Journal Pre-proof

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Please cite this article as: Al-Afifi M. & Nygren T., Gaining Tolerance of Immigrants through Simulating Migratory Experiences: Quasi-Experimental Evidence from Secondary School Classrooms *Computers & Education*, https://doi.org/10.1016/j.compedu.2026.105603.

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Gaining Tolerance of Immigrants through Simulating Migratory Experiences:

Quasi-Experimental Evidence from Secondary School Classrooms

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Declaration of Interest Statement

The authors report there are no competing interests to declare.

Abstract

An increase in migrant inflows across various countries has caused rising levels of anti-immigrant sentiment. Anchored in intergroup contact theory, this study examines whether a classroom-based simulation can improve students' attitudes toward immigrants. A digital simulation of a migratory journey from the Middle East and North Africa was implemented in five Swedish secondary and upper-secondary schools ($N = 148$, ages 14–19). Using a repeated-measures design, we assessed changes in attitudes toward immigrants, encompassing political and social tolerance. Data were analysed using Wilcoxon signed-rank tests and hierarchical regression, including moderation analysis. The findings demonstrate that overall tolerance levels improved significantly after the intervention, suggesting that exposure to a simulated migratory experience can foster tolerance. When analysed as separate outcomes, the effect of simulated migration on social tolerance was significantly greater post-intervention, but political tolerance remained statistically insignificant. Hierarchical regression analysis revealed that attitude changes were associated with variations in students' exposure to the simulation, baseline attitudes, perceived learning, and parental political interest. Additional statistical tests showed that susceptibility to attitude change due to simulated migration may depend on prior knowledge of the reasons for migration. Contributing to a scarce body of research, the study provides insights into the effects and critical considerations when using simulated migratory experiences in educational practice to stimulate positive attitude change. These findings extend the contemporary understanding of the mechanisms at play in the relationship between migration background and attitudes towards immigrants, opening a new line of inquiry into leveraging simulations to improve tolerance.

Keywords: simulation, migration, intergroup, intervention, secondary education

1. Introduction

We live in an age of migration with hardening international borders (de Haas et al., 2020; Fielding, 2021). A recent UN International Organisation of Migration (IOM) report (2024) shows that the number of international migrants has increased substantially over the past decades, from approximately 150 million in 2000 to 281 million in 2020. Concurrently, rising immigration levels have triggered a local anti-immigrant backlash (Kapelner, 2024; Vertovec & Wessendorf, 2010), which has affected the intolerance of immigrants across different national contexts (Cea D'Ancona, 2018; Igarashi & Laurence, 2021). Intolerance is reflected in individuals' attitudes towards immigrants (ATI), expressing cultural incompatibility and hostile sentiments (Carlsson, 2024; Schilling & Stillman, 2024).

The central claim of this paper is that a lack of personal attachment to migratory experiences is a core issue underpinning negative ATI. A fundamental asymmetry exists in how people with and without a migration background understand migratory experiences and, in turn, perceive immigrants. On the one hand, people who have firsthand experiences of migration, a kinship with migrants, or migrants in their social networks develop insight into the motivations and obstacles related to migration (Becker, 2019; Just & Andersson, 2015). This predisposition has consistently been observed to relate to higher levels of understanding and positive ATI in previous research (Dražanová et al., 2024; Neureiter & Schulte, 2024). Conversely, people without a migration background or a kinship with migrants are more detached from migratory experiences and can sense a lack of commonality with immigrants (Rustenbach, 2010). We posit that this disconnect from migratory experiences can influence the perception of immigrants and reinforce intolerance. Thus, the gap in experiential understanding highlights the need to engage with the perspectives of migrants.

To this end, we explore how education can provide migratory experiences that address the limits of students' migration perspectives to foster tolerance. Specifically, we theorise that

exposure to migratory experiences through a simulation that depicts migration may improve students' ATI. This line of reasoning is in part substantiated by empirical findings on the Proteus effect (Yee & Bailenson, 2007, 2009), which suggests that embodying a particular identity through a digital avatar may shape self-perception, behaviour, and attitudes (Liu, 2023; Ratan et al., 2020). As applied in this study, participants assumed the roles of migrants within the simulation, which, according to the Proteus effect, can influence attitudinal convergence with the perceived identity of the character they inhabit (Cross et al., 2025; Szolin et al., 2022). The study rationale lends further support from perspective-taking research. An accumulating body of simulation and game-based research has identified perspective-taking, that is the cognitive process of adopting the viewpoint of others to understand how an experience is perceived (Galinsky & Moskowitz, 2000; Gehlbach & Mu, 2023), as a key contributing factor to attitude change (Goldfarb Cohen & Dishon, 2024; Gutierrez et al., 2014; Kolek et al., 2023; Li & van Berlo, 2025). While both the Proteus effect and perspective-taking provide useful theoretical underpinnings for our research, we situate the study within the framework of indirect intergroup contact (i.e., exposure to outgroups without in-person contact), studying a simulation as a means of indirect contact with migrants and, in turn, facilitating attitude change.

1.1 *Affordances of Computer-Based Simulations for Teaching about Migration*

Drawing on the work of Wright-Maley (2015), a simulation can be generally defined as an environment designed to mirror the complexity of real-world events or processes in a limited way, lacking delineated outcomes, and pedagogically mediated, which can be used to facilitate experiential learning (Kessner, 2021). As argued in previous research, simulations can be effective for various attitudinal learning outcomes (Boyle et al., 2016; Lamb et al., 2018) and are easily scalable across educational settings (cf. Barzilai & Stadtler, 2025). This research utilises computers as the modality for simulating migratory experiences.

Focusing on a computer-based simulation is motivated by various factors. Recent literature reviews underscore that compared to traditional teaching methods, the interactivity and agency in computer-based digital tools have been significantly associated with higher learning outcomes (Petersen et al., 2022; Santilli et al., 2024) and increased intrinsic motivation and engagement (Almaki et al., 2023; Huang et al., 2025). The present study draws further justification for employing computer-based simulations from Zhang and Zhou's (2023) meta-analysis of technology-based interventions for promoting intercultural competence, which found that computer simulations of intercultural scenarios yielded the most substantial learning gains compared to other digital tools.

Although computer simulations offer fewer affordances regarding fidelity to reality compared to more immersive tools, such as augmented or virtual reality-based simulations, this limitation is not necessarily a drawback in the context of what the simulation is intended to emulate. As stated by Aldrich (2009), "A completely 'real' environment is not always the best initial learning environment" (p. 466). To facilitate learning from the use of simulations, the verisimilitude of simulations should be limited and not overburdening (Wright-Maley, 2015). In line with this view, Alinier and Oriot (2022) argue that the degree of simulation realism should be modulated following the learning objectives and learners' needs. Given that the present simulation will emulate migration, a topic that involves real-world issues of discrimination and violence, inducing too intense content would therefore not only be ethically contentious but also obstruct learning. Accordingly, although a lower level of fidelity compromises the quality of immersion, digitally proxying migratory experiences through computer-based simulations presents a viable approach to emulating complex migration processes and gaining migratory experiences without inherent perils. Opting for computer-based simulation also enhances the applicability of the intervention in educational settings, as scaling and implementation possibilities of high-fidelity simulations in schools are limited.

Moreover, compared to traditional teaching approaches about migration, simulations enable learners to adopt the role of a migrant, gaining insight into the multifaceted processes of migration. Conventional teaching approaches to migration, including descriptive instruction on migration causes, historical comparisons of migration statistics, and emotive cases of other people's migration stories (Blanck, 2021; Salmon & Melliou, 2021), often lack the interactivity and agency that digital tools, such as simulations, can provide. In comparison to traditional teaching, simulations offer access to learning experiences that would otherwise be inaccessible, enabling students to observe the effects of their actions without real-world consequences (Bachen et al., 2015; Lean et al., 2021). Hence, in contrast to teaching *about* migration emphasised in conventional approaches, we argue that simulations enable teaching *through* migration by emulating migratory experiences from a first-person perspective. To this end, we investigate the effects of simulating migration in a Swedish educational context.

1.2 *Demographic and Sociopolitical Factors Motivating the Study Setting*

Sweden is today one of the most heavily immigrant-populated countries in Europe (Holloway et al., 2021; IOM, 2024), with a majority of its immigrants originating from the Middle Eastern and North African (MENA) region (Malmberg et al., 2018; Statistics Sweden, 2025). In addition, Sweden has rapidly reformed its 'praxis of generosity' to a restrictive immigration policy (Abiri, 2000; Loxbo, 2024), legitimising previously stigmatised hostile beliefs about immigrants and immigration (Ekholm et al., 2022; Hellström, 2021). A significant consideration further motivating the study setting is the International Civic and Citizenship Education Study (ICCS) results, showing that one in five Swedish eighth graders does not support equal rights for immigrants (IEA, 2022; Swedish National Agency of Education [NAE], 2022a). Native Swedish students showed significantly more negative attitudes towards immigrants' equal rights than first and second-generation immigrant students (NAE, 2022b),

indicating a higher tolerance for immigrants among those who understand migratory experiences through their background. The intolerance of immigrants starkly contrasts with the trajectories of global policy initiatives aimed at strengthening democratic values in multicultural societies (CoE, 2022; UNESCO, 2018). In response, this paper proposes an educational intervention to mitigate anti-immigrant sentiment among Swedish youth, aiming to address the negative trends in attitudes towards immigrants in Sweden and beyond.

