What Students Need:
Exploring Teachers' Views via Imagined Role-Playing

By Rina Zazkis & Masomeh Jamshid Nejad

On Role Playing

Role-playing is an unscripted "dramatic technique that encourages participants to improvise behaviors that illustrate expected actions of persons involved in defined situations" (Lowenstein, 2007, p. 173). In other words, role-playing is "an 'as-if' experiment in which the subject is asked to behave as if he [or she] were a particular person in a particular situation" (Aronson & Carlsmith, 1968, p. 26). Role-playing is used as an effective pedagogical strategy in a variety of fields, a few of which we mention here. Traditionally it is used in social studies classrooms in order to provide participants with more authentic experiences of historic events and people who experienced them (e.g., Cruz & Murthy, 2006). It is used to explore the complexities of social situations, such as prejudice, and ethical issues (e.g., Lawson, McDonough, & Bodle, 2010; McGregor, 1993, Plous, 2000). Participants, after engaging in role-playing, reported being better prepared to deal constructively with everyday instances of prejudice (Plous, 2000) and generated more effective responses to prejudiced comments (Lawson, McDonough, & Bodle, 2010). Additionally, role-playing was used with English language learners, where

Rina Zazkis is a professor and Masomeh Jamshid Nejad is a Ph.D. student, both with the Faculty of Education at Simon Fraser University, Burnaby, British Columbia, Canada. zazkis@sfu.edu

teachers used role-playing in an attempt to move from a prescribed dialogue to an improvisational one. In this context Shapiro and Leopold (2012) suggested that implementing role-playing in a classroom provides a "space between practice and play [which] is a fertile ground for cognitive and linguistic growth" (p. 128).
Role-playing is also used in the education of various groups of professionals in organizational research, where, for example, participants assume roles of performance evaluators or interviewers of job applicants (Greenberg & Eskew, 1993). It is also prevalent in the training of health professionals, where the participants play the roles of a care-giver and a patient, practicing their clinical, diagnostic and patient managements skills, and as such developing empathy and tolerance in a low-risk environment (e.g., Joyner & Young, 2006). However, among various uses in developing professionals, the use of role-playing in teacher education is rather rare.

On Role-Playing in Teacher Education

In considering role-play in teacher education, Van Ments (1983) described it as experiencing a problem under unfamiliar constraints, as a result of which one's own ideas emerge and one's understanding increases. In this sense, role-playing can also be seen as role-training. It is aimed at increasing teachers' awareness of various aspects of their actual work. Despite the known advantages, role-playing in teacher education is underdeveloped. While some authors advocate for this method and report on its implementation, this is most often done in the form of self-reports and anecdotal evidence of participants' experiences.

Kenworthy (1973) described a method in which one participant takes on a teacher-role while others take on the roles of various students (e.g., a slow student, a gifted student, a disturbing student). He considered this type of role-playing to be "one of the most profitable, provocative and productive methods in the education of social studies teachers" (p. 243). He claimed that engagement in role-playing activities helped participants anticipate difficulties they encounter in their classrooms and as such gain security in their successful experiences should they face similar situations on the job. Assigning participants teacher and student roles was also used in a skill training workshops to deal with disturbing behaviour (Jones & Eimers, 1975). Teacher training via role-playing reduced disruptive student behaviour and demonstrated gains in productivity for most students.

More recently, in Palmer's (2006) study, pre-service teachers took on the roles of children as their professor modelled science teaching. It was reported that teachers' self-efficacy increased and they were more open to the idea of implementing role-playing in their teaching. In Howes and Cruz (2009) research students in an elementary science methods class were invited to assume roles of scientists and take part in an "Oprah Show" interview. In addition to learning about contributions of different scientists, this activity sharpened the prospective teachers' understanding of what science is and what image of science they wish to convey to their students.

Role-playing was used in teaching "anti-bias curriculum" (Lin, Lake, & Rice, 2008). It was suggested that role-playing "provides opportunities for teacher candidates to develop a better understanding of how another person might think or feel, to increase the range of their responses to what others say or do" (p. 195). Role-playing was considered useful in developing cultural competence and in shaping personal "identities, attitudes and appropriate dispositions as educators" (ibid). Similarly, simulation of "cross cultural situations" helped participants develop empathy, further understanding and sensitivity towards the issues of diversity (Cruz & Patterson, 2005).

On Script Writing

Despite the recognized advantages, time and participation logistics are a significant limitation of role-playing. If we intend to engage our students in role-playing during class time, only a few will be active players and the remainder will serve as an audience. To give all students the opportunity to participate in the role-playing scenario we turned to imagined role-playing, that is, writing a script for a dialogue between characters. We consider this to be imagined (rather than enacted) role-playing.

The use of script writing as an instructional tool has been implemented in prior mathematics education research. For example, Gholamazad (2007) developed the 'proof as dialogue' method. Prospective elementary school teachers participating in her study were asked to clarify statements of a given proof in elementary number theory by creating a dialogue, where one character had difficulty understanding the proof and another attempted to explain each claim. This method was amended and extended by Koichu and Zazkis (2013) and D. Zazkis (2013) in their work with prospective secondary school teachers. In both studies the participants had to identify problematic issues in the presented proofs and clarify those in a form of a dialogue, referred to as a proof-script. These scripts revealed participants' personal understandings of the mathematical concepts involved in the proofs as well as what they perceived as potential difficulties for their imagined students.

