

# Can Virtual Reality Best Assess Peer Exclusion Affecting Mood and Emotions within an Experimental Design?

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**Abstract.** Peer exclusion is a pervasive phenomenon that can lead to negative mood states in affected individuals. To model peer exclusion experimentally, the Cyberball paradigm has been widely used. However, the effectiveness of this paradigm may vary depending on the presentation format. The primary objective of this study is to investigate the effectiveness of the Cyberball paradigm in a virtual reality (VR) environment and compare it to the traditional 2D version. Specifically, we aim to determine which paradigm is more effective in experimentally manipulating peer exclusion. To achieve this objective, we will recruit 150 children and adolescents aged 8-16 years. Participants will complete a background questionnaire, which will collect data on their social support, rejection experiences, and demographic variables. They will then be exposed to two peer exclusion situations, one in 2D and one in VR, in random order. After each situation, participants will be asked to report on their mood, satisfaction, and frustration with their basic psychological needs and immersion. We expect that both experimental situations will result in a decline in participants' negative mood on average. However, we hypothesize that the VR paradigm will be more effective in inducing negative mood states than the 2D situation. By exploring the differential effectiveness of the Cyberball paradigm in different presentation formats, this study will contribute to the existing literature on peer exclusion and pave the way for future research on the use of VR in this domain.

**Keywords.** Peer exclusion, Cyberball, Virtual Reality, 3D paradigm, Mood, Educational Psychology

## 1. Introduction

Research on peer relationships in schools is important to understand how they affect academic achievement and well-being. By identifying factors that contribute to positive relationships, schools can develop interventions to promote healthy social connections among students. Overall, this investigation is crucial in creating a positive and supportive learning environment for students, fostering positive peer relationships and improving academic achievement and well-being.

This study focuses on peer relationships as a proximal developmental context and the impact it has on the development outcomes of children and adolescents [1]. Although the literature on peer relationships has emphasized its role within the school context, there is no overall agreement on how peer relationships can be operationalized and measured in terms of short-term effects. Therefore, the main aim of the research presented in this paper, which is the first study of a PhD project, is to find the strongest way to investigate peer relationships within the school context, focusing on the

immediate and short-term impact of peer exclusion on students' mood and psychological needs.

Peer relationships within the school context can be considered a continuum, with peer inclusion at the positive pole and peer exclusion at the negative pole [2]. Peer inclusion describes the condition in which an individual feels accepted and included by peers or peer groups, while peer exclusion refers to the condition in which an individual feels excluded or rejected [3]. Children and adolescents can be excluded by peers both in an emotional and physical way, and exclusion can be acted directly or indirectly, implicitly or explicitly [4]. The literature on peer relationships emphasizes that peer exclusion can lead to negative mood, unsatisfaction of basic psychological needs, lower self-esteem, and meaningful existence, as well as internalizing problems, loneliness, and school disengagement in the long term [5]. Excluded children and adolescents show more learning difficulties and academic problems, absenteeism, discipline problems, poor academic skills, and higher dropout rates [6]. The transition from childhood to adolescence is an important factor to consider as peers become more important in satisfying adolescents' basic psychological needs [7]. Gender-specificity exists in the exclusion behaviours performed and the specific outcomes of peer exclusion [8]. Friendship and social support are important protective factors against peer exclusion, especially for females [9].

There is still no agreement on how to operationalize and measure the short-term and long-term effects of peer exclusion within both between-subjects and within-subjects designs. The Cyberball paradigm has been widely used to operationalize peer exclusion in experimental designs for short-term effects [10]. The Cyberball paradigm is an online ball-tossing game, in which participants believe they are playing with real peers but are playing with standardized computer players. In the peer exclusion condition, participants rarely or never receive the ball, whereas, in the neutral or inclusion condition, they often receive it. The Cyberball paradigm allows researchers to examine the individual effects of peer exclusion experiences without considering pre-existing relationships [11]. However, the Cyberball paradigm has limited ecological validity as it is a 2D paradigm. Therefore, a 3D paradigm using a virtual environment can work better in replicating reality, achieving higher ecological validity, and refining current findings to understand the mechanisms through which peer exclusion exerts its effect on children and adolescents [12].

Virtual Reality (VR) is a 3D immersive advanced technology that allows researchers to build experimental paradigms and lab situations closer to what people would experience in everyday life [12]. VR has higher ecological validity than other technologies used in educational contexts, making it a useful tool for educational activities and intervention [13]. Studies have shown that VR can help students to improve their writing skills, social skills, and learning outcomes [14].