1.3 *Aims and Research Questions*

This study assesses how students' attitudes towards immigrants change after digitally embodying an out-group character from the MENA region in a simulation. It also examines factors that predict attitude change, with a focus on intervention-related factors. In this article, we ask the following research questions:

- How does engaging in a simulation of a migratory experience influence students' attitudes towards immigrants and their political and social tolerance of immigrants?

- To what extent does variability in exposure to simulated migratory experiences predict changes in attitude while controlling for background factors?

Following Dražanová et al.'s (2024) recommendation to treat immigration-related attitudes as separate outcomes, we utilise Ziemes's (2024) distinction between political and social tolerance to conceptualise ATI. For this research, political tolerance refers to attitudes towards equal opportunities for participation in political processes and beliefs about how the state should afford immigrants specific rights, such as voting rights and access to education (Munck et al., 2018; Ziemes, 2024, p. 3). Social tolerance refers to interpersonal attitudes towards immigrants as an outgroup (Ziemes, 2024), including beliefs about immigrants' contributions to society (Dražanová et al., 2024), feelings about being in contact with immigrants (Isac et al., 2018), and perceived consequences of immigration (Just & Andersson, 2015).

2. Indirect Intergroup Contact and Attitude Change

Extensive research on indirect intergroup contact (Di Bernardo, 2017; Miles & Crisp, 2014; Vezzali et al., 2014) informs the relationship between simulated migratory experiences and attitudes towards immigrants (ATI) that is studied. Indirect contact research suggests that intergroup attitudes, that is attitudes between the group which one identify with (ingroup) and the group one does not identify with (outgroup), can be enhanced through vicarious, extended, or imagined interactions with outgroup members, and it seeks to examine the effects of indirect engagement between ingroup and outgroup members (Gabrielli et al., 2022; Tropp et al., 2022). These approaches have been shown to improve tolerance (Vezzali et al., 2012; Shamloo et al., 2018). Indirect intergroup contact can be established in schools through first-person perspective narrative readings (Kaufman & Libby, 2012; Vezzali et al., 2012), video watching (Cocco et al., 2021), and via digital platforms (Imperato et al., 2021; Stiff & Kedra, 2020). Concerning the latter approach, in their meta-analysis of $N = 9385$ participants across 88 independent samples, da Costa et al. (2024) found that digital contact was most effective when it was as direct as possible with outgroup members, such as computer-mediated communication. While statistically insignificant in the study by da Costa et al. (2024), Tassinari and colleagues' (2022) systematic review of embodied contact with simulated characters showed that digital embodiment can significantly improve intergroup attitudes. Many of the studies reviewed by Tassinari et al. (2022) positioned participants as embodying an outgroup member to provide a contrasting perspective on the ingroup experience, thereby prompting attitude change, such as decreased prejudice and increased empathy (e.g., Banakou et al., 2020; Zhang et al., 2021). This result is consistent with other studies supporting the potential of digital tools for reducing intergroup bias (e.g., Breves, 2018; Pech & Caspar, 2022). However, results from Tassinari et al.'s (2022) review also reveal that the simulated embodiment of outgroup members had a negative effect on outgroup attitudes, rather than improving empathetic engagement. Hence,

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the bidirectional outcomes underscore the need to understand the potential positive and negative effects of indirect contact via simulations before mainstreaming them in educational practice.

While intergroup contact research has explored immigrants as target outgroups (e.g., Igartua et al., 2019; Nshom, 2023), these have rarely been examined in simulations. Among the few studies investigating immigrants as outgroups through indirect contact on digital platforms is the study by Chen and colleagues (2021), which examines how virtual reality embodiment influences the attitudes of Singaporean university students towards Chinese immigrants. In addition, Peña and Hernández Pérez (2020) investigated how simulation-based perspective-taking, involving the embodiment of an immigration inspector, influenced Spanish students' willingness to help immigrants. The results showed that engaging in the simulation decreased their attitudes towards helping immigrants after the intervention. As a final example, Cross et al. (2025) investigated the impact of digitally embodying a Syrian refugee for 30 minutes on prejudice and empathy towards this outgroup. Compared to the active control, the intervention group showed a greater improvement in attitudes towards refugees.

The present study contributes to the limited body of research on indirect contact with immigrants as the target outgroup through simulated migratory experiences from the MENA region. Specifically, the study adds to previous research by analysing a new empirical context with a different target population (secondary and upper-secondary school students aged 14–19), country context (Sweden), target outgroup (migrants from the MENA region), medium of intervention (computer-based simulation), and disciplinary focus (education).

3. Method

The study employs design principles for quasi-experimental intervention studies, utilising dependent sample groups and repeated measurements to gauge the intervention outcomes (de Vaus, 2001). The intervention design is structured according to a repeated measures design, with a measurement cycle consisting of a pretest and a posttest (Shadish et al., 2002).

3.1 *Participants and Sampling Procedure*

Five Swedish secondary and upper-secondary school teachers, along with 225 students aged 14–19, participated in the study. In the spring of 2024, a call for research participation was sent out through school-research collaborative networks. The choice of schools was based on self-selection. 197 students completed the pretest, intervention, and posttest. After controlling for participant matching across pre- and posttests, the dataset consisted of 148 students. The main reason for participant attrition was incorrect or missing anonymised ID codes. Additionally, some younger participants failed to submit parental consent. Although the participant attrition rate of 12.5% is well within the expected limits of classroom-based studies (Rickles et al., 2018), an additional 21.8% of collected data was unmatchable or inadmissible.

The sample comprised 85 females and 66 males, as well as one individual of another gender. Most participating students spoke Swedish as their first language (93.2%). Eleven students reported having been enrolled in Swedish as a second language classes. The students were nested in ten classrooms across secondary and upper-secondary schools: 47 in Grades 8 and 9 and 101 in Grades 10, 11, and 12. Ethical approval from the Swedish Ethical Review Authority (ref. nr: Redacted for review) was sought and obtained. The research process and data collection adhered to the ethical procedures stipulated by the Swedish Research Council (2024). In line with ethical recommendations, all participants provided voluntary and informed consent, with the possibility of withdrawing with immediate effect. For students under 15, parental consent was also sought from consenting participants. Ethical considerations of the intervention modality included opting to use a browser-based computer simulation, rather than a high-fidelity simulation, to minimise the risk of inducing full immersion due to the sensitivity of the simulated content. Regarding data availability, due to the sensitive nature of the study's subject matter, which includes students' political beliefs and social attitudes towards immigrants, participants were assured that their raw data would remain anonymous and not be shared.

3.2 *Procedure*

Before the intervention, participating teachers attended a 2-hour seminar that explained their role as intervention facilitators and provided detailed instructions on the intervention protocol, including teaching materials, consent forms, and lesson plans. Participating teachers could choose when to implement the intervention within a six-week timeframe in the fall of 2024, with the restriction that once participants completed the pretest, teachers were instructed to carry out the intervention module in the next scheduled lesson to minimise the students' retention gap. The intervention's experimental setting was set within the context of the participating students' standard classroom.

The teachers administered the pretest directly before the intervention began and the posttest directly following the intervention. After the posttest, the teachers responded to a questionnaire to evaluate the implementation process and report any deviations from the intervention protocol.

3.3 *Intervention*

The intervention followed a standard framework for simulation sessions, consisting of briefing, gameplay, and debriefing (Alinier & Oriot, 2022; Freese & Lukosch, 2025; Supplementary Material A). The briefing phase consisted of a pre-briefing (Freese & Lukosch, 2025), which involved introducing the participants to the subject matter. Specifically, teachers were provided with a three-slide PowerPoint presentation and a manuscript on global migration, which included definitions of key terms and statistics on international migration. The teacher defined 'migrant' based on IOM (2024) descriptions. Drawing on UN statistics (IOM, 2024), the teacher proceeded to report the approximate estimate of migrants in the world today. Following this, the teacher transitioned from pre-briefing to briefing by presenting the game

'Real Lives'[1] and instructed students to log in to the Real Lives website. To ensure that each participant received the same simulation instruction, a step-by-step tutorial video was provided to guide them through navigating from the Real Lives starting page to begin the simulation. The teachers screened this video for the whole class. Importantly, the briefing included no information measured in the posttest, omitting the risk of introducing an interaction or confounding effect with the interventions' first two parts. The briefing spanned 10–15 minutes.