Additionally, the 'lesson play' method was developed and used in teacher education in which participants were asked to write a script for an imaginary interaction between a teacher-character and student-character(s) (Zazkis, Liljedahl, & Sinclair, 2009; Zazkis, Sinclair, & Liljedahl, 2009, 2013). 'Lesson play' was juxtaposed with the traditional 'lesson plan' and how the former may account for the deficiencies of the latter was outlined. The method was advocated as an effective tool in preparing for instruction, as a diagnostic tool for teacher educators, and as a window for researchers to studying a variety of issues in didactics and pedagogy (Zazkis, Sinclair, & Liljedahl, 2013).

In this study we extend the script-writing method by using it to investigate experienced teachers' perceptions of teaching mathematics.

The Study

Participants (n=21) in this study were practicing teachers from different cohorts of a two-year Master of Education professional development program in mathematics. Their teaching experience varied considerably, between two and 18 years. Towards the end of the program, as one of their elective 'capstone' assignments, the teachers were asked to write scripts for an imagined conversation in which they explain and argue for their approach to teaching. The interlocutor in this conversation had to be either a colleague or a school principal. The particular setting for such conversations and starting prompts were provided:

> *Conversation with a colleague*. It is 8:15 in the morning and you are busy preparing for your classes. A colleague comes to you room and says something like that: "Listen, I know you are doing your Master's and all. But have you thought about what this is doing for the kids?"
>
> *Conversation with a school principal*. It is the lunch break and you are invited to the principal's office. (You noticed that the principal walked by your class earlier that day). The principal says: "I asked you to come in here because I want to give you a little guidance."

The task was to continue either of these conversations. The morning hour for a conversation with a colleague was chosen to keep the dialogue rather focused, as 8:30 is the usual time when classes start. Similarly, the lunch break conversation with the principal implied a limited time. It also provided an opportunity to interrupt the conversation 'by the bell' without reaching a conclusion or an agreement, though only a few opted for this choice. The reference to 'kids' was also intentional in order to guide the conversation towards students' activity rather than general teaching strategies. The mention of "little guidance" by the principal in the presented prompt suggested some disagreement with the teacher's approach. The scripts had to be submitted two weeks after the task was presented, so the particular time allocated to creating the script was flexible.

Out of the two cohorts of 26 elementary/middle school teachers (Grades 1-8), 10 chose to write a script for a conversation with a colleague and five chose write a script for a conversation with a school principal. Out of the cohort of 14 secondary school teachers (Grades 9-12), 4 chose to write a script for a conversation with a colleague and two chose write a script for a conversation with a school principal. As such, in this article we analyse the 14 (10+4) scripts that presented dialogues with a colleague and seven (5+2) scripts that presented dialogues with a school principal.

As mentioned, in this study we extend the script-writing method by using it to investigate experienced teachers perceptions of teaching. In particular, we aim at addressing the following research questions: What is revealed by the scripts composed by practicing teachers' about their views on the teaching of mathematics? What is revealed in the perceived concerns of a colleague or an administrator?

Our analysis identified and categorized the main themes that appeared in the

scripts. In particular, we highlight the script-writers' focus on the needs of students that are attended to in the imagined dialogues, as explained in the next section.

Theoretical Considerations: Students' Needs

Sfard (2003) surveyed a variety of theoretical frameworks and identified ten needs of learners, according to these theories, that are "the driving force behind human learning and must be fulfilled if this learning is to be successful" (p.357). These are: the need for meaning, the need for structure, the need for repetitive action, the need for difficulty, the need for significance and relevance, the need for social interaction, the need for verbal symbolic interaction, the need for a well-defined discourse, the need for belonging, and the need for balance. While the theories that Sfard considered were not specific to learning mathematics, she described how these various needs were featured in the NCTM (National Council of Teachers of Mathematics) Principles and Standards for School Mathematics.

Furthermore, with a particular focus on teaching and learning mathematics, Harel (2008) identified five intellectual needs that can be attributed to learners as well as to a community of practice: the need for certainty, the need for causality, the need for computation, the need for communication, and the need for connection and structure. While the terms used by Sfard (2003) and by Harel (2008) are different, the overlap of ideas is apparent when one examines the detail of how these needs are described. For example, the need for causality is explained by Harel as the need to understand and explain a phenomenon, which echoes Sfard's main interpretation of the need for meaning as the need to understand mathematics. Harel's need to compute can be easily misinterpreted if one acquaints this with performing arithmetic calculations. However, according to Harel the need to compute describes the desire to quantify and determine the relationship among objects by means of symbolic algebraic manipulation. As such, it intertwines with the need for verbal-symbolic interaction described by Sfard.

Conducting the Analysis

In our analysis we began by identifying the main themes that emerged in teachers'/participants' arguments as well as in the arguments of their imaginary interlocutor. Then we attempted to match the identified themes with the intellectual needs described by Sfard (2003) and Harel (2008, 2013). However, as Harel (2013) noted, "these categories of needs are inextricably linked—a feature that makes it difficult to discuss them in separation from each other" (p.123). As such, in order to proceed with identification, we designed an operational description for what claims in the scripts can serve as indicators of the writer's attention to learners' needs. While a few of these needs, such as the need for social interaction, are self-explanatory, others could be misinterpreted and required elaboration and operationalization.

