

## **Teacher and student learning through a Teacher Design Team (TDT)**

Fer Coenders

University of Twente, ELAN, Teacher Education and Science Communication

Program abstract (max 350 characters)

Giving students autonomy can be disturbing to teachers. To monitor the “what and how” of student groups working independently, teachers in a team developed learning material plus a student group log that was class enacted. The log stimulated interaction, reflection, influenced learning, and the fast written feedback on student work was appreciated.

Proceedings abstract (max 2100 characters)

The change from teacher dominated to student controlled classrooms is not easy as teachers fear poorer learning. However, in context based education students need more autonomy. Mandatory context based curricula for the natural sciences were introduced in 2013 in the Netherlands. To support teachers during preparation and implementation, teacher design teams (TDT) were set up. In a TDT subject teachers from different schools under supervision of a teacher educator, (re)design student learning material suitable for context based education, subsequently enact this in their classes, and discuss the outcomes. In 2012, nine chemistry teachers participated in such a TDT. The teachers realized that autonomous cooperative learning groups would be appropriate, but wondered how to monitor student progress as their concern was that students would not stay on task, make mistakes without being corrected and that this would only surface after the final test. A group log was designed to allow students to record their progress during each period. Each group had to write down all results from their activities and all answers to questions, and had to answer specific questions related to the cooperation process and products. To do this the group had to reflect on their cooperation.

During the design of the material in the discussions in the TDT one concern often surfaced: how often do teachers need to check the logs, what information do they need to provide and how time consuming is all this?

Four teachers class enacted the learning material plus group log. These teachers were interviewed after use at school, group interviews with their students were held, and the logs analyzed.

The results showed that teachers needed between 3-5 minutes per log after each period for feedback. They stressed that this time was well invested as they could see how students had worked and what the result was.

Students were also positive, and especially appreciated teachers' quick feedback.

The log stimulated student interaction, guided the learning processes, and stimulated reflection.

Proposal (max 16000 characters).

### **The challenge**

In September 2013 new mandatory high school examination programs for the natural sciences, including chemistry, have been introduced in the Netherlands. Characteristics of this program are the context concept approach, in which students learn concepts starting from an appealing context (Bencze & Hodson, 1999; Gilbert, 2006), and student autonomy in determining the content and the process of their learning (Bianchini, 2011; Driessen & Meinema, 2003). Preparing teachers for a curriculum change, like the introduction of a context concept approach, is not a simple task (Bakkenes, Vermunt, & Wubbels, 2010; Fullan, 2007). The purposes and goals for teaching science at a particular grade level change and this affects instructional decisions about teaching science (Friedrichsen, Driel, & Abell, 2011). This in turn has its bearing on teaching and learning material, on how students learn and the difficulties they will face, and on assessment strategies and instruments. Teachers need to bring their Pedagogical Content Knowledge (PCK) in line with the new requirements. After Shulman (1986), quite a few scholars have conceptualized PCK in different ways. We use the five PCK domains described by Magnusson, Krajcik and Borko (1999).

This contribution is about moving teachers from teacher dominated classes to student autonomy in a context concept approach.

### **Theoretic framework**

Literature shows that effective professional development in which teachers expand their PCK should: (a) focus on content and the way students acquire this content, (b) facilitate active teacher participation, (c) consist of linked and coherent activities, (d) have sufficient contact time and time at school, (e) foster cooperation in a learning community (Bencze & Hodson, 1999; Desimone, 2011; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Schneider & Plasman, 2011). Based on the above elements a teacher design team (TDT) was set up, in which teachers from different schools under the guidance of a teacher educator redesign existing innovative modules (series of lessons), class enact the resulting materials, and discuss learning processes and outcomes. Our own research (Coenders, Terlouw, Dijkstra, & Pieters, 2010) showed that when the goal of a professional development program is to change classroom teaching, teachers need to go through two phases during the preparation process: a development phase in which teachers in a team develop student learning material plus the pedagogy to introduce this in class, followed by a class enactment phase where teachers enact materials in own classes and discuss the outcomes (Coenders, 2010)

One of the advantages of developing student learning material in a TDT is that the teachers during this development process concurrently prepare for class enactment. In the discussions during the redesign of a module, in which cooperative learning would be introduced to allow student groups to work rather autonomous throughout the module, teachers expressed their anxiety about students

ability to work independent as a group with little teacher direction. Teachers feared that students would not stay on task and not focus enough to get to understand the content, and that this would result in lower grades on the final test. To address these concerns a student group log enabling teachers to monitor the process and the progress was developed.