Secondly, the main phase of the intervention involved playing Real Lives, a single-player simulation that allows users to vicariously experience the lives of others worldwide. Previous research in American and South Korean contexts has demonstrated Real Lives' effectiveness in increasing high school and university students' global empathy and interest in other cultures (Bachen et al., 2012, 2015; Kwon et al., 2025). Still, its impact on the target variable for the present research, ATI, remains unknown. In this simulation, users are randomly assigned to experience the life from birth to death of another person from a different country. At the start of each simulation, users are randomised into real-life scenarios based on the statistical likelihood of being born in a given country, with predefined resources in accordance with context-appropriate constraints. As such, birth in countries with, for instance, elevated mortality risks will shape a character's life trajectory differently than birth in more favourable conditions. Based on general artificial intelligence integration, the simulation generates unique background information about the character to create an immersive experience, including name, family members, country of birth, and characteristics such as gender, religious affiliation, health, and skills (Schulzke, 2012). Users engage with the simulation by ageing one year at a time, and for each year, context-relevant events occur, such as conflicts, crime, diseases, natural disasters, and macroeconomic shifts (Schulzke, 2012). The software calculates the probability of events consistent with the statistical regularities in the region where the character resides (Bachen et

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[1] The intervention was conducted using version 4.03 of the game, accessed via the official website at https://reallivesworld.com/website/home-2/

al., 2012; Schulzke, 2012). Based on these statistics, Real Lives presents users with various events that require them to take action to survive and create better life circumstances. Users can make life choices regarding their education, employment, hobbies, and relationships, but their character customisation is constrained by the resources available in their social, political, and economic context. The character narrative thus varies across playthroughs, but the overarching narrative follows an underlying structure that randomises a starting position and delineates statistically probable conditions under which they can act to survive and improve their lives. In contrast to other software based on statistics, such as Gapminder[2], Real Lives does not visualise Big data but enables a scenario-based experience of the statistics through gameplay.

As the Real Lives simulation lacks delineated outcomes (cf. Wright-Maley, 2015), we created an assignment for participating students that explicitly targets the gameplay mechanism that allows users to attempt migration in Real Lives. Participants were tasked with migrating to another country from their birth country, playing individually on their school laptops. The simulation was parameterised by content customisation of simulation settings to match the intervention objective of simulating migratory experiences. We specifically limited the pool of countries where characters could be born to the MENA countries, as this region has one of the world's highest emigration ratios per capita. The specific countries encompassed by this geopolitical region vary between organisational contexts, such as the UN agencies, the World Bank, and the World Economic Forum. While most definitions encompass Middle Eastern and Maghreb countries, some also include neighbouring countries, such as Turkey, Pakistan, Armenia, Georgia, Cyprus, and Malta (El-Mikawy & El Baradei, 2024; Jones-Antwi & Cunningham, 2023). This study adopts the software's definition of the MENA region, which comprises multiple international organisations' definitions. By considering the context-specific life experiences and political, social, and economic disparities of people living in MENA

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[2]See https://upgrader.gapminder.org/ for details on Gapminder.

countries, students had to decide where to emigrate and why their character might be better off in the target country, taking into account the political, social, and economic conditions given their starting position. If participants managed to emigrate, they would have to try to establish a life in the new country, accounting for integration questions such as language learning, employment, relationships, mental health, and happiness. If the character died for whatever reason, the participants were instructed to replay the simulation and attempt to migrate again, in which their new character would randomly spawn in another or the same MENA country, but likely under different circumstances. There were no limits on the number of attempts, and the total number of played lives could therefore vary between participants based on their character's survival expectancy and life decisions. The simulation was further configured to suit the participants' needs by matching the simulation language to Swedish. Informed by previous computer simulation studies' conditions for effective intervention durations (Zhang & Zhou, 2023), a 60-minute simulation duration was allocated for this research.

The intervention concluded with a debriefing phase, comprising a teacher-led reflection on the similarities and differences between the students and their characters, as well as their birth countries and the countries to which they migrated. Specifically, the students were instructed to individually reflect upon questions related to their learning experience, such as "What political, social or economic obstacles did your character encounter throughout their life?" and "How did your migration decision affect your character's well-being and quality of life?" (Supplementary Material A). Including guided reflections is not only important to assist learners in clarifying the learning experience (Tan et al., 2024; Freese & Lukosch, 2025) but also an ethical responsibility of the intervention facilitator (Klabbers, 2018; Kriz, 2008). However, we limited the intervention's debriefing to mitigate its potential confounding with the simulation effect. As such, the debriefing was restricted to about 10 minutes.

3.4 *Data Collection*

The participants completed online questionnaires pre- and post-intervention (Table 1). The pretest comprised background information, a knowledge test assessing reasons for migration, and an attitude test evaluating political and social tolerance. The posttest replicated the attitude test and added items about simulation conditions, perceived learning, and experiences. When appropriate, internal consistency was calculated using Cronbach's coefficient α. All test items and the variable codebook can be found in Supplementary Material B.

Table 1

Overview of the Questionnaire Content in Pretest and Posttest

Variable category	Variables included
Background variables	Books at home
	Swedish at home
	Gender
	Grade level
	Highest education in the household
	Immigration discussion frequency
	Parents political interest
	Political discussion frequency
	Political interests
	Prior gaming experiences
	Prior knowledge of reasons for migration
	Social science interest
Attitudes towards immigrants (ATI)	Political tolerance towards immigrants
	Social tolerance towards immigrants
Exposure variation	Amount of playing time
	Number of lives played
	Played outside of class
	Played Real Lives
Simulation conditions	Country of character birth
	Country of target migration
	Reasons for target country
Perceived learning	Living conditions of others
	Perspectives on migration
	Other countries
	Positive outlook on immigration
Simulation satisfaction	Present gaming experiences

Note. Variables are listed in alphabetical order, not the order in which they occurred in the pre- or posttest.

3.4.1 *Background Variables*

Background variables accounted for individual differences and confounding factors. Participants' gender (girl = 1, boy = 2, other = 0), language spoken in the home (Swedish = 1, another language = 2), and grade level (Grades 7–12, ages 13–19) were recorded to control for demographic and developmental differences that could influence the measured outcomes.

Three variables related to political interest were included to control for associations between political interest and immigrant acceptance identified in prior research (Hannuksela et al., 2024). We measured participants' interest in social science (not at all interested = 1, very interested = 6), politics (not at all interested = 1, very interested = 4), and their parents' political interests (Parent 1: not at all interested = 1, very interested = 4; Parent 2: not at all interested = 1, very interested = 4). A composite score (2–8) measuring the interest of students' parents in politics ($\alpha = 0.744$) was computed. Social science interest was used as a proxy for political interest, as the sample comprises younger participants who may not identify as politically interested due to a lack of understanding about what political interest entails. Parents' interest in politics was added to capture the relative effect of political socialisation.

A scale from the ICCS 2022 student questionnaire on political discussion frequency was also replicated, reporting discussion frequency with parents, friends, and other adults on six Likert-scale items ranging from 1 (very seldom) to 4 (very often). We also added an adapted scale related to immigration discussion frequency, where participants reported discussion frequency with parents, friends, and other adults on six Likert-type scale items ranging from 1 (very seldom) to 4 (very often). Two composite variables, political discussion frequency ($\alpha = 0.798$) and immigration discussion frequency ($\alpha = 0.806$), were computed by summing the scores of the respective subscales. These scales were included to account for individual political engagement in general and specifically about immigration, which is associated with attitudes towards immigrants (Kalogeropoulos & Hopmann, 2019; Miklikowska et al., 2022).

As indicators of socio-economic status (SES), participants were asked about the number of books they had at home (None or very few [0-10 books] – Enough to fill three or more bookshelves [more than 200 books]) and their parents' educational level. Rather than constructing a composite SES variable, parents' educational level was treated separately from the number of books variable to isolate the potential effect of parental education on attitudes, as prior research has indicated that higher parental education correlates with more positive attitudes towards immigrants (Donnaloja & Borkowska, 2025; Dražanová et al., 2024). The parental education variable was recoded on a five-point scale, ranging from 'he/she has not finished primary school' to 'he/she has studied at university for three years or longer', asked separately for each parent. The highest level of education attained by either parent was recorded for each participant to capture the maximum potential educational influence in the household.

After playing Real Lives, participants were also asked to rate how often they engaged in similar simulations on a scale from 1 (very seldom) to 6 (very often) in the posttest.

3.4.2 *Prior Knowledge of Reasons for Migration*

Baseline knowledge of reasons for migration was measured with an item replicated from the Swedish National Test in Social Science (NAE, 2017). Participants were tasked with 14 true-false items on beliefs about reasons for migration (e.g., "The main reason for migration is that people want to spread their religion" and "Political persecution in the home country is a common reason for people to flee"). Eight statements were factual, and six stated erroneous facts. Each answer was recorded as (0 = incorrect, 1 = correct), and an aggregate variable (0-14) was calculated to represent knowledge about reasons for migration. This variable was included to mitigate the effects of pre-existing knowledge of migratory experiences, as it may substantially contribute to explaining the observed effects on attitudes towards immigrants (Dražanová et al., 2024; Neureiter & Schulte, 2024).

3.4.3 *Attitudes Towards Immigrants (ATI)*

ATI was measured on two scales: political and social tolerance. Participants reported their ATI on a Likert-type scale ranging from 1 (completely disagree) to 4 (completely agree) on both scales. Negatively worded statements (e.g., "all too often, immigrants have customs and traditions that do not fit in with Swedish society") were recoded so that a high score on all ATI variables suggests that the student tolerates immigrants to a greater extent. A composite variable, ATI (14–56), was computed by summing the scores of political and social tolerance subscales (pretest $\alpha = 0.882$, posttest $\alpha = 0.847$).