Figure 1 presents our summary and interpretation of what claims in the scripts—that refer to instructional approaches and students' engagement—were identified as consistent with students' needs identified by Sfard (2003). (We followed Sfard's framework as it provided a more elaborated categorization with an explicit focus on learners.)

Despite the recognised overlap, we identified the needs that are most evident in the teachers' descriptions of what they do or intend to achieve in their teaching (noted with an ✔ on the tables). Further, in several scripts we noted what appeared to be the most prevalent need of students to which the participants alluded (noted with an ✔ ✔ on the tables).

We analysed each script individually identifying script-writers' attention to particular needs of learners and choosing illustrative excerpts. We then compared the analyses and reconciled minor differences. Initially, we focused on the claims of the participant-character in the scripts. Subsequently we attended to the claims of the interlocutor in the dialogues—a colleague or a school principal—which led to identifying additional themes that repeatedly appeared in the scripted dialogues.

Figure 1
Students' Needs According to Sfard (2003)—Operational Interpretation

The need for	Operational summary and interpretation
Meaning	Making sense, learning with understanding mathematics, focus on reasoning and problem solving
Structure	Connections among various topics, concepts and procedures, attention to patterns
Repetitive Action	Attention to "doing mathematics" and reflecting on actions
Difficulty	Offering attainable challenge
Significance and Relevance	Attention to students' interests, to 'realistic' situations, to applications, growing new knowledge from prior knowledge
Social Interaction	Cooperative learning, group work, interaction among students
Verbal /Symbolic Interaction	Attention to mathematical symbols, in early grades—work with manipulatives
Well-defined Discourse	Attention to the use of proper mathematical terminology in communication with peers and the teacher
Belonging	Reference to history, to aesthetics, to cultural importance of mathematics; participation in the community
Balance	Attention to various abilities of students, attention to multiple approaches/solutions, implementing variety of teaching strategies

Results and Analysis: Conversation with a Colleague

Table 1 indicates what needs of students in the scripts were attended to by teacher-characters. As is evident in Table 1, the need for meaning/causality and the need for communication or social interaction were featured in almost all the scripts and were of central importance to most script-writers. We exemplify below how these needs were described in the imaginary dialogues. While the participants often used their personal names in the dialogues, we refer to interlocutors anonymously as 'participant', 'colleague,' or 'principal.' Consider the following excerpt from a dialogue written by a Grade 4 teacher, Participant #9 (P#9).

Excerpt from P#9 (teaches grade 4)

Participant: Students are expected to explain and justify their methods on all of their work, both oral and written. Any confusion can be turned into a valuable mathematical discussion. […]

Colleague: Why do they spend so much time talking and writing about mathematics?

Participant: It is important for students to have a chance to discuss their mathematical ideas, argue, and justify their reasoning. Students' learning is enhanced by the reflective thought that social interaction promotes. Classroom discussion

Table 1
Students' Needs According to Sfard (2003) Identified by Participant-Characters in the Scripts for a Conversation with a Colleague

Needs/ /Participant#	meaning	structure	repetitive action	difficulty	significance and relevance	social interaction	verbal symbolic interaction	well-defined discourse	belonging	balance
P#1	✔	✔		✔		✔ ✔	✔	✔		✔
P#2	✔ ✔	✔		✔				✔		
P#3	✔ ✔	✔			✔					✔
P#4	✔	✔		✔	✔	✔ ✔	✔			✔
P#5	✔ ✔	✔				✔	✔			✔
P#6	✔					✔ ✔	✔		✔	✔
P#7	✔	✔					✔			
P#8	✔			✔	✔ ✔	✔			✔	
P#9	✔	✔ ✔	✔	✔	✔	✔ ✔				
P#10	✔					✔				✔
P#11	✔ ✔			✔		✔				✔
P#12	✔	✔ ✔	✔			✔				✔
P#13			✔	✔	✔				✔	✔
P#14	✔		✔	✔		✔				✔

based on students' own ideas and solutions to problems is absolutely foundational to students' learning. By seeing how others derived their solutions, students who initially find it difficult to come up with their own strategies, can use the thinking of others as a springboard for their own discoveries. By sharing their solution methods students can organize their thinking through expression, receive helpful feedback, and also be exposed to new ideas which will deepen their understanding. Through justifying and reasoning, students learn that mathematics makes sense.

Colleague: All this explaining and justifying takes a lot of time. How do you have time to cover the curriculum?

This excerpt demonstrates not only the script-writer's awareness of the students' need for interaction, but also that such interaction is the means to achieve understanding, to make sense, that is, to satisfy the need for meaning.

While in some scripts one particular need was emphasized, we chose to present the next script because it attended to a variety of students' needs. It was written by a Grade 2 teacher, Participant #4 (P#4).

Excerpt from P#4 (teaches grade 2)

1 *Colleague:* I know you have been busy with your masters, and are very passionate about what you have been doing but have you thought about how confusing this new type of math might be to them, not to mention the fact that when they come to me next year the math will be totally different?

2 *Participant:* Well Tom I am sure it will be different—I don't expect you to teach like me. But I do question why you would think it would be confusing for the kids?

