

Music, Mathematics and Lesson Study Groups

A presentation of an Educational Action Research work

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Abstract

We discuss challenges and opportunities in the development of integrative learning concepts and learning materials with music and mathematics by using the Lesson Study method.

Keywords:

Lesson Study Groups
Mathematics and Music
Music and sound design

1 Introduction

“...collaboration, dialog and the exchange of ideas are paramount for optimising educational achievement.”
(CORDIS, 2013)

Those support the learner’s development to acquire skills for learning and even more. Biological development has always been collaborative and integrative (Barbault et al., 2003).

Educational strategies supporting this intellectual development and, however, are not yet sufficiently applied in a collaborative and integrative way. So this collaborative learning has to be accepted to overcome the fragmentation of learning. Music and arts have to find their place in this way alongside practice and science.

Only through active and inspiring exchange it is possible to realise “good teaching and education” – learning from and with each other in the context of dialogic, collaborative and integrated processes (Gruber, 2012).

2 Starting point

Against this background and on the basis of the findings of the initiative “Musik und Mensch/music and life”, a collaboration between the University of Applied Sciences and Arts Northwestern Switzerland with our University College of Teacher Education Lower Austria, my partners and I argue that through a collaborative and dialogical way of using music as one “part” of learning, pupils and students can learn more efficiently and learning can be more sustainable (Cslovjescek & Gruber, 2013).

Therefore one of the overall aim is to develop the key-principle/life-principal of integrative thinking and behavior to be a principal of teaching, as well, and to methodically embed it in school and study subject. I am/we are convinced that within such projects, the work with “Lesson Study” and “Lesson Study Groups” play a central role. The following project example will show this.

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3 Lesson Study in a Bachelor thesis

Within the lesson study team and as part of our Bachelor thesis, we created two different audio stories – one of them is presented here today. The topics of the Bachelor thesis are: “Opportunities and possibilities in developing specific conceptions and materials for integrated and interdisciplinary teaching and learning in class in Music and English – and on the other hand – in Music and Mathematics.”

One of them was written by Janina Hübner-Trieb. It combines Music and English and revolves around the history of slavery in the USA and the development of Spirituals and Gospels (Hübner-Trieb, 2017). As this conference takes a closer look at Mathematics and Arts in Education we are presenting the other Bachelor thesis written by Alexander Popovic combining Mathematics and Music (Popovic, 2017).

4 Mathematics and Music

We combined musical aspects with mathematical content. In our case a complex mathematical system was broken down for the students and told in a simple yet memorable story.

Storytelling as an ancient form of learning, has lost relevance in everyday schooling today. Yet stories can illustrate complex ideas about life in very simple ways. This is what we did.

4.1 The story

The legend about Sissa ibn Dahir, the mythical inventor of the game chess, is in fact included in many mathematical secondary course books. However, the story is only presented as a little unexciting note. The legend of Sissa illustrates the exponential growth.

We used this legend for creating an audio story. As the audio tale evolves, the pupils learn about Sissa tricking the king – not only through content but also through dramaturgic components, such as musical elements and sound effects.

You will now listen to the beginning of the story. The narrator sets the scene in India under the reign of the cruel and merciless king Shihram. Sissa has invented the game of chess as a special present for the king. The king is pleased by the game that places him into the center of attention. Yet the king cannot win the game without all the other players – Sissa’s well-hidden and clever lesson.

Example 1: the beginning of the story “Es war einmal...” (“Once upon a time...”)

4.2 The Lesson Study Group

This was the beginning of the “audio story” called “Die Legende vom König und dem Schachbrett” (“The Legend of the King and the Chessboard”).

It was created within a Lesson Study Group consisting of three persons: Janina Hübner-Trieb, Alexander Popovic, and Hubert Gruber, teaching and researching at the University College of Teacher Education of Lower Austria. Sometimes also teachers of schools were part of this Lesson Study Group, especially those who supervised the students during their practical studies in schools.

4.3 The Key Features of Lesson Study

For John Elliott Lesson Study is a form of Educational Action Research (John Elliott is Professor Emeritus at the Centre for Applied Research in Education University of East Anglia, UK and editor of the International Journal for Lesson and Learning Studies):

- Carried out by a group of teachers (3-8 members).
- Focuses on the collaborative development of a lesson defined in terms of a topic.
- The study proceeds through cycles of planning, teaching, and evidence-based discussion.
- In each cycle a collaboratively planned lesson is taught by a different teacher, while the other teachers collect observational data, which is then discussed in a post lesson conference as a basis for moving into the next cycle of planning a revised lesson, teaching and discussion.
- The teacher group may be facilitated by experts specializing in the curriculum area concerned.

So Lesson Study brings teachers and academic experts together as learning communities in schools (Elliott, 2014).

4.4 The experimental design of Lesson Study

So teaching a lesson becomes an integral part of a cumulative research process in which practical hypotheses developed from discussions of data are systematically tested. As a form of experimental research, lesson study does not fit traditional experimental designs in educational research. Such designs involve a particular methodology for securing access to truth and they employ control groups as a basis for comparison with experimental groups. In lesson study there are no control groups (Elliott, 2014).

But we get another forms of comparison: that of conceptualisations of learning and teaching and everything which belong to these – but on the focus of only one lesson. And this lesson will be tested in cycles of modified variations, twice, three times or even four times, to gain insights for a new way of understanding and knowledge.

4.5 New visions and ways

In our particular case, we tried to investigate the potential of a specific learning material, that of an “audio story”.

