

# Mathematics anxiety playback

Markku S. Hannula<sup>1</sup>, Jaana Taskinen<sup>2</sup>, Tero Kärkkäinen<sup>3</sup> and Tuula Lassila<sup>3</sup>

<sup>1</sup> University of Helsinki, Finland

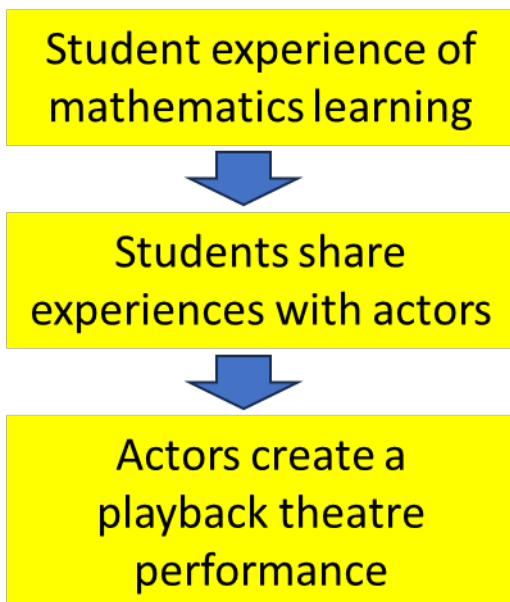
<sup>2</sup> Q-theatre, Finland

<sup>3</sup> Helsinki Vocational College and Adult Institute, Finland

**Abstract:** Applied theatre is one method to help people address their emotional issues. In this article we report of a playback theatre in a vocational institute where professional actors performed students' stories about their life as students and presented them on stage. One of the plays was about mathematics anxiety in a test. In our analysis of the performance, we identified a variety of physiological and psychological effects of the anxiety, such as worrying, attending to other students in the test, feeling tense, and not being able to think clearly. In our reflection, we see the playback theatre being able to present a realistic presentation on anxiety, capturing several aspects of it in a way that students seemed to relate to.

**Keywords:** applied theatre, mathematics anxiety, emotion, expression, vocational education

Correspondence: [markku.hannula@helsinki.fi](mailto:markku.hannula@helsinki.fi)



# 1 Introduction

Mathematics anxiety can have detrimental effects on learning (Dowker et al., 2016). Theories of anxiety have their roots in psychoanalytic theory, behaviourism, and social psychology, all of which also provide methods to reduce anxiety (Hannula, 2018). Drama is one of the methods used for promoting personal growth, including also helping overcome emotional or mental problems (Berghs et al., 2022). In this article we will report how actors interpreted students' stories about their mathematics anxiety and dramatized these in a playback theatre performance.

Mathematics anxiety is characterized by “feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems” (Richardson and Suinn, 1972, 551). Anxiety is studied within different theoretical frameworks, the fundamental foundation being social psychology research on attitudes (Thurstone, 1931). However, it has older roots in psychoanalytic research (e.g., Freud et al., 1981).

Some approaches to alleviate mathematics anxiety have been influenced by psychoanalytical therapeutic models. For example, narrative rehabilitation and bibliotherapy have been successfully used to help pre-service teachers rework their mathematical identities as more positive (Lutovac & Kaasila, 2011). When these students write and share their mathematical autobiographies or read accounts they can identify with, they are involved in similar processes of self-reflection and therapeutic support as in psychodynamic therapy.

One therapeutic approach stemming from psychoanalytical tradition is psychodrama (Moreno, 1975). Research has shown its effect on relieving anxiety (e.g. Wang et al., 2020). A related alternative theatre is playback theatre. It is a form of interactive performance and community engagement created in 1975 in New York, and now practiced in 70 countries in a wide range of contexts (Fox, 2007).

The main connection between psychodrama and playback theatre is the mirror technique (Rahmel, 2021). In the mirror technique, the person processing their issue (the main character) gets an opportunity to look at their issue from a distance, as from seeing oneself from a mirror. Such a new perspective often allows self-empathy and novel insight, allowing to renew own identity. Whereas in psychodrama participants stage issues that relate to other participants' relationships or inner roles, in playback theatre the participants are not the performers. However, the basic idea is the same: make the whole experiential world of a person visible.

