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Gender-based learning and behavioural differences in an educational social media platform

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Abstract

Background: Gender differences in the use of educational environments and social media platforms have been a topic of interest in research. Several studies have examined the disparities between female and male participants in terms of participation, engagement, and motivations in either educational or social media platforms. On this end, this study proceeds to explore gender disparities in an innovative educational environment that sees the incorporation of an educational component within a simulated social media environment.

Objectives: Driven by a dual objective, this study aims to first investigate the impact of gender on skills development in an educational social media platform, and second, to explore the behavioural differences between female and male adolescents social interactions within the platform.

Methods: The study involved 142 high school students in Barcelona and utilised an ad-hoc questionnaire to assess students' skills. To explore students' behaviour within the platform, actions such as likes, comments, publishing, visiting profiles, and viewing images, were recorded using the Experience API.

Results and Conclusions: Our study's findings indicate that both female and male students benefited from the intervention implemented within the educational social media platform. Moreover, the results revealed distinct interaction patterns between female and male participants. These findings provide valuable insights into how adolescents of different genders interact within an educational social media platform. Additionally, the design principles outlined in this study can inform the development of future educational social media interventions that effectively engage the preferences of both genders.

KEYWORDS
educational social media platform, gender, social media behaviour, social media literacy

1 | INTRODUCTION

In today's rapidly evolving world, technology has become an integral part of our daily lives, infiltrating every aspect of society. Technology's constant influence has also revolutionised the field of education through the integration of various technological tools with the aim to create more engaging and meaningful learning experiences for students across diverse fields.

One notable example of the integration of technology into education is the rise of virtual education platforms. Educational platforms

have emerged as complements to traditional educational approaches, optimising teaching and learning processes (Valencia et al., 2017) without seeking to replace face-to-face interactions, but rather by enhancing teaching through the use of technological advancements (Berrio-Quispe et al., 2021). They offer an array of versatile tools that can be accessed from any location with a computer and an internet connection, fostering both synchronous and asynchronous interaction between students and teachers (Valencia et al., 2017). The increasing prominence of digital platforms in education gained a greater momentum with the onset of the COVID-19 pandemic, as traditional in-person education was disrupted, and these platforms emerged as a strategic alternative for sustaining education (Alshammary & Alhalafawy, 2023).

Educational platforms offer a number of benefits for students and learners. They are often found useful, engaging, and effective in promoting learning (Alshammary & Alhalafawy, 2023; Lopez-Pernas et al., 2021). They foster learner-centred approaches, adapt content for individual differences, and create multimedia-rich environments that encourage information retrieval and collaborative learning (Alshammary & Alhalafawy, 2023). At the same time, students react positively to educational platforms, appreciating the ease of access and the opportunities for interaction and exchange of ideas (Rakhmetov et al., 2022).

However, despite their many advantages, educational platforms also face challenges. Issues related to technology, such as the lack of devices, outdated equipment, poor connectivity, and budget constraints, can hinder their implementation (Nieto-Márquez et al., 2022). Teachers may require training and support for effective use (Nieto-Márquez et al., 2022), and students' dissatisfaction can arise due to absence of face-to-face relationship among learners and teachers (Joshi et al., 2022). Moreover, despite their potential to promote inclusivity and equity (Gunn, 2019; Raj, 2023), educational platforms can be susceptible to gender disparities.

Extensive research has revealed that gender plays a significant role in shaping how individuals use and behave on these platforms. These disparities are particularly evident in aspects such as social behaviours and use intentions (Crues et al., 2018; Padilla-Meléndez et al., 2013). For instance, female students tend to engage significantly more in forum participation, actively viewing and posting, in contrast to their male counterparts, who are more inclined to passively view forum content but not actively contribute to the discussions (Crues et al., 2018). This diversity of learning needs and styles necessitates different educational features to engage each individual student in productive learning and underscores the importance of exploring and addressing gender-related discrepancies that can exist within educational platforms (García-Gil & Andreu, 2017; Ong & Lai, 2006; Stege et al., 2011). Addressing this can lead to a digital learning environment that caters to the needs and preferences of all students without affecting their learning, regardless of their gender.

