if and how this knowledge facilitates adaptive thinking and flexible calculation.

We present the theoretical justification and the design principles that we use to develop each mathematical task. We also present how one nine year student – Pedro- interprets the task and how we analyze and interpret his way of thinking.
Theoretical framework

General idea

Authors like Freudenthal (1991) and Sfard (1991) characterize the process of constructing mathematics as a series of transitions in which mathematical processes are transformed in objects, which in turn became part of new processes. From this point of view they stress the importance of organizing the learning of mathematics from a conceptual development point of view.

We use this perspective as a model to organize the development of flexible and adaptive reasoning and computing, in the domain of addition-subtraction and multiplication-division with integers and fractions. This means that we use the learning process of humanity to model individual learning in mathematics education (Freudenthal, 1991; Sfard, 1994; Tall, 2004).

In this perspective, we follow the idea proposed by several authors that flexibility refers to the ability to manipulate numbers as mathematical objects which can decomposed and recomposed in different ways using properties of the arithmetic operations and different symbolisms for the same objet (Sfard, 1991; Gray & Tall, 1994; Gravemeijer, 2004; Baroody, 2003; Verschaffel, Greer & De Corte, 2007). This means, for de comprehension of ‘multiplication’, that children have to understand that ‘4 x 5’ both represent the process of multiplying (the procedure ‘five multiplied by three’), and the number ‘twenty’ (the concept of ‘product’), and that this number is associated with a lot of other numbers (objects) in a great network of multiplicative relations, for instance 5 x 4, 2, 5 x 8, 2 x 10, 20 x ½ etc.

On one side, we consider this dual nature of mathematical conception and the hierarchical nature of the development of multiplicative reasoning. On the other side, we consider what Gray & Tall (1994) called ‘proceptual reasoning’ (the way of thinking arithmetically), based on the intelligent use of the ambiguity of mathematical symbolism and connections between concepts and procedures, as prerequisite to become flexible and inventive expert in the sense of Hatano.

Core elements of de conceptual analyze of multiplicative reasoning
We present globally the theoretical frame work we constructed to develop de instructional sequence in our teaching experiment *Flexible and adaptive reasoning and computing*. Following the idea of conceptual analyze of Thompson & Saldanha (2003), we organize a chart of what Sfard (1991) call the operational (as process) and structural (as objects) conceptions/understanding of ‘multiplication’. This means that we identified and connected the core element of conceiving/understanding problems ‘multiplicatively’ in situations related with ‘measuring’, ‘multiplication’, ‘division’, ‘fractions’ and ‘proportionality’, independently of the nature of the quantities (discrete and continuous) and the numbers (integers, decimals, fractions). (figure2).

In this presentation we focus on the understanding of ‘multiplication’ with whole numbers and discrete quantities. We take account five aspects of multiplications referred in the theoretical literature:

i. Multiplication of whole numbers is the ‘systematic creation of units of units’ What means ‘quantifying something made of identical copies of some quantity’ and/or ‘envisioning the result of having multiplied’ – ‘anticipating a multiplicity’, mentally, and before calculating (Thompson & Saldanha, 2003).

ii. This involves the use of the expression “... x ....” with two complementary meanings: as the symbolic notation of the process of multiplication, and as representation of a number (or fraction) of some quantity. (Thompson & Saldanha, 2003, Tall & Gray,1994; Sfard, 1991).

iii. ‘Times’ is used to compare two quantities of objects or measures (multiplicative comparison) (Freudenthal, 2002; Vergnaud, 1983, 1988): The ‘3’ in ‘3 rolls’ is the number that is 3 times as large as one roll and the cost of 3 rolls is 3 times as large as the cost of one roll. Analyzing this type of situations children abstract the idea that the product increases as the increasing factor.

iv. Envisioning multiplicities and comparing the quantities structures, children discover the corresponding proportional relations involved in the product. We distinguish two clusters mathematical relations:

- given the product, to maintain the relation between the quantities, increasing one factor implies decreasing the other. 2 x 10 is as much as 4 x 5 and 6 x 4 is as much as 12 x 2;
given a product as $4 \times 5 = 20$. 4 is $1/5$ of 20. 5 is $\frac{4}{5}$ of 20.

v. These relations conceptually connect multiplication with division (Freudenthal, 1981, p. 115) and open the possibility to conceive the isomorphism of the two division structures (portioning/distributive division and segmenting/ratio division, Thompson & Saldanha, 2003; Freudenthal, 1981).

Fig. 1 Core elements of the conceptual analyze of multiplicative reasoning.

**Methodology**

**Design research**

The project plan is based on a three-tiered teaching experiment design research (Lesh, Kelly & Yoon, 2008). The design and reformulation of mathematical tasks that can foster adaptive thinking and flexible calculation is an important part of the project, associated with the development of knowledge of researchers (tier one), development of knowledge of teachers (tier two) and development of learning of students (tier three).
The research team developed multiplication tasks that were reformulated according to the analyses of data provided by clinical interviews and classroom observation. The data was analyzed and interpreted keeping the objective of developing adaptive reasoning and flexible use of number calculation through the development of multiplicative reasoning (Thompson and Saldanha, 2003). In this article we will present results centered in part of the work done at the level of tier one.

**Task design**

We use the example of the task `Prawn skewer´ to present the general principle of the task design and the core characteristics of the common characteristics of experimental tasks.

**The task “Prawn skewers”**

For Vasco’s birthday lunch he prepares prawn skewers. He hesitates between using three or five prawns in each skewer.

1. Can you explain what Vasco is thinking?
   - How would you explain it to one of your colleagues?
   - Which type of skewers would you prepare? Why?

2. Vasco is counting the prawns that his mother bought:
   ... 52, 54, 56, 58, 60, 61!
   - Think in your choice. Imagine the number of skewers you can do with this number prawns. How many, more or less? More than 5? More than 10? More than 20? ...
   - How would you find the exact number of skewers?

**General design principle**

According to Freudenthal (1973), the students should be given the opportunity to experience a process similar to the process by which a given piece of mathematics was invented. It means, that we must imagine a route that would allow the students to connect the elements of his understanding of multiplication as mapped in figure 1 and to discover which concept and/or procedure allows him to shift from one point of view to the other in order to use efficiently well-known facts of relation to find what he doesn’t knows.
Three main aspects of students’ activity

To design the tasks we take in account three different aspects of students’ activity: orientation, mathematical discourse topics and levels of reasoning and calculating.

Orientation. The idea in the task Prawn skewers is to introduce multiplication in situations that stimulate children to "envision something in a particular way", this means to think of copies (including share of copies) of some amount "(Thompson & Saldanha, 2003, p. 24).

In this perspective, contexts, given numbers and relationships, illustrations and / or models available to students, focus their attention on the relationship between the quantities in question and /or the structure of these relationships (order structure). This is different from conventional tasks that engage in calculating a product or quotient - the process of multiply / divide.

As Thompson & Saldanha (2003), we consider, in the perspective of flexible and adaptive reasoning and computation required at the end of primary educations (12 years), that ‘non-calculation way to think of products will be important in comprehending situations in which multiplicative calculation might be useful. The comprehension will enable students to decide on appropriate actions’ (p. 25).

Mathematical discourse topics. In the context of a birthday, students will describe and compare two ways of making prawn skewers and justify its own preference - choose 3 skewers prawns or 5 skewers prawns.

From an arithmetic point of view they have to build, compare and segment multiplicatively imagined quantities of identical objects (skewers with 3 or 5 prawn), using memorized facts and their concept/understanding of ´product’, ´proportionality’, properties of multiplication and equivalence between multiplication and division.

In the terminology of Vergnaud (1983, 1988) the proposed situation belongs to the class of isomorphism problems of measurement. This is a situation that can be analyzed in terms of simple ratio of the measure of two quantities, in this case the number of prawns and the number of skewers.
Levels of reasoning and calculating

In this context and with this numbers students can think and calculate in different levels of conceptualization and / or understanding and use of multiplicative relationships and familiarity with calculation procedures (multiplicative and / or proportional).

The literature (for instance Vergnaud, 1983, 1988) identifies three levels:

- additive reasoning through counting all the represented objects (repetitive addition);
- multiplicative reasoning starting from the representation of the structure of accumulation described with the product.
- proportional reasoning focusing on the relations between the factors and the product.

Analyzing Pedro’s multiplicative reasoning

We conducted a clinical interview, proposing to Pedro (9 years) to solve the task “Prawn skewers”.

We selected 13 episodes that are relevant to understand Pedro’s conceptual knowledge associated with the different levels of understanding of numbers and multiplication/division. We analyze these episodes in the light of the conceptual framework of multiplicative reasoning that we presented earlier.

Episode 1 (1-7)

| Pedro: It is like this, he will make three, five skewers with three prawns, is it not? | Pedro imagines the quantity in two different way (five “threes” and three "fives") and verbalize this correctly. |
| Researcher: See if he is going to prepare three skewers ... | Pedro uses the product as a symbol of a quantity and does not mention the total number of prawns. |
| Pedro: No, three skewers with five prawns |

Episode 2 (19-21)

| Researcher: If you were Vasco what would you do? | Temporary confusion (he doesn’t associate 5 with the number of |
|                                                                 | |

**Pedro:** I would prepare ... prepare 5 skewers with ... I don’t know!

*pawns, he associates it with the number of skewers*

*From the measure point of view Pedro confuses the number of groups with the number of unities in each group (measure).*

---

**Episode 3 (22-24)**

**Researcher:** Five skewers?

**Pedro:** No, three skewers, for instance, with 5 skewers.

**Researcher:** You would prepare skewers with more prawns, with 5?

Pedro: Yes. And after preparing 3 skewers I would use 5 prawns in each one. I had 3 skewers and I would do 5 times 3 that gives 15 prawns, 5 in each skewer, adding it all I would have 15.

*Pedro corrects his own thinking.*

*Verbalization of the structure 3x5*

---

**Episode 4 (24-27)**

**Researcher:** I would prepare skewers with more prawns, with 5.

**Pedro:** Yes. And to prepare 3 skewers I would take 5 to each skewer. So, at the most I had 3 skewers and I would do 5 times 3, which gives me 15. So there were 15 prawns, 5 on each skewer and adding it all it was going to give me 15.

*(line 26) it is the first time that Pedro speaks of a total quantity of prawns and associates 5x3 to describe the structure that gives 15.*

*Pedro repeats a verbalization, but with another expression. This may be a sign that he has the notion of the commutative propriety of multiplication.*

---

**Episode 5 (34-37)**

**Researcher:** More then 5, this was asked in the task?

**Pedro:** Yes.

**Researcher:** Why?

Pedro: Because ... hum ... 13 times 5 are 65.

*Does he continues or not the table of 5? Is this a known fact? Trial and error?*
### Episode 6 (41-47)

**Researcher:** And no more than 10?

**Pedro:** Hum, hum!

**Researcher:** And it is more than 20?

**Pedro:** Probably. Yes! It is more than 20.

**Researcher:** Are you sure?

**Pedro:** Yes.

**Researcher:** Why?

**Pedro:** Because 20 times 1 is 20, 20 times 2 is 40, 20 times 3 is 60, until 5 prawns in each skewer. As until now I have 60, this gives me 80, and this is more than 61.

*Confusion related with the number 20 that seems to be associated to a pattern with the multiples of 20 that Pedro knows. Another inconsistence between the image of the structure and the number that symbolizes the product. Want Pedro verbalizes does not match with this structure: he thinks 2x20 and he says 20x2.*

### Episode 7 (71 - 74)

**Pedro:** Than, if each skewer has only 5 he only can invite 12 friends.

**Researcher:** How do you know it is 12? Explain it to me.

**Pedro:** Because if we take here 13, we do 13 times 5 that is 65. If I have 12 times 5 I have 60.

Writes 12x5 = 60 + 1 = 61

*Connection between multiplication and division and of the understanding of remainder.*

### Episode 8 (75 – 78)

**Researcher:** How do you know so quickly that 12 times 5 is 60? Explain it to me.

**Pedro:** Because 10 times 5 is 50, so 11 times 5 is 55 and 13 times 5 is 60!

**Researcher:** Good!

**Pedro:** And here more 1 it gives 61. So there is one prawn left.

**Researcher:** There is one prawn left?

**Pedro:** Yes because he only can invite 12 friends. I’ve already done 13x5 that gives 65, so I have more than the prawns I had.