In playback theatre, teams of actors and musicians listen to stories told by audience members and then act them out without script, score, or rehearsal, building dialogue and connection. The conductor (sometimes called the facilitator or the host) of the playback interviews people in the audience and anyone can tell, for example, about their own experience, observation, or memory (Fox, 2007). Through the questions of the conductor, the personal story becomes enriched with dramaturgical elements and using techniques chosen by the conductor, the actors improvise the told story on stage.

## 2 Context

### 2.1 The college

In this article, we report a playback theatre event on one of the five campuses of Helsinki Vocational College and Adult Institute (<https://stadinao.fi/briefly-in-english>). The institute provides both young and adult students degrees in 29 areas of study. It has 8951 students, out of whom 44.7 percent are second language learners. The number of special education students has increased yearly. In 2020, 13 percent of students had been given a plan for special needs support, while in 2023 25 percent of students had such plan. This trend of increased need for support is seen also in mathematics.

Based on their experiences in teaching mathematics and working with special needs students, two of the authors have recognized many students to have negative emotions towards mathematics: anxiety, fear, even disgust. Self-confidence has been shattered at some point on the educational path, and poor ‘math head’ is accepted as a family burden. Negative emotions lead easily to giving up, skipping lessons, and not even trying because of shame.

### 2.2 The theatre

The community theatre *Hyvä Kätilö* (Kind Midwife) was a group under the umbrella of Q-theatre. In the group there were professional actors who have participated in special training and who master methods of playback theatre. *Hyvä Kätilö* has functioned since 2015 and completed several projects with vulnerable target groups, such as child protection and social welfare. Q-theatre was a partner in the EU-funded project Tule Nähdäksi (2016–2022) (<https://tulenaahdyksityopajat.diak.fi>), aiming to strengthen the interaction and emotion competences of those adolescents, who were outside work and education.

Through their education and practice, actors can provide unique support to training emotional intelligence (Koskinen, 2013). Actors can direct their emotional states and thus tune the interaction with an adolescent. Through activating and extinguishing emotions, the actors also model the experiencing of emotions and their effect. The work is based on an idea to scaffold emotions in the zone of proximal development (c.f. Hart, & Lindahl Jacobsen, 2018).

There are some universal playback theatre techniques, and, in addition, *Hyvä Kätilö* has developed their own techniques. In playback theatre, the performance is often divided in two parts. First, so called short techniques are used to illustrate some observations or experiences that were told. After short techniques, follow longer stories that include relations and events. One common technique, three images, presents three different stages of the same person. A fluid sculpture is a technique, where one person’s mood and state at a certain moment is presented first, and then there is a change into another mood and state. Also widely used are voice of thoughts and inner monologues. Sometimes the inner voices of sculptures are activated by a touch.

## 2.3 The collaboration

The collaboration between the college and the theater began, when Q-theatre community theatre actors used playback theater in a clinical supervision afternoon organized for school staff, fall 2022. The third and fourth author participated the event and suggested to organize something similar for students to reflect upon their relationship with mathematics.

The playback theatre for students was organized by dividing the students into five small groups (3–4 students each), with an actor facilitating discussions in groups. These discussions related to studying mathematics and emotions that arise from it. The actors reflected that it wasn't easy for the students to talk about negative emotions regarding exams.

The actors have described that their aim was to provide space for reflection rather than solving the emotional issue. When the discussions didn't focus on solutions at once, but rather stopping to elaborate how the difficult situation feels, they provided plenty of observations. The aim was to recognize all related elements and their interactions.

Not everyone in a small group shares the same experience. It is important that while these experiences are understandable, recognizable, and relatable, not everyone must have the same relation to the issues. Also here, it was important to make space for all experiences.

After the discussion, the actor suggested what kind of act would be taken to the stage. There was always a confirmation from the students that they felt ok to have the actors perform on what has been spoken, as they had to feel safe watching the performance. Often, the actor combined different experiences in a way that situations become intertwined and united. This way, the performance was not specific to one person, but, rather, a collection of many people's experiences. It is possible to recognize situations, utterances, and sometimes longer sentences. The performances always aim to be suitably anonymous, yet to speak of the issues as they were discussed in the group.

## 3 Analysis of the playback performance

The playback performance was recorded on video and edited. The video is available on the Internet, see link at the end of the article. Emotions in exam is the first of several small performances they presented. The emotions were negative and can be interpreted as different forms of anxiety. The duration of the performance was 3 min 33 s. Below is a script based on the video.