1.1 | An educational platform for social media literacy

The widespread use of social media, particularly among adolescents, has become increasingly prevalent, with a notable surge since the onset of the pandemic. The average daily screen media usage has escalated significantly among adolescents (Rideout et al., 2022). While social media is an integral part of our lives, it comes with both positive and negative aspects. On the positive side, social media can serve as a valuable tool for reducing stress, facilitating social connectivity, strengthening friendships and providing tools for emotional support (Bickham et al., 2022; O'Reilly et al., 2023). However, there are concerns related to screen media usage, including its potential to interfere with activities like sleep, family time, academic performance and body image influences (Bickham et al., 2022). In addition, research has shown that high social media use in early adolescence can have a negative impact on well-being in later adolescence, especially for girls (Booker et al., 2018). Problematic social media usage can further exacerbate these concerns, leading to emotional distress and the adoption of maladaptive behaviours (Daniels et al., 2021). This is especially concerning given that the number of children reporting being harassed online has substantially increased in most European countries in the last 10 years, with girls reporting being harassed more often than boys (Smahel et al., 2020).

When it comes to gender-based differences in social media behaviours one can find disparities in motivations for use, behaviours, engagement types, media consumption types and time of usage (Fujimori et al., 2015; Noguti et al., 2019; Ottoni et al., 2021; Smahel et al., 2020; Szell & Thurner, 2013). These disparities are also evident in adolescents' social media platform preferences, with male adolescents tending to use more community-based platforms than female adolescents, who use more self-expression platforms (Pew Research Center, 2022). Additionally, boys and girls exhibit different levels of proficiency in using social media, with boys generally displaying higher competence in information navigation skills (Smahel et al., 2020).

To address the negative impact of social media use in adolescents and raise awareness of hidden threats, a variety of online tools and interventions have been developed (Gordon et al., 2020; Micallef et al., 2021; Theophilou et al., 2023). One innovative approach to enhance social media literacy is presented by Instareal, an educational platform that employs narrative-based techniques to immerse students in authentic learning scenarios within a controlled educational social media environment (Hernández-Leo et al., 2021). Instareal's methodology provides a unique and engaging learning experience (Lobo-Quintero et al., 2023), fostering an authentic approach to social media education that focuses on enhancing adolescents' social media self-protection skills. The utilisation of narrative-based platforms to deliver educational content offers a multitude of advantages and effectively supports student learning across diverse subjects and disciplines, as evidenced in previous studies (Chen et al., 2018; Rodríguez-de-Dios et al., 2021; Rowe et al., 2010). Even though narrative-based platforms have not shown gender differences in skills improvement (Nietfeld et al., 2014; Rodríguez-de-Dios et al., 2021) and minimal students behaviours differences (Rowe et al., 2010), Instareal may be vulnerable to gender disparities due to its social media facet.

While previous research has produced insightful findings regarding gender-based differences in educational platforms and social media networks, to date, no study has yet examined gender-based skills improvement and behaviours within a controlled educational

social media platform, to determine whether these gender dynamics reflected in social media environments persist in a controlled educational environment. Therefore, this study aims to fill this gap by examining and comparing the skills gained and social interactions of male and female adolescent students in the context of an educational social media platform. By examining student interactions, this research aims to provide insights into gender-specific patterns that can contribute to a better understanding of how students utilise social media features within educational environments. This led to the formulation of the following research questions (RQ):

> **RQ1.** What is the role of gender in the development of social media self-protection skills among students using a social media intervention implemented within a controlled educational social media platform?
>
> **RQ2.** What gender-based differences exist in user behaviours within an educational social media platform?

The findings of this study have the potential to provide valuable insights for educators, researchers, and policymakers involved in developing educational platforms enhanced with social media driven interactions. Understanding the impact of narrative-based platforms on gender-based skill development and user behaviours can inform the development of more effective and inclusive educational strategies that cater to the diverse needs and preferences of students.

This article is divided into the following sections: Section 2 presents an overview of gender-based differences in educational platforms and social media environments. Section 3 presents the methodology employed to investigate the research questions and describes the educational platform of Instareal in more detail. Finally, Sections 4 and 5 summarise and discuss the key findings, insights, and limitations.