The political tolerance scale was replicated from the ICCS 2022 student questionnaire on attitudes towards immigrants' rights and consisted of three items (pretest $\alpha = 0.790$, posttest $\alpha = 0.847$) (e.g., "immigrants should have the same rights that everyone else in the country has" and "immigrants who live in a country for many years should be granted voting rights"). A composite score (3–12) for political tolerance of immigrants was computed in both tests.

The social tolerance scale comprised 11 items (pretest $\alpha = 0.860$, posttest $\alpha = 0.821$) from the ICCS, previous research, and self-creation to capture the intended construct. Two items from the ICCS scale on attitudes towards immigrants' rights ("immigrants should have the opportunity to continue their own customs and lifestyle" and "immigrants bring many cultural, social, and economic benefits to the country") were replicated. Considering these statements have been standardised to be valid in all ICCS participating countries, we found these items too broad to accurately capture the participants' social tolerance towards immigrants in Sweden. This scale was therefore supplemented with statements on immigrants that more accurately reflect sentiments towards foreigners used in previous Swedish research (e.g., Nilsson et al., 2019), and we constructed our own statements to enhance contextual relevance. We computed a composite scale (11–44) for social tolerance of immigrants in both the pre- and posttest.

3.4.4 *Exposure Variation*

The posttest included variables related to exposure to simulated migratory experiences during the intervention, including whether participants played Real Lives, whether they played beyond the prescribed intervention timeframe, the total time spent playing, and the number of lives they played. The latter variable fluctuated based on performance in the simulation and the simulation's survival rate conditions, and was tracked using participants' estimates of their character count. As students were instructed to replay the simulation in the event of their character's death within the prescribed intervention time, we expected the total number of played lives to vary across participants. By discerning the total time spent playing and the number of lives they played, we assess how exposure to additional simulated lives of migratory experiences affects ATI when controlling for time spent playing.

3.4.5 *Simulation Conditions*

Variables related to participants' randomly generated simulation conditions to understand which MENA contexts they played in and where they migrated were included. These conditions included the country of character birth and the country of target migration, self-reported by participants in an open-ended format. Participants were also asked to explain their motivations for migrating to their chosen target country, providing insight into their understanding of why migration was beneficial or necessary giving their character's life circumstances.

3.4.6 *Perceived Learning*

Participants self-reported how they thought playing Real Lives (1) provided insights into others' living conditions, (2) offered new perspectives on migration, (3) made them more positive to immigration, and (4) enhanced their understanding of other countries compared to reading about them in a textbook. This variable was included for two reasons. First, as we have

identified in prior research (Author, 2025), the use of digital tools may lead users to overestimate their actual learning, contributing to a false sense of simulation effectiveness, which the perceived learning items control for. Second, through this variable, we gain insight into participants' perceptions of how vicariously living through their character's migration experiences shapes their learning about migration-related topics. All items were measured on a Likert-type scale ranging from 1 (completely disagree) to 4 (completely agree). A composite variable, perceived learning (posttest $\alpha = 0.853$), was computed by summing the scores of their self-reported learning about the living conditions of others, perspectives on migration, other countries, and a positive outlook on immigration.

3.4.7 *Simulation Satisfaction*

The study also measured participants' satisfaction with the simulation. It used a scale from 1 (completely disagree) to 4 (completely agree) to determine whether participants wanted to play Real Lives again, partially serving as an indicator of simulation quality.

3.5 *Statistical Analyses*

Assumptions of normality were checked using a Shapiro-Wilk test ($p < .05$). Since our sample data were non-normally distributed, a Wilcoxon signed-rank test was used to analyse students' ATI changes before and after implementing the intervention. Effect sizes were calculated using biserial rank-correlations.

Hierarchical multiple regression was used to investigate the relationship between engaging in a simulation of a migratory experience, attitude change, predictors, and covariates. ATI outcome scores were regressed on predictors. In Model A, we entered covariates to account for the association between background factors and posttest ATI levels, while also controlling for pretest ATI scores. In Model B, we regressed variables related to their intervention exposure

variation, such as the amount of playing time and the number of lives played. Adding these variables to the model tests how exposure to migration, measured in terms of lives and time, predicts students' ATI scores. In Model C, controls for perceived learning and simulation satisfaction were added. In Model D, an interaction term of baseline knowledge of reasons for migration and exposure variation was added to explore whether the association between exposure to migratory experiences and attitude change was moderated by prior knowledge. Informed by intergroup contact theory and previous research, the relationship between exposure to migratory experiences and ATI can depend on a person's insight into the motivations and obstacles related to migration. Mean-centring of the predictor variables was performed prior to constructing the interaction term to mitigate multicollinearity between the predictor variables and the interaction term. Variation inflation factor analysis confirmed low multicollinearity (Supplementary Material C).

By adding the covariates, predictors, and interactions sequentially, we examined the relative contributions of different factors to ATI change. The order of entry was justified as exposure variation, perceived learning, and simulation satisfaction resulting from partaking in the intervention are potential mechanisms driving attitude change, rather than pre-existing individual differences. Regression coefficients are reported at a 95% confidence level. Regression outputs presented in the results comprise key statistical estimates, and comprehensive tables are reported in Appendix A. The relative strength of association between significant variables is compared using standardised beta coefficients.

The statistical conclusion validity of the results has been strengthened by not violating the inherent assumptions of the employed statistical tests (Shadish et al., 2002). As the assumption of normality was violated for conducting a Student's t-test, the non-parametric alternative was applied. The following assumptions of linear regression have been tested and met in this

sample: non-zero variance, linearity, no multicollinearity, homoscedasticity, independent errors, and normally distributed errors (Supplementary Material C).

3.6 *Qualitative Coding*

Students' open-ended responses to the question of why they chose to migrate to their target country were coded. The corpus of open-ended responses from the 148 participants totalled 1079 words. Each respondent's unique motivations were documented and grouped into categories of similar content (Saldaña, 2013). For example, responses stating dictatorship, corruption, or political instability could be categorised under governance. Other examples of factors driving migration include war and conflict, persecution, human rights violations, exploitation, natural hazards and disasters, economic circumstances, or food scarcity. If students did not manage to migrate, it was noted as 'failed' to mitigate and the reasons motivating attempted migration may explain migration failure. We primarily examined these responses to gain insights into participants' reasoning about the driving and drawing factors that shape their decision-making when migrating from and to a particular country during the simulation, offering supplementary insights to the statistical analyses.

4. Results

First, descriptive statistics of intervention-related and attitudinal factors are summarised, followed by an overview of participants' migration pathways and reasons for migration. Next, inferential statistics are presented on how students' attitudes changed after simulating migration from the MENA region. Finally, regression diagnostics are presented to explicate the factors that predict attitude change related to the intervention. Statistical outputs from inferential measures in their entirety are reported in Appendix A.

4.1 *Summary Statistics of Key Variables*

Table 2 presents an overview of intervention-related variables and attitudinal factors. Three participants reported not playing Real Lives between the pretest and posttest, and 36 reported playing beyond the designated intervention class time. Participants had seldom engaged in simulations like Real Lives before the intervention. The average playing time during the intervention was 50–60 minutes, consistent with the prescribed duration of the intervention. The mean number of lives played was about 3.5. On average, three out of four participants said they would like to play Real Lives again.

Table 2

Descriptive Statistics on Intervention-related and Attitudinal Factors

Variable	N	Missing	Mean	Median	SD	Minimum	Maximum
Intervention-related variables							
Played Real Lives	139	9	1.02	1.00	0.146	1.00	2.00
Played Real Lives outside of school	139	9	1.74	2.00	0.440	1.00	2.00
Prior gaming experiences	137	11	1.80	1	1.242	1	6
Amount of playing time	139	9	5.94	6.00	1.598	1.00	8.00
Number of lives played	139	9	3.44	3.00	1.602	1.00	7.00
Simulation satisfaction	138	10	2.86	3.00	0.909	1.00	4.00
Attitudinal factors							
Baseline ATI	146	2	37.18	37.50	6.908	15.00	54.00
Posttest ATI	139	9	38.20	39.00	6.552	20.00	56.00
Baseline Political Tolerance	146	2	10.14	11.00	1.856	3.00	12.00
Posttest Political Tolerance	139	9	10.14	11.00	2.026	3.00	12.00
Baseline Social Tolerance	146	2	27.05	27.00	5.666	11.00	42.00
Posttest Social Tolerance	139	9	28.06	28.00	5.395	12.00	44.00

Regarding outcomes, ATI levels improved in the posttest compared to the pretest. Similarly, social tolerance improved from the pretest to the posttest. Central tendency measures for political tolerance levels showed a marginal increase in the mean but no increase in the median value. The average ATI change was positive; however, the outcome variability also indicates that some students exhibited negative ATI changes.

4.2 *Migration Pathways and Reasons for Migration*

Figure 1 illustrates migration pathways chosen by participants in Real Lives from their birth country in the MENA region and neighbouring countries to their target country. During the simulation, participants were randomly spawned in different simulation conditions across 34 counties in and around the MENA region. Cyprus (8.2%), Turkey (6.5%), Morocco (4.9%), and Iran (4.9%) were among the countries with the highest frequency of spawning. Regarding the target countries, approximately 98% of the 23 targeted countries were located outside the MENA region. Approximately one out of every four participants attempted migration but failed to migrate their characters to a target country.