3 *Colleague:* I know that the kids in your class do some math but in all honesty it isn't really the math that the rest of the staff is teaching. I don't actually see a lot of them sitting down and doing math like the way they would be doing it in my class and I'm quite concerned that you have not provided them with a strong foundation. […] You see me marking my mad minutes everyday but I don't see that in your class?

4 *Participant:* Well I do think learning math facts has its place, however we usually do this through math games or some kind of partner activity. Computation is just one part of the math in my classroom. It's important to try and integrate a variety of tasks that challenge students in the area of problem solving and being able to communicate their understanding in mathematics. I know it looks a bit chaotic and its noisy, but I do believe the students are building strong understanding in their mathematics.

5 *Colleague:* Math should be a quiet time. It should be a time for students to focus on solving problems without all this noise.

6 *Participant:* Quiet is not always good. It could mean that students are stuck and don't know what to do? I look at talking time in math as a time to share different ways to arrive at an answer. It's a chance for students to learn from

each other. […] I try to differentiate instruction through open ended learning tasks. […] Not only are the problems designed for kids with different learning capabilities, but all the kids are helping each other. Sometimes it's not the final answer that's important, but rather the path they took to solve the problem.

7 *Colleague:* Well sometimes the beauty of math is they either have the right answer or they don't. Math needs to be quiet and kids need to be able to perform the operation correctly so they can solve the problem. Too much talking is a distraction.

8 *Participant:* It is true my kids are talkative during math, and yes we spend a lot of time on the floor, but that doesn't mean they are distracting others. By having them work on the floor with a friend kids can make connections and communicate with each other -it's a way of getting them to dig deeper into the math. Sometimes they blow me away with their explanations! […] They are trying to construct their knowledge so eventually they can move from the concrete to the symbolic. You might see that as play in grade one but it is important that students are able to show their understanding through those concrete materials. So what do you think my kids are doing on the floor, just out of curiosity? Do you think when you walk by and you see the kids on the floor that they are not doing math?

9 *Colleague:* Well like I said—it really doesn't look like math to me. It looks like they're having a good time, lots of talking.

10 *Participant:* (chuckle) Yes, you're right they are having fun.

11 *Colleague:* Well Math needs to be about learning. We've got so much to cover. How can you spend so much time on group work?

12 *Participant*: […] Students are given a question but looking for different strategies to solve it. In their groups, they discuss the different strategies so they know there is more than one way to arrive at an answer. Then together in a gallery walk, the kids get to explain their thinking in numbers, pictures and words as to how they solved that problem. Not only have they shown it, they now have to explain it and its really incredible how some of them arrive at an answer. It is a great opportunity for me to see who really understands the task.

13 *Colleague:* How am I supposed to keep track of what they actually learn or what they can do in my class at the end of the day? In my class, I have that workbook that I can look at. I choose a series of questions from the textbook so I can see all the questions and things they have solved. At the end of the day, what do you have to show as evidence as to what they have learned? You've had lots of great discussions again just going by what I see you've got these kids rolling on the carpet with their toys but they are not learning the importance of paying attention during a math lesson and they are not getting used to sitting in their desks quietly! They have all had a lot fun but have they really learned the math?

14 *Participant:* Well I have their completed work, I have their verbal explanation, I've got their group work mark… We also do a combination of worksheets that they would have to show me their learning, but not just worksheets all the time. I'm not sure that the depth of their explanations would be as great if they simply do just worksheets. If they don't show it with manipulatives then do they really get it? For some students memorization of procedures is easier, but for others, in order for them to move forward they have to be able to understand it – not just memorize an algorithm? Will they just have to calculate as opposed to showing you? We have really worked hard as a staff at encouraging the use of concrete materials into math. Our math room has all these wonderful manipulatives.

15 *Colleague*: If I show them on the board and give them practice examples then they can do it. Isn't that what we want at the end of the day? I am still not convinced that just giving them the procedure is a bad thing?

16 *Participant:* Well, there is definitely more to math now than just computation and procedure.

17 *Colleague:* Well it is the way were were taught and then the parents can help the kids at home. […] I feel valuable math time is being wasted playing with these manipulatives when we could be practicing with some questions out of the textbook.

Much like in Excerpt from P#4, we note here a strong connection between students' need for social interaction and the need for meaning making in mathematics ([4], [8], [14]). The script-writer emphasizes the connection between students' understanding and their ability to explain. Furthermore, Excerpt from P#9 demonstrates attention to other needs of learners. The mention of differentiated instruction and the design of tasks to accommodate learners of different capabilities [6] is consistent with the need for balance. In addition, the need for balance is acknowledged, implicitly, in mentioning a variety of tasks [4] and a variety of solution strategies [6], [12]. The need for difficulty is seen in the reference to tasks that challenge students [4]. The need for structure appears in mentioning connections and in the move from concrete to symbolic [8]. Further, in the repeated mention of concrete materials [8], manipulatives [14], or pictures [12] we recognize this script-writer's attention to students' need for significance and relevance as well as for symbolic interaction.