Developing the learning material constituted the first part of the Lesson Study project phase. Alexander Popovic describes this process in his Bachelor thesis as follows: In the past I have often produced audio stories in my own studio and thus have inspired many listeners. As part of my teaching practice in schools I decided to do it together with my colleague Janina Hübner-Trieb. We are convinced that such learning materials, audio stories in conjunction with music and soundscapes, can increase the attention and imagination of the children. It is a kind of integrated learning with music and sound (Popovic, 2017).

Moreover, we are convinced that by linking the stories – which tell something about the history of humankind, the English speaking world or that of the mathematics – with our special music- and sound-design the content will remain more memorable for the children. These stories should open up many and new ways of thinking.

Not least, they should be a help for teachers when they substitute in a class they do not know, although they are no specialists in the disciplines of Music, Mathematics, English or History.

4.6 The story again

Back to our story: King Shihram is very pleased by the special present. To show his appreciation the monarch grants Sissa one wish. The clever inventor however comes up with a seemingly modest wish: He asks the king only for rice. One grain for the first field on the chessboard, two grains for the second field, four for the third field, and eight for the next field – until all fields on the chessboard are covered with rice.

The king is outraged about the humbleness of Sissa’s wish: He would have expected gold, jewels and diamonds for he is the richest man alive. Sissa’s demand for rice insults his shining glory. We all know the end of history: it was an incredible amount of rice!!! This is exponential growth.

Example 2: “Dein Wunsch soll dir gewährt werden...” (“Your wish will be fulfilled...”)

4.7 Mathematics and Music

After listening to the audio story, the pupils worked in groups: each with their own chessboard and a package of rice. Just like the king’s financial advisors the children in our classroom soon gasped the effects of exponential growth – counting and recounting their grains of rice.

This is where we implemented musical theory by introducing the value of musical notes. We used the first few fields on the chessboard to demonstrate the value of a whole note, half notes, quarter notes and so on.

4.8 New visions and ways

Our objective of instruction was to awaken curiosity, to motivate students to think for themselves and to encourage networked thinking and new ways of integrative thinking, learning and acting.

The resonance with pupils in four different classes proved that entertaining stories and interdisciplinary elements enrich instruction. Teaching faculty likewise reacted in very positive ways to developed materials. The

teachers' feedback not only helped to further improve the materials and methods. Furthermore, they triggered the discovery of new paths for the interdisciplinary schooling experience.

4.9 Make the numbers visible and audible

Back to our testing units in school: One of the outcomes of the first testing session of the Lesson study was that we had to find a way to visualize the incredible expanse of the exponential growth. But it was not just the question of making them visible, but also making them audible.

Long story short: now we will show you the shortened version of a 9 minute film. The fascination of numbers and their rhythm was enough for the pupils to be completely captivated by the world of numbers.

5 Lesson Study Groups in Austria

Peter Posch (until 2000 Professor at the Alpen-Adria-Universität Klagenfurt, Austria) also sees working with lesson study groups as a new perspective for Action Research in Austria. In 1971 he met Lawrence Stenhouse and his former assistant John Elliott in Vienna.

There he received his first impulses for action research which he continued to work together with his college Herbert Altrichter (Professor at the Johannes Kepler University, Linz, Austria) and also John Elliott.

Now they try to implement the concept of Lesson Study (as a form of Educational Action Research) in the Austrian education system, because over the last 15 years, Japanese Lesson Study has attracted growing interest as an alternative to conventional teacher professional development.

For Peter Posch, in Japan Lesson Study is a grassroots movement that is initiated and supported by the teachers themselves. But they are also promoted by state institutions; thus, the idea of Lesson Study is deeply anchored in Japanese culture, but also in the school cultures of other East Asian countries. This cultural context is defined by collaboration and reciprocal accountability and can be experienced as a "way of life", not just as a strategy for some projects (Posch, 2014).

6 The quality of lesson study groups

Lesson Study promotes sustainable the quality of dialogic and collaborative processes, which enables the development of an integrated learning and teaching with music in collaboration with all subjects and disciplines. And moreover such professional learning communities also have numbers of other strengths that could have a very positive impact on the environment of school and education:

- Lesson Study Groups prevent professional isolation of teachers.
- LSGs professionalize teachers by appreciation of their expertise.
- Strengths and challenges of teachers are known publicly and prevent privatization of education.
- LSG provide continuous support for teachers.
- LSG offer and create professional growth by space, time and structure for systematic reflection of practice.
- And working in Lesson Study groups generates a collective knowledge base within each school.

(Posch, 2014; William, 2006)

It is therefore important, especially in Austria, to "promote and advance the research and practices focused on Lesson Studies in order to improve the quality of teaching and learning." (WALS, 2016)

And I hope, we can do it also in this way in developing the key-principle/life-principal of integrative/inclusive thinking and behavior in teaching and learning, also with music.

As you have just seen we have started last year with two students, writing their Bachelor thesis. This year a group of four teachers at a secondary school (New Middle School) and a group of three teachers of our Practice Elementary School has followed. And in the next year it will be a whole Primary school and maybe more.

7 Music and sound design

To conclude our presentation we would like to focus on the core elements of our audio stories: music and atmosphere sounds. Although the content of the story is in the center of the listeners' attention, the audible atmosphere is crucial for the development of emotional participation. We composed musical elements and used them to support the dramaturgic structure of the story. You are now invited to an audible journey to ancient India.

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