*Pedro justifies that 1 prawn corresponds to the remainder.*
### Episode 9 (85-88)

<table>
<thead>
<tr>
<th>Researcher: And if we wanted to invent more friends, what could he do?</th>
<th>Pedro’s response may be a sign of reciprocal reasoning.</th>
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</thead>
<tbody>
<tr>
<td>Pedro: Probably he would take less skewers.</td>
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</tr>
<tr>
<td>Researcher: The number of prawns in each skewer ...</td>
<td></td>
</tr>
<tr>
<td>Pedro: Yes, or he could ask the mother to buy more</td>
<td></td>
</tr>
</tbody>
</table>

### Episode 10 (89-91)

<table>
<thead>
<tr>
<th>Researcher: But imagine that she couldn’t do it.</th>
<th>Pedro’s answer can correspond to an interpretation of the context in terms of quantity and not in terms of measure with different units.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedro: Than he can take fewer prawns in each skewer.</td>
<td></td>
</tr>
</tbody>
</table>

### Episode 11 (94-98)

<table>
<thead>
<tr>
<th>Pedro: he could do ... I’ll do like this, as 30, still is less, 60 is 20 times 3, it is 60.</th>
<th>Pedro associates 60 to 3x20 or to 20x3? He repeats the justification for the remainder.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researcher: write it here.</td>
<td></td>
</tr>
<tr>
<td>Pedro: I have to have 20 friends. He can invite 20 friends.</td>
<td></td>
</tr>
<tr>
<td>Researcher: Ah, if he wants to invite 20 friends ..., write it there.</td>
<td></td>
</tr>
<tr>
<td>Pedro: 20 times 3 is 60 60 plus 1 is 61.</td>
<td></td>
</tr>
</tbody>
</table>

### Episode 12 (99-103)

<table>
<thead>
<tr>
<th>Researcher: If he wants to invite more friends he can invite up to how many?</th>
<th>Peter reveals thought of proportionality. Confirmation of understanding of proportional relationships between the number of shrimps and the number of punctures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedro: Up to 60, al, oh, up to 20 friends.</td>
<td></td>
</tr>
<tr>
<td>Researcher: 20 friends.</td>
<td></td>
</tr>
<tr>
<td>Pedro: Because the number of prawns decreases and this gives more friends.</td>
<td></td>
</tr>
</tbody>
</table>


**Episode 13 (105-111)**

<table>
<thead>
<tr>
<th>Pedro: I do not know if you can do it but if I diminish increasingly the number of shrimps, I could invite more friends!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example of isomorphic structures: 30x2; 20x3; 1x60 and its interpretation in the context that is being discussed.</td>
</tr>
</tbody>
</table>

Pedro: Because, for instance, 30x2 is 60, I invite 30 friends; 1x60 is 60, I invite 60 friends.

Researcher: How many shrimp ate each friend?

Pedro: 1

---

**Concluding remarks**

We propose the following conclusion, using the core aspects of understanding presented by the start of the presentation. We focus on two question. First what tell Pedro´s activity during this session about his understanding of multiplication? Second, what could we say about his ability of `adaptive expert`?

**Understanding of multiplication**

**Acquisitions**

**Multiplication of whole numbers.** Pedro´s description of the way of making skewers and the structure of each skewer shows his understanding of multiplication as the ‘systematic creation of units of units’ (Thompson & Saldanha, 2003). He correctly describes the two multiplicative structures in question: \( n \times 3 \) and \( n \times 5 \).

‘Times’. Pedro used spontaneously the notion that the product increases as the increasing factor. He use the expression \( n \times 3 \) and \( n \times 5 \) as symbol for the number of prawns. He connects \( 5 \times 3 \) with 15 and associates at the same time this number with \( 3 \times 5 \).

We don’t know how Pedro finds the product \( 13 \times 5 \). It could be through repetitive addition or through the continuation of the table of 5, from \( 10 \times 5 \) to \( 13 \times 5 \).
Pedro describes with understanding the difference between $12 \times 5$ that give 60 and $13 \times 5$ that give 65, noticing that the second product is greater than the number of prawns available (see division).

**Proportional relations between factors and product.** Pedro describes with ‘a kind of common sense’ the proportional relation between the numbers of prawns and the number of skewers. He understands that increasing the number of units implies decreasing the number of groups.

**Relation with division.** Pedro uses multiplicative structure to find the numbers of skewers that he can prepare with 61 prawns. He compares multiplicatively $12 \times 5$ and $13 \times 5$, interprets this with the available numbers of prawns, understands that some quantities cannot be exactly divided and symbolizes this arithmetically, using the notion of remainder: $12\times5 = 60 + 1 = 61$. (line 71-74)

**Local temporary confusions**

One temporary/local confusions focus the attention on the transition from thinking in terms of the relation between the numbers of units and the numbers groups and reasoning in terms of relation between the product and his two factors.

Pedro confuse 5 skewers with 3 prawns with 3 skewers with 5 prawns (line 21).

It seems that Pedro’s familiarity with the pattern of multiples of 20 (40, 60, ...) inhibits him to estimate the numbers of skewers (line 43-49).

**Adaptive expertise**

Pedro seems to be relatively familiar with these type of multiplicative structures. Hatano associate expertise with the use of what is learned to invent effective procedures for solving new problems. We identify three elements that could allow Pedro to learn to do this:

1. the use of product ($3 \times 5; 13 \times 5$) and of expressions as $`12 \times 5 + 1`$ as symbol for a quantity;
2. the use of memorized facts as $3 \times 5 = 15$ and $3 \times 20 = 60$,
3. reasoning on the base of properties of multiplication, for instance commutative (3 x 5 = 5 x 3) and distributive (13 x 5 = 12 x 5 + 1 x 5),

4. the solution of the ration division (How many times does 5 go into 61) through seeing division as the inversion of multiplication.

5. The association of the remainder with the pattern of multiples of n.

This combination of operational and structural knowledge about ‘multiplication’ (Sfard, 991) connected with the use of the ambiguity of expression as 3 x 5 and 13 x 5 (Gray and Tall, 1994) seems to give Pedro the prerequisites to think and operate in a flexible and inventive way in the field of multiplication and division problems.

References


Reflective Practice and Teaching for Thinking
New ways to retain vulnerable teachers in the job

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Denmark

The project *New ways to retain vulnerable teachers in the job* is an action research project about group mentoring with a focus on action learning.

The project has a threefold aim:

- To support and develop the participating teachers professionally in order to build up their self-efficacy and retain the teachers in their jobs
- To explore group mentoring with a focus on action learning as method for developing and retaining teachers in the job
- To further develop the mentors’ mentoring skills

**Research question**

The research question is:

Which kind of possibilities and challenges does action-learning present as a method within group mentoring, aiming to strengthen the professional development and satisfaction in the job for mentees as well as mentors?

The underlying questions are:

Does the course contribute to more satisfaction in the job for the participants?

Are there signs that the participants’ professional identity has been boosted?

Has the group mentoring caused the mentees to feel less isolated? Has it built up their self-efficacy? Has it improved their reflection on their practice?

Do the mentors feel that they have advanced in their practice of mentoring?

**Theoretical frame**

The framing of the group mentoring is based on an understanding of mentoring drawing on a critical constructive view of learning working with deconstruction and construction of knowledge and practice, based on experiences with practice, in an equal cooperation between mentors and mentees (Wang and Odell, 2007) and a reciprocal exchange of ideas and construction of knowledge. A process where both mentor and mentees are learning by verbalizing understandings, experiences and knowledge (Heikkenen et al., 2012; Hobson, 2009; Feiman-Nemser, 2001; Little, 1990).

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The design is based on constructivist theory of learning with a sociocultural perspective (Illeris, 2006; Rasmussen, 2004; Heikkinen et al, 2012; Dysthe, 2003 with reference to Bakhtin; Säljö, 2000).

Furthermore, the project has been inspired by the ‘Revantical’ way of understanding action learning (Revan, 1998) as described by Benedicte Madsen (Madsen et al, 2010). Revan assumed that the most important factors in permanent changes in behavior are reinterpretations and reorganizing previous experiences, not supplying knowledge (Revan, 1998). In this process, equal colleagues can have an important influence, and this potential is exploited in a ‘learning group’ (Madsen et al, 2010 with reference to Revan). Knowledge and learning are negotiated by dialogue and reflections combined with distance, focus and support in a tight framing of the process, which must at the same time be broad enough to open up in relation to the person and her challenges. New curious inquiries from equal colleagues are therefore an important instrument in action learning.

The participants learn through inquiry dialogue with equals to gain understanding of the person herself and/or a case in practice and through this they are able to gain new insights. The project has used the VIA action model, defined by the formula \( \Delta L = Q(A,L) + R + P \): Action learning is learning (L) in community achieved through questioning investigation (Q) and reflection (R) in relation to the participants’ action (A). The result is reflected learning. P is for planned, adjusted teaching that may or may not be connected to the other processes. \( \Delta \) in \( \Delta L \) refers to growth in learning during time (Madsen et al 2010, p. 85).

Furthermore, the design of the project relies on:

- The report of Tallis who points to a clear connection between the professional efficacy of teachers and the number of days used for professional development (Pedersen, 2010).
- Jank and Meyer (1997) who point out that reflection is a way to combine theory and practice. Reflective approaches to practice are a way to develop the ability to analyze and evaluate different practical alternatives of acting and in that way contributes to developing skills in practice.
- Korthagen (1995), Korthagen and Wubbels ( 1995) who point out that teachers who reflect are more satisfied with their job, and in relation to this it can be expected that if teachers acquire skills to reflect in and on practice, the self-efficacy will increase.
- The point of Hargreyves that isolated teachers are in danger of losing self-efficacy and skills (Pedersen, 2010). In relation to this it can be expected that self-efficacy may be of importance in regard to retaining teachers in the job.
- Frederiksen (2012) who points out that practicing mentors themselves develop their practice in the inquiry set up and are able to develop and keep up joy of teaching through mentoring.
• Frederiksen (2011) who points out that it is possible to facilitate professional development through group monitoring.

The data analysis relies on the concepts of professional identity (Heggen, 2008), professional development (Rønnestad, 2008), reflection (Chin and Benne, 1969; Korthagen and Wubbels, 1995) and the concept of vitalization as it is developed in Frederiksen (2007), and Kohut (1977,1971,984). Vitalization is loosely linked to intersubjective recognition (Honneth, 1992, 2003).

**Method**

To be able to explore the phenomenological aspects, the general approach has been qualitative research (Kvale and Brinkmann, 2009). The data collection consisted of logbooks from the researcher, mentors, and mentees and additional interviews.

**Logbooks**

After each mentoring session, all members wrote 15 minutes logbook (paid time) in relation to open questions from the researcher. The questions were varied based on content from earlier written logbooks and observations by the researcher.

The aims of the logbooks were several: to strengthen the participants’ insight and reflections on learning processes and in that way strengthen the participants as reflective practitioners, to provide the researcher with insight in the way of thinking of mentors and mentees in relation to the mentoring process. On this basis, the researcher could develop actions based on the reflections on the mentoring process and outcome from the mentors, especially the mentees and from the researcher herself.

**Interviews**

By the end of the course, individual qualitative interviews were conducted with mentees and group interviews with the mentors based on a semi-structured questions guide. Furthermore, questions were asked on personal issues from the observations or the logbooks, primarily to make sure that I (the researcher) actually saw what I thought I saw and, in relation to that, that the interpretation was correct. This can be considered a kind of vocal dialogical validation (Kvale, 1997) to increase the understanding of “the observed phenomena”.

The data collection did not include observations of the practice of the mentees; neither before, during nor after the course. This means that there is only personally experienced evidence about the outcome. The results therefore only show how the participants themselves evaluate the outcome. In relation to this it is obviously difficult to delimit the experienced outcome solely to the course of group mentoring.

**Action research**

Action research was used. This means that I as researcher participated in the process (Andersen, J.V., Bayer M., Plauborg, H. 2007, Madsen et al, 2012, Starrin, 1993). The process was accompanied by reflections and observations written in a researcher log. This together with the logbooks from the participants resulted in different actions such as:
• Input in relation to relevant theory
• Actions “since the last time”
• “The good example” (the aim was here to facilitate and exercise reflection on practice concerning learning in practice)
• Clarification of items in the dialogue for mentors and mentees respectively (aiming to maintain focus on learning in the dialogues)
• Continuous repetition and controlling of the frame for the dialogue (aiming to maintain a discussing and challenging conversation)

Additionally, the mentors carried out individual actions. Actions that the mentors have identified in their action learning related to group mentoring for mentors, parallel with the mentoring for mentees. Actions which they themselves identified as important in the work as mentor.

**The design of the course**
The group mentoring course consisted of 9 sessions of 3 hours with an average of 3 weeks between sessions. 6 out of 9 possible mentees participated, and so did 4 mentors and 1 researcher.

The mentees came from different schools (country, town; big and small towns) from the same community. They teach different subjects and different age groups, have widely different levels of teaching experience and have different ages and sex.

The work was done in 2 learning groups and one common big learning group. Each learning group consisted of a mentor and a mentee, as well as a reflecting team consisting of the other mentees in the group and one more mentor (in order to keep focus upon the learning aspect and the changes in perspective, and to create ideas in relation to perspectives, and to explore challenges and actions). The action researcher was frame consultant.

The conversations typically alternated between:

• Conversation between mentor and one mentee, where the mentee tried to find challenges and focus of learning (with a listening reflecting team in the background)
• Time-out periods, where the reflecting team formulated their reflections and new perspectives (Madsen et al, 2012)

The conversations took place in the learning group, while the other activities were carried out in the common big group.

Parallel with the group mentoring process, a mentor network was established consisting of educated mentors, who participated in an action learning course with a frame consultant in order to qualify the mentor competences further. The actions from this course of action learning were supposed to be related to the mentoring going on in the group mentoring project.

**Results and discussions**
The data show that the group mentoring with a focus on action learning has many possibilities to support and develop mentees. The questioning and exploring dialogue combined with actions develop and make changes. According to Chin and Benne (1969) and Korthagen and Wubbels (1995), reflections are a decisive factor for professional development and change. There are many signs of reflection on practice and experiences of reflection on practice with mentees in the project. Reflections that led to experiments and development of practice and to reinterpretation of experiences that resulted in new positive experiences as a teacher. Reflections on practice were facilitated both by the continuing dialogues, by presentations of “good examples” and by input of theory, related to the problems in the conversations. Theory that could be used to understand or analyze the practice further.