Figure 1

Migration Pathways in Real Lives from MENA Birth Country to Target Country

[Insert Figure 1]

Participants provided various reasons for migrating their character to a particular country. A widely expressed reason was that they chose their target country to improve their economic circumstances. For instance, migration was motivated by the desire to achieve upward economic mobility and escape economic deprivation stemming from a lack of economic opportunities in the birth country. Participants thus used migration to gain market access, increase income, and improve their living standards. Another prominent category of reasons for migration was motivated by seeking peace and safety from the risk of war and violence in the

country of birth, as well as the pursuit of educational opportunities and access to healthcare through migration. Furthermore, participants motivated their choice of target country for social reasons, such as gender equality, family formation, and hopeful beliefs about the future. Other motivations included law and order, targeting countries that had rights and 'good laws'. Some participants reasoned strategically and targeted countries based on their geographical proximity to maximise the likelihood of reaching them.

Participant reports on their randomly generated simulation conditions showed that migration pathways from their characters' birth countries in the MENA region were overwhelmingly directed at Sweden (approximately 40%). In students' open-ended responses, their reasoning for choosing Sweden was primarily grounded in familiarity, based on their experiential understanding of living there. They attributed targeting Sweden to positive attributes such as being a 'good', 'safe', 'stable', and 'well-developed' country with high standards of living, welfare, rights, education, work opportunities, equality, and rule of law. Participants also chose Sweden as a target destination due to its 'good treatment' of immigrants. Fair treatment was also a motivation for targeting other countries, such as France, which one student reported targeting since "I know that there is a large Islamic population there and, being a Muslim myself [referring to the simulation character], I thought it might be nice to be among other Muslims and that it might be easy to emigrate".

The second-largest group in terms of target selection was participants who failed to migrate their characters. Given the nature of migration, which carries immense risks and requires appropriate conditions, randomly spawning in the MENA region and successfully navigating political, social, and economic circumstances from birth to create the possibility of migration later in life is statistically unlikely. In this sense, the Real Lives simulation effectively captured what migrating entails, including the inherent obstacles and not achieving migration. In our sample, one-fourth of participants who attempted to migrate from their birth country were

unsuccessful in reaching their target country. There were no systematic explanations for participants' non-migration beyond stating that they were unable to migrate, but isolated examples of reasons attributed to not migrating their characters included mental illness and poor economic circumstances.

4.3 *Changes in ATI*

A Wilcoxon signed-rank test was conducted to compare the three attitude levels (ATI, political, and social tolerance) between the pre- and posttests. Scores on the ATI ranged from 14 to 56, with higher values indicating higher tolerance levels. The Wilcoxon test revealed that ATI levels were significantly higher after participating in the intervention ($Mdn = 39$) than before ($Mdn = 38$), $W = 4562$, $p = 0.005$, $r = 0.2995$. Social tolerance, ranging from 11 to 44, was also significantly higher post-intervention ($Mdn = 28$) than pre-intervention ($Mdn = 27$), $W = 4432$, $p = 0.002$, $r = 0.3288$. However, differences in political tolerance, ranging from 3 to 12, were non-significant, $p = 0.927$.

The effect sizes on the signed-rank tests that reached a 95% confidence level could be interpreted as weakly to moderately positively related to change, with a biserial rank correlation of slightly below or above 0.3. This result suggests that exposure to simulated migratory experiences positively improved ATI and social tolerance.

4.4 *Predictors of Attitudinal Change*

Table 3 presents the outcomes of the final model in the four-step hierarchical regression analysis, which includes covariates, predictors, and the interaction term, with ATI posttest scores as the outcome variable. Regression Model A examined how preexisting individual differences were associated with ATI change. Among the predictors, gender, parents' political interest, and baseline ATI were significantly associated with ATI change.

Table 3.

Hierarchical Regression Output with ATI Posttest Score as the Outcome Variable

Predictor	B	SE B	t	p	β
Intercept	7.915	6.324	1.252	0.213	
Gender:					
Male – Female	-1.538	0.790	-1.947	0.054	-0.243
Non-Binary – Female	-5.168	3.871	-1.335	0.185	-0.816
Grade:					
9 – 8	-0.835	1.765	-0.473	0.637	-0.132
10 – 8	0.962	1.875	0.513	0.609	0.152
11 – 8	0.342	1.801	0.190	0.850	0.054
12 – 8	-0.458	1.888	-0.243	0.809	-0.072
Swedish at home	2.419	1.452	1.666	0.099	0.382
Political interest	-0.455	0.580	-0.786	0.434	-0.057
Political discussion frequency	0.425	0.314	1.356	0.178	0.135
Immigration discussion frequency	-0.241	0.298	-0.809	0.420	-0.071
Parents political interest	-0.694	0.280	-2.478	0.015*	-0.151
Social science interest	-0.372	0.352	-1.057	0.293	-0.070
Highest education in the household	0.338	0.201	1.682	0.095	0.096
Books	0.207	0.282	0.734	0.465	0.043
Prior knowledge	-0.026	0.247	-0.107	0.915	-0.007
Prior gaming experiences	0.019	0.304	0.062	0.951	0.004
Baseline ATI	0.648	0.065	9.994	<.001*	0.676
Played Real Lives	3.295	4.112	0.801	0.425	0.045
Played Real Lives outside of school	0.384	0.822	0.467	0.641	0.026
Amount of playing time	0.547	0.263	2.076	0.040*	0.131
Number of lives played	0.242	0.261	0.930	0.354	0.061
Simulation satisfaction	-0.718	0.465	-1.544	0.125	-0.102
Perceived learning	0.342	0.155	2.210	0.029*	0.151
Interaction	0.303	0.133	2.270	0.025*	0.125

Note. * $p < .05$, indicating statistical significance at the 95% confidence level.

The second model, which included the exposure variation variables, showed no significant improvement over the first model ($\Delta F(4, 113) = 0.944$, $p = 0.0441$, $\Delta R^2 = 0.00968$). Gender, parents' political interest, and baseline ATI remained statistically significant in Model B, indicating that these variables independently contribute to explaining the outcome. The model remained statistically significant when controls for perceived learning and simulation

satisfaction were introduced to Model C. However, it showed no significant improvement from the second model ($\Delta F(2, 111) = 2.959$, $p = 0.056$, $\Delta R^2 = 0.01466$). Of the two added variables in Model C, students' perceived learning significantly and positively predicted their change in ATI. Parents' political interest and baseline ATI remained statistically significant in Model C, but gender did not reach significance, indicating that gender differences do not hold independent significance for ATI change once intervention-related factors of perceived learning and simulation satisfaction are accounted for. In the final step of the hierarchical regression analysis, the relative contribution of an interaction term involving pretest knowledge of migration reasons and the amount of playing time in predicting ATI change was assessed. Including the interaction term significantly improved the model fit ($\Delta F(1, 110) = 5.155$, $p = 0.025$, $\Delta R^2 = 0.01231$). Main effects of parents' political interest ($B = -0.694$, $p = 0.015$), baseline ATI ($B = 0.648$, $p < .001$), amount of playing time ($B = 0.547$, $p = 0.040$) and perceived learning ($B = 0.342$, $p = 0.029$) were statistically significant in Model D. Hence, including the interaction term qualified the statistical significance of the amount of playing time, which was insignificant in previous models.

The significant interaction term ($B = 0.303$, $p = 0.025$) suggests that the relationship between time exposure to migratory experience and ATI changes as a function of their knowledge of the reasons for migration. Specifically, the positive standardised beta coefficient ($\beta = 0.125$) suggests that the effects of simulated migration on ATI change are stronger when prior knowledge of migration reasons is higher.

To further explore how this moderation differs across student groups, we conducted a simple slope analysis to examine how prior knowledge moderates the relationship between the amount of playing time and the change in ATI. To account for pre- and posttest ATI scores in the moderation estimate, ATI change scores ($\Delta = Post - Pre$) were set as the dependent variable. In this isolated moderation model, the interaction term did not reach significance in the

moderation estimates ($B = 0.230$, SE $= 0.131$, $p = 0.080$). The discrepancy in the significance of the interaction between the hierarchical regression model and isolated moderation analysis is likely due to reduced power and robustness loss when analysed separately from the other control variables. Consequently, reporting simple slope estimates is futile since the moderation estimation is not statistically reliable.

Moreover, among the significant predictors, the ATI baseline score ($\beta = 0.676$) had the strongest association with ATI posttest scores relative to other variables. The standardised beta coefficient signifies a large effect size on the outcome, and a standardised $\beta > 0$ indicates that ATI change increases as the ATI baseline score rises. This result reveals that participants' ATI levels upon entering the intervention are highly predictive of the extent of attitude change they will experience as a result of simulated migratory experiences.

Other statistically significant predictors included perceived learning and parents' political interest. The beta coefficient on perceived learning ($\beta = 0.151$) suggests that subjective perceptions of learning about other countries, living conditions, perspectives on migration, and gaining a more positive outlook on immigration align with actual intervention outcomes of positive ATI change. Furthermore, higher parental interest in politics ($\beta = -0.057$) was negatively associated with ATI change, indicating that having politically interested parents is related to less ATI change. Lastly, the standardised beta coefficient for the amount of playing time ($\beta = 0.132$) was positively associated with the change in ATI, indicating that greater exposure to migratory experiences through simulations can enhance ATI.