### 3.1 The mathematics exam

#### Cast of Characters

- Mrs. Math: The teacher and the narrator
- Erasebrain: A student
- Crypanic: A student

- Iwassosure: A student

SETTING: Three chairs representing a mathematics class.

MRS. MATH

(Mrs. Math walks to the front of the stage with big sheets of paper in her hands. She checks her watch. Speaks with a stern voice and expression.)

The mathematics exam begins.

ERASEBRAIN

(Exhales. Walks determinedly to the chair. Talks to himself.)

I know this. I know this.

(Sits down nervously.)

I have trained this, I know this. I know this.

CRYPANIC

(Somewhat hesitantly walks to the front, stops, and exhales.)

Yea, yes, I know this.

(Walks to the second chair and sits down nervously.)

IWASSOSURE

Hum dum dee dum. I know. I know. I know.

(Relaxed and confident. Walks to the third chair and sits down)

Yes, I know this!

MRS. MATH

(Gives one sheet of paper to each student.)

Don't turn the exam paper, yet.

(Claps her hands.)

Turn the exam paper now.

(ERASERBRAIN, CRYPANIC, and IWASSORURE turn their papers and look at the paper.)

IWASSOSURE

(Doesn't feel well. Squints his eyes. Rubs his face. Is gasping his breath. Pulls his collar loose.)

Uhm.. No, I don't. ... No, I don't know this.

CRYPANIC

(Holding back tears.)

No, I don't know this.

ERASEBRAIN

(Looking at the paper, then stares into space vacantly.)

I don't know anything. I don't remember anything. I don't know anything. I don't remember anything.

MRS. MATH (narrator)

Yet, everybody writes, because you must write something. Everybody writes. Everybody writes. All the students here write, because they want to try something.

(Walks behind the students. Rubbing hands fast to make sounds resembling writing on paper.)

Here comes the sound of the others writing. But these three. These three don't know anything. They think that they don't know anything, but all the others know.

(Claps hands sharply.)

The exam is over.

(Collects students' papers.)

Thank you. Thank you. Class dismissed.

(ERASERBRAIN, CRYPANIC, and IWASSOSURE get up, looking defeated and sad.)

IWASSOSURE

(Leans towards CRYPANIC)

Noooo... horrible.

CRYPANIC

I didn't know anything.

(Starts to laugh, giggles hysterically.)

IWASSOSURE and CRYPANIC

(Both speak fast and loudly, over each other, and move a lot. CRYPANIC laughs).

Totally screwed ... Uhm, no... Gotta get coffee!

(They run towards the table, where they pick a cup each.)

IWASSOSURE

I didn't know anything at all.

CRYPANIC

Doesn't matter! Doesn't matter at all. You know what? I think I knew that one task. I can help you. Well, I'm not sure, but what if we look at it together.

IWASSOSURE

That would be awesome. Let's try again. Let's try again so many times that we pass it.

(While they have been speaking, ERASEBRAIN walked to the front of the stage, carrying a guitar, looking sad, and playing a few careful chords. While they continue more quietly, ERASEBRAIN begins to talk to the audience.)

ERASEBRAIN

(Accompanying his talk with a few cords and notes.)

It didn't go well, the exam. After the exam I go to ease myself. I take a coffee with me. And I walk to the shore. And I see the sea. And I calm down there. Next time it'll go better. Next time better. Next time better.

The End

### 3.2 Analysis

Next, we will analyse the performance from the perspective of how the actors expressed anxiety.

While they all were saying that they “know it”, when they entered the scene, two of the actors expressed nervousness. Both ERASERBRAIN and CRYPANIC had somewhat jerky movements, and they made restless movements and were nervously touching themselves as they sat down. CRYPANIC was also visibly tense when walking to the scene and sitting down (See Figure 1).

**Figure 1.** Actors as students (ERASEBRAIN, CRYPANIC, AND IWASSOSURE) waiting for the exam to begin.



Note. Three actors sitting on chairs.

When they turn the exam paper over, each actor expresses the anxiety in somewhat different way. IWASSOSURE’s expressions focus on the physiological aspects of anxiety, he gasps and pulls his collar, obviously having difficulty to breath (Figure 2c), he also squints his eyes and rubs his face. CRYPANIC’s expressions focus on the emotional aspect of anxiety. She is holding back tears, she is very tense (Figure 2b), and her voice cracks. ERASEBRAIN’s expressions focus on the cognitive aspect – mind going blank. He stares vacantly into space (Figure 2a) and repeats that he doesn’t remember anything.