Several participants tell and show in their actions that they have come to a further understanding or development of their own professional identity. A development which the action learning has contributed to. In the conversations, the participants have been helping each other with focusing, structuring and getting perspective and distance, as well as giving each other advice and suggestions for future actions.

The participants experienced solidarity and recognition of their actions and contributions to the reflections in the learning group, all very important factors in order to experience enjoyment and engagement and to develop a feeling of self-efficacy that in the long term can contribute to a greater satisfaction in working life (Honneth 1992, 2003). The participants experienced that their self-confidence in their work increased because of the positive experiences with new actions in practice and by reinterpretations of earlier experiences. Through appreciation and actions several of them experienced an ability to insist on their own individuality, which in turn produced self-confidence. Hopefully after the group mentoring course this will lead to new actions, reflections, self-confidence etc. Throughout the whole group mentoring course it was possible for mentees to experience different forms of supporting self-object environments (Kohut, 1971,1977,1984; Frederiksen, 2007) which also may have contributed to joy and vitalization.

All participants experienced that the conversations were demanding and that they demanded great concentration. They learned most from their own conversations and actions, but also were able to draw parallels from others’ conversations and points to their own practice.

The group mentoring was built up over a narrow frame setting. This narrow frame setting for the conversations along with the awareness of roles and process has without doubt contributed to analytical distance, focus and support in the conversations.

Some mentees felt pressured by the demand for action. Pressure that lead to positive experiences, but which might also have led to a feeling of insufficiency and thereby having the opposite effect of the intention of the project. In this connection, it is important to realize that actions can have different sizes and still be important in the development.
To start action learning courses for teachers who were already experiencing ample challenges enough in their daily work was a somehow daring matter at the start. Actions connected with learning, parallel with the daily work with many challenges, might turn out to be last straw. Action learning is demanding, but at the same time lasting changes in behavior occur (Revens in Madsen et al, 2010) as a consequence of new interpretations and organizations of experiences — as a result of conversation, reflection over actions connected with social learning processes (here in the learning group) are important parts of the learning process. There is no doubt that the participants experienced the process as demanding. A significant insight in this connection is to be aware that the actions and steps can vary in size, but that actions of any size can move and develop the individual person.

It was not without significance that the group mentors were experienced mentors and very experienced teachers who are used to and have intuition for building up confidential and broad learning environments. In their mentor courses and in mentor networks the mentors acquired communication competences as well as competences in keeping focus on learning in conversation, among other things focusing on generalization of experiences. In the group mentoring course with action learning, it became clear how important it was that the mentors were experienced, educated mentors, trained in questioning communication and capable of acting within a narrow frame setting. This factor may be decisive for whether such a course can succeed or not.

The most difficult thing for the mentors was without doubt to have the mentees stick to their own learning processes, to get them to reflect and to generalize their own experiences after the actions and through that stick to the forward perspective. When the concrete actions succeeded for mentees, this was success enough, and further reflections over this were judged unnecessary; and if the actions did not succeed, they rather wanted to ignore it. It cannot be ruled out that just the lack of reflection on practice might be just the factor that gives some of the mentees many challenges. If this is right, the importance of creating room for reflection and to learn mentees to reflect over practice is even more important. So when there are signs of reflection on practice in the end of the course there, this is a powerful indication of a successful group mentoring process.

It has not been an easy job for mentors to carry out group mentoring; they felt that it has been tough and full of responsibility; they used much energy and many thoughts on some of the mentees and on process, both during and after the conversations. In this connection, the participation of the mentors in a mentor network was necessary and rewarding. Participation in the network where they also worked with action learning has improved the competences of the mentors and this way advanced the group mentoring. In addition, the whole course contributed to pride, self-confidence and engagement in the mentors.

Action learning presupposes that you have courage and energy to change practice or thoughts about practice, and in that light the principle about voluntariness becomes important. Most of the participants had not signed up themselves for the project, but had been selected to participate by their headmasters. This had the effect that two mentees left the project before it started and one during the course, after creating some insecurity and a bad atmosphere in the group. The rest of the mentees chose after the very first meeting to see the participation in the group mentoring as a possibility for getting professional support and development. The principle of voluntary participation is a dilemma in a project
concerning vulnerable teachers and demands ethical considerations in each case. On the one side, the principle can mean that a school or a community not will be able to reach the persons that particularly need it, because exactly these persons not are capable of overviewing such a process. On the other side, you risk lack of motivation and drive, and with that no real learning for the participants together with a bad atmosphere in the rest of the group if the participation not is voluntary. This will damage the learning processes of the motivated participants because the process is about commitment in learning groups. Thorough ethical considerations, solid information about the positive intention with the project and the process and the thoughts behind the process is therefore a necessity.

References


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What can Narrative and Metaphor contribute to Students’ Understanding of Scientific Concepts, e.g. Evolution Theory?

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Abstract

We investigated the role of (1) metaphor and (2) the “narrative mode of thought” (Bruner 1996) for meaning making in the science classroom, exploring how students make sense of an adaptation phenomena in lower secondary school (n = 107, age 12-13 ys.). Before and after a teaching sequence on the evolution theory, students explained the evolution of modern whales from their terrestrial ancestors by writing narrative or non-narrative texts on the issue. Text analysis, combined with student interviews, revealed students’ conceptions and their use of stories and metaphors. Eight explanation patterns were identified.

Keywords: metaphor, narrative, evolution, explanation, meaning making

Introduction

In a couple of scientific fields, students tend to stick with their own, non-scientific explanations in spite of instruction. One of these fields is evolution theory, where learning difficulties have been explored and described by several authors (e.g. Halldén, 1988; Weitzel, 2006). Evans (2008) presents three conceptual barriers to evolutionary thinking due to intuitive reasoning: essentialism, teleology and intentionality. Given the fact that some scientific topics are obviously difficult to learn, and intuitive reasoning persists despite instruction, a theoretical framework is needed that provides understanding of why students and laypeople construct these explanations and why they persist. In their construction process, two different tools of imaginative understanding appear to be important: narrative and metaphor. Our aim is to progress from merely describing student conceptions on species evolution to actually explaining how they emerge. We believe this is an important step towards more effective teaching strategies.

Theoretical background
Our study attempts to explore conceptual change processes in evolution teaching by applying two perspectives in science teaching: (1) the perspective of narrative and cultural psychology (Bruner 1990, 1996; Echterhoff & Straub 2003), and (2) the cognitive linguistic theory of George Lakoff and Mark Johnson (1999), called experientialism.

*The role of metaphor for science education*

According to experientialism (Lakoff & Johnson 1999), thought is embodied, that is, our basic conceptions grow out of bodily experience, i.e. perception, body movement, and experience with our physical and social environment. Lakoff (1990, 269f.) distinguishes between basic-level concepts such as »cat«, »sit« or »mat«, and kinaesthetic image schemas such as up-down, center-periphery, front-back, or inside-outside. Wherever we lack experience, e.g. in abstract domains, we tend to use these kinaesthetic schemas in order to imagine this target domain, mainly by means of a metaphor.

In other words, conceptual metaphors serve as unidirectional projections of a schema from a source to a target domain (Lakoff & Johnson 1999). There is convergent evidence from neural science to the theoretical framework of experientialism. The structure of certain schemas was found to correspond to neural structures of our brain (Gallese & Lakoff 2005).

*The role of narrative for science education*

Narrative isn’t merely a text style, but a way of thinking that influences our perception and interpretation of the world. This makes stories comparable to metaphors in that both can be fundamental tools of imaginative understanding (Lakoff & Johnson 1999, Gropengiesser 2003).

Bruner (1990, 1996) assumes that there are two distinct "modes of thought": a narrative mode and a scientific one, each of these with universal characteristics, and stresses the importance of narrative thinking for meaningful understanding. However, it remains to be examined empirically whether the two modes are really as mutually exclusive as Bruner assumes. Furthermore, while narrative has become an issue in science teaching (e.g. Kubli 1996, Kurth et al. 2002, Zabel 2009) and explanatory stories are part of curricular recommendations (Millar & Osborne 1998), there is still no comprehensive theory and very little evidence concerning the use of narrative in the science classroom. The ubiquity and complex nature of narrative makes it hard to explore the “power of story” in learning science. With regard to the role of narrative in learning and understanding, we refer to narrative psychology (e.g. Echterhoff & Straub 2003). Theories of narrative (Labov 1977,
Sutton-Smith 1981, Martinez & Scheffel 2003) and meaning making (Bruner 1990, 1996) are used to analyse students’ texts and interview data.

**Key objectives**
The main questions of this investigation are:

(1) How do 13 year-old students explain adaptation phenomena before and after instruction in this field?

(2) What is the role of narrative for understanding evolution theory, and what do metaphors contribute?

**Research design**
The study and involved five classes from three different grammar schools (Gymnasium), all situated in small towns in northern Germany. The sample encompassed a total of 107 lower secondary students (grade 7, average age 13). All students followed a teaching sequence on evolution theory over a period of five weeks, about 10 lessons in all, designed according to the theory of conceptual change (Posner & Strike 1992). At the beginning and end of the teaching sequence, the students wrote texts that explained the evolution of modern whales from terrestrial ancestors. It was left to them to decide whether to write either a narrative text or an essay.

All texts were analysed for students’ conceptions, using Qualitative Content Analysis (Mayring 2007). Patterns of explanations for whale evolution were identified and examined in the light of cognitive linguistic theory. Structural similarities between the explanation patterns and known schemas described in the literature (Gallese & Lakoff 2005) were analysed. In narrative texts, structure and story plots were examined. A total of 30 students were interviewed individually, focusing on the writing process, conceptions of evolution and their individual significance. The process of meaning making was examined by carefully exploring the individual attitudes, value judgements and biographical aspects that were linked to the text in the author’s mind.

**Findings**

**Explanations**

Eight patterns of explanations for evolutionary change were identified in the learners’ texts (see Zabel & Gropengießer 2011, 146), two of them “Darwinian” in a broader sense:

(1) Intentional adaptation of individuals

(2) Intentional adaptation over generations
(3) Environment causes evolution
(4) Evolution caused by need
(5) Usage of organs
(6) Evolution through interbreeding
(7) Evolution by variation of a type and natural selection
(8) Evolution by full variation and natural selection

Whereas pattern no. 8 represents the scientifically correct Darwinian explanation, no. 7 is close and can be considered a preliminary state. The instruction on evolution theory increased the frequency of Darwinian explanations in the post-instructional texts.

**Metaphor**

Our analysis revealed that three of the rather naïve explanations, no. 1 to 3, exhibit a common metaphorical structure: The pattern that connects them is the action schema, described by Gallese and Lakoff (2005, 461) as follows: “action, that is, a movement executed to achieve a purpose”. Our data suggest that it is the action schema that is responsible for the genesis of three widespread and misleading explanation patterns for species evolution.

**Figure 1**: Sample of students’ work: Max, 13 years, post-instructional text

<table>
<thead>
<tr>
<th>The Evolution of the Whale</th>
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| Bernd was teased by the other prehistoric whale kids all the time, only because he was bigger and had a longer tail. Besides that, he swam very well.

As more and more children were born, there soon was a famine on the island. Even the youngest ones fought for food. But not Bernd. As he could swim, he gathered his food from the sea. He was an individual. All the pre-whales were broken-down and the females all had a crush on Bernd because he was strong.

Finally he started a family with Susy. Their kids could swim, too. They also started families. And that is how the whales evolved.

**Narrative**

Both narrative and non-narrative texts contained Darwinian explanations for whale evolution. Those students who chose to write narratives often used common story plots and motives. Some of these plots, e.g. social outcast stories, appeared to help students to understand key concepts of Darwin’s
theory. The social outcast stories in our data are narratives based around a single individual which turns out to have hidden qualities when the conditions change, e.g. when food gets scarce, and thereby manages to survive and become an attractive mating partner (see Fig. 1). In this case, the author’s understanding of the scientific conceptions could be related to an underlying biographical experience (Fig. 2). The explanation pattern of Max’ story is obviously ‘Evolution by variation of a type and natural selection’ (no. 7). For learners as young as Max, this kind of simplified darwinian explanation appears to reflect a considerable learning progress, compared to the pre-darwinian explanations (1) to (6) that most of them used before the instruction.

Figure 2: Interview sample Max, 13 years, post-instructional text

| I:  | What I would like to know first: Sometimes you write such a story because it reminds you of something. |
| M:  | Well, it did.... about bullying and so. In the fifth grade, there was a girl who got bullied all the time, and that was what I had thought of somehow, and then this (story) came to my mind, and then I wrote this. |
| I:  | What was her name? |
| M:  | She was called Lisa. |
| I:  | And why was she bullied? |
| M:  | No idea. For some reason, no one else liked her, and she didn’t have any friends. And so she was bullied all the time. |

Conclusions

Our findings allow some conclusions on the role of narrative and metaphor in science teaching, particularly evolution theory. The interview data provide examples of narrative meaning-making in science. Plausibly, in order to explain an event as counter-intuitive as species evolution, humans are seduced to look for an agent, for reasons and purposes, which means reasoning with the structural frame of the action schema. However, for many scientific explanations, including natural selection, this is obviously misleading, as the explanation patterns no. 1-3 show. This doesn’t mean though that teachers should avoid all imaginative understanding and anthropomorphism in the science classroom. E.g., for 13 year-old learners, social outcast stories appear to be a good stepping stone to a more developed understanding of Darwinism. However, Bruner’s assumption of two distinct and mutually exclusive modes of thought, a narrative and a scientific one, is rather challenged by our data.