We acknowledge that while the participant-characters featured in the scripts refer mostly to students' intellectual needs, their colleague-characters refer to the needs dictated by the system, that is, by their understanding of their job description. This includes, for example, classroom management [3], covering the curriculum [11], following the textbook and providing assessment [13, 17] or considering parents [17]. We also note a significant disagreement between the characters with respect to their views of mathematics. Additionally, in the Excerpt from P#4 the main concern of the colleague-character had to do with time that needs to be al-

located to the described activities, at the expense of 'covering' the curriculum. These issues are explored in our subsequent analyses.

Table 2 summarizes concerns of colleague-characters that appeared in the scripts. The need for attention to the prescribed curriculum—and a concern that participants deviate from it—was the most frequently mentioned theme, that appeared in 12 out of 14 scripts. Additional rather frequent concerns (appeared in 9 out of 14 scripts) was that the students may not do well on the exams and be ill prepared for the next year.

We exemplify several additional ways in which the concerns were voiced.

Excerpt from P#3(teachers grades 5-6)

1 *Participant:* Somehow students need to take what they know and fit in the new knowledge so it makes sense to them. That means that we, as teachers, need to make sure that we find different ways of doing things so that all students will have the opportunity to learn to their full potential.

2 *Colleague:* But that is impossible. We don't have time to be able to make a different lesson for every kid. We can't do that kind of thing. That's why there

Table 2

Concerns of Colleague-Characters Identified in the Scripts

Colleague's concerns	Assessment/ performance	Preparing for next year	Communication with parents	Following curriculum/ textbook	Basic skills/ practice	Attention to classroom management	Time factor
P#1	✔	✔		✔	✔	✔	
P#2	✔	✔		✔	✔		✔
P#3	✔	✔	✔	✔			✔
P#4	✔	✔	✔	✔	✔	✔	✔
P#5	✔	✔	✔			✔	✔
P#6				✔		✔	✔
P#7		✔		✔	✔		
P#8	✔	✔		✔	✔		
P#9	✔			✔	✔	✔	✔
P#10		✔		✔	✔	✔	✔
P#11	✔	✔		✔	✔	✔	✔
P#12	✔	✔			✔	✔	✔
P#13		✔		✔			✔
P#14				✔	✔	✔	✔

are worksheets and textbooks. Kids just have to learn it that way because it is easier to teach that way.

3 *Participant:* I am not saying that we have to make different lessons for every student. I am saying that we need to learn how to differentiate the learning so that all students have the opportunity to show their learning. We need to come up with problems and questions that allow all students to participate in the lesson. […]

4 *Colleague:* Where are we supposed to find those kinds of questions? I have a hard enough time finding the page number that I need to go to next and then understanding the teacher's guide. I don't have the time to find all this other new stuff.

5 *Participant:* There are lots of resources out there, which I found out as I was doing all my courses. If you want to come to my class and look through what I have, you are more than welcome.

6 *Colleague:* That all sounds well and good but how am I supposed to mark that? If everyone is working at their level that means that everyone will be doing something different. I already spend a ton of time marking; I don't want to spend every evening only marking. I have a life outside of school too![…] You have to teach so that you can collect marks and put them on the report cards that way. Parents just want to see that final mark anyway.

Excerpt from P#3 demonstrates how the participant's attention to the need for balance [1, 3] is dismissed putting forward the time concerns. The colleague-character's alert that planning for differentiated instruction [2] as well as assessing (marking) students' work [4, 6] when such instruction is implemented requires more time than she can afford. She also notes that parents are interested only in the final mark [6]. Similarly, in Excerpt from P#6 the 'no time' refers to the implied change in instruction.

Excerpt from P#6 (teaches middle school)

Colleague: What about the curriculum? Your students are playing games and sometimes I see them working on the whiteboards and windows. That doesn't seem like they are working diligently on mathematics. It looks more like they are fooling around. I saw some of the students on the whiteboards drawing pictures. […] There are always new programs and theories being put to us, and I don't have the time or feel the need to be constantly changing how I teach.

However, while in Excerpts from P#3 and P#6 above it is the teacher who believes that there is no time for a different instructional method, in Excerpt from P#10 the time concern—referring to problem solving as "waste of time"—is attributed to students' activity.

Excerpt from P#10 (teachers grade 5)

Colleague: you are crazy! All that problem solving is a waste of time. It doesn't teach them how to do math. They need practice.

The colleague-character in Excerpt from P#10 claims that students need practice. A similar theme is exemplified in Excerpt for #7 and Excerpt from #12. It is notable that while P#12 teachers high school and P#7 teaches early elementary, similar claims are featured in the colleague's concerns.

Excerpt from P#7 (teachers grades 1-2)

Colleague: I've been teaching for 20 years now. The curriculum tries to make it look like its changing, but the math is still the same. I have been through all of these "Big Ideas", "Positive Learning Communities", and any new fad that comes into our education system. The students still have difficulties with math, they need the drill and practice so that they are able to do it in the real world later on.

Excerpt from P#12 (teachers high school)

Colleague: Don't you want your students to have the skills necessary for next year? Where is the drill and practice? I do not see how one of your kids will be able to do well on one of my tests. […] We teach math to prepare students for Calculus. What more is there?

Participant: I want students to experience the thrill of finding or proving a mathematical idea on their own. They don't need to always be shown what to do.
Colleague: You are going to have them figuring out how to trisect an angle with a compass and straight edge?