4.5 *Summary of Findings*

This study aimed to assess how students' attitudes change after engaging in a simulated migratory experience from the MENA region and to examine the factors that may predict this change. The results showed that participants' tolerance levels were significantly higher after

participating in the intervention, indicating that exposure to simulated migration can improve ATI. Further statistical tests revealed that while social tolerance changes were observed, political tolerance remained unaffected. The regression results showed that ATI relates to variations in exposure to migratory experiences, baseline attitudes, perceived learning, and parents' political interest. Additional statistical tests indicated that susceptibility to ATI changes through simulated migration could depend on prior knowledge of reasons for migration, moderating the relationship between the amount of playing time and posttest ATI; however, the moderation estimate was not statistically reliable, precluding establishing how this association differed between student groups' levels of prior knowledge in this sample. Together, these results provide insights into the potential positive and null effects of using simulated migratory experiences for attitude change. Additionally, our findings suggest that there may be differences in the susceptibility to ATI changes, depending on baseline knowledge of reasons for migration.

5. Discussion

For the first time, the present study explored changes in attitudes towards immigrants associated with simulated migratory experiences from the MENA region. The aims of the present work were twofold: to examine how engaging in a simulation of a migratory experience relates to students' attitudes towards immigrants and to investigate the extent to which variability in exposure to simulated migratory experiences predicted changes in attitude. Several important findings were made regarding these objectives, informing the didactic considerations of using simulations to strengthen tolerance for immigrants.

Our results add insights into how contact with characters in a simulation can improve intergroup tolerance (c.f. Jarrell et al., 2021; Pech & Caspar, 2022), contributing to the experimental evidence base of technology-based interventions (Zhang & Zhou, 2023) and indirect intergroup contact research (Costa et al., 2024; Tassinari et al., 2022). The observed

improvement of ATI and social tolerance aligns with previous research showing that digital learning tools centred on perspective-taking can facilitate attitudinal shifts (Kolek et al., 2023; Li & Van Berlo, 2025). While the observed effect size is small to moderate, these results are both in line with attitudinal effects reported in similar research (Cross et al., 2025; Peña & Hernández Pérez, 2020) and may still hold practical significance, as small gains in tolerance could have a real-world impact on how immigrants are perceived and treated. Considering the broader context of the levels of intolerance of immigrants across different national contexts (Cea D'Ancona, 2018; Igarashi & Laurence, 2021; Schilling & Stillman, 2024), our findings provide a scalable and actionable approach to mitigate anti-immigrant sentiment, directly addressing the negative trends in attitudes towards immigrants in Sweden and beyond by strengthening the democratic value of tolerance. Also consistent with prior studies concluding that digital learning tools can yield null effects and mixed outcomes (Cole et al., 2023; Dehghanzadeh et al., 2024), our findings show no significant differences between the pre- and posttest political tolerance levels, suggesting that exposure to simulated migratory experiences may not impact all aspects of tolerance.

The hierarchical regression results offer important explanatory insights into the extent to which variability in exposure to simulated migration predicts changes in attitude. First, distinguishing between exposure as the number of lives played and the time spent playing provided insight that the duration of play is a more meaningful predictor for attitude change than the number of lives played. To improve tolerance, creating simulation conditions that focus on students forming a deeper connection to a single character rather than multiple characters during the same period of simulation may therefore be more effective. Viewed through the approaches of intergroup contact theory, these results align with prior findings on the limited impact of superficial contact (Pettigrew & Tropp, 2006, 2013; Yaylacı & Bakiner, 2023).

Second, time spent engaging in the simulation had a positive influence on ATI change, inferring that prolonged engagement enhances tolerance. The simulation duration was modelled after Zhang and Zhou's (2023) conclusion that short durations of computer simulations can significantly impact learning relative to run-time. While our findings concur with Zhang and Zhou (2023) that brief simulation-based interventions can be effective, extended gameplay and repeated exposure may yield stronger effects, which agrees with Zhu et al. (2025). Manipulating the dose response of exposure to simulated migration is encouraged in future research to explore the linearity of simulation exposure in relation to attitudinal gain.

However, circumstantial factors may provide competing explanations for the observed association between attitudinal change and playing time, thereby limiting causal inference. A drawback of this finding is the implementation gap between the prescribed dose response – 60 minutes – and the reported playing time of the participants, some of whom played for as little as 0–10 minutes or 11–20 minutes. The variability in simulation time can be partly explained by the participating teachers' implementation reports, where two teachers noted taking more instructional time than allocated in the prescribed briefing, which in turn affected the students' total playing time. Previous classroom-based studies have reported similar deviations in intervention implementations (e.g., Hermansson et al., 2019). The subsequent variation caused by the offset in the intervention's briefing created natural variability in exposure to simulated migration, with some students receiving the full 60 minutes and others receiving less. While unintended, varying the treatment dose through natural variation (Shadish et al., 2002) allowed us to probe the potential added effects of time-varying exposure to simulated migratory experiences on ATI. Yet this natural variation contributes little to our understanding of the students who reported playing less than half the allocated time. This leads us to believe that some participants also self-regulated their playing time to some extent. The differences observed in the regression analysis of students' ATI changes based on playing time may thus

confound playing time with playing interest, implying that students who opted for longer play durations were potentially already more interested in the subject and, in consequence, more likely to experience a positive attitude change than those who chose to play for shorter durations. Consequently, the meaningfulness of this result should be considered in relation to the circumstantial factors contributing to natural variation and the self-regulation of participants' dose responses.

Adding another dimension of explanatory insights to this result, the interaction between prior knowledge about migration and playing time indicated that the effects of simulated migratory experiences vary among student groups. The observed interaction effect implied that exposure to simulated migration does not uniformly affect students' ATI change but rather is conditional upon a baseline understanding of the reasons for migration. Specifically, the positive attitudinal shifts were more substantial for students with greater prior knowledge of the reasons for migration. While the regression model's explanatory power qualified the statistical robustness of the result, we believe this finding has significant implications for understanding the preconditions for attaining attitude change through simulated migratory experiences. Consistent with Lee and colleagues' (2019) findings that prior knowledge has an effect on performance in simulation games, this study finds that students already knowledgeable about migration reasons showed a more positive improvement in ATI than less knowledgeable students, indicating a knowledge threshold for comprehending the simulation's content. Hence, to harness the potential attitudinal gain from simulated migration, students should be educated about the reasons for migration before implementing Real Lives in teaching practice, underscoring the importance of briefing (Freese & Lukosch, 2025).

The results also indicated that participants' ATI levels upon entering the intervention highly predict the extent of attitude change they experience due to simulated migratory experiences. In particular, high baseline ATI scores were strongly and positively associated

with attitude change, suggesting that higher baseline ATI predict greater ATI change. This finding contradicts previous reports of ceiling effects noted in earlier intergroup contact research for participants with already positive attitudes (Aamodt Bentsen, 2017; Hodson, 2011). The tested simulation may therefore be sufficient to boost positive attitude change among student groups that are predisposed to favour immigrants. Conversely, it may not be as sufficient to boost positive attitude change among those who are less favourable to immigrants, which might be the target group for whom these interventions are designed. Some previous research suggests that students with strong opinions may be relatively unaffected by educational interventions (Porat, 2005), and higher-quality contact with people holding opposing views may be necessary (Goldberg et al., 2011).

As a final point in the discussion of the results, we briefly reflect upon the qualitative findings from the simulation conditions. The intervention prompted participants to consider two central questions in migration theory: why people migrate and where they move (Carling, 2024; Van Hear et al., 2018). Our examination of participants' migration pathways and reasons for migration provided insight into secondary school students' responses to these questions following a simulated experience. The qualitative analysis indicates that students' explanations for target countries were justified by a range of distinct reasons when deciding where to migrate and why, providing an empirically grounded account of the forced and voluntary factors considered important in motivating their character's migration. Rather than framing the questions of why people migrate and where they move as pertaining to others, the simulation allowed participants to approach them from the perspective of a prospective migrant in the MENA region. In this simulated context, participants vicariously experienced causes of migration and how migration processes are shaped by structural conditions and agency (Van Hear et al., 2018). As we have argued based on findings from previous research (Becker, 2019; Dražanová et al., 2024; Just & Andersson, 2015; Neureiter & Schulte, 2024), forming

attachment to migratory experiences and creating a sense of commonality with migrants can be a fruitful strategy for strengthening positive ATI, and the tested intervention constitutes a promising approach in fostering such connections by teaching *through* migration using computer-based simulations.