Student narratives, such as these social outcast stories, probably trigger meaning making processes, or at least to make them visible. Therefore, our results encourage the use of student narratives in the science classroom.
References


Abstract

Science centres are visited by schools with children that have a good comprehension of Dutch and by schools with children that have a poor comprehension of Dutch. This study investigates the learning gain of both groups in the new interactive exhibition ‘Treasure Island’ at the Boerhaave Museum in Leiden, The Netherlands. Children with a poor comprehension of Dutch score worst on an knowledge test before and after the visit to the exhibition compared to the children with a good comprehension of Dutch. The later learning even more about the exhibition than the first, although not significantly. The results suggest that a good comprehension of Dutch is important in learning in a science centre but can also be interpreted as a case for interactive exhibitions.

Introduction

Over the last fifty years many people migrated to The Netherlands to settle permanently. They tended to settle in cheap housing, creating areas with many migrants in the larger cities. Consequently the schools in these areas were confronted with many children who did not speak Dutch. Over the decades this process created schools were students have a poor comprehension of Dutch but also a lack in general knowledge like the subjects History (Wagenaar, van der Schot & Hemker, 2011) and Science and Technology (Thijssen, van der Schoot & Hemker, 2011). In The Netherlands these schools are referred to stratum-3 schools and get extra funding from the government to felicitate smaller classes and extra teaching, focussing on language and mathematics and spending less attention to other disciplines. Schools that have mainly children from Dutch origin and score within the norm are referred to as stratum-1 schools.

This pattern led to the hypothesis that students with an education gap would learn less from a visit to a science centre compared to students with no gap. For the latter have more
background knowledge to make sense of the visit and their language skills are better developed enabling them to ask more explicit questions and understand the answers given by text or word. To test this hypothesis six groups of students from six primary schools were followed during their visit to Museum Boerhaave.

A visit to such a museum can be a valuable learning experience (Henrikson & Jorde, 2001, Morentin & Guisasola, 2011, Ottenheim & Hoogenboom, 2014). In order to make it a learning experience instead of just fun (Morintin and Guesasola, 2010) the teacher should focus on the integration of the visit in the school curriculum and the activation of the student’s curiosity (Ottenheim & Hoogenboom, 2014) instead of focusing on the organisation (McLoughlin, 2004). Therefore also the role of the teacher during the visit to Museum Boerhaave was observed.

*Treasure Island / ‘Schateiland’*

The city Leiden has an old centre were many museums are located. In general a class of student visits about once a year a museum (Geukema, 2011). The Boerhaave museum is a Science Centre that specializes in the history of science and medical science. In 2012 a new room around the Dutch explorations of the 17th century was opened for visitors and primary schools. The exhibit invites the visitor to interact aiming to give meaning to the items due to experience (Kolb, 1984)

**Methods**

Six classes (7th grade, 9-11 years) of 6 different primary schools were selected to participate in the experiment: Three classes of stratum-1 schools and three classes of stratum-3 schools. The group size varied between 10 and 27 student with stratum-3 school having considerable smaller class sizes. In total 101 students participated. The visits took place over a period of one and a half month; between the first of April until the fifteenth of May 2013.

The students were given a pre-test directly before the visit to the exhibition Treasure Island. It consisted of twelve questions about the exhibition some of which were possible to know and some questions were very specific and would not be taught in class. During the visit to the exhibition students were observed how they interact with the exhibition. Directly after the visit, students were confronted with the post-test which consisted of the same 12
questions as the pre-test but in a different order. Teachers were observed during the visit and asked to fill in a short questionnaire about the textbooks they used and the number of museum visits the class had.

Results

Students preformed on average significantly (paired T-test $t_{100}=-13.4; P<0.001$) better on the post-test (correct answers=5.89, sd=2.23, n=101) compared to the pre-test (correct answers=3.81, sd=2.03, n=101) with stratum-1 schools significantly outperforming stratum-3 students in the pre-test ($F_{1,99}=9.97; P=0.002$) and post-test ($F_{1,99}=20.5; P<0.001$). Stratum-1: pre-test= 4.26, sd=2.10, post-test=6.56, sd=2.05, n=65; stratum-3: pre-test= 2.97, sd=1.62, post-test=4.63, sd=2.03, n=35. A two-way anova was preformed on the difference between the pre- and post-test with stratum and sex as factors. No difference between boys and girls was found (Boys: pre-test= 3.73, sd=2.36, post-test=5.88, sd=2.41, n=51. Girls: pre-test= 3.90, sd=1.66, post-test=5.90, sd=2.06, n=50. $F_{1,97}=0.53; P=0.46$). Although there were differences between the schools (table 1) it did not break with the pattern. The difference between the pre-test and post-test was greater for stratum-1 students but also not significantly ($F_{1,97}=3.73; P=0.056$). No interaction was found ($F_{1,97}=1.50; P=0.22$).

Table 1: Summary of number of correct answers of the pre- and post-test made by the three stratum-1 schools (Str 1.1-1.3) and the three stratum-3 schools (Str 3.1-3.3). B/G= Boy/Girl. #=number of students. Ave=average, sd=standard deviation. Difference is the post-test minus the pre-test.

<table>
<thead>
<tr>
<th>School</th>
<th>B/G</th>
<th>#</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ave</td>
<td>sd</td>
<td>Ave</td>
</tr>
<tr>
<td>Str 1.1</td>
<td>B</td>
<td>7</td>
<td>4.0</td>
<td>2.6</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>5</td>
<td>2.8</td>
<td>2.2</td>
<td>5.8</td>
</tr>
<tr>
<td>Str 1.2</td>
<td>B</td>
<td>13</td>
<td>3.3</td>
<td>2.6</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>14</td>
<td>4.8</td>
<td>1.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Str 1.3</td>
<td>B</td>
<td>15</td>
<td>5.3</td>
<td>1.7</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>12</td>
<td>4.2</td>
<td>2.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Str 3.1</td>
<td>B</td>
<td>4</td>
<td>2.5</td>
<td>1.7</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>8</td>
<td>4.1</td>
<td>0.80</td>
<td>5.6</td>
</tr>
<tr>
<td>Str 3.2</td>
<td>B</td>
<td>9</td>
<td>3.1</td>
<td>2.0</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>4</td>
<td>3.0</td>
<td>0.82</td>
<td>4.5</td>
</tr>
<tr>
<td>Str 3.3</td>
<td>B</td>
<td>3</td>
<td>1.0</td>
<td>1.7</td>
<td>2.7</td>
</tr>
</tbody>
</table>
**Teachers**

During the visit five out of six teachers (of which four asked the guide what was expected of them) explored the exhibit together with the children. Asking questions and encouraging students to engage with the exhibit. Only the teacher of Str. 1.2 was not engaged with the students. Al teachers indicated that they make about two visits a year to a museum in the city of Leiden. All stratum-1 schools used the same history textbooks, the stratum-3 school used three different textbooks, different again from books the stratum-1 schools used.

**Discussion**

It is clear that students from stratum-3 schools have a less knowledge of history of the golden age of Holland compared to the students from the stratum-1 schools. Although the difference is only on average only one less correctly answered question it is in the direction of the expectation (Wagenaar, van der Schot & Hemker, 2010; Thijsen, van der Schoot & Hemker, 2011). Furthermore the stratum-3 students tended to more often to answer the questions with ‘I don’t know’. All groups score better on the post-test suggesting that they learned something during their visit to the ‘Treasure Island’ exhibition. Other studies also showed an increased knowledge of the subject on hand after a museum visit (Morentin & Guisasola, 2011; Ottenheim & Hoogenboom, 2013) but in those studies a different methodological approach was used. In the current study the same questions were used but presented in a different order. Consequently student could recognize the questions from the post-test and priming may have taken place. The aim of the study was to compare stratum-1 students with stratum-3 student and there is no reason to assume that the priming had a different effect on the two groups.

The difference between the pre- and post-test can been seen as a measure for how much the students learned about the subjects tested during the visit to the Treasure Island exhibition. In this light the stratum-1 students learned more than the stratum-3 students, although not significantly. The probability is very low, bordering on significant, suggesting that stratum-1 student not only start at a higher knowledge level but also benefit more from the museum visit compared to the stratum-3 student. A possible explanation of this effect
can be found in a general lower comprehension of the Dutch language. In any exhibit there is a large information contribution via texts. Alternatively, because stratum-3 student lack knowledge on the subjects, new information cannot be adopted in the knowledge web (context) resulting in a lower information uptake.

Of the stratum-1 schools the students supervised by the teacher that did not interact with the students during the visit, preformed worst suggesting that an active engagement of the teacher with the students is beneficial for the total museum experience as suggested by Ottenheim & Hoogenboom (2013).

The number of students and groups in this study is very low, furthermore using the same questions in the pre- and post-test was not the best method for exploring the learning of migrant and non-migrant children in a science centre. However, the results do point in the expected direction. Non-migrant children start of on a higher level and gain more by a museum visit. This effect only confirms that teachers from migrant (stratum-3) schools are confronted with a formidable task of not only teaching language but also providing the children with much context and background knowledge to facilitate stronger learning in Real Life Learning situations like a science centre visit. On the other hand the nature of the exhibition in Boerhaave Museum (interactive learning) may have influenced the learning of both groups of children since little texts are used and learning mainly occurs with experimental learning. The results can also be interpreted that both groups learn as much in such a museum set up.

**Literature**


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Science teachers’ foreground for continued professional development

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Abstract
There is a lack of studies that are dedicated to qualify our understanding of the significance of lived experiences as well as foregrounds for science teachers’ participation in professional development. Seven Danish science teachers were interviewed and observed. Three teachers exemplify how present experience contributes to aspired career foregrounds. Birger’s focus on the academic basis of the in-service program reflects his aspiration to become a teacher educator. Poul is focused on improving his present teaching and aspires to keep on teaching science. Karl is focused on how to help colleagues and aspires to become a science teaching guide.

Keywords: Foreground, lived experience, science teacher, continued professional development, narrative research.

Background
Life history research has established how science teachers experience with teaching, nature and science has significance for their teaching practice as well as their motivation for participation in continued professional development (Daugbjerg, 2013; Day, Sammons, Stobart, Kington, & Gu, 2007; Roychoudhury, 2012). The retrospective approach that founds life history research leaves out a future perspective in understanding science teachers’ present teaching practice and career aspirations. Science teachers’ current aspirations of their future – their foregrounds – are likely to have significance for their commitment in actual professional development. There is however a lack of studies that are dedicated to qualify our understanding of the significance of experiences as well as foregrounds for science teachers’ participation in in-service training. In this study I have listened to narratives regarding science teachers’ motivation and commitment for participating in science education in-service training in Denmark. Seven science teachers participated in interviews regarding their life history, their experience as science teacher and their reasons for participating in continued professional development.
Lived experience and foreground as a conceptual framework

A science teacher brings his or her personal and professional experience with science, nature and teaching into any professional development program he or she participates in. His or her participation is however not only based on the experiences he or she brings into the program, but also based on how he or she aspires that the program will support his or her career foreground.

**Lived experience**

Teachers’ narratives on their experiences contribute to enriching the understanding of their present teaching and career choices (Day & Gu, 2010; Goodson & Sikes, 2001; Müller et al., 2011). Experiences are often deduced from the stories that life history researchers hear from their research participants. But the relation between the actual life, the lived experience and the stories told about these experiences is not straightforward. Emotions as well as foregrounds influence the way the experience relates to what actually happens and what has happened and how it is retold (Plattner & Bruner, 1984). This calls for reflections on what experience is and how it can contribute to an understanding of the relation between present life and work.

Daugbjerg, de Freitas and Valero (2014) refer to Roth about how teacher experience is always acquired through presence in “this classroom at this time and with these students” (Roth, 2002, p. 21 italics in original). They see that this indicates that teacher experiences are gained in specific teaching situations. Personal experiences can be characterised by temporal, situational and interactional principles (Dewey, 1938), principles that can be aligned along inward, outward, backward and forward directions of experience (Clandinin & Connelly, 1994, p. 417).

The inward direction relates to feelings and moral dispositions. The outward direction relates to the social environment. The backward and forward directions relate to time. Clandinin and Connelly (1994) condense these 4 directions to 2 dimensions, one dealing with inward-outward and one dealing with backward-forward, then they add a third dimension space, which deals with the landscape of inquiry. Based on the work of Clandinin and Connelly, we redefine Dewey’s
principles of experience as three dimensions. We see one dimension dealing with the temporal continuity of actions and experiences, another one dealing with the educational settings of the actions and experiences and a third dealing with the social, material and personal relations of the actions and experiences. The three dimensions provide our overall analytical framework for the interpretation of teachers’ lived experiences and their living bodies in the classroom. (Daugbjerg et al., 2014)

Humans’ power to act knowledgeably in their familiar world and settings is inseparably intertwined with their everyday experiences (Hwang & Roth, 2011, p. 2). The fundamental conditions of teacher experiences arise from an irreducible unit of being in the world and everyday knowing (Roth, 2002).