The questions guiding this research are how such a log is perceived and used by both teachers as students.

### **The context**

The Teacher Design Team (TDT) in 2012-2013 consisted of nine experienced chemistry teachers under the guidance of a chemistry teacher educator. The group met monthly, ten times in total, on a set date for three hours.

The title of the redesigned module is “Do plants grow better with Chili saltpeter”, and deals with ions, salts and its characteristics. Ionic compounds is a common topic in chemistry education and the teachers were familiar with it, but in this module the student groups would work autonomous on rather open assignments for several weeks. To monitor this process and the progress made, each group received a log to complete during each period. The log consisted of an introduction, where the use of the log and the cooperation plus the revolving roles are explained, followed by two pages for each period: an empty left hand side page and a right hand page with six specific questions. The empty left page served to write down all answers to questions, all observations and results of practical work or other activities. The questions on the right page were about the cooperation process, but also to plan the lesson and to encourage reflection on what was done, what the result was and what according to the group was learned that lesson. The group logs had to stay in school as the idea was that the teacher would go over the logs after each period and mark errors and comment on the cooperation process and the pace. During the development of the module plus log no consensus could be reached about whether or not to grade the logs, and so this was left to the teacher discretion.

Even after the discussions during the development of the module plus log the teachers expressed concerns about the feasibility of its use: will the students be able and willing to use the logs, how much time will it cost the teacher to go over each log, and what will it bring to both students and teacher?

So class enactment of the log resulted in the following research questions: 1) how will students and teachers use the log, and 2) how do they assess the log and its different components?

### **Research method**

Four of the nine participating teachers from this TDT class enacted the module plus log. The four teachers were from three high schools. All teachers had a master's degree plus a teaching qualification, and none had previous experience with cooperative learning.

To answer the research questions three instruments were used: the completed group logs, semi-structured interviews with each of the teachers (the two teachers in one school were interviewed together), and semi-structured group interviews with a selection of the students at each school.

All the interviews were transcribed and coded (atlas.ti). The questions from the interviews served as initial codes. For each code teacher and student answers were combined in a word table. Further analysis resulted in the seven categories shown in the results section below.

## **Results**

Brief results for the seven categories are given below.

### **1. Teacher time**

All teachers went over the logs, but differences in approach surfaced. All teachers marked correct answers and mistakes and all commented on the progress made. Questions like “why is this not filled in or done” or “why was this not answered”, and suggestions to scaffold the cooperation or the results like “it is better to plan the period with the complete group first” and “improving a skill is also learning” were added. One teacher however not only marked the mistakes the students had made but also corrected these!

As the teachers initially envisaged that going over the logs would take a lot of time, they were asked how much time they actually spent on this, and whether they had other lesson preparations to do. Eelko said that it took him 2-3 minutes per log, Tess said about 5 minutes and Julia also about 5. All could finish all logs of a class in not more 35 minutes. They all responded that there were no other lesson preparations, the preparation before the module started was sufficient.

### **2. Students use of teacher comment**

The teachers were asked what their students did with their comments, and the students were posed a similar question.

Eelko said that his students needed concrete directions as they did not know how to deal with his comments. Finally he thought that students used his feedback in nine of the ten instances. Eelko's students said that they had tried to correct the indicated mistakes and provided the missing answers. The first thing Tess' students looked at when in class were her comments and then the given grade. She experienced that students did not automatically correct mistakes, students needed instructions for this. Her students said that they often wondered what silly mistakes they had made and then made corrections. They indicated that they learned a lot from the comments and that teacher time was well spent.

Julia had similar experiences: students make changes when asked. Her students said that often the comments were on the process and less about the content.

### **3. Grading**

Eelko did not grade the logs as he did not think his student needed encouragement through grades, and grading always gives a lot of discussion. His students indicated that grades would have made them work neater, but that it would not have influenced their learning.