In Except from P#7 the colleague elaborates further: drill and practice are needed for students' future in the real world. Alternatively, in Excerpt from P#12 the skills that are developed through drill and practice are supposed to serve students in the next year, specifically, in order to succeed on exams. Furthermore, the mention of the "next year" also appears in Excerpt from P#13, in which the colleague foresees students' difficulties and attributes those to the unconventional teaching of the participant.

Excerpt from P#13 (teaches high school)

Colleague: To be honest, I think you are putting your students at a HUGE disadvantage; they're going to have a heck of a difficult time in my classroom next year. And don't even get me started on some of the stuff you've been doing this year; students gallivanting down the halls, writing on the windows, problem posing—whatever that means – ridiculous! […] All this philosophy and beauty of mathematics stuff is great if you're writing a paper for your Masters class, but how does it translate to the classroom. I don't get why you do what you do. […] I'm worried your students are going to spectacularly fail their final exam.

The colleague-characters express unanimous disapproval not only of the teaching approaches presented by the participant-characters, but also of the way their classrooms are organized. The students are not "sitting quietly", but, for example, "gallivanting down the halls, writing on the windows" (Excerpt from P#13),

"working on the whiteboards and windows, ... fooling around, …drawing pictures (Excerpt from P#6).

Note also that in Excerpt from P#12 the colleague-character demonstrates some sarcasm, where the participant's desire to have students experience the joy of discovery is countered with, "You are going to have them figuring out how to trisect an angle"? (Trisecting an angle with only a compass and a straight edge is one of the famous classic problems of ancient Greek Mathematics, that was proved impossible to achieve only in the 19th century.) A similar sarcastic tone we find in

Table 3

Students' Needs According to Sfard (2003) Identified by Participant-Characters in the Scripts for a Conversation with a School Principal

Needs/ /\Participant#	meaning	structure	repetitive action	difficulty	significance and relevance	social interaction	verbal symbolic interaction	well-defined discourse	belonging	balance
P#15		✔			✔	✔				
P#16	✔					✔				
P#17	✔					✔				
P#18	✔	✔			✔	✔	✔			✔
P#19	✔			✔		✔	✔			✔
P#20	✔	✔				✔	✔			
P#21	✔	✔		✔	✔	✔				✔

Table 4

Concerns of Principal-Characters Identified in the Scripts

Principal's concerns	Assessment/ performance	Preparing for next year	Communication with parents	Following curriculum/ textbook	Basic skills/ practice	Attention to classroom management	Time factor
P#15	✔						
P#16	✔	✔					
P#17	✔ ✔	✔		✔	✔	✔	
P#18		✔	✔	✔ ✔	✔	✔ ✔	
P#19	✔		✔			✔	
P#20	✔			✔	✔		✔
P#21			✔	✔		✔	

Excerpt from P#13, "All this philosophy and beauty of mathematics stuff is great if you're writing a paper for your Masters class […]"

Results and Analysis: Conversation with a Principal

In analysing the imaginary dialogues with school principals, we focused separately on the issues brought up by participant-characters and by principal-characters. Table 3 summarizes the needs of students that were mentioned in the scripts for conversations with a principal by participant-characters. Table 4 summarizes what issues were brought forward by the principal-characters.

As evident from Table 3, the issues voiced by participant-characters in a conversation with a school principal, are similar to those appearing in conversations with colleagues. The need for meaning or understanding the concepts and the need for social interaction are the most frequently mentioned themes. Those appear in discord with the principals' ideas of how a mathematics classroom should operate.

In comparing Tables 2 and 4 we note a significant similarity. That is, the principal-characters views on how a mathematics classroom should look like were rather similar to the perceived views of colleagues. The main difference was that the time factor was mentioned in the majority (10 out of 14) conversations with colleagues, but only in a single conversation with a principal. We suggest that this is because all the other issues relate to the constraints of the system, while time presents a personal teacher's interpretation of how the constraints of the system are to be met. Another difference (not noted on Table 4) was that in 3 excerpts the principal-characters referred to the lack of support from other teachers in school. This is exemplified in the following excerpts:

From P#15 (teaches high school)

Principal: Well every time I walk by your class the students are moving around. They are never in their desks. They look as though they are playing and the noise level in your classroom is very high. I cannot believe that anyone is learning anything with all that noise. Before you started your masters program your classroom seemed more manageable and in control. […] I am sure you have learned some new approaches in one of your math courses and it works for a while, but if you do it too long the children will suffer. I feel it is just not working in your classroom. Children need to show their understanding by drill and practice. Math is quiet and you rarely send completed work home. I have had several teachers come to me and share their concerns about there being too much free time in your room.

From P#18 (teaches grade 4)

Principal: Wow, and what are your colleagues saying to all this? I'll bet you anything they're not really thrilled with this 'out of this world' thinking

How the Conversation Ends

As mentioned above, most conversation with the principal ended in a positive spirit, where the principal-characters expressed some kind of appreciation for the methods advocated by the participant-character. This is exemplified in the following excerpts (P#19, P#21):

From P#19 (teaches grade 3)

Principal: I see how you are improving student learning and how your math program is making a difference for your kids. Thank you for working so hard. I will make an effort to spend more time in your classroom and I look forward to learning more.