Relations are experienced most intensively in the present, in the immediate now of communicating with a person, or sensing an emotion, or enjoying a landscape, or participating in an event. All these moments of presence in relations and settings are somehow continuously seasoned into general experiences that can be activated when a similar relation or setting is encountered (Daugbjerg et al., 2014)

Teachers’ experiences are contextualised to the teachers’ living bodies based on their bodily engagement in managing classrooms, illustrating scientific principles, setting up experiments or investigations, guiding field trips, dealing with emotional relations, hunting, fishing, picking berries, gardening, bringing up their own children, feeding their own pets, etc. It is this entanglement of feelings, actions, knowledge and experiences that the teacher uses when (s)he teaches the subject matter of science to the pupils (Daugbjerg et al., 2014). It is the same entanglement that guides him or her in aspiring different career foregrounds.

**Foreground**

Within mathematics teaching it has been empirically established that pupils’ dispositions for engaging in learning and teaching originate from a dynamic relation between their lived experience and their expectations to the future (Skovsmose, 1994). When pupils decide to learn e.g. subject matter concepts, this happens in relation to their individual previous experience and in relation to their individual considerations and interpretations of options for actions in future situations and relations (Daugbjerg, Svejgaard, & Valero, 2014). This
significance of expectations of future use and benefit of actual learning is described as foreground by Alrø, Skovsmose and Valero (2009). Learning is not seen as only a prescribed activity but also as a present understanding of a possible future (Daugbjerg et al., 2014).

Within adult education the significance of participants interpretation of the intention of ongoing teaching is well established (Düsterdich, 2009). Adult learning is thus also connected to the participants’ aspirations to the future benefit of the ongoing educational activity.

Conceptualizing this participant interpretation as foreground in professional teacher development offers a coherent operationalization of the teachers lived experience and their aspirations. The participating teachers’ perspective on past, present and future forms the pivotal point of the analysis in the present study.

**Methodology**

A basic principle in narrative research is that each participant must be understood and treated on his or her own terms. This enables a deeper analysis of, among other things, hidden emotional experiences, experiences that hold central turning points and dilemmas of a human life story (Antoft & Thomsen, 2002). Narrative conventions of specific societies, as in this case the teaching profession, contextualise a given narrative. Interpretation of the narratives and the experiences behind them is performed in an existing culture where text, jargon and genre are given cultural resources (Antoft & Thomsen, 2002). The presented narratives can be combined to create many different valid versions of the person’s life story, but always representing the person as a subject in a text (Antoft & Thomsen, 2002). In order to contextualise the participating science teachers’ narratives in the teacher profession and add a perspective on science teaching to their narratives, I had to do more than interview them. Traianou emphasises the importance of studying teachers’ actual teaching practice:

> [...] the assessment of an individual’s knowledge should be based on how this person performs, and not on what this person says about his/her own performance or what he/she can and cannot do in artificial situations. (2007, p.40)

She can be read as though she finds the use of interviews misleading or even unnecessary. Rather she puts her finger on the need to study teachers as closely as you can get to real situations. Thus, rather than simply recounting verbatim the teachers’ own accounts of their practice, nor confining one’s study to their performance in teaching situations, you should
apply a research method that brings together diverse field data and presents teachers in all their complexity. This is important in order to saturate our insight in the teacher’s actual practice and his or her background for interpreting participation in in-service training.

**Method**

In order to have a rich account of a teacher’s professional life I have included interviews, observations and some contextual data regarding the school and local area where they live and work. Such a method has been tried out by Norrie and Goodson (2011) and Brickhouse and Bodner (1992). Norrie and Goodson focused on “educational restructuring and the work lives and professional knowledge of primary teachers in England” (2011, p.11). Their analysis of work life narratives was based on: “two life-history interviews and observations (of two to three days)... First interviews were unstructured and second interviews explored emerging themes.” In the present study interviews have likewise been conducted in two turns. Furthermore the participating teachers were observed and videotaped to saturate their interview description of their science teaching practice.

**Research context**

In Denmark the pupils follow the same cohort of peers from year 0 (kindergarten class) until year 9. During these 10 years of schooling the pupils meet 4 different science subjects. From year 1 to 6 they have a primary science subject called ‘Natur/teknik’ (Nature/Technique) and from year 7 to 9 they have Biology, Geography and Physics/Chemistry as three independent science subjects.

A science teacher in Denmark can teach one or several of the science subjects depending on the local school organisation and his/her pre-service and in-service education. In Denmark teachers’ normally teach different subjects and different years. The Danish teacher education for primary and lower secondary school is a 4-year bachelor program.

The teachers in this study have participated in four different in-service training programs:

A) A 6 months full-time subject matter training program within primary science.
B) A 2 years part-time general science education program with elements of guidance of colleagues.

C) A 3 year part-time program with focus on school-based collaborative development of science education

D) A 2-year part-time program with focus on developing primary science.

Teachers who had participated in one or more of these four different in-service programs were asked to participate in the present study. They volunteered in having a stranger like me talking with them about their life and being present in their classroom.

Participating teachers

Table 1: Basic biographic data of the participating science teachers.

<table>
<thead>
<tr>
<th>Teacher alias</th>
<th>Gender</th>
<th>Birth year</th>
<th>High school or similar finished</th>
<th>Other training or employment prior to teacher training</th>
<th>Start of teacher education</th>
<th>Graduation as teacher</th>
<th>In-service training program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane</td>
<td>♂</td>
<td>1954</td>
<td>1974</td>
<td></td>
<td>1974</td>
<td>1978</td>
<td>A</td>
</tr>
<tr>
<td>Simon</td>
<td>♂</td>
<td>1971</td>
<td>1990</td>
<td>Laboratory worker</td>
<td>1997</td>
<td>2001</td>
<td>A, B</td>
</tr>
</tbody>
</table>

Teachers’ expectations to school based collaborative development.

The analysis of the interviews and observations were focused on eluding how foregrounds were expressed and on how they reflected lived experience. In the following interview excerpts from three teachers will be presented. The three teachers illustrate in different ways how their individual foregrounds affect the way they engage with the school based collaborative development in-service training program C.

Birger, age 47 years, 13 years as a teacher
Birger has changed to the teaching profession after 13 years as a hardware dealer. He has had his interest for nature from very early childhood; he has been studying nature and science literature all his life. He has ever since he left lower secondary school known that someday he wanted to become a teacher. During the interviews he repeatedly talks about becoming a teacher educator. In the above excerpt he puts emphasis on his devotion to evidence and an explicit knowledge base for educative activities. He sense that this approach to education can fulfilled better as a teacher educator.

<table>
<thead>
<tr>
<th>Danish interview transcript</th>
<th>English translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>... fordi det er det jeg savner nogle gange ved efteruddannelse, det er at dem der står og snakker og underviser, de ved hvad de har med at gøre. Det er ikke altid man oplever det ved vores efteruddannelse. Jeg har været til et hav af sådan nogle efteruddannelser, hvor jeg har hørt meget om hvad andre synes man skulle gøre, men der har aldrig rigtig været nogen der har snakket om hvad man ved man bør gøre. Det er sådan noget som den aktuelle efteruddannelse er udtryk for, at der har man noget belæg for at sige det man siger. Det savner jeg nogle gange ved efteruddannelse, det er det belæg for de ting vi går og gør.</td>
<td>... because that is what I miss sometimes at in-service training, that those who talk and teach, they know what they are dealing with. This is not always what you experience at our in-service training. I have been at many such in-service training, where I have heard what others think you should do, but it has never really been someone who knows what you should do. It is this that the present in-service training reflects, that here you have evidence for what you say. That is what I sometimes miss at in-service training, that there is evidence for the things that we do.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Poul, age 30 years, 4 years as a teacher</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Danish interview transcript</td>
<td>English translation</td>
</tr>
<tr>
<td>Jamen det man måske kunne se i det lange løb, det er måske, at der kunne komme lidt mere samarbejde på tværs af skolerne her i kommunen. I 8. klasse der får vi elever fra naboskolen, hvor vi så snakker sammen om vores 7. classes-planlægning, så det de lærer i 7. i fysik, det skulle også gerne være det de lærer de andre steder i fysik. Så det har vi sådan lidt på tværs, det kunne vi måske få lidt mere af, det der med at man kan vidensdele på den måde, det tænker jeg er en del af den aktuelle efteruddannelse ... Det er det vi skal bruge det til.</td>
<td>Well, what you might see in after a while, that is perhaps, that there could be a bit more cooperation between schools in the municipality. In year 8 we get pupils from the neighbor school, then we discuss our year 7 planning, so what they learn in year 7 physics, should be the same they learn the other places in physics. So that we have sort of a little in common, that we might have some more off, sharing knowledge like that, that I think is part of the present in-service training ... that is what we shall use it for.</td>
</tr>
</tbody>
</table>
Poul has been very focused on becoming a science teacher and he is dedicated to keep on teaching science. In the above excerpt he is developing his own local rationale for the in-service program he is participating in. He sees it as an opportunity to strengthen the curricular collaboration with the neighboring 7 year school in order to improve the coordination and joint planning. The pupils from this school enter Poul’s physics class in year 8 along with pupils he himself has had in year 7 at his own school. He wants to make sure that all the pupils are well prepared for his 8 year physics teaching. This shows how focused he is on his present classroom teaching and on improving his teaching.

<table>
<thead>
<tr>
<th>Karl, age 33 years, 7 as a teacher</th>
<th></th>
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<tbody>
<tr>
<td>Danish interview transcript</td>
<td>English translation</td>
</tr>
<tr>
<td>Jamen jeg forventer jo i det, at, og det er vi også enige om tror jeg nok, en generel styrkelse af naturfagene og tænke det mere sammen. Vi har et par geografilærere med, som jo, det kan jeg godt tillade mig at sige uden at fornærme dem, er blevet sat til kort med nogle ting, når vi har snakket arbejdsmetode fx. Og har diskuteret det og ikke... Og lige “hov hov hov, det er jeg ikke med på. Hvad er det lige der menes her? Og hvad er det for nogle modeller i andre snakker om her?”. Og det er jo dejligt også at få snakket om det og få dem med også jo.</td>
<td>Well I expect, that, and I think we agree on that, a general boosting of science and thinking it more integrated. We have a couple geography teachers, they, I can say this without insulting any, had to give up when we were talking about ways of working in science. We discussed it and they ”hey, hey, hey I’m not following you. What do mean by this? What kind of models are you talking about?” It is nice to be able to talk about it and help them along also.</td>
</tr>
</tbody>
</table>

Karl has been engaged in a Danish Boy and Girl Scout movement [FDF] for more than 20 years, here he have been working with developing children and youngsters personal character and practical skills. Karl has been very focused on becoming a science teacher and has taking a - for Denmark - special 3-year teacher bachelor training program focusing exclusively on Physic, Chemistry and Mathematics. In the interviews he repeatedly talks about wanting to be a science teaching guide for his colleagues. In the excerpt above he also focuses on how his colleagues express their insecurity and how he can help them. Karl emphasizes how collaboration on the school can support other colleagues to improve their science teaching. This emphasis relates back to his scout engagement and coincides with his aspired foreground as a science teacher guide.
Discussion
The three presented teachers show different foregrounds for their participations in the same in-service program focused on collaborative development of science education. The expressed foregrounds reflect their career aspirations and relate to dimensions of their lived experience.

Relations
Poul and Karl refer to former and present collaboration with colleagues in order to establish their foreground for the expected outcome of the ongoing in-service program. All three teachers relate to their own experience-based intentions with participation in the ongoing in-service program.

Settings
Any in-service training is imbedded in the local school culture and setting. This local perspective is in the above excerpts most significant in Poul’s narrative on the pupils being transferred to his school in year 8. Other of the seven participating teacher has narratives on how on-going school restructuring affect their own and colleagues engagement and commitment to in-service science education programs.

... well for the time being we try to arrange all these meetings, but as we also are being merged with the neighbor school, then there is very, very, very many meetings at the moment. This we have to take into account, that we don’t drown people in something, so we try to make it as free takeaway science teaching, because what get for free you usually accept. (Laila, age 51 years, 21 as a teacher)

Continuity
The continuity between on the one hand former school development and on the other hand present in-service training shape whether the teacher expects former positive experience to be met or whether it will support skepticism towards in-service training. This becomes clear when the teachers talk about their expected outcome of the in-service program and their career aspirations are combined. Birger wants academic evidence and he aspires to become a teacher educator, which is an academic profession in Denmark. Poul wants to improve the teaching by coordinating it across several schools; his aspiration is to teach science. Karl
wants to help his colleagues to improve their science teaching and he aspires to become science education guide.

**The significance of addressing the individual foreground**

The teachers’ aspired foreground for participating in the present in-service program does affect the engagement the teachers tell about their participation of the present in-service program. Narratives about the teachers lived experience enrich the understanding of their aspired foregrounds.