Tess had made a rubric to grade each period, but she said that next time she would do this only once a week. Her students appreciated the grades as they felt that it had helped them to work hard.

Julia provided each group with a grade at the end, but did use symbols to rate after each period. Her students said that because the final grade they had even typed it before final submission to make it look better.

#### 4. Usefulness of the log

Eelko indicated that he wondered whether his students would see the log as an instrument to check them or to provide feedback. He could see that students had been busy and in that aspect the log was very useful. His students were positive as they said that the log served as a planning instrument for the group and to record progress. They also appreciated the fact that they could quickly see their mistakes.

Tess thought that her students would appreciate the fast feedback on their answers, but had doubts about students appreciation of the process and planning questions on the right hand side. Her students however also appreciated these questions as it helped them plan and maintain an overview of the process. They also valued the fact that their teacher provided fast feedback.

According to Julia, her students would see it as something she required, less as a useful instrument for their learning. Her students however appreciated the planning and having the results properly combined and said that it helped them in their discussions.

#### 5. The log to influence learning process and learning

Eelko normally gave students feedback after a test, but said that this feedback was ineffective. The log offered him an opportunity to provide immediate feedback. He said that in the past his students often not even noticed their mistakes, but now he clearly pointed them out. He loved it when his students entered the classroom and asked "can we get on with it sir?" , and quickly started. His students were also quit happy with the log as it provided clarity about the when and what. They said the question to write down what was learned that lesson was difficult to answer.

Tess said that her students took the responsibility for the work and that the group roles helped in this. Especially the teacher feedback, but also reflecting on what is learned was appreciated by Tess' students.

Julia hoped to make students more conscious about their learning through the log, and especially through the questions in the log. Her students noticed that in the group they sometimes had discussions on concepts some members already understood.

#### 6. Roles and cooperation

According to the students all teachers had introduced the student group roles. In practice however some groups never changed the roles.

Eelko's students said that taking a specific role happened automatically, someone just started and took the leadership role and the student who had finished filled in the log and took the writers role. They did explain one another in the group but also sometimes had to ask the teacher for clarification.

Tess' students did change the roles and said to appreciate this. They had discussions when for example the writer did not know how to answer a specific question, or about preparing for the next period.

Julia's students felt that the roles were unneeded, and did not change roles. When a student had a specific role often another was asked to do a task belonging to that role. They also had reasons for not changing roles as they said "when someone writes unreadable it is better when this person does not write". These student were positive about their cooperation.

#### 7. Usefulness of specific questions according to students

In general all students did see advantages in answering the specific questions and were able argue why these were helpful. The only exception was the time indication in the planning phase: students had to plan each period and indicate how much time they thought to spent on each activity. All students said that this was impossible and therefore advised to remove this question.

### **Conclusion and discussion**

Teachers had doubts about the feasibility of the log and had therefore hesitations to use these in class, especially as they feared that it would take much time to correct the logs. However after use they were all positive and judged the time investment as rewarding and valuable. Julia phrased it as follows: "Think it was worth the time as I got more information about my students".

Students also appreciated the logs, they looked at teachers comments and corrected their mistakes when their teacher requested this. Students valued the fast feedback on their efforts and thought it was worth teacher time investment.

There is no consensus about grading. Neither among the teachers nor among the students. It is remarkable that the students are satisfied with the system their teacher used: when the work was graded they appreciate it, when it was not graded they did not think they would learn more when it would have been graded. It seems that students get used to a system and appreciate its advantages. Worthwhile mentioning is that teachers themselves needed to get used to this kind of teaching. Tess formulated this as: "we also have to learn how to best deal with these logs, how can we direct students, what do we do with the logs in class, and is it still necessary to discuss content in the whole class?". Essential aspects of log use are the possibility to provide fast feedback, to direct student interaction in the group and the opportunity for students to develop metacognitive skills, without the teacher losing sight of the learning process and progress.