2 | GENDER DISPARITIES IN EDUCATIONAL PLATFORMS AND SOCIAL MEDIA

2.1 | Gender-based differences in educational platforms

Gender differences in the use of educational platforms have been a topic of interest in research for the past decades. Studies show that males are generally more willing to use computers for educational purposes than females (Drabowicz, 2014; González-Gómez et al., 2012). This may be due to divergent perceptions of online learning environments, as females often view educational platforms more as communication platforms than dedicated learning spaces (García-Gil & Andreu, 2017). This is further supported by research showing that factors such as perceived usefulness and playfulness play a significant role in students' use of educational platforms, with male students emphasising perceived usefulness while females prioritise playfulness (Padilla-Meléndez et al., 2013).

It is notable that educational platforms do not exhibit a gender-specific advantage in terms of learning performance (Nietfeld et al., 2014; Rodríguez-de-Dios et al., 2021), which underscores their potential benefits for both male and female students. However, to enhance participation and user intentions, several factors should be considered in the design process (Ong & Lai, 2006), especially since students with higher engagement tend to perform better compared to students with moderate and lower engagement patterns (Mame Abdo et al., 2021).

Although prior research on online participation rates found no significant gender differences (Davidson-Shivers et al., 2003; Masters & Oberprieler, 2004), previous work has revealed gender-specific behaviours with female students participating more actively in online forums than male students, both in terms of viewing and posting significantly more than male students. Similarly, Yukselturk and Top (2013) found that female students posted more messages than male students in both chat sessions and discussion forums. Given that students who actively post on forums exhibit higher persistence in the course than those who do not participate actively (Crues et al., 2018), it is important to recognise these gender-based behavioural patterns when designing educational platforms to enhance the learning experience for all students.

Gender disparities in narrative-based educational platforms can manifest as higher engagement in off-task behaviours, especially among male students (Rowe et al., 2009). In learning environments, off-task behaviour occurs when students disengage from learning activities, even though they may still interact with the learning environment. Although these activities may have little educational value, they do not seem to have a significant impact on students' learning experience or overall performance (Rowe et al., 2009). Furthermore, factors such as gameplay frequency do not appear to be influential in determining students' skill development within these platforms (Nietfeld et al., 2014; Rowe et al., 2010). Overall, the evidence suggests that gender disparities in narrative-based educational platforms are relatively minor and do not appear to have a significant impact on students' learning outcomes. However, more research is needed to better understand how these disparities can manifest in narrative-based environments utilising social media features and to develop strategies to mitigate them.

2.2 | Gender-based differences in social media

Social media usage has become increasingly prevalent among teenagers and has sparked extensive research into gender-based differences in their behaviours and interactions within these platforms. Notably, studies have observed differences in platform preferences, with adolescent boys tending to favour YouTube, Twitch, and Reddit, while adolescent girls lean towards TikTok, Instagram, and Snapchat (Pew Research Center, 2022). Platform preferences seem to reflect the motivational factors for using social media with female users placing greater emphasis on maintaining friendships when using social media platforms (Hargittai & Hsieh, 2010; Noguti et al., 2019; Thelwall, 2008). On the other hand, male users utilise them for forming new relationships or for entertainment purposes (Muscanell & Guadagno, 2012; Narasimhamurthy, 2014; Noguti et al., 2019). Additionally, these

findings align with the observation that females place a stronger emphasis on social aspects, while males tend to exhibit a greater interest in practical aspects, such as information sharing (Lu et al., 2010; Lu & Hsiao, 2009). Recent research provides additional support for this observation, indicating that females are primarily motivated by their interest in obtaining social information, while males are driven by their desire to acquire general information (Krasnova et al., 2017).

This is also supported by behavioural data collected from social networks which demonstrated distinct differences in how females and males manage their social networks. Females tend to have more communication partners and a greater diversity of individuals they post photos of, compared to males (Lewis et al., 2008; Szell & Thurner, 2013). Moreover, females show a greater tendency to invest effort in exchanging social links, exhibit higher levels of activity, and engage in more diverse content generation (Ottoni et al., 2021). The social approach of females in social networks is also reflected in their communication styles, which prioritise social affiliation, affection and emotional connection (Iosub et al., 2014; Kivran-Swaine et al., 2012; Ottoni et al., 2021).