From P#21(teaches grade 2)

Principal: Thank you for your time Mrs. C. You have given me a lot to think about. Let me just end this conversation by saying that I do appreciate your efforts.

Most conversation with a colleague also ended in a positive spirit, where the colleagues expressed the desire to learn more, to try different ways of teaching for themselves or to collaborate with the participant.

From P#5 (teaches grade 3)

Colleague: Well I'll let you go; I guess we'll have to talk again so you can explain some of this stuff in more detail. It sounds interesting I just can't see myself doing it all.

Participant: I didn't do it all at once either. I look forward to talking to you more about this. I know it started small with me and one thing lead to another and here I am!

From P#6 (teaches middle school)

Colleague: Well, I don't know if I am totally convinced on what you are doing is the right way to teach. However, I understand your philosophy better.

Participant: We would love to have you in for a visit during our math class, if you are able to fit it into your schedule. You can then better see what we are doing and how we are doing it.

Colleague: I would like to do that if you don't mind.

Participant: I don't mind at all.

From P#9 (teaches grade 4)

Colleague: Unfortunately we have to start the class now, but I would be curious to talk more about this with you.

Participant: Feel Free to come in any time. I'm more than happy to chat with you.

From P#12 (teachers high school)

Colleague: I'm not saying I entirely agree with you, but I thought I would try some new things. If I need some help…? (he trails off)

Participant: … I'd be happy to work with you.

Only in four (out of 21) scripts that we analysed the principal or colleague remained skeptical. Below are the final words from two scripts that follow the participant's invitation to visit her class.

From P#18

Participant: Well, come on into my room because these kids love coming to school and they love coming into my room and working together.

Principal: Well, yes I will come in and I hope you don't mind me being quite critical because I have seen good teachers over time, and you know what? I really think that they belong in rows and they are on task when they are working quietly and they have to learn what the real world is like. Now, the bell is going to ring and I have another meeting. I will visit your class next week.

From P#3 (teaches grade 5-6)

Participant: But wouldn't you, as a teacher receiving most of my students, really want to know what they know? Wouldn't you want some more specific information so that you can teach from where they are? Wouldn't you want to know more than just that the student got 76% in math?

Colleague: It doesn't matter anyway because I always have to review and then I find out what they know and go from there. I always have to re-teach things because they have forgotten so much over the summer. It is amazing how often we have to go over the same stuff again and again. They just don't seem to get it.

Participant: So then does it really matter how I teach them? Maybe they will remember the concepts that I have taught them… Then, just maybe, you won't have to do as much review and you will actually have time for the content.

Colleague: I guess time will tell. I hope for the kids' sake that you are right and they haven't just wasted a year with you. (Bell rings to start the day)

The positive endings of the plays can be interpreted either as a wishful thinking of the participants, or as their confidence not only in implementing non-traditional teaching approaches, but also in their ability to communicate their views and get approval from sceptical colleagues and administrators.

Imagined Role-Play: What Is Lost, What Is Gained

Enhanced interaction among group members, enhanced skills in collaboration, and communication are often considered among the outcomes and benefits of role-playing (e.g., Jackson & Walters, 2000; Mogra, 2012). These outcomes are unlikely to result from writing an imagined dialogue, unless participants

collaborate on creating a script. But with this loss there are overwhelming gains, as we discuss below. Role-playing, as an improvisational procedure, requires that the players have a feeling of relative safety. Many unpleasant experiences of participants in role-playing have been attributed to a teacher's failure to "warm up" the group where members learn to know and trust each other. In script-writing the safety concern is marginal as the play is confined to personal imagination.

An important goal that is attributed to role-playing is training professionals to "think on their feet" (Alkin & Christie, 2002). However, one does not necessarily have to think on his/her feet in order to be prepared for it. To the contrary, the script-writing avoids the necessity of an immediate response and as such provides an opportunity for a more-thoughtful and a more-balanced response, that can be redrafted and reconsidered, and—eventually—be relied upon when the opportunity to think on one's feet presents itself.

Many authors agree that simulations and imagined situations can induce learning. In particular, Blatner (2009) described role-playing as "a technology for intensifying and accelerating learning." We add to this that script writing invites a thoughtful and balanced response to an imagined situation and in such can induce learning even further. In addition, it provides researchers with a recorded account of one's imagined scenario from a perspective of both (or several) interlocutors.

In this study the scripts produced by participants demonstrated their views of teaching, analysing which their emphasis on students' intellectual needs as learners becomes apparent. They also demonstrated participants' perceptions of which traditional views they may be facing in their practice. It was notable that participants with different teaching experience and teaching different grade levels identified similar concerns in the voices of their interlocutors.

We noted that both participants and their imagined interlocutors exemplified care for the students. However, their care took on different forms. While participants cared mostly of students intellectual needs, their colleagues and principals cared mostly about students' survival in the system, such as performing on the exams and being well prepared for learning that takes place in other mathematics classrooms, where students individually drill and practice while sitting quietly in rows.

Script writing appeared a useful way to exemplify and elaborate upon a potential struggle teachers who strive to improve their practice encounter. Further, the exercise helped in articulating their argument for their instructional approaches and beliefs, should the script become a reality rather than an imagined role-play.

References

Alkin, M. C., & Christie, C. A. (2002). The use of role-play in teaching evaluation. *American Journal of Evaluation*, 23, 209-218.