Although this material was developed in a TDT, with ample discussion about the log itself and the questions posed to students, the teachers remained some reservations until they had the first real class experiences. Changing practice is not easy (Bencze & Hodson, 1999; Gillies & Boyle, 2010), a complicating factor might be teachers' emotions (Van Veen, Slegers, & van de Ven, 2005). Having teachers use a new pedagogy apparently is not a straightforward process and it clearly requires time and patience and in that aspect our results are similar to what other scholars found (Davis, 2003; Fullan, 2007). Giving teachers opportunities, time and ownership over the design and implementation

is absolutely necessary. The two phases used in the development process in the TDT, the *(re)design phase* and the *class enactment phase*, proved to be instrumental for teacher learning.

### The presentation

The start of the presentation will be previous work on teacher professional growth when teachers collaborate in a TDT and go through the two phases, the *redesign phase* and the *class enactment phase*. Then the why of introducing a group log and the research plus the results will be presented. In the discussion the focus will be on what our results mean for professionalization programs.

The presentation will be specifically of interest to pre- and in-service teacher educators, and curriculum developers.

### References

- Bakkenes, I., Vermunt, J. D., & Wubbels, T. (2010). Teacher learning in the context of educational innovation: Learning activities and learning outcomes of experienced teachers. *Learning and Instruction*, 20(6), 533-548. doi: 10.1016/j.learninstruc.2009.09.001
- Bencze, L., & Hodson, D. (1999). Changing practice by changing practice: Toward more authentic science and science curriculum development. *Journal of Research in Science Teaching*, 36(5), 521-539.
- Bianchini, J. (2011). How to foster student–student learning of science? The student, the teacher and the subject matter. *Cultural Studies of Science Education*, 6(4), 871-882. doi: 10.1007/s11422-011-9359-x
- Coenders, F. (2010). *Teachers' professional growth during the development and class enactment of context-based chemistry student learning material*. PhD, Doctoral Thesis University of Twente, Enschede.
- Coenders, F., Terlouw, C., Dijkstra, S., & Pieters, J. (2010). The Effects of the Design and Development of a Chemistry Curriculum Reform on Teachers' Professional Growth: A Case Study. *Journal of Science Teacher Education*, 21(5), 535-557.
- Davis, K. S. (2003). "Change is hard": What science teachers are telling us about reform and teacher learning of innovative practices. *Science Education*, 87, 3-20.
- Desimone, L. M. (2011). A Primer on Effective Professional Development. *Phi Delta Kappan*, 92(6), 68-71.
- Driessen, H. P. W., & Meinema, H. A. (2003). *Chemie tussen context en concept. Ontwerpen voor vernieuwing. [Chemistry between context and concept. Design for renewal.]*. Enschede: SLO.
- Friedrichsen, P., Driel, J. H. V., & Abell, S. K. (2011). Taking a closer look at science teaching orientations. *Science Education*, 95(2), 358-376. doi: 10.1002/sce.20428
- Fullan, M. G. (2007). *The new meaning of educational change*. (4th ed. ed.). New York: Teachers College Press.
- Gilbert, J. K. (2006). On the nature of "context" in chemical education. *International Journal of Science Education*, 28(9), 957 - 976.
- Gillies, R. M., & Boyle, M. (2010). Teachers' reflections on cooperative learning: Issues of implementation. *Teaching and Teacher Education*, 26(4), 933-940. doi: 10.1016/j.tate.2009.10.034
- Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome & N. G. Lederman (Eds.), *Examining Pedagogical Content Knowledge* (pp. 95-132). Dordrecht: Kluwer Academic Publishers.
- Penuel, W., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What Makes Professional Development Effective? Strategies That Foster Curriculum Implementation. *American Educational Research Journal*, 44(4), 921-958.
- Schneider, R. M., & Plasman, K. (2011). Science Teacher Learning Progressions. *Review of Educational Research*, 81(4), 530-565. doi: 10.3102/0034654311423382
- Shulman, L. S. (1986). Those who understand, knowledge growth in teaching. *Educational Researcher*, 14(2), 4-14.
- Van Veen, K., Slegers, P., & van de Ven, P.-H. (2005). One teacher's identity, emotions, and commitment to change: A case study into the cognitive-affective processes of a secondary school teacher in the context of reforms. *Teaching and Teacher Education*, 21(8), 917-934.