

Pre-service and in-service teachers' vocal, psychophysiological and self-reported responses to different 360-degree virtual classroom environments

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1. Introduction

- Virtual reality (VR) technology: a new tool for therapy → Treatment-specific, interactive, 3-dimensional, reusable environments, for stimuli hard to recreate and control in real life.
- VR immersive experiences can enhance various aspects such as learning, engagement, and emotion → Help learning effective voicing techniques in behavioural voice therapy.
- One of the three major occupational health problems of Hong Kong teachers: Voice problems.
- VR simulations in virtual classrooms may help generalising voicing techniques from clinical environments to application in real-life classrooms.

Research questions:

1. What are the effects of different 360-degree VR classrooms with increasing levels of contextual distractions on teachers' vocal and psychophysiological performance?
2. Are there any differences among the responses of teachers with varying lengths of teaching experience?

2. Hypothesis

Three **within-subject independent variables**:

1. Virtual **students'** level of **attentiveness** (low and high),
2. Virtual **parent attendance** (presence and absence of parents in the classroom),
3. Virtual **parents'** level of **attentiveness** (low and high).

Between-subject variable: Teaching experience.

Interaction effect between students' class performance and parents' attention on teachers → VR classrooms containing **both misbehaving students and attentive, observing parents** would cause the **most stress** among teachers.

3a. Methods: Participants

Cantonese-speaking pre-service and in-service teachers in primary and secondary schools, and Bachelor of Education programmes (n = 8, mean age = 42.73, SD of age = 16.13)

Novice teachers (formal teaching experience shorter than or equal to 5 years):

3 males (1 DSS primary school teacher, 1 DSS secondary school teacher, 1 BEd student)

Intermediate-experience teacher (formal teaching experience between 6 and 29 years):

1 male (Government secondary school teacher)

Veteran teachers (formal teaching experience equal to or longer than 30 years):

1 male and 3 females (1M: aided secondary school teacher. 3F: aided primary school teachers)

3b. Methods: Data collection

Ethical approval had been obtained from the Human Research Ethics Committee, Faculty of Education, HKU (Reference number: EAU25091) prior to data collection.

Participants filled out a **background questionnaire** when signing up. Foci of background questionnaire: 1. Their **teaching experience (in years)**, and 2. **Whether the school they taught at organised regular class observation activities for parents** → **exposure towards parents and students of different behavioural standards**, and 3. **Self-report digital literacy of teachers** (based on self-ratings of their knowledge towards a list of innovative teaching strategies) → **potential ICT anxiety**, readiness and acceptance of new technological products e.g. the VR device in this study.

Individual lab session:

- **psychophysiological indicators (pulse rate and oxygen saturation (SpO2))**: a **fingertip photoplethysmographic oximeter** on ring finger of non-dominant hand
 - **voice qualities (F0, intensity, shimmer, jitter, noise-to-harmonics ratio)**: **hand-held microphone**, in dominant hand, with a cotton swab stick touching the chin for fixed distance
- a. **Baseline recording: Pulse rate and oxygen saturation measurement** for around **2 minutes**, **reading aloud** a **standardised paragraph "North Wind and the Sun" thrice**.
 - b. Viewing **6 pre-recorded VR classrooms in randomised order** using a **VR goggle** and an **open headphone**, while doing a **mock lecture**, with **voice and psychophysiological indicators** recorded.
 - Classroom A – **Attentive students, no parents** Classroom B – **Inattentive students, no parents** Classroom C – **Attentive students, inattentive parents**
 - Classroom D – **Attentive students, attentive parents** Classroom E – **Inattentive students, inattentive parents** Classroom F – **Inattentive students, attentive parents**
- **After viewing** each classroom, completing 1. an **11-point OMNI scale** for **vocal effort** needed to speak in that classroom (0 = minimum, 10 = maximum), and 2. a **self-report emotion questionnaire** on their **emotional intensity**, in **10-point scales** (1 = minimum, 10 = maximum), especially on **calmness, anxiety and fear**.
 - **Between** each VR classroom, a **3-minute break**.

4. Results and Discussion

Small sample size and huge individual variance (especially in biology and raw acoustics) → **major trends of objective data by classroom hardly observed**.