VR, as a simulated experience that can be completely like the real world, has been used in a variety of settings, including entertainment, education, and therapy [15]. In recent years, the technology for VR has improved dramatically, and it has become more accessible to consumers [16]. VR is a technology that has been increasingly used in educational contexts, particularly in schools, providing a simulated experience that enables users to interact with a three-dimensional environment, allowing them to explore, manipulate and learn in a more engaging and interactive way [17]. The use of VR in education can provide an immersive learning experience that can enhance student engagement, improve knowledge retention and lead to better academic performance [18]. Additionally, VR can provide a safe and controlled environment for students to explore and experiment, particularly in subjects that require practical training, such as science or engineering [19].

Overall, the use of VR in education has shown great potential in improving student engagement, knowledge retention and academic performance. One example of the use of VR in schools is the use of virtual laboratories. Virtual laboratories can provide students with a safe and controlled environment to learn and experiment in subjects such as biology, chemistry, and physics [19]. VR laboratories can also provide students with access to equipment and experiments that may not be available in traditional classrooms

[20]. This can help to enhance their practical skills and understanding of scientific concepts. However, more research is needed to better understand the impact of VR on learning outcomes and how to effectively integrate VR into educational settings.

The present study's research question is focused on identifying the most effective paradigm to assess peer exclusion in an experimental design. Specifically, the study aims to address the question, "How can peer exclusion be best assessed in an experimental design?" To accomplish this, the study will evaluate the effectiveness of two paradigms, Cyberball and VR, in assessing peer exclusion. As the Cyberball paradigm has already shown no significant differences between 2D and 3D versions [21], and VR paradigms based on conversational situations have already shown significant results assessing social exclusion in adult samples [22], we aim to compare Cyberball with a VR paradigm built ad hoc by conversational situations. In this study, several hypotheses have been formulated to guide the investigation.

The first hypothesis (H1) predicts that peer exclusion will have a negative impact on children's exclusion perception, mood, and psychological needs, as already confirmed by worth noting literature [5].

The second hypothesis (H2) predicts that females will be more sensitive to peer exclusion than males, as the literature has shown females marked by stronger ethical feelings than males [8].

The third hypothesis (H3) predicts that adolescents aged 13-16 will be more affected by peer exclusion than children aged 8-12, as adolescents, compared to children, give higher importance to peer relationships and, consequently, they are more related to their peers feeling higher belongingness toward them [7].

The fourth hypothesis (H4) predicts that social support and previous rejection experiences will moderate the effects of peer exclusion, as these two variables have been widely demonstrated to be powerful moderators of peer exclusion [9][23].

The fifth hypothesis (H5) predicts that a VR version of the peer exclusion paradigm will be more effective and immersive than the classic 2D version, as already demonstrated by simulating a social exclusion experience within an adult sample [22].

## 2. Methods

### 2.1 Sampling plan

The study aims to enrol a minimum of 150 participants aged 8 to 16 years old to detect main and two-way interaction effects in a repeated measure ANOVA. The sample will be stratified by gender (male and female) and age (children aged 8-12 and adolescents aged 13-16). Based on Abrams et al. [5], we anticipate a small-to-medium effect size of  $f=0.15$  for the impact of peer exclusion manipulation on mood and psychological needs, with a power of .80 and an alpha of 0.05 (using G\*Power 3.1). We plan to recruit the sample through various primary and secondary schools by requesting at least one class per grade from 4th to 10th grade, ensuring gender and age balance. Upon receiving the approval and agreement of the headmasters, informed consent forms will be sent to the parents or legal guardians of the participants.

### 2.2 Design

We plan to collect our data by the end of the year 2023. We will schedule a timeframe with school headmasters to collect data at schools within two months. Meanwhile, parents will receive informed consent forms, a questionnaire to evaluate the family's socioeconomic status (SES), and a self-report questionnaire to collect demographic information from their children (gender, age, grade, and school type attended), previous rejection experiences, and perceived social support from parents, teachers, and friends. Parents will be requested to fill out and sign the informed consent forms, as well as to assist their children in completing all the questionnaires and bringing them to school. After obtaining informed consent from the parents or legal guardians, each participant will take part in the test in a quiet room at their school during school

hours. Children and adolescents will experience two peer exclusion situations using two different experimental paradigms: Cyberball and VR. We will administer the Williams Scale and the Basic Psychological Need Satisfaction and Frustration Scale through a Qualtrics questionnaire displayed on a computer screen before and after every exclusion condition to assess participant mood and psychological needs changes. We will include also an item aimed to measure immersion after every experimental condition. To prevent carry-over effects, the participants will experience the two experimental situations on different days, with one inclusion or neutral condition of both paradigms introduced after every exclusion condition for ethical reasons and to reset the exclusion effects on children and adolescents.

The Cyberball paradigm [11] is an online ball-tossing game played by three players, with participants believing they are playing with real peers, although their peers are actually standardized computer players. In the exclusion condition, the children and adolescents will receive the ball rarely or never, whereas in the inclusion or neutral condition, they will receive the ball frequently.