**Figure 2.** a (ERASEBRAIN), b (CRYPANIC), and c (IWASSOSURE). Actors expressing anxiety.



Note. Three actors' faces.

Moreover, the narrator (MRS. MATH) even captured the social aspect of anxiety. The three students hear everyone else writing. They are painfully aware of the social context, where they are the ones failing, and if they don't write something – pretending to perform – the other's will know their failure.

## 4 Reflections

After the play, the conductor (the second author) commented the performance, focusing on emotions that were presented, the importance of finding ways to either vent out emotions or calm them down – as the students did in the play. She posed a question for the audience to think about the future and whether there could be some way they could work with the emotions in the situation. To this, one of the actors (MRS. MATH) commented, that they thought about it. That there are things one could do. But they just don't help *right now* (emphasis on the italicized).

This performance applied and mixed several of the playback theatre techniques with some elements coming from other traditions of applied and participatory art.

The beginning was formed as a mixture of *Hyvä Kätilö* group's own technique, situation image (creating a situation) and three images. The situation image was the exam, and the actors performed three ways of how it feels to fail in an exam and what are the reactions to it. These came from the discussions with the students. The actor of MRS. MATH used the hand touch to activate each student's inner voice at that moment.

The technique fluid sculpture is essentially about change from one stage to another. The element of change was applied in this performance as well. As they left the exam situation, they each made a change in the person's state. Two actors faced each other (technique: encounter) and started to talk and laugh. Then, they verbalized their failure, and supported each other to ease the bad feeling.

The third actor (ERASERBRAIN) took a guitar and started to play calm music. Dramaturgically, he returned to the earlier situation image, but changed its emotional tone. He made again an inner monologue, telling where he finds the spaces for calming and how he recovers from failure. All these strategies for coping had been collected from the students.

We did pay attention to the audience reactions. Their attention was intensive, and they tuned in with the performance. There were touching moments and they laughed to humour on stage. At the end of the show, when the conductor asked if it felt familiar, the audience was nodding in agreement.

## 5 Conclusions

This playback performance was based on discussions with students and the actors found from their repertoire ways to perform these student experiences on stage. Voice and body are their primary tools for expression. This sets limits to what they can express. For example, the feeling of heart beating stronger and faster is difficult to show on stage. Yet, the inner monologues allowed expressing such things that are hidden from onlookers. For example, ERASERBRAIN said that he doesn't remember anything, reflecting how the mind completely blanks sometimes under anxiety.

Overall, a three-minute episode managed to build an intensive emotional roller coaster, and, moreover, providing a verisimilitude in representing physiological, emotional, and cognitive aspects of mathematics anxiety. How the performance is presented in this text, is a pale shadow of the live performance. Go and see the video for a more vivid experience.

## Research ethics

### Author contributions

M.S.H: conceptualization (article), formal analysis, investigation, methodology, visualization, writing—original draft preparation, writing—review and editing.

J.T: conceptualization (playback theatre activity), investigation, methodology, resources, writing—original draft preparation, writing—review and editing.

T.K.: conceptualization (playback theatre activity), data curation (video recordings), resources, writing—review and editing.

T.L.: conceptualization (playback theatre activity), resources, writing—review and editing.

All authors have read and agreed to the published version of the manuscript.

## Artificial intelligence

Artificial intelligence was not used for preparing this article.

## Funding

The playback theatre project was funded by a grant TKT/90/5498/2022 from Taiteen edistämiskeskus.

## Institutional review board statement

The study did not require an ethics review.

## Informed consent statement

Informed consent was obtained from all research participants.

## Data availability statement

A video of the analyzed performance is available at [https://drive.google.com/drive/folders/1fgecHHNSOsZWx\\_CGUIp4sEviFw1OuuFo](https://drive.google.com/drive/folders/1fgecHHNSOsZWx_CGUIp4sEviFw1OuuFo). The analyzed performance begins at 5:24.

## Acknowledgements

Thanks to the actors in the community theatre of Q-teatre: Outi Condit, Jenni Kitti, Timo Mäkynen, Irina Pulkka, and Tuomo Rämö.

Helsingin Virittämö did the video recording and editing of the playback performances.