**Conclusion**

Addressing the teachers lived experiences and foregrounds bring forward different and individual intentions of the participating teachers. Some teachers wants to improve own teaching others wants to help colleagues improving their teaching. Awareness of such differences can help in understanding why teachers do not respond or act as expected in continued professional development. Some even have foregrounds that differ from the agenda of the in-service training program, as they might see an in-service training as a career change opportunity. The differences should be dealt with pedagogically – or rather andragogically – so that in-service program planners and educators acknowledge these differences and address them directly. This indicates that the purpose of a given in-service program should be clearly stated and communicated, so that teachers with intentions deviating from the stated purpose can be met with understanding and guidance in order to stay in or leave the program.

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Technology, Teaching and Learning
Attitudes of pre-service teachers towards taking risks

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Abstract

When asked teachers tend point to external factors as an explanation why certain activities in primary education is not done like real life learning, science and technology or story telling. To little time, money or assistance. This paper aims to explore an internal factor as a possible explanation for the lack of innovation in primary schools in the Netherlands; the attitude toward taking risk your self and letting student take risks in a school situation. A questionnaire was formulated to assess the amount of risk taking student teachers would take and would allow pupils to take. A link to actual behaviour in the classroom was sought but not found. Student teachers tended to take more risk in know situations compared to novel or less familiar situations. Pupils were allowed to take more social and intellectual risked than physical risks. This questionnaire can be used for further research to investigate the cause of innovation failures in school situations

Introduction

Science and technology is differently taught compared to other subjects. Instead of working with pen and paper, science and technology teachers prefer a hands on approach where students are encouraged to interact with real materials asking inquisitive questions (Kolb, 1984; Donovan & Bransford, 2004; Walma van der Molen, et al., 2009). Technological museums like Heureka (Helsinki, Finland) Nemo (Amsterdam, The Netherlands) and the Eureka Museum of Science (San Sebastian, Spain) follow a similar practical approach. Visitors to these centres are challenged to engage in an exploratory dialog (Kolb, 1984) while physically interacting with the exhibition. These pedagogical approaches are very different from the daily practice in primary and secondary schools. Most often students read a text about a subject after which questions are answered testing not the comprehension of a scientific concept but the understanding of a text. This is a very old problem that frustrated many science teachers on the educational colleges and raises the question why it does not change. Not just the discipline of science and technology struggles with this problem but changes in pedagogical methods due to recent scientific insights in other disciplines have not become common practice in school in The Netherlands like using visual aids and object sin history; story telling for language development; engaging activities
with geography; and outdoor education. Several reasons for the problem have been put forward. Teachers lack the knowledge about these different kinds of teaching and have no experience in teaching them (Palmer, 2004; Walma van der Molen, de Lange & Kok, 2009). Schools tend to stick to what works therefore there is no pressure from the management to change the current teaching methods.

In a study about Real Life Learning teachers themselves indicate that they are positive toward outdoor learning and would like to teach more outdoors but need more money, transport and time for outdoor learning in the curriculum (Slikke et al., 2010). However, when these factors did not play a role, student teachers still found it challenging to organize a outdoor activity (Slikke et al., non published data) with several student teachers not completing the outdoor learning assignment. This has led to the hypotheses that not only external factors play an important role in changing the schools methods from 'verbal' to 'engaging', but that internal factors like the willingness to take risks might hamper this change in paradigm.

In the German Socio-Economic Panel (SOEP), over 22,000 participants are asked to fill in a questionnaire dealing with issues like social status, economic status and attitude towards taking risks. Several questions estimate the level of the willingness to take risks in general but also in more specific situations like, during driving or in economic decisions. Dohmen et al. (2011) validated these questions by having 440 participants make choices in a real-stakes lottery experiment. On the basis of these questions a questionnaire was develop with the intention to measure the willingness to take risks in a teaching setting. The aim of the study was to couple the results on willingness to take risks to actual teaching behaviour.

**Method**

On the basis of the seven questions about the attitude toward risk taking of Dohmen et al. (2011) a lengthy questionnaire was constructed. Eight questions were formulated to assess the attitude towards risk taking in the classroom during lessons. Four questions aim to assess risk taking during known and novel situations. Two assess the risk taking during a lesson when someone is present. And two questions assess the risk raking outside the classroom. The third sections aims to assess how much risk the participant allows students
to take. Four questions concern normal activities of students in the classroom. Three questions concern normal activities outside the classroom and two questions concern irregular activities that might be stressful for the participant. The fourth section aims to assess a number of behaviours the participant displays during his interaction with the students. Some behaviours are thought to be general practice in The Netherlands but others are generally done by children but not in a school environment.

The questionnaire was presented to students of the fourth year of the college of education of the University of Applied Sciences Leiden (The Netherlands) as a online questionnaire using Google Drive. A link to the questionnaire was sent to 102 students with a short note asking them to participate. Three days later a reminder was posted on the Electronic Learning Environment (Blackboard) and a second e-mail was send a week after the first email asking specifically men to participate since only one man (of a total of seven) had responded after a week. A week after the second email the questionnaire was closed.

The Google Drive spreadsheet was exported to SPSS 20 for Mac and analyzed using exploratory statistics and factor reduction. The factor analysis yielded no obvious patterns therefore it will not be presented

**Results**

Of the 102 student teachers invited to participate, 41 actually contributed to the dataset of which four were men. Because of this small number of men only the total data is presented. In general student teachers tend to take more risks in their spare time (during sports) than in all other circumstances used in the SOEP questionnaire (Dohmen, et al., 2009) (table 1). The least risk was taken during money affairs. Only two student teachers did not own a driving license and four student teachers interpreted the question about professional career as not important. The distribution of the first general question is tailed toward the low side but other distributions almost show multiple peaks as indicated by high standard deviations. Some of the results test significant deviation from normal distribution (table 1, 2, 3)
Table 1. The mean and standard deviation for the seven questions derived from the SOEP questionnaire. Each question is tested for normality with a Shapiro-Wilk-test. * = P < 0.05; ** = P < 0.01; *** = P < 0.001.

<table>
<thead>
<tr>
<th>Question</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>In general, how easily do you take risks or take no risk?</td>
<td>41</td>
<td>5.78*</td>
<td>1.65</td>
</tr>
<tr>
<td>How much risk do you take when driving a car?</td>
<td>39</td>
<td>4.56</td>
<td>2.98</td>
</tr>
<tr>
<td>How much risk do you take in money affairs?</td>
<td>41</td>
<td>3.85</td>
<td>2.56</td>
</tr>
<tr>
<td>How much risk do you take during your free time and/or sports?</td>
<td>41</td>
<td>6.83***</td>
<td>1.91</td>
</tr>
<tr>
<td>How much risk do you take in your professional career?</td>
<td>37</td>
<td>5.78</td>
<td>1.92</td>
</tr>
<tr>
<td>How much risk do you take with you health?</td>
<td>41</td>
<td>4.93</td>
<td>2.54</td>
</tr>
<tr>
<td>How much risk do you take in trusting unfamiliar people?</td>
<td>41</td>
<td>4.88**</td>
<td>3.00</td>
</tr>
</tbody>
</table>

Compared to the first general question student teachers take more risk on their practice school on all question except teaching ‘… with a parent present’; ‘… in the school playground’, and ‘… in the school surroundings’ (table 2). Especially high scored ‘teaching with a familiar classroom activity’ and ‘… a familiar subject’, signalling confidence during those situations. Distributions tended to be normal except for ‘… on the school playground’ and ‘… school surroundings’ where a strong tail was present (figure 1 & 2). This pattern can be found at several questions were the distribution is found to be significantly not normal. A small number of students displayed a extremely low willingness to take risks compared to the average score.

Table 2. The following questions address your attitude towards taking risks in your professional area (as a teacher at the primary school). Each question is tested for normality with a Shapiro-Wilk-test. *= P < 0.05; ** = P < 0.01; *** = P < 0.001.

<table>
<thead>
<tr>
<th>Question</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>When teaching a new subject?</td>
<td>41</td>
<td>6.56</td>
<td>1.94</td>
</tr>
<tr>
<td>When teaching with a colleague present?</td>
<td>38</td>
<td>6.13</td>
<td>2.06</td>
</tr>
<tr>
<td>When using a familiar classroom activity?</td>
<td>41</td>
<td>7.37**</td>
<td>2.17</td>
</tr>
<tr>
<td>When teaching with a parent present?</td>
<td>38</td>
<td>4.71</td>
<td>2.10</td>
</tr>
<tr>
<td>When teaching a familiar subject?</td>
<td>41</td>
<td>7.76**</td>
<td>1.32</td>
</tr>
<tr>
<td>When teaching on the school playground?</td>
<td>41</td>
<td>5.59*</td>
<td>2.24</td>
</tr>
<tr>
<td>When using a new classroom activity?</td>
<td>41</td>
<td>6.07</td>
<td>1.88</td>
</tr>
<tr>
<td>When teaching a lesson in the school surroundings?</td>
<td>41</td>
<td>5.49***</td>
<td>2.05</td>
</tr>
</tbody>
</table>
The first two sections of the questionnaire addressed the amount of risk the student teacher him-/herself was willing to take. In the following section the student teachers indicated how much risk he/she allows primary school students to take in a school situation. The questions about gymnastics, walking and bicycling stand out due to a low score and a high standard deviation (table 3). Also most distributions were found to differ significantly from normal. The last four questions addressed school situations were students would
engage with intellectual, organizing or social challenges, scored high compared to more physical challenges.

Table 3. The following questions address how much risk you allow students to take in and around the school. Each question is tested for normality with a Shapiro-Wilk test. *=P<0.05; **=P<0.01; ***P<0.001.

<table>
<thead>
<tr>
<th>Question</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>During a PE (Physical Education) lesson?</td>
<td>34</td>
<td>4.28</td>
<td>2.73</td>
</tr>
<tr>
<td>When playing on the school playground?</td>
<td>41</td>
<td>5.61*</td>
<td>2.12</td>
</tr>
<tr>
<td>When walking through the neighbourhood?</td>
<td>41</td>
<td>3.20*</td>
<td>2.18</td>
</tr>
<tr>
<td>At a camp?</td>
<td>35</td>
<td>5.14**</td>
<td>2.02</td>
</tr>
<tr>
<td>Riding a bicycle to an off school activity?</td>
<td>37</td>
<td>2.89*</td>
<td>2.01</td>
</tr>
<tr>
<td>When engaging in an intellectual challenge?</td>
<td>39</td>
<td>6.33***</td>
<td>2.08</td>
</tr>
<tr>
<td>When planning their own work?</td>
<td>40</td>
<td>6.40**</td>
<td>1.73</td>
</tr>
<tr>
<td>When choosing a subject for a presentation?</td>
<td>40</td>
<td>6.78</td>
<td>1.86</td>
</tr>
<tr>
<td>When working in a group?</td>
<td>41</td>
<td>6.63*</td>
<td>1.83</td>
</tr>
</tbody>
</table>

The risk questions were scored on a one to ten scale but the behaviour indicators were scored on a Lickert scale of five (table 4). A high score indicates that the student teacher often shows that specific behaviour. Children are allowed to run on the schoolyard but are not allowed to climb trees or jump ditches. Student teachers read to the class but less tell stories from the heart. The intermediate score of showering might be there because most students have not taught in higher grades were showering is needed. It is interesting to note that when student teacher were asked to indicate how much risk a student is allowed to take during classroom activities (table 3, the last four questions) the answer not translates to actual behaviour in the classroom. For example: ‘...when working in a group.’ scores high when allowing students to take risk but students are modestly allowed to form groups for themselves.

Cronbach’s alfa for the questions from the SOEP questionnaire was relatively high (0.78; N=7) but the Cronbach’s alfa for the second and third part of the questionnaire about the risks students themselves take, was even higher (0.90; N= 17) indicating a strong relation
between them. Cronbach’s alfla for the fourth part of the questionnaire was very low (0.45; N=14) indicating that questions measure different behaviours.

Table 4. Indicate your opinion about these statements. The mean represents the mean score of the participants on a Likert scale where 1 is ‘I don’t do it’ and 5 ‘I do it all the time’.