Trends in self-report data:

- **Longer teaching experience, less affective influence** received from the VR classrooms in general
Veteran teachers: largely ↑ calmness, ↓ fear and anxiety, ↑ emotional stability
Novice teachers: ↑ fear and anxiety, ↓ calmness, ↑ fluctuations in intensity ratings.
Intermediate-experience teacher: sandwiched in between

- Correlations between self-report data

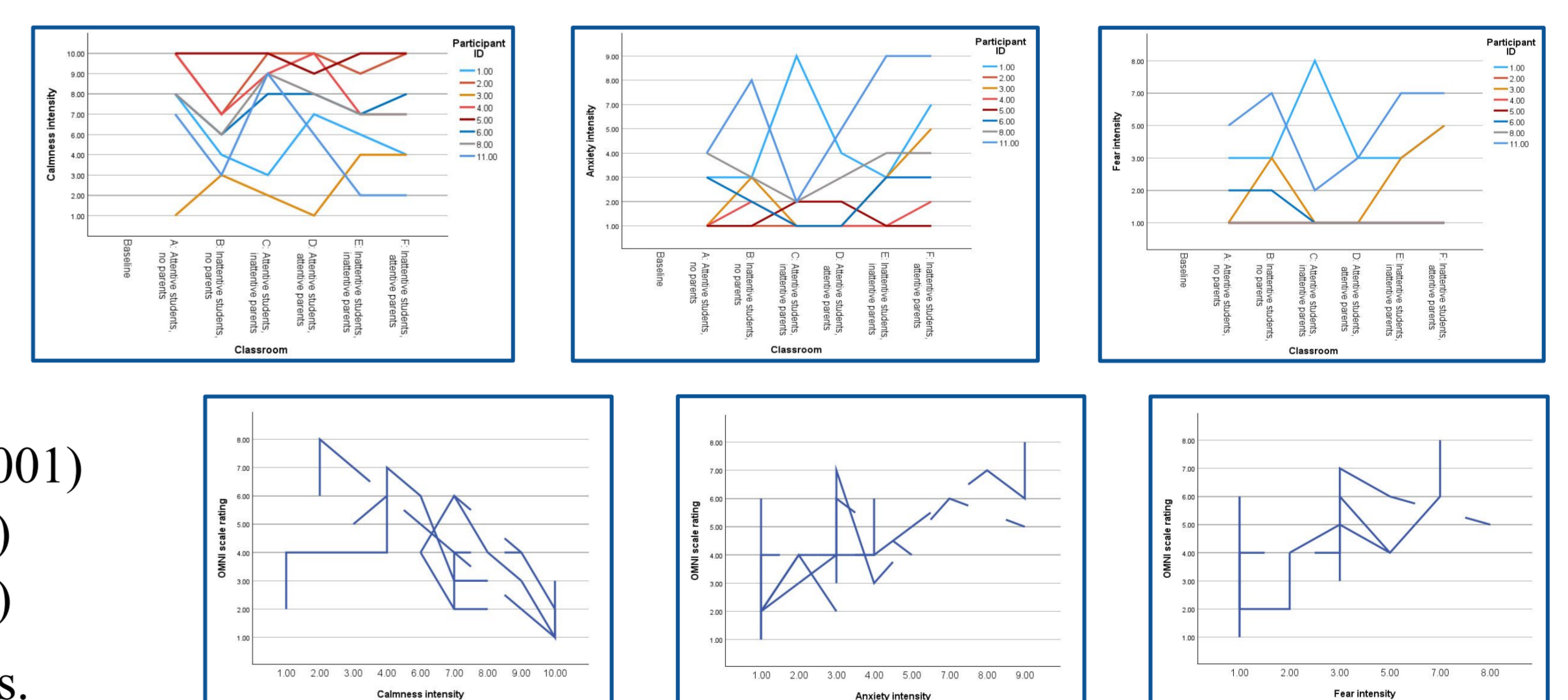
OMNI scale rating vs Calmness intensity: strong negative correlation (Spearman $\rho = -0.709$, p-value < 0.001)

OMNI scale rating vs Anxiety intensity: strong positive correlation (Spearman $\rho = 0.694$, p-value < 0.001)

OMNI scale rating vs Fear intensity: moderate positive correlation (Spearman $\rho = 0.594$, p-value < 0.001)

Not a lot of data matched our hypothesis on the physiological and emotional impact of increasing distractions.

Qualitative feedback: habituation, sense of virtuality, lack of immersiveness due to absence of interaction, subjectivity (varying focuses on nuances, different situational assessment)



5. Conclusion

Notable trends:

- **Teaching experience linked with affective responses** in VR classrooms
- **Greater emotional stability in veteran teachers**
- **Elevated fear and anxiety correlated with increased perceptual vocal effort**

Limitations of setup: (from qualitative feedback)

- **Pre-recorded nature of the VR classrooms**
- **Insufficient contrast between variable levels**
 - Awareness of the **artificial settings**
 - **Inadequate immersiveness and stimulus strengths**

Further research:

- A **larger participant pool**
- **Incorporation of AI** for more **realistic environments with real-time interactions** and **common classroom incidents**

6. References

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