

Self-video-based discourse as a lever for developing pre-service mathematical knowledge for teaching



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Why use video for teachers' professional development?

- ❑ Videotaping has been widely accepted to be a useful tool for teachers' PD (Sherin, 2004; Santagata and Guarino 2011; Blomberg, Sherin, Renkl, Glogger & Seidel, 2014).
- ❑ Compared with analyzing other teachers' videos, teachers who analyzed their own teaching experienced higher activation, resonance, and motivation. They became more aware of relevant components of teaching and learning (Borko, et al., 2008; Sherin & Han, 2004; Rosaen, Schram, & Herbel-Eisenmann, 2002).
- ❑ Leaders of teachers' video-based PD programs should be aware that "Video alone does not define a lesson, it must be embedded within an instructional approach in order to foster teacher learning" (Blomberg et al., 2014, p. 458).

Theoretical framework -(Mason, J., 1998)

Teachers' professional growth involves levels of awareness with regard to teaching

1. Awareness in action

2. Awareness in discipline (knowledge of awareness in action)

3. Awareness in counsel (knowledge of awareness in a discipline)



This led us to develop Video Based Didactics (VBD) program

The program aimed at:

Fostering a discourse, based on teachers videoing their own teaching

Developing skills in conducting an inquiry (not an instructive) based discourse with teachers

Developing skills in identifying interesting teaching instants (with a special focus on the content) for the discourse

The VBD: Principles and practice

- ❑ The VBD program goal is to assist math (and physics) teachers professional development by using video analysis effectively
- ❑ Our target populations are pre-service and in-service Math and Physics teachers as well as teachers' trainers
- ❑ The VBD discourse was generated purely for the **teachers' PD** and not for their administrative evaluation.
- ❑ We consider teachers' **privacy** and **independence** to be highly important factors in teaching as a profession.
- ❑ **Not all of the teachers** are **comfortable** in opening themselves up to such inspection (Sherin & Han, 2004).

Rules of the VBD discourse

- A. Use of evidence** - The teachers bring pieces(episodes) of video recordings from their lessons
- B. Ownership** - The teachers record their lessons on their own devices (commonly, their own phone)
- C. Autonomy** - The teachers choose the episode (5-7 minutes) they wish to discuss from a whole lesson
- D. Clear role** - The owner of the video evidence is the trainee and his/her partner is the trainer
- E. Shared professionalism** - The trainer and the trainee are teachers of the same subject matter
- F. Mutual development** – The trainer and the trainee develop together their observation analysis tools.

Goals of the VBD discourse

- I. **Introspection** – The introspection process addresses both the cognitive and the affective dimensions.
- II. **An inquiry focus** – The viewer of a video, being the trainee or the trainer, is encouraged to adopt a “curious eye” rather than a judgmental one when looking at the segment for topics to be discussed during the discourse.

The steps of the program

(a) The trainee videotapes his/her own lesson, chooses a short episode and provides it with a title.

