

The Joy of Math:
Flow Experience in High
School Mathematics Students

Why Flow?

- Only 16 percent of American high school seniors are proficient in mathematics and are interested in STEM careers (“Science, Technology, Engineering,” 2015)
- Personal experience: emic and etic.
- Flow and gaming addiction (Voiskounsky, A, 2010)
- PsycNET search mathematics and ...
 - enjoyment (113 hits)
 - anxiety (1027 hits)
- Problem solving, creativity, and deep comprehension require high levels of positive emotions (Schiefele, & Csikszentmihalyi, 1995).
- Enjoyment has a significant influence on student motivation (Bailey, Taasobshirazi & Carr, 2014; Pinxten, Marsh, De Fraine, Van Den Noortgate & Van Damme, 2014; Huang & Lin, 2015; Malpass, O’Neill Jr. & Hocevar, 1999)

Questions

What type of math experiences induce flow?

How do flow experiences affect subsequent academic decisions?

Design: Grounded Theory

- **Fit** - The theory emerges only from gathered and analysed data. No stated hypothesis.
- **Understanding** - The theory must be understandable to mathematics educators.
- **Generality** - Open (identifying), axial (organizing), and selective (linking data to the core) coding will be used to identify and describe the essence of flow experience and consequences.
- **Control** - The theory should describe a controllable phenomenon that mathematics teachers can make practical and effective use of.

Participants

Current and former students of Fair Studio, a teaching studio in Fairfax County, VA. Use snowball sampling if necessary to obtain additional participants. Selected because of an existing personal relationship with the researcher.

1. Begin with a homogenous convenience sample of 10-12 participants.
 - a. High school student.
 - b. Placed in AP or IB calculus. These are the top level math students who are most likely to have experienced flow.
2. As theory is developing use a negative-case sample of 10-12 participants.
 - a. High school student.
 - b. Placed in remedial or general mathematics. Explore the boundaries of the phenomenon.

Procedure: Data Collection

Interview and Observation

- Open-ended interviews to take place at the studio, a comfortable and familiar environment for the participants. Prompt participants to describe their flow experiences:
 - Feelings, setting, prelude, response
 - Photo-interviewing analysis: Use 1st or 2nd grade math worksheets to prompt memories of early experiences.
- Researcher memo thoughts during interview and immediately afterward about concepts, emerging themes and patterns.
- Video and audio recording
 - Typed transcriptions of all interviews
 - Thick description of participants body language, pace of response (observation)

Analysis

- **Open Coding**
 - A priori codes developed from the literature (Csikszentmihalyi, 1990; Moneta, 2012).
 - Identify discrete elements
- **Axial coding**
 - Create hierarchical categories from the general to the specific
 - Key features, causal conditions, consequences

Repeat data collection and analysis processes until there is sufficient data for:

- **Selective coding** - the refinement of the central idea and alignment between the theory and the data to theoretical saturation.

Validity

- **Descriptive Validity**
 - Video recording and transcriptions of all interviews
 - Thick description of participants body language, pace of response
- **Interpretative Validity**
 - Low-inference descriptors - use the participant's words to support the theory
 - Timely memoing of impressions and thoughts.
 - Member checking and follow-up interviews - review analysis with the participant.
 - Check for intercoder reliability using trained coders.
- **Theoretical Validity**
 - Initial analysis based on previously operationalized elements of flow experience
 - Continuous crosschecking of theory and data during data collection and analysis,
- **External Validity**
 - Theory should describe a controllable abstract phenomenon that practitioners can use

Ethical Considerations

- **Harm** - There are time considerations, and deep reflection on prior experiences may cause some anxiety to participants.
- **Privacy and Confidentiality** - Participants will be identified by alpha-numeric codes. Once the study is completed all video and audio recordings and any documents identifying participants will be destroyed.
- **Consent and Assent** - Voluntary participation, and right to withdraw.
- **Benefits** - The potential for learning about positive experiences with mathematics that may affect student career choices.
- **Results** - To be provided to the participants at the end of the study.
- **IRB** - Provide information and obtain approval

References

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