When approached about their behavioural habits in social media, adolescent girls are more likely than boys to express the belief that they spend excessive time on social media (Espinoza & Juvonen, 2011; Pew Research Center, 2022). This finding is consistent with self-reported data on the duration and frequency of social media use, which shows that female users spend more time on social media platforms and use them more frequently than their male counterparts (Barker, 2009; Fujimori et al., 2015; Kim et al., 2010). Interestingly, when asked about their perception of spending an appropriate amount of time on social media, a majority of adolescent boys agreed, indicating a sense of satisfaction with their usage. In contrast, only half of the adolescent girls agreed, suggesting a higher level of self-awareness and concern regarding excessive time spent on social media (Pew Research Center, 2022).

Research on the relationship between excessive use of social media and social media addiction has produced mixed findings. Some studies have reported no association (Bekalu et al., 2019), while others have found evidence linking social media use to negative outcomes (Fujimori et al., 2015; Pellegrino et al., 2022). Even so, research suggests that female users are more prone to exhibit addictive behaviours in relation to social media compared to male users (Fujimori et al., 2015; Stănculescu & Griffiths, 2022; Su et al., 2020).

Building on the growing literature on gender disparities in social media behaviours and the existing literature on gender-based disparities in virtual learning environments behaviours, we aim to investigate whether gender-based disparities exist within an educational social media platform and to improve our understanding of participation patterns among adolescent students.

3 | METHODOLOGY

3.1 | Instareal: An educational social media platform

The study utilised the educational social media platform of Instareal, which was specifically developed to offer students an authentic learning experience to understand and navigate through different threats and risks hidden within social media (Hernández-Leo et al., 2021). Studies on the Instareal platform have shown that it helps students develop critical thinking skills towards social media algorithms (Theophilou et al., 2023) and students find the learning experience enjoyable and engaging (Lobo-Quintero et al., 2023).

Instareal was developed extending the open-source code from Pixelfed (Pixelfed, 2021), allowing a replication of the interface of popular social media platforms (see Figure 1 for visualisation of the platform). This enabled students to upload content, follow their friends, and engage in social interactions such as liking and commenting. To enhance the educational aspect, the open-source code of Pixelfed was customised and augmented to incorporate an educational module within the platform's interface. This enabled the incorporation of a scripted chatbot to deliver educational material to students. The platform is accessible via a web browser, allowing students to access it using various devices such as school computers, tablets, and their personal phones.

3.2 | Social media intervention

For this study, we implemented a social media literacy intervention within the Instareal platform, guided by the narrative scripts approach (Hernández-Leo et al., 2021). This innovative method aimed to cultivate an authentic and dynamic learning experience, empowering students to explore social media topics within a simulated social media environment while actively addressing challenging scenarios.

Each student was able to access the platform by setting up their individual profile, granting them access to educational materials and the ability to participate in social media interactions. Throughout the intervention, students received messages from a scripted chatbot that imitated different teenagers who encountered problematic scenarios on social media. During their interactions with the chatbot, students were presented with information about a situation unfolding in the simulated environment. They were then guided to access fictional profiles (in a process referred to as 'guided roaming') with the aim to analyse these profiles and develop their own critical perspective. The chatbot used scaffolding techniques to deliver educational material in the form of advice and asked further questions to increase student learning. The aim during the educational activities was for students to complete the learning module, which consisted of dialogues with the chatbot, guided roaming activities, and on occasions collaborative activities or mini games. Students worked individually and in some activities a computer supported collaborative learning tool was utilised to allow students share their opinions regarding a problematic situation.

The intervention under this study consisted of a total of six sessions conducted throughout an academic year, with each session lasting approximately 90 min. Each session addressed a different topic in regards to social media education (social media wellbeing, digital footprint, social media addiction, fear of missing out, body image). At the start and end of each session, students were allocated time to freely explore the educational social media platform (in a process referred to as 'free roaming') (see Figure 2). This encouraged students to create their profiles by uploading images, mainly memes and funny photos,