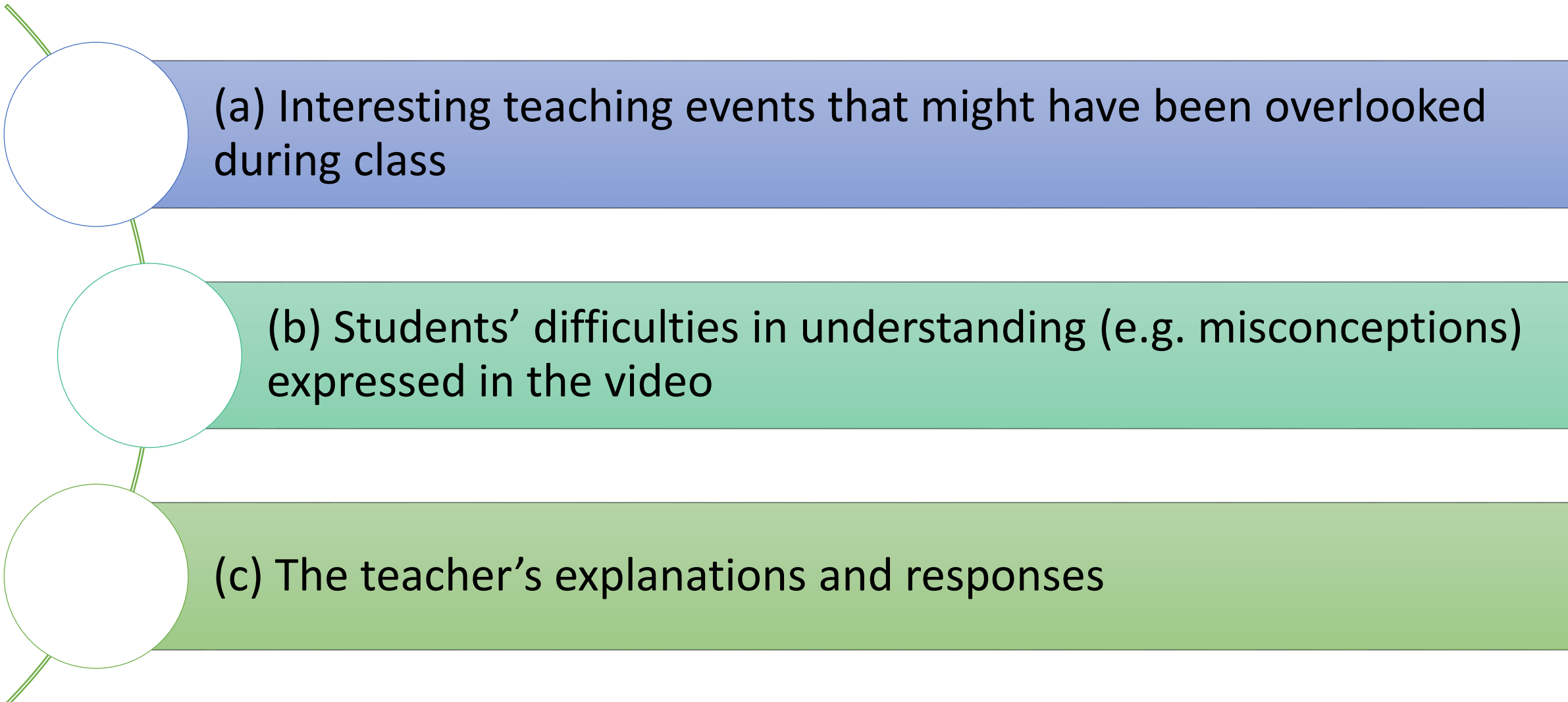


(b) The trainer views the video and prepares for the didactic discourse inquiring questions that arose from his observation.



(c) The trainer and the trainee discuss the inquiries that arose. The meeting is recorded and is a common property of the trainer and the trainee.

The focus of the mutual inquiry-based discourse



(a) Interesting teaching events that might have been overlooked during class

(b) Students' difficulties in understanding (e.g. misconceptions) expressed in the video

(c) The teacher's explanations and responses

Research method

The purpose of our research: to study how the VBD discourse effected the professional development of pre-service mathematics teachers. The research method focuses on case studies

Research Questions: What support is provided by the VBD discourse to the development of mathematical knowledge for teaching of pre-service math teachers?

Research Population: five pre-service teachers' MKT, during their participation in a Didactics of mathematics course at the Academic College of Education.

Research Instruments

- (1) **Short video segments** from mathematics lessons of five pre-service math teachers.
- (2) **A VBD discourse** with each of the five pre-service math teachers.
guided by one member of the project team. (recorded)
- (3) **Group interview** with the five pre-service math teachers. after the VBD sessions. (recorded)

Data analysis

We adopted Chapman's definition of an effective video-based discourse as **one that generates new insights of new teaching ideas, strengthens one's awareness regarding the teaching-learning process, and creates critical incidents and significant turning points**

(Chapman, 2017)

The analysis focused on **identifying the levels of awareness and the turning points between those levels.**

The results of the analysis of the members of the research team were then compared in order to evaluate their mutual agreement

(Chapman, 2017 ; Mason, J., 1998)

Finding and the first interpretation

Episode 1: Movements of the quadratic function

Uri taught the ninth graders the subject of the movement of the quadratic function graph. Starting with the investigation of the function $y = x^2$, and thus the vertical movement of the function $y = x^2 + k$.

Uri held a discussion with his students, leading them to understand that when k represents positive values, the function $y = x^2$ moves k units upward, and where k represents negative values, the function $y = x^2$ moves k units downward.

Finding and the first interpretation

Episode 1: Movements of the quadratic function

Then Uri asked the students

Uri: “What can be said about the graph of the function $y = (x-p)^2$, related to p ?”