Aronson, E. & Carlsmith, J. M. (1968). Experimentation in social psychology. In G. Lindzey

& E. Aronson (Eds.). *The handbook of social psychology, Vol. 2* (pp.1-79). Reading, MA: Addison-Wesley.

Blatner, A. (2009). *Role playing in education*. Available: http://www.blatner.com/adam/pdntbk/rlplayedu.htm

Cruz, B., & Murthy, S. (2006, January-February). Breathing life into history: Using roleplaying to engage students. *Social Studies and the Young Learner, 18*(3), 4-8.

Cruz. B. C. & Patterson, J. M. (2005). Cross-cultural simulations in teacher education: Developing empathy and understanding. *Multicultural Perspectives, 7*(2), 40-47.

Gholamazad, S. (2007). Pre-service elementary school teachers' experiences with the process of creating proofs. In Woo, J. H., Lew, H. C., Park, K. S. & Seo, D. Y. (Eds.), *Proceedings of the 31st Conference of the International Group for the Psychology of Mathematics Education* (vol. 2, pp. 265-272). Seoul, Korea: PME.

Greenberg, J., & Eskew, D. E. (1993). The role of role-playing in organizational research. *Journal of Management, 19*(2), 221-241.

Harel, G. (2008). DNR perspective on mathematics curriculum and instruction, Part II. *ZDM—The International journal on mathematics education, 40*, 893-907.

Harel, G. (2013). Intellectual need. In K. Leatham (Ed.), *Vital directions for mathematics education research* (pp.119-151). New York: Springer.

Howes, E. V., & Cruz, B. C. (2009). Role-playing in science education: An effective strategy for developing multiple perspectives. *Journal of Elementary Science Education, 21*(3), 33-46.

Jackson, P. T., & Walters, J. P. (2000). Role-playing in analytical chemistry: The alumni speak. *Journal of Chemical Education, 77*(8), 1019-1026.

Jones, F. H., & Eimers, R. C. (1975). Role-playing to train elementary teachers to us a classroom management "skill package." *Journal of Applied Behavior Analysis, 8*, 421-433.

Joyner, B., & Young, L. (2006) Teaching medical students using role play: Twelve tips for successful role plays, *Medical Teacher, 28*(3), 225-229.

Kenworthy, L. S. (1973). Role-Playing in teacher education. *Social Studies, 64*(6), 243-247.

Koichu, B., & Zazkis, R. (2013). Decoding a proof of Fermat's Little Theorem via script writing. *Journal of Mathematical Behavior, 32,* 364-376.

Lin, M., Lake, V. E., & Rice, D. (2008). Teaching anti-bias curriculum in teacher education programs: What and how. *Teacher Education Quarterly, 35*(2), 187-200.

McGregor, J. (1993). Effectiveness of role playing and antiracist teaching in reducing student prejudice. *Journal of Educational Research, 86*(4), 215-226.

Mogra, I. (2012). Role play in teacher education: Is there still a place for it? *Tean Journal 4*(3) [Online]. Available at: http://bit.ly/AtMwtr (Accessed 28 October 2012).

Lawson, T. J,. McDonough, T. A., & Bodle, J. H. (2010). Confronting prejudiced comments: Effectiveness of a role-playing exercise. *Teaching of Psychology, 37*, 256-261.

Lowenstein, A. J. (2007). Role play. In M. J. Bradshaw & A.J. Lowenstein (Eds.), *Innovative teaching strategies in nursing* (4th ed., pp. 173-182). Boston: Jones & Bartlett.

Palmer, D. H. (2006). Sources of self-efficacy in a science methods course for primary teacher education students. *Research in Science Education, 36*, 337-353.

Plous, S. (2000). Responding to overt displays of prejudice: A role playing exercise. *Teaching of Psychology, 27*(3), 198-201.

Sfard, A. (2003). Balancing the unbalanceable: The NCTM Standards in the light of theories of learning mathematics. In J. Kilpatrick, G. Martin, & D. Schifter (Eds.), *A research companion for NCTM standards* (pp. 353-392). Reston, VA: National Council for

Teachers of Mathematics.

Shapiro, S., & Leopold, L. (2012). A critical role for role-playing pedagogy. *TESL Canada Journal, 29*(2), 120-130.

Van Ments, M. (1983). *The effective uses of role-play: A handbook for teachers and trainers*. London, UK: Kogan Page.

Zazkis, D. (2013). Odd dialogues on odd and even functions. *Proceedings of the Conference for Research in Undergraduate Mathematics Education*. Denver, CO.

Zazkis, R., Liljedahl, P., & Sinclair, N. (2009). Lesson plays: Planning teaching vs. teaching planning. *For the Learning of Mathematics, 29*(1), 40-47.

Zazkis, R., Sinclair, N., & Liljedahl, P. (2009). Lesson Play—A vehicle for multiple shifts of attention in teaching. In S. Lerman & B. Davis. (Eds.), *Mathematical action & structures of noticing: Studies inspired by John Mason* (pp. 165-178). Dordrect, Netherlands: Sense Publishing.

Zazkis, R., Sinclair, N., & Liljedahl. P. (2013). *Lesson play in mathematics education: A tool for research and professional development*. New York: Springer.