5.1 *Research Contributions*

We have addressed three limitations of earlier studies. First, while several classroom-based approaches for improving attitudes toward outgroups have been studied, including deliberative discussions (Miklikowska et al., 2022), open classroom climate (Miklikowska et al., 2021), and classroom diversity (Janmaat, 2012; Liebkind et al., 2014), this classroom intervention is, to the best of our knowledge, the first study examining how a simulation of migratory experiences can improve ATI. Previous research on simulations for attitude change has focused on, for instance, changing attitudes towards a specific subject (Jere & Mpeta, 2024), willingness to help immigrants (Peña & Hernández Pérez, 2020), attitudes towards Chinese immigrants (Chen et al., 2021) as well as prejudice and empathy towards Syrian refugees (Cross et al., 2025). The present study adds to this literature by examining the affordances of simulated migration for attitude change towards immigrants. Second, field experiments in classrooms with teachers as facilitators of the intervention material have been requested to improve the applicability of intergroup attitudes intervention research (Liebkind et al., 2019; Ülger et al., 2018). The study enhances ecological validity by utilising regular teachers as intervention facilitators, as called for in previous intergroup contact research. Third, by adding continuity between studies, the simulation explored was previously investigated in American and South Korean educational contexts by Bachen et al. (2012, 2015) and Kwon et al. (2025), albeit with a different target outcome. Von Gillern and Nash (2024) note that there are very few instances of the same digital intervention tool being examined across studies, which this study has responded to.

Arguably, the most significant contribution of this work is that our findings extend the contemporary understanding of the mechanisms at play between previously observed effects of migration background on attitudes towards immigrants (Becker, 2019; Dražanová et al., 2024; Just & Andersson, 2015; Neureiter & Schulte, 2024) by reframing the focus from *background* to *experience*. Migration background, commonly defined as an individual-level characteristic based on a combination of one's birth country, parental birth country, and present residence, is often thought of as a fixed attribute that one possesses or does not. Consequently, researchers often treat migration background as a non-manipulable independent variable. By shifting the analytical focus from static background characteristics to dynamic migratory experiences, this study introduces a novel educational approach to studying and influencing attitudes toward immigrants. This reorientation not only advances theoretical understanding but also highlights how migratory experiences can be rendered more actionable within educational settings.

5.2 *Limitations and further research*

Our findings demonstrate the potential of simulations as educational tools for fostering tolerance, but they also highlight the need for careful implementation, ensuring that simulations are accompanied by adequate preparatory knowledge to maximise their positive impact. Future research should explore how different instructional strategies can enhance the effectiveness of simulations in promoting political tolerance.

The present exploratory study design lacks several important aspects for inferring the causal implications of the intervention's effect on students' attitudes. Major drawbacks include a lack of control group, randomisation, follow-up testing, convenience sampling, and a small sample size. A particularly relevant approach to strengthen causal inference possibilities is to create conditions for counterfactual evidence by adding a control group. Future research can include participants receiving a comparable intervention conceptually unrelated to the outcome variable

to control for the potential confounding effect of introducing *simulation gaming* rather than *simulated migration*. Creating variation in simulation assignments allows for disentangling the effects of multiple treatments (Shadish et al., 2002). Alternatively, adding a no-treatment condition controls for test-retest effects such as RTM. Hence, inferential issues related to causal effects can be partially addressed by adding this design feature, allowing exploration of alternative plausible mechanisms and isolating potential effects. Future research is also encouraged to use multiple posttests to address the present study's limitations in gathering evidence of potential long-term effects on ATI change. Testing participants at multiple time points post-intervention enables observation of how effects change over time (Shadish et al., 2002, p. 266), such as prolonged and diminishing effects. Accordingly, to create more favourable conditions for causal inference, we recommend further enhancements to the present study design – such as those mentioned – in a follow-up study.

A key design choice in this study, which may potentially affect the results and warrant further investigation in future work, is the potential interaction and confounding effects between the three intervention phases: briefing, simulation, and debriefing. While our discussion has focused on the simulation as the primary factor influencing the ATI outcomes given that the majority of the intervention was dedicated to the simulation and served as the novel component around which the other two phases were structured, there remains the possibility that the briefing and debriefing contributed to the observed effects. We sought to prevent this by (1) not including any information in the briefing that was evaluated in the posttest and (2) keeping the debriefing brief and closely linked to the simulation experience to minimise its effect on the posttest results. From an ecological validity perspective, structuring the intervention to comprise both an introduction and summary more accurately mirrors real-world educational practice than simply engaging in a simulation without contextual framing, which responds to prior critique of not considering broader teacher contexts in game-based interventions (Cole et

al., 2023). Nevertheless, future studies can isolate the potential contributing influences of these phases from gameplay on ATI by placing them prior to and following the pre- and posttests, respectively, to enhance internal validity.

The generalisability of the study findings is limited in several respects. The analysed material includes matched data from 148 students, which is a relatively small sample for intervention studies. In addition, contextual factors and representativeness also have limitations, such as applying only to the context of one country. Future research should address these external validity aspects to enhance the generalisability of the results.

This study also overlooked an important aspect noted in intergroup contact research: the quality of interactions that occur when outgroups are represented through simulations. Research consistently demonstrates the bidirectional effects of intergroup contact, where prejudice reduction depends on positive interactions (da Costa et al., 2024; Paolini et al., 2024). Individual simulation aimed at strengthening intergroup relations during lessons presents a black box issue; whether students perceive interactions with the simulation as positive or negative remains outside the teacher's control. Therefore, implementing simulations for attitude change may carry the risk of worsening negative attitudes, especially given that the quality of intergroup interactions lies beyond the teacher's influence. This can be assessed in future studies by asking students to record more specific information about their characters' lives and living conditions to explore how, for instance, the extent to which differences between simulated characters. Further research is needed to determine the quality of student interaction with outgroups through simulated migration in Real Lives.

Funding statement

CRediT Author Statement

Author A: Conceptualisation, Writing – Original Draft, Writing – Review & Editing, Formal Analysis, Investigation, Validation, Methodology, Project Administration, Resources, Visualisation. **Author B:** Conceptualisation, Writing – Review and Editing, Methodology.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process
During the preparation of this work, the corresponding author used Grammarly and ChatGPT in order to improve the readability of some passages. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Glossary

Attitudes towards immigrants: Beliefs held by an individual towards immigrants as a collective group. It can be operationalised as different sets of beliefs, such as related to prejudice or tolerance.

Indirect intergroup contact: Exposure to outgroups without in-person contact.

Ingroup: A group with which one identifies.

MENA: Abbreviation of the Middle Eastern and North African Region. Used to denote a geopolitically defined area, and the specific countries encompassed by this term vary between organisational contexts.

Outgroup: A group one does not identify with.

Simulation: An environment created to reproduce real events or processes.

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Appendix A – Statistical Outputs

The software used to conduct the statistical calculations was Jamovi, version 2.6.44. The output of the following statistical tests is accounted for in the appendix: Wilcoxon signed rank test for comparing means between pre- and posttest; Shapiro-Wilk Test for test of normality; hierarchal regression for predicted values of the dependent variable based on independent variables; and model fit measures for the hierarchal regression.

Table A1

Wilcoxon Signed-rank Test between Pre- and Posttest Scores

			z	p	Effect Size
Post_ATI	ATI	Wilcoxon W	4562[a]	0.005	0.2995
Post_Political Tolerance	Political Tolerance	Wilcoxon W	1118[b]	0.937	0.0113
Post_Social Tolerance	Social Tolerance	Wilcoxon W	4432[d]	0.002	0.3288

Note. Effect size is measured in Rank Biserial Correlations.

H_a $\mu_{Measure\ 1\ -\ Measure\ 2} \neq 0$

[a] 20 pair(s) of values were tied

[b] 72 pair(s) of values were tied

[c] 23 pair(s) of values were tied

Table A2

Shapiro-Wilk Test for Wilcoxon Signed-rank Test between Pre- and Posttest Scores   57

Normality Test (Shapiro-Wilk)

			W	*p*
Post_ATI	-	ATI	0.969	0.003
Post_Political Tolerance	-	Political Tolerance	0.811	<.001
Post_Social Tolerance	-	Social Tolerance	0.963	<.001

Note. A low p-value suggests a violation of the assumption of normality.

Table A3

Hierarchical Regression Output Model A with Posttest ATI Scores as Dependent Variable

Predictor	B	SE B	t	p	β
Model A					
Intercept	15.0433	3.7918	3.967	<.001	
Gender:					
Male – Female	-1.7108	0.7865	-2.175	0.032	-0.27016
Non-Binary – Female	-3.4714	3.9127	-0.887	0.377	-0.54818
Grade:					
9 – 8	-0.9381	1.7393	-0.539	0.591	-0.14813
10 – 8	0.4488	1.8848	0.238	0.812	0.07087
11 – 8	-0.2973	1.8235	-0.163	0.871	-0.04694
12 – 8	-0.5602	1.9176	-0.292	0.771	-0.08846
Swedish at home	1.9799	1.4706	1.346	0.181	0.31264
Political interest	-0.2525	0.5886	-0.429	0.669	-0.03160
Political discussion frequency	0.1768	0.3092	0.572	0.569	0.05618
Immigration discussion frequency	-0.0483	0.2922	-0.165	0.869	-0.01418
Parents political interest	-0.7111	0.2883	-2.467	0.015	-0.15514
Social science interest	-0.1970	0.3581	-0.550	0.583	-0.03545
Household highest education	0.2989	0.2031	1.472	0.144	0.08484
Books	0.2817	0.2833	0.994	0.322	0.05859
Prior knowledge	-0.0367	0.2456	-0.149	0.882	-0.00925
Prior gaming experiences	0.1350	0.2976	0.454	0.651	0.02548
ATI	0.7173	0.0642	11.166	<.001	0.74822