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I let students plan their own tasks in the week.</td>
<td>39</td>
<td>2.36</td>
<td>1.35</td>
</tr>
<tr>
<td>I read to the class.</td>
<td>41</td>
<td>3.32</td>
<td>1.03</td>
</tr>
<tr>
<td>I allow students to run on the school playground.</td>
<td>41</td>
<td>3.90</td>
<td>0.37</td>
</tr>
<tr>
<td>I have students performing tasks above the level.</td>
<td>40</td>
<td>2.35</td>
<td>0.70</td>
</tr>
<tr>
<td>When possible I allow students to climb trees</td>
<td>40</td>
<td>1.65</td>
<td>1.33</td>
</tr>
<tr>
<td>I let students make their own groups</td>
<td>41</td>
<td>2.10</td>
<td>0.97</td>
</tr>
<tr>
<td>When possible I allow students to jump ditches (with water)</td>
<td>39</td>
<td>0.90</td>
<td>0.97</td>
</tr>
<tr>
<td>I read books for children for my own pleasure.</td>
<td>39</td>
<td>2.41</td>
<td>1.50</td>
</tr>
<tr>
<td>I let students light candles.</td>
<td>39</td>
<td>1.51</td>
<td>1.43</td>
</tr>
<tr>
<td>I allow student to answer the central school telephone.</td>
<td>40</td>
<td>0.30</td>
<td>0.91</td>
</tr>
<tr>
<td>I let student shower after PE (boys and girls separate).</td>
<td>36</td>
<td>1.97</td>
<td>1.78</td>
</tr>
<tr>
<td>I tell heartfelt stories.</td>
<td>40</td>
<td>2.27</td>
<td>1.32</td>
</tr>
<tr>
<td>I use the interactive white board.</td>
<td>41</td>
<td>3.54</td>
<td>0.78</td>
</tr>
<tr>
<td>I am inquisitive.</td>
<td>41</td>
<td>3.63</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Discussion

As expected student teachers indicate that they take most risk during familiar situations in their school practicum and somewhat less risk during new and unknown situations. Even less risk is taken with working in the school playground and in the school surroundings. Especially low risks were reported when teaching with a parent present. This is to be expected because the student teachers feel observed and may feel judged. On the other hand student teachers report more risk taking with a colleague present. Student teachers are used to being observed by their supervisor and lecturers from the college of education, which might explain their boldness.
Several scores on risk taking dropped when the questions addressed how much risk the student teachers allow the children in school – their own students – to take while under their supervision. Especially ‘when walking through the neighbourhood’, ‘cycling to an off school activity’ or ‘physical education’ scored low. These student teachers report giving the students a lot of responsibility in organising their own education but do not allow that much space when the student teachers are asked to report on their actual classroom behaviour signalling are divide between intention and action. Alternatively student teachers can have reasonable explanations for this presumed discrepancy. Pupils tend to team up with friends, choosing the safe group composition. When de student teacher makes groups the situation is more challenging for the pupils and they have to take more risks. Either way it shows that future research must be carefully designed.

The Dutch student teachers answered the questions in the questionnaire that originated from the German economic SOEP questionnaire in a similar pattern as the German participants did (Dohmen, et al., 2011). The student teachers take more risks in their spare time and during sports compared to the first general risk question. Least risk is taken at money affairs. Dohmen, et al. (2011) validated their general questions by a economic game that participants played. They concluded that the general question is a good indicator of the actual behaviour of the respondent in that economic game. This however is not the case in this study. A factor analysis did not yield specific principle components even though the Cronbach’s alfa’s were high.

Dohmen, et al. (2011) found that younger participants and men generally report more risktaking than older participants and women. Neither result could be tested in this study since almost all participants were female and between the age of 20 and 24. It would however be an interesting test to do on a large sample of in-service teachers. In the Netherlands fewer and fewer men teach at the primary schools with numbers as low as 10% of the teachers being male (Driessen & Doesborgh, 2004). Although no detrimental effect for the schoolchildren could be proven in a large statistical study (Mee, 1997), many experts feel that the schoolchildren miss the manly approach in education (Woltrinng, 2003; Veendrick, Tavecchio en Doornenbal, 2004) an approach that could involve men allowing students to take more physical, intellectual and social risks.
The aim of the study was to couple the attitude towards risks to actual practice in schools. Although many significant correlations between measured factors were present no general pattern was found in this small sample of mainly young female pre-service teachers. The study did show that the questions about risk taking is aligned with the questions about risk taking used by Dohmen et al. (2011) and therefore can be used as an instrument to assess risk taking in a larger educational context. Further research can use these questions to investigate why school innovations like technology, real life learning and story telling take so long to become common in the Dutch primary schools.

**Literature**


Urban Education
How can exposure to practice in a foreign context enhance the professional development of teacher students? - Case study from South Africa

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Norway

Abstract

This research paper presents a case study aimed to explore and analyse teacher students’ professional development through exposure to the concept of Teacher Well-Being in a foreign context. Norwegian teacher students have been placed in three primary schools and kindergartens in South Africa for up to three months since 2010. The schools have in the same period been piloted for a Teacher Well-Being programme. A number of educational programmes world-wide focus on the needs of learners and learner well-being. However, very little is being done to understand and support teacher well-being. Collett and Olsen argue that through a focus on involving teachers in addressing their well-being needs, the collective agency at school level to promote school improvement can be generated (Collett, Olsen 2012).

The research design of the case study draws on leadership and organisational change theories and studies (e.g. Dalin, 1998; Fullan, 2004). The methodological rationale for the qualitative research approach forms part of a search for meaning within the cultural diversity of the three schools situated in semi-urban and urban poverty-stricken communities. The Teacher Well-Being rationale form the theoretical framework for the students’ practical and academic stay in South Africa. Through exposure to the Teacher Well Being interventions, the students explore how caring for the teachers is organized and put into practice, and they are challenged to reflect on their role as professional practitioners. We argue that the reflection competence regarding the students’ own perspectives and learning approaches is enhanced in ways that will benefit their future position as teachers in Norway.

1 Introduction

In this paper we focus on how an exchange model being implemented between a Norwegian Higher Education Institution (HEI), Oslo and Akershus University College (HIOA) and three South African primary schools linked to the University of the Western Cape (UWC)
impact on the professional development of the participating students. The findings presented are based on a case study over a period of two years.

It is hoped that the assessment of the impact of the exchange and recommendations emerging from the field research will provide useful knowledge to further develop teacher education programmes in Norway. We also trust that the flexibility of the exchange model examined makes provision for it being applicable to other countries and cultures.

1.1 Background

Norwegian teacher education policy states that HEIs must stimulate students’ global awareness in a complex world. HEIs should therefore contribute to students acquiring an understanding of how education, pedagogy and schooling are linked to a country’s educational policy and culture. To achieve this understanding the students are encouraged to make meaning of, and identify themselves with the role of teachers in other countries and cultures. HIOA has developed a model for student mobility in the 2nd and 3rd year of the institution’s teacher education programmes. The model chosen consists of a up to three month placement in a foreign context in which practice is combined with a number of academic assignments such as practice reflection notes, specific essays linked to the students’ specific area of study and BA thesis (the latter applies to the teacher students only).

Annually, since 2012 a total of around 24 Norwegian teacher education students and 10 early childhood education students (from now referred to as teacher students) were placed in three primary schools located in the province of Western Cape, South Africa. The student teachers are observing and practicing teaching in these primary schools that are all associated with the promotion of teacher well-being. The students have received academic training from a lecturer based at the UWC, to strengthen their awareness and capacity around teacher well-being issues in challenging school contexts. The definition of well-being we use is inspired by Seligman (2002) in Collett & Olsen (2012) includes both (1) “a sense of gratification” and (2) “a sense of meaning that derives from doing one’s job in the service of something of wider significance than oneself”.

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The student placements are ‘culturally grounded’ in the sense that their form of accommodation is homestay with teacher families. The purpose is to provide the students with a unique reflection and dialogue opportunity from which valuable in-depth learning may take place.

Principals and contact teachers from the practice schools are visiting Norway in order for them to learn about the Norwegian education system and culture, pre-service and in-service teacher education programmes as well as observing everyday life in primary schools and kindergartens. The purpose of the visits is to strengthen the meaning of exchange by South African teachers acquiring an understanding of the background of the Norwegian students they are hosting in their classrooms and homes – and thus further enhance their roles as mentors and reflection partners for the students.

1.2 Exposure to practice in a foreign context

In the South African education, the legacy of apartheid has left many schools under-resourced and unprepared to cope adequately with transformation-related policies regarding, amongst others, new school curriculums, restructuring and re-culturing of the whole education system.

The learners at the practice schools come from impoverished urban and peri-urban settlements (townships). The communities of all schools observed for this paper are characterised by high levels of unemployment, substance abuse, violence, sexual abuse, teenage pregnancies, HIV/AIDS and tuberculosis. Idle, out of school youth who are observed in close proximity to the school added to the health risk embedded in the impoverished circumstances. As summed up by Collett and Olsen poor home circumstances, poverty, risk behavior and poor nutrition are therefore identified as impacting on children and affecting conditions in the classroom (2012).

The background for the Teacher Well – Being (TWB) project is found in the context described above which results in the extreme teacher stress and duress that have been recorded over the last few years in South Africa as well as from the attrition rates for teachers that have significantly increased over the same period. South African research studies (Hay, Smith & Paulsen, 2001; Xaba, 2003; Theron, 2009 in Collett & Olsen, 2012)
report high levels of stress in the teacher workforce and the need to address teacher support and mental health issues. The TWB project was implemented from 2009 to 2013 through a partnership between the South African Democratic Teachers Union (SADTU), Teacher In-service Project (TIP) at the University of the Western Cape, and the Centre for Education Policy Development (CEPD). Staff from each of these three organisations engaged in the need to urgently address the support needs of teachers in public schools in order to assist with teacher retention, job satisfaction and the achievement of quality education for all learners.

The research design for the TWB project was informed by the comprehensive approach of whole school development, the learning organization and the participatory action research approach. We understand in line with e.g. Dalin, 1998; Fullan, 2004; Lazarus & Lolwana, 2011 and Davidoff & Lazarus, 2002, whole school development and the learning school as approaches to develop effective schools, involving all stakeholders and all elements of the school towards enhancing effective teaching and learning. We have adapted components of the TWB approach in order to explore the students’ practice in some of the same schools. The TWB project built participatory processes of reflection on practice in at a school, inter-school and systems level. Teachers were encouraged to access their own agency in addressing issues influencing their well-being on a professional, personal and emotional level through an approach to counselling in work discussion groups.

The students were encouraged to identify and reflect on factors supporting or constraining their well-being during their school practice. Their well-being was monitored through group supervision by UWC and HIOA lecturers as well as by local support provision. It is expected that the issue of context in which the teachers and teacher students/ research participants live and work has a significant bearing on their experiences and reflections. Young (2000) and Wenger (2008) argue that experience forms the foundation of all knowledge and for this study we have given ample space to student voices expressing their experiences.

2.0 Methodology

A qualitative research approach was adopted for this case study. The rationale for using the qualitative approach is represented by the search for meaning within the context and
cultural and structural setting of the three practice schools. The reflexive qualitative research approach was decided upon in order to describe and understand how, and to what extent, the teacher students might benefit from an international teaching practice.

The case study provided us with an opportunity to focus on the learning process of the participants in the study through a continuous reflection on data collected over a period of two years. (Bryman, 2001; Yin, 1993; Merriam, 1988). Crossley and Broadfoot (1992) bring the usefulness of the local case study to a global level and argue that the significance of context at micro level is fundamental in understanding the more direct links to comparative and international research in education. (1992).

As mentioned above, a participatory action research (PAR) approach informed the overall research design for the Teacher Well Being (TWB) project implemented in the practice schools 2009 – 2013. As described in the chapter above components of this action research approach are adapted for the student practice model in order to explore its impact on the professional development of the students. PAR - is understood in line with Babbie and Mouton (2009: 645) in Collett & Olsen (2012) – as “participatory to the extreme, as it is based on the people’s role in setting the agendas, participation in the data gathering and analysis, and controlling the use of outcomes. PAR postulates participation to the extent of shared ownership of the research enterprise.”

As the data for our study need to be rich in description, the instruments or techniques chosen for the case study are loosely structured questionnaires and in-depth group interviews of all students (34). Unstructured, non-participant observation of everyday school life constituted a part of the research methods employed. Observing how students were teaching and relating to classroom challenges was conducted for most students. In the search for a comprehensive understanding different categories of data are analysed as closely as possible to the notes taken, recorded or transcribed in order to capture all the richness.

Literature review on social learning theories, school leadership and organisational change are used to provide an analytical framework to explore the impact of the exchange programme on the professional development of the teacher students. Following key concepts are used as analytical tools to understand the context of the students’ placement in school: school leaders leading pedagogy of care; schools as learning organisations;

In the group interviews we found the students in general to be speaking openly and freely, and they became often very engaged in the topics discussed, and at times these discussions developed their own dynamics, which sometimes needed our guidance to get ‘back on track’.

The advantage of group discussions became evident when the discussions took form. The students expressed similarities and differences concerning their opinions and experiences. As Morgan (1997) points out it became clear that the method of group interview required greater attention to the researcher’s role as the moderator, and the method provided less depth and detail about the opinions and experiences of individual participants (1997).

We argue that the students in the group interviews, after some time, experienced a level of safety that encouraged them to also express differences in experiences and opinions between them. We therefore argue that the group discussions provided a valuable source of insight into both students’ and teachers’ behaviour and motivation with regard to teaching and learning processes.

There were situations, however, when we directly intervened in a situation to influence the research process. The most obvious example is perhaps when we interrupted a group discussion in order to direct the discussion back ‘on track’, that is within the pre-set structure for the interview, although the structure was relatively wide. Morgan highlights this: “There is a very real concern that the moderator, in the name of maintaining the interview’s focus, will influence the group’s interactions” (1997:14).

Data collection and analysis were interwoven right from the start of this study, as recommended by e.g. Miles and Huberman (1994) and Alvesson and Skøldberg (2000). The methodology used in this work offered an opportunity to analyse the dynamics of student mobility.

The nature of the qualitative data was important during the process of interpreting the meanings that the students themselves attached to their experiences in the schools, and how they linked these to the social reality of the school communities. “Meaning” is of
essential concern to the qualitative approach and we use the case study to provide an understanding of a phenomenon from a local and holistic perspective.