Student 1: ““The function $y = (x-p)^2$ is always positive”.

Uri (did not respond to student 1): “first we saw that the parameter k in the algebraic expression $y = x^2 + k$ influencing the parabola graph movement up or down. So, what can be said about the parameter p in the function $y = (x-p)^2$?”

student 2: "May be the function moves along the x-axis".

Uri: “good answer”

Finding and the first interpretation

Part of the VBD discourse between Uri and one of the program's staff (following episode 1):

The first part of the discussion with Uri focused on the fruitful discussion he had with his students.

Uri explained that his goal in the current lesson was to establish the students' understanding the relationship between the algebraic expression and the quadratic function graph.

The following dialogue ensued:

Finding and the first interpretation

Part of the VBD discourse between Uri and one of the program's staff (following episode 1):

Trainer: I noticed that when you asked about the function $y = (x-p)^2$, student 1 answered that "the function always receives positive values. Did you hear that?"

Uri: No, I did not.

Trainer: What do you think about his answer?

Uri: Well, this is not the direction; I intend to lead the discussion.

Trainer: What was the direction you intend to lead the discussion?

Uri: I wanted to lead the discussion so that the students would understand the relationship between the algebraic expression function $y = (x-p)^2$ and the graph. I wanted to lead them to understand that the values of the parameter p moves the parabola graph to the right or left.

Finding and the first interpretation

Part of the VBD discourse between Uri and one of the program's staff (following episode 1):

Trainer: “Do you think student 2 understood the relation between the values of the parameter p and the movement of the parabola graph?”

Uri: I do not know”.

Trainer: “How can you recognize that the student did understand?”

Uri: “Just as they realized that the parameter k affects the vertical shift, they understand that the parameter p affects the horizontal shift”.

Trainer: “Do you think that for students the understanding the vertical displacement is the same as understanding horizontal displacement?”

Uri: “... I never thought about it ... I thought that the same level of understanding”

Finding and the first interpretation

The VBD discourse led Uri to a turning point (Chapman, 2017), as expressed in the VBD discourse. This turning point aroused Uri's awareness as a mathematics teacher on two levels (Mason, 1998):

Awareness in action:

Awareness of the presenting the connection between the parabola algebraic expression and the graph, awareness to listening to students' answers.

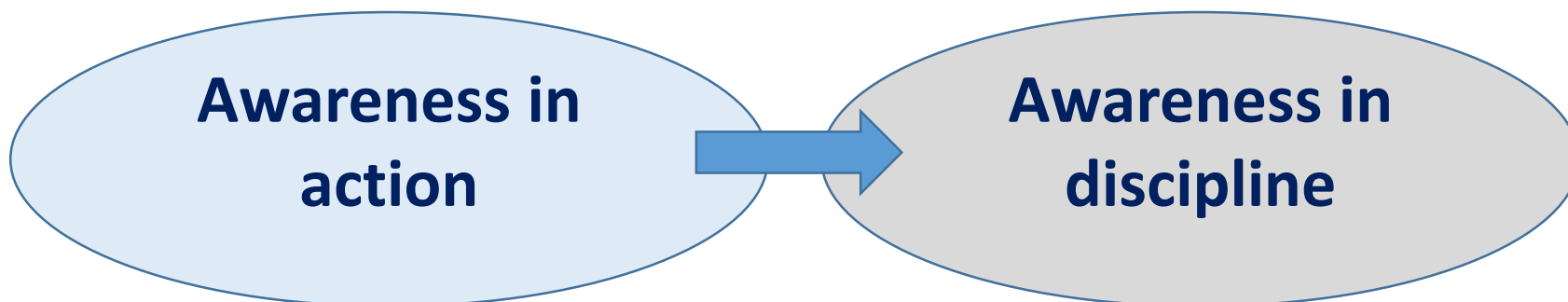


**Awareness
in action**

Finding and the first interpretation

Awareness in discipline

Awareness of the importance of using students answers to promote effective discussion, awareness of the important of using technology through teaching, awareness of different ways to explain the role of the parameter in the algebraic expression of the parabola, awareness student's difficulties



Conclusion

In the present study, we presented some evidence for the professional development of one pre-service mathematics teacher during an effective VBD discourse. The findings of this study indicate that VBD discourse is a significant tool that contribute to the professional development of pre-service mathematics teachers, as well as, to the development of their SCK and KCS.

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