Table A4

Hierarchical regression output Model B with Posttest ATI Scores as Dependent Variable

Predictor	B	SE B	t	p	β
Intercept	8.2430	6.4501	1.278	0.204	
Gender:					
Male – Female	-1.7382	0.7984	-2.177	0.032	-0.2745
Non-Binary – Female	-4.1682	3.9683	-1.050	0.296	-0.6582
Grade:					
9 – 8	-0.9437	1.8122	-0.521	0.604	-0.1490
10 – 8	0.5404	1.9221	0.281	0.779	0.0853
11 – 8	0.2638	1.8521	0.142	0.887	0.0417
12 – 8	-0.2194	1.9417	-0.113	0.910	-0.0346
Swedish at home	2.2599	1.5019	1.505	0.135	0.3569
Political interest	-0.3959	0.5962	-0.664	0.508	-0.0496
Political discussion frequency	0.2130	0.3179	0.670	0.504	0.0677
Immigration discussion frequency	-0.0655	0.3038	-0.216	0.830	-0.0192
Parents political interest	-0.6937	0.2899	-2.393	0.018	-0.1513
Social science interest	-0.2158	0.3593	-0.601	0.549	-0.0388
Household highest education	0.3389	0.2064	1.642	0.103	0.0962
Books	0.2974	0.2899	1.026	0.307	0.0618
Prior knowledge	-0.0615	0.2552	-0.241	0.810	-0.0155
Prior gaming experiences	0.0983	0.3102	0.317	0.752	0.0186
ATI	0.6987	0.0652	10.711	<.001	0.7288
Played Real Lives	4.0729	4.1323	0.986	0.326	0.0554
Played Real Lives outside of school	0.3117	0.8502	0.367	0.715	0.0214
Amount of playing time	0.3417	0.2573	1.328	0.187	0.0821
Number of lives played	0.2519	0.2676	0.941	0.349	0.0635

Table A5

Hierarchical Regression Output Model C with Posttest ATI Scores as Dependent Variable

Predictor	*B*	*SE B*	*t*	*p*	β
Intercept	6.2332	6.3971	0.9744	0.332	
Gender:					
Male – Female	-1.4073	0.8021	-1.7545	0.082	-0.2222
Non-Binary – Female	-3.9808	3.9068	-1.0189	0.310	-0.6286
Grade:					
9 – 8	-0.8211	1.7978	-0.4567	0.649	-0.1297
10 – 8	0.5241	1.8994	0.2760	0.783	0.0828
11 – 8	0.0697	1.8306	0.0381	0.970	0.0110
12 – 8	-0.6111	1.9213	-0.3180	0.751	-0.0965
Swedish at home	2.2338	1.4767	1.5127	0.133	0.3527
Political interest	-0.3705	0.5891	-0.6290	0.531	-0.0464
Political discussion frequency	0.3495	0.3175	1.1006	0.273	0.1111
Immigration discussion frequency	-0.1673	0.3018	-0.5543	0.581	-0.0491
Parents political interest	-0.7122	0.2852	-2.4974	0.014	-0.1554
Social science interest	-0.3147	0.3576	-0.8799	0.381	-0.0566
Household highest education	0.3789	0.2039	1.8586	0.066	0.1076
Books	0.2826	0.2852	0.9906	0.324	0.0588
Prior knowledge	-0.0546	0.2510	-0.2174	0.828	-0.0138
Prior gaming experiences	0.1143	0.3066	0.3728	0.710	0.0216
ATI	0.6669	0.0654	10.1889	<.001	0.6956
Played Real Lives	4.6250	4.1455	1.1157	0.267	0.0629
Played Real Lives outside of school	0.3150	0.8370	0.3763	0.707	0.0217
Amount of playing time	0.4184	0.2620	1.5973	0.113	0.1005
Number of lives played	0.2675	0.2651	1.0092	0.315	0.0674
Simulation satisfaction	-0.7768	0.4728	-1.6432	0.103	-0.1103
Perceived learning	0.3774	0.1569	2.4051	0.018	0.1664

Table A6

Hierarchical Regression Model Fit Measures

Model	R	R²	Adjusted R²	Overall Model Test			
				F	df1	df2	p
1	0.837	0.701	0.657	16.1	17	117	<.001
2	0.843	0.710	0.657	13.2	21	113	<.001
3	0.852	0.725	0.668	12.7	23	111	<.001
4	0.859	0.737	0.680	12.9	24	110	<.001

Note. Models estimated using sample size of N=135

Table A7

Hierarchical Regression Model Comparisons

Comparison							
Model		Model	ΔR²	F	df1	df2	p
1	-	2	0.00968	0.944	4	113	0.441
2	-	3	0.01466	2.959	2	111	0.056
3	-	4	0.01231	5.155	1	110	0.025

Acknowledgements

Figure 1

Migration Pathways in Real Lives from MENA Birth Country to Target Country
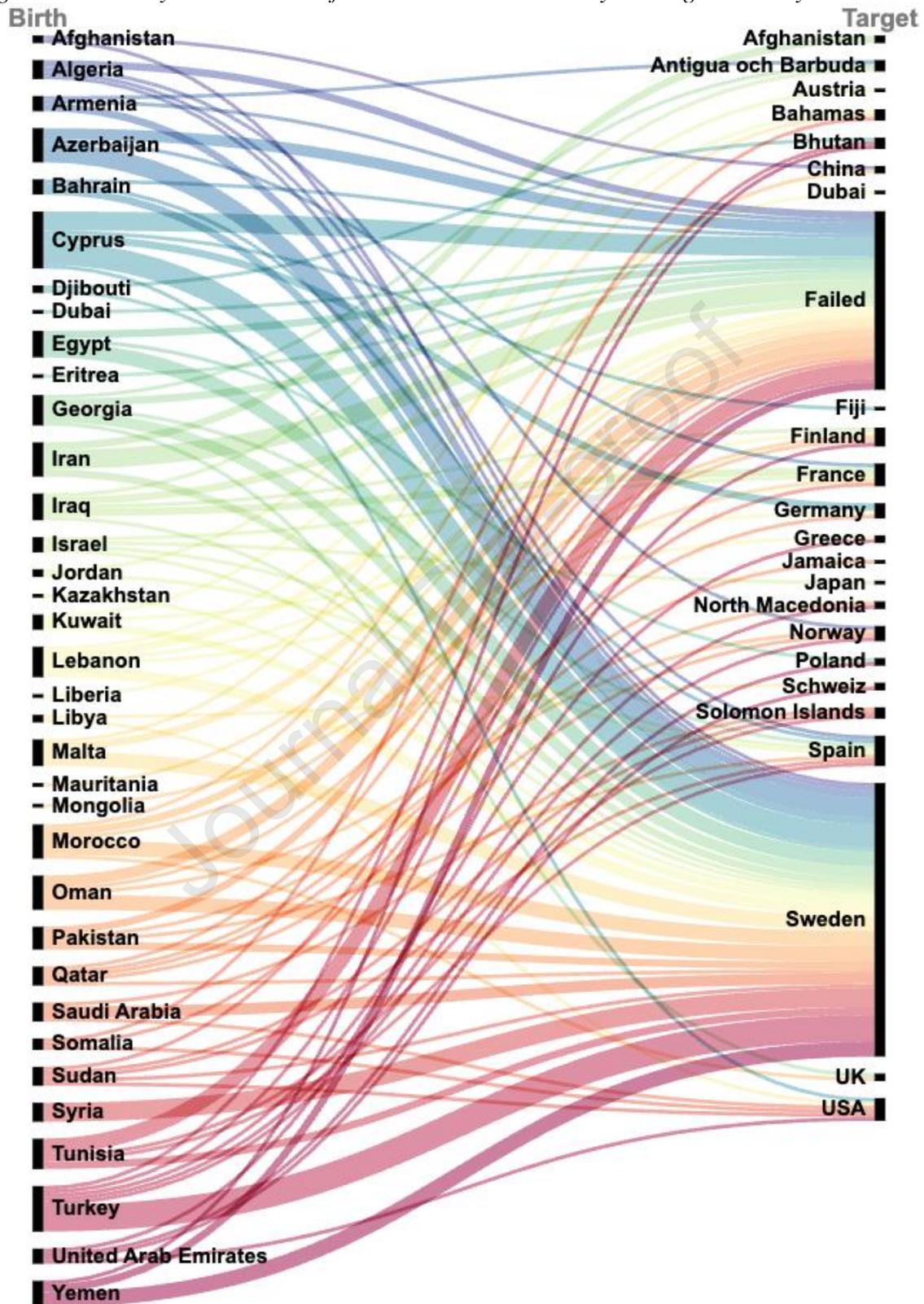
Note. Pathways to 'Failed' marked on the right margin of the figure denote failed to mitigate.

Highlights

- There are growing concerns about anti-immigrant sentiments in many countries

- Understanding migratory experiences increases tolerance towards immigrants

- Teachers can foster connections to migratory experiences through simulations

- Students' tolerance for immigrants improved after engaging in simulated migration

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