Reflexivity is understood as multidimensional and interactive in nature. According to Alvesson and Skoldberg, most research usually glides between two or more of the different levels, e.g. the handling of empirical material, interpretation, critical interpretation and reflection (Alvesson and Skoldberg in Olsen, 2011). Through these processes, self-reflection became an integral part of the methodology of this study.

This research study was guided by the general codes of ethics of educational and social research. In words, and indeed, this means that the research process was led by the principle of ‘do no harm’ to any participant.

The case schools are protected in terms of confidentiality and non-traceability. Incidents of unethical behavior observed in the case schools by the students and possible misinterpretations that could cause harm to any of the teachers were avoided through ‘reality checks’ from discussions with fellow, locally-based researchers at the University of the Western Cape.

3. Findings and discussion:

3.1 Introduction

Student practice from schools and kindergartens constitute a fundamental and integral component in the teacher education programmes at HIOA aimed at strengthening students’ ability to act and reflect on their learning experiences. In addition to the strengthening professional qualities of ‘act and reflect’, practical placement in other countries and cultures represents an opportunity for the students to develop a deeper global understanding and knowledge. Students are therefore encouraged to experience the exposure to a foreign context in which they do not find the immediate recognition and familiarity. In this unfamiliar situation, the students are expected to actively observe, take part in all school activities and reflect.
What characterize the structural and cultural conditions in which the students are experiencing their practice in South Africa? How do the students interpret and make meaning of their experiences?

We have chosen Wenger’s social theory of learning as a theoretical framework to describe, analyse and discuss students’ own perceptions of their learning and professional development. Wenger uses the concept of ‘practice community’ in order to create a context for the negotiation of meaning of mutual and shared histories of engagement, participation, identification and learning. He claims that the components of learning are interconnected and depending on each other from the beginning (2008).

We make use of Wenger’s socio-cultural learning perspective which underlines that people learn from experiences by actively participating in the world. He builds his perspective on the following: 1) we are social beings 2) knowledge is a matter of competences with respect to valued enterprises 3) Knowing is a matter of participating in the pursuit of such enterprises, that is, of active engagement in the world. 4) Meaning – our ability to experiences the world and our engagement with it as meaningful- is ultimately what learning is to produce. (Wenger, 2008: 4)

3.2 The role as student teacher in a foreign context

Introduction to the concept of Teacher Well - Being (TWB) is part of the students’ preparation for the practice in South Africa. Among the aims for the course, is to:

a) Inform the students of the South African post-apartheid education system and policy as well as of the frequent curriculum reforms since 1994.

b) Give a deeper awareness of the school context in South Africa, to prepare the students to what to expect when they came to the practice school such as the conditions of the school and the large classes.

The students felt that the teacher well-being course had helped to prepare them for some of the realities they were confronted with in the practice school. They found the large classes and multiple demands on teachers a real challenge even although this aspect is part
of the preparation courses even before they leave Norway and reinforced through the TWB course in the introduction week upon arrival in South Africa.

Student A said:

“After the course I felt more prepared I still had a shock when I got here, if we had not had TWB course it would have been more of a shock”.

The students elaborate on how they at first experience frustration and uncertainty with regard to their role as teachers in the South Africa. It seems clear that the students need time to adjust to the foreign contextual conditions in terms of the school’s structural and cultural environment. After some time they also seem to manage to make use of both theoretical and practical knowledge developed in their teaching programme at home institution (HIOA) in order to interpret and make meaning and knowledge from their life in the school and community.

The students experience a curriculum and teaching methods that are different from what they know from the Norwegian context. Observing and testing other teaching methods than what they know from Norway have, they claim, inspired them to be more open to a greater variety of teaching methods and therefore to become more creative in their teaching practice. The students observe that a significant number of the learners are not able to follow the teaching taking place. The differences observed and experienced between the Norwegian well-resourced schools and the under resourced practice schools have challenged the students on own values, contextual conditions for teaching and learning and even to rethink what knowledge they regard as important. Given certain conditions the students seem to indicate that they have achieved a better understanding of why teacher – centred teaching methods are chosen as the dominant approach.

Reflection by student B:

“You do not understand everything, but you get at least a somewhat larger picture of why things are as they are. I think at least, that I became more humble, what we do in Norway or Europe is not always the best way. They do it their way, because that works for them, and we make our way because that works for the best of us”.
3.3 A caring school culture for teachers and learners?

A challenging task for the students is linked to how to negotiate own values and knowledge when confronted with another reality.

One such ‘reality check’ is their pre-conception and experience of the importance of teachers being able to ‘see’ the learner; to give attention and care to and interact with the individual learner. This is supported by international research on school quality which argues that interaction between teacher and learner is the single most effective factor to promote learning (Hattie, 2009).

Research shows that the trust needed for professional sharing of practice is enhanced in all TWB schools (Collett & Olsen, 2012). Collett and Olsen found that the TWB project intervention helped to support the development of the school as a caring and safe environment through developing a culture of caring and support between teachers. Collett and Olsen argue further that the creation of institutional space for staff reflection and critical engagement helped to build a culture and practice of support (2012).

This caring culture does not; however, seem to encompass the learners in the school to the same extent as for among the teachers. Our findings indicate that the students struggle to interpret and negotiate as ‘right’ or ‘wrong’ some of the attitudes and actions they observe in some teachers in the schools. As for the dominant teaching method employed, the students express an understanding in terms of why individual attention and care become much more limited with the teacher/learner ratio of 1/40 as compared to what the students are familiar with from their home country (1/25). In addition, the locations of the schools meant that all learners came from an environment troubled with socio-economic challenges; challenges the school and the teachers had to deal with on a daily basis. Dawes (2003) makes the point that positive school environments can play a supportive role in learners’ lives without going beyond what he describes as teachers’ “overstretched schedules” to become therapists to children (2003:8).

Could it be that ‘overstretched teachers’ in a few cases use corporal and verbal punishment and abuse against learners? Teachers must abide to the professional code of conduct for educators in South Africa that explains issues of discipline and discharge (The Employment of Educators Act 1998). Students from all the schools talk about how some teachers used
derogatory descriptions of learners and their parents and also used corporal punishment to achieve discipline in the class.

3.4 Expectations, action and connection

Wenger (2008) claims that action and connection are interwoven, depending on each other and a prerequisite for creating meaning. This means that ‘someone’ must act as ‘door – opener’ in terms of inviting into the community – in our context the school community, the students’ contact teachers and host families.

The students were warmly welcomed into all three schools and host families. They even indicate that the teachers in the practice schools demonstrate great confidence in the students’ competence and capability to teach. They seem to some extent to be regarded as extra help and assistance to the teachers as well as the “superior white teacher from the North”. The impression that they are associated with better competence because of the color of their skin comes as a surprise and in a sense frightening to the students. The psychological legacy of apartheid still seems to be apparent in South Africa and especially in impoverished working class areas as where the practice schools are situated (Olsen 2013).

The principal in one of the schools claimed in one of the interviews we had with him that the status of the school itself had raised because the locals observed White students in the school. He even attributed the fact that the numbers of learners had increased substantially in the past couple of years to the presence of the Norwegian student teachers.

Student C expresses;

“At the school they almost treated us as "god" .. ehm., They thought that we knew everything and they put much higher demands on us, and we got opportunities to try out more tasks, it was completely different from what I am used to in practicum in Norway.”

3.5 Culturally grounded practice

The students live with teacher families (home-stay) in the school community – they live with the same peer groups as in the class. Wenger’s concept of community practice (2008) include both the school and its community in our study: «The concept of practice connotes doing, but not just doing in it and of itself. It is doing in a historical and social context that
gives structure and meaning to what to do. In a sense, practice is always social practice» (Wenger 2008: 47).

As we anticipated, a main finding in our study indicate that the students have got a deeper (holistic) insight into the children’s living environment and how it impacts on the quality of teaching and learning. Homestay obviously gives time and access to discuss and reflect on issues they have encountered during the school day- both with the host teacher and each other.

Reflection by student D;

“One thing is to be alone during the day at the school, but when you come home in the afternoon (...) then it is very good to have someone you can talk to, someone who has similar beliefs as you and have undergone the same training, so that one can talk and reflect on the experiences together. Talk through it, and be able to leave it behind”.

As described in chapter 1.3 the practice schools are located in township with poor home circumstances, poverty, risk behavior and poor nutrition. We argue that the homestay contribute strongly to the sharp learning curve as described earlier in this paper. The exposure to poverty and poverty-related social challenges in the learners’ home environment - combined with the opportunity to discuss their observations and experiences with their host family - have given the students a deep – rooted understanding of how this negatively impact on the teaching/learning processes in the classroom. The South African researcher Dirk Meerkotter argues that the socio-economic environment of the school must be conducive to what happens in school in order to make learning meaningful and relevant. The quality of education for the learner cannot be improved unless the situation for the learner outside the school is also fully understood (Meerkotter, 2001).

Student E states;

“Never before have had I thought about the importance of contextual conditions for effective teaching. Another experiences for me, is how students' home conditions and their access to, among other foods affect them, I have seen this in a much larger scale than ever in Norway”.

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3. 6 Students reflection on how the practice placement will influence their future identity as teachers

“I think that this whole experience has made me become more aware of own behavior. And I think we all have become much more reflective. Not necessarily that we makes things better, but that we certainly think and reflect more on why you do things” (Student A).

A main finding is that a significant number of the students express increased confidence personally and professionally. Analysing the many examples they share to explain their increased confidence in teaching, e.g. independence of technology such as a classroom ‘smartboard’, we argue that the many encounters with the unfamiliar made the students more confident in new and unforeseen situations. Feelings of frustration and even in some cases fear that they could feel in the beginning gradually merged to feelings of strength as they managed increasingly more challenging tasks in the school. We argue that the opportunities provided for reflective practice together with the teachers – both in the school and at home – have clearly enhanced the students’ cultural insight, respect and understanding.

These encounters with the unfamiliar combined with reflection have built their capacity to work in diverse contexts in Norway. The students claim that the cultural insight and communication skills acquired from being the ‘different one’ have given them more knowledge about how to communicate with children and families with minority background in Norwegian schools and kindergartens. They have encountered communication challenges – language problems - and learned ways to prevent, avoid or minimize miscommunication and misinterpretations. The students claim that one major technique they have improved, that is to interpret non-verbal communication.

Furthermore we find that the students emphasize that the impressions and the experiences they had during their stay in the South African school and community context have touched them in such a way that it can be considered to have an on-going impact at both a personal and professional level. As underlined by many researchers, e.g. Wenger (2008), learning is a continuous process when negotiating meaning based on engagement with the world takes place (2008).

Wenger elaborate this by using the concept of identity: Wenger argues that “Building an identity consist of negotiating the meaning of our experiences of membership in social
communities (Wenger 2008:145). The interplay between the community of practice and the person is essential to the process. How the students reflect on personal and professional development, how they interpret their position and how they act and reflect, are neither simply individual choices nor the result of participation in the community. They are mutually enhancing each other.

Student F represents all when s/he says:

“I've become a better teacher and person, more reflective, humble and grateful. Puts things into perspective and have become more appreciative of what we have at home. I think all students would have benefited from this practice abroad”

Wenger (2008) explains life as a constant process of negotiating meaning in which we expand our knowledge, interpret and re-interpret, modify and confirm or dismiss knowledge. He emphasizes that engagement in practice entail interaction between knowing and understanding reifications and participation. We found that the students’ participation in a new and foreign practice community demand increased effort and critical engagement in order to interpret and negotiate meaning of their experiences. As pointed out by Wenger (2008) participation is to be understood as “a process of taking part and also to the relation with others that reflect the process” (2008:55). He further states that:

There are times in our lives when learning intensified; when situation shakes our sense of familiarity, when we are challenged beyond our ability to respond, when we wish to engage in new practices and seek to join new communities (Wenger, 2008: 8).

Based on our findings we claim that by encountering a different curriculum and contextual conditions, the students seem to become more aware of how pedagogical approaches are adapted to different contextual realities. The students acquire an in-depth insight into the structural conditions influencing their own teaching and that of their contact teachers. The insight and understanding acquired represent a sharp learning curve for the students that are being challenged on their own values and pedagogical approach. We argue therefore that by participating and engaging in the practice within the teacher-well being supportive framework and on-going reflection, the students develop an understanding of how to manage the foreign context; that is to act accordingly and adequately to the structural and cultural conditions in the school. Wenger (2008) claiming that the duality
between participation and reifications is fundamentally to negotiation of meaning supports our argument.

4.0 Conclusion: Practice abroad to become better at home!

This paper has described and analysed how a student teacher exchange involving practical placements and academic fieldwork in schools focusing on the well-being of teachers enables a successful approach to students’ professional development. Drawing on the findings from three South African primary schools situated in a working class area, we argue that through addressing the well-being needs of the student teachers using a participatory action research approach, the students develop a deeper understanding of how a supportive, safe and caring school culture can influence effective teaching and learning. Key findings show how the students both benefit from and help to support a strengthened capacity at an individual, school and cultural level. We argue that the reflection competence regarding the students’ own perspectives and learning approaches is enhanced in ways that will benefit their future position as teachers in Norway. These findings both endorse and add to existing research in the areas of social theory and of school development and educational change. The focus on the teacher well-being during their practice using components of the action research methodology provides a new and innovative approach to enhance their professional ability within a whole school development approach.

References


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