Regarding the VR paradigm, we will develop a virtual classroom environment in which a group of virtual and unreal children or adolescents will sit around a desk discussing a school group project. Participants will be seated around the desk with their peers and required to actively participate in the school group project. In the VR condition, the virtual peers will actively exclude the participants during the school group project.

### 2.3 Measures

The study will use several specific measures, including:

Descriptive variables:

Gender, Age, Socioeconomic and cultural status (SES) assessed using a questionnaire that includes three factors: parents' employment status, parents' educational level, and possession of specific properties.

Dependent variables:

Williams Scale: A 36-item scale developed by Williams to assess participants' perception of being excluded, mood, and psychological needs. It includes 5 items for each psychological need, 8 items related to mood, and 3 items related to the perception of being excluded [24].

Basic Psychological Need Satisfaction and Frustration Scale: A questionnaire consisting of 24 items, including 12 need satisfaction items and 12 need frustration items, assessing participants' psychosocial needs of autonomy, relatedness, and competence [25].

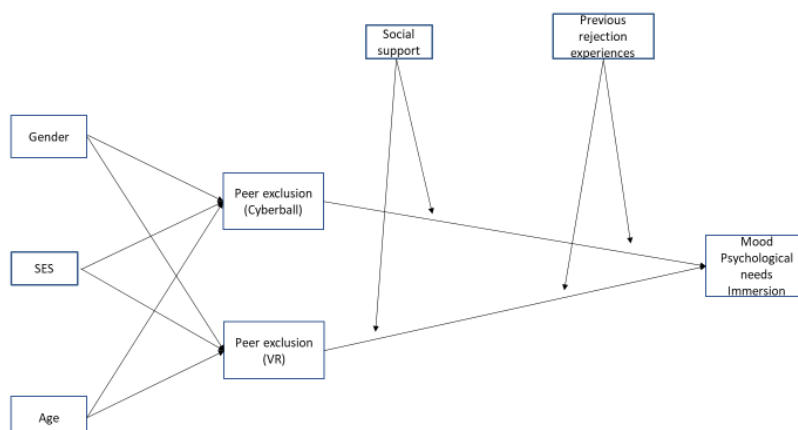
Immersion: Assessed using a specific close-ended item built in line with previous literature on VR.

Moderator variables:

Child and Adolescent Social Support Scale: A questionnaire aimed to evaluate children and adolescents' social support received and perceived, consisting of 40 items in 4 subscales: support received and perceived by parents, teachers, classmates, and close friends [26].

Previous rejection experiences: Assessed using a specific self-report measure built in line with the operationalization of peer exclusion, consisting of 25 items in 9 subscales.

To validate the last-mentioned measure, we will use factor analysis and Cronbach's Alpha. It's worth noting that the Italian validation of the Williams Scale has reported adequate internal consistency and the same is true for the Basic Psychological Need Satisfaction and Frustration Scale. Also, the internal consistency of the Child and Adolescent Social Support Scale in an Italian sample was reported to be high.



**Figure 1.** Analytic plan

#### 2.4 Analytic plan

We will use repeated measures ANOVA to analyse the effect of peer exclusion manipulation on mood and psychological needs measured by the Williams Scale and Basic Psychological Need Satisfaction and Frustration Scale (see Figure 1). The independent variables will be the two experimental paradigms (Cyberball and VR) and the two exclusion conditions. The dependent variables will be the scores on the Williams Scale and the Basic Psychological Need Satisfaction and Frustration Scale before and after each experimental condition and immersion after each experimental condition. We will also examine the main effects of gender and age group (children aged 8-12 and adolescents aged 13-16) and the interaction effects between experimental condition and gender, and experimental condition and age group.

We will conduct post-hoc analyses using Bonferroni-corrected pairwise comparisons to determine which specific conditions differ significantly from each other. We will also calculate effect sizes (partial eta squared) to determine the practical significance of any significant findings.

In addition, we will examine the relationship between socioeconomic status and the dependent variables using regression analysis, controlling for gender and age group. We will also explore the potential moderating effects of social support (perceived by parents, teachers, and friends) and previous rejection experiences on the relationship between peer exclusion and mood/psychological needs. These analyses will provide a more comprehensive understanding of the impact of peer exclusion on psychological well-being among children and adolescents, as well as the potential mitigating factors.

### 3. Conclusion

In conclusion, this study proposes to investigate the effects of peer exclusion on mood and psychological needs in children and adolescents using two experimental paradigms: Cyberball and VR. The findings of this study may contribute to the understanding of the negative consequences of peer exclusion on children and adolescents' psychological well-being and provide insights for developing prevention and intervention programs for peer exclusion in schools. Furthermore, the study may also shed light on the effectiveness of using virtual reality as a tool for studying social exclusion in a controlled laboratory setting. Lastly, based on the results we will obtain, in a future study we can plan to investigate possible relations between dynamics and contents of "exclusion communication", changes in attitude, moderator variables already presented in this protocol and SES.

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