## Conflicts of Interest

The authors declare no conflicts of interest.

## References

- Berghs, M., Prick, A. E. J., Vissers, C., & van Hooren, S. (2022). Drama therapy for children and adolescents with psychosocial problems: A systemic review on effects, means, therapeutic attitude, and supposed mechanisms of change. *Children*, 9(9), 1358. <https://doi.org/10.3390/children9091358>
- Dennis, R. (2004). *Public performance, personal story: A study of playback theatre*. Griffith University.
- Dowker A., Sarkar A., & Looi C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? *Frontiers in Psychology*, 7, 508. <https://doi.org/10.3389/fpsyg.2016.00508>
- Fox, H. (2007). Playback theatre: Inciting dialogue and building community through personal story. *The Drama Review*, 51(4), 89–105. <https://doi.org/10.1162/dram.2007.51.4.89>
- Freud, S., Strachey, A., Freud, A., & Tyson, A. (1981). *The standard edition of the complete psychological works of Sigmund Freud: Vol. 20, (1925-1926): An autobiographical study; Inhibitions, symptoms and anxiety; The question of lay analysis and other works* (Repr.). The Hogarth Press and The Institute of Psycho-analysis.
- Hannula, M. S. (2018). From anxiety to engagement: History and future of research on mathematics-related affect. In E. Bergqvist, M. Österholm, C. Granberg & L. Sumpter (Eds.), *Proceedings of the 42nd conference of the International Group for the Psychology of Mathematics Education: Umeå, Sweden* (Vol. 1, pp. 19–34). International Group for the Psychology of Mathematics Education.
- Hart, S., & Lindahl Jacobsen, S. (2018). Zones of proximal emotional development — Psychotherapy within a neuroaffective perspective. *Journal of Infant, Child, and Adolescent Psychotherapy*, 17(1), 28–42. <https://doi.org/10.1080/15289168.2018.1425588>

- Koskinen, A. (2013). *Tunnetiloissa: Teatterikorkeakoulussa 1980- ja 1990-luvuilla opiskelleiden näyttelijöiden käsitykset tunteista ja näyttelijöiden tunnetyöskentelystä*. Teatterikorkeakoulu. <https://urn.fi/URN:ISBN:978-952-6670-12-6>
- Leichsenring, F., Luyten, P., Hilsenroth, M. J., Abbass, A., Barber, J. P., Keefe, J. R., ... & Steinert, C. (2015). Psychodynamic therapy meets evidence-based medicine: A systematic review using updated criteria. *The Lancet Psychiatry*, 2(7), 648–660. [https://doi.org/10.1016/S2215-0366\(15\)00155-8](https://doi.org/10.1016/S2215-0366(15)00155-8)
- Lutovac, S., & Kaasila, R. (2011). Beginning a pre-service teacher's mathematical identity work through narrative rehabilitation and bibliotherapy. *Teaching in Higher Education*, 16(2), 225–236. <https://doi.org/10.1080/13562517.2010.515025>
- Moreno, J. L. (1975). *Psychodrama. Foundations of psychotherapy*. Second volume, 2. edition. Beacon House.
- Rahmel, P. (2021). *Kerro, katsotaan! Opas tarinateatteriin ja narratiiviseen pedagogiikkaan*. Metropolia Ammattikorkeakoulu
- Richardson, F. C., & Suinn, R. M. (1972). The mathematics anxiety rating scale: Psychometric data. *Journal of Counseling Psychology*, 19(6), 551. <https://doi.org/10.1037/h0033456>
- Thurstone, L. L. (1931). The measurement of social attitudes. *The Journal of Abnormal and Social Psychology*, 26(3), 249. <https://doi.org/10.1037/h0070363>
- Taskinen, J. (2022). Nuorten hyvinvoinnin tukeminen näyttelijöiden avulla. In M. Ärling, & R. Lamminmäki (Eds.) *Haluamme kuulla tarinasi-Havainnot Tule nähdyksi-hankkeesta*. (pp.13–27). Diakonia-ammattikorkeakoulu.
- Wang, Q., Ding, F., Chen, D., Zhang, X., Shen, K., Fan, Y., & Li, L. (2020). Intervention effect of psychodrama on depression and anxiety: A meta-analysis based on Chinese samples. *The Arts in Psychotherapy*, 69, 101661. <https://doi.org/10.1016/j.aip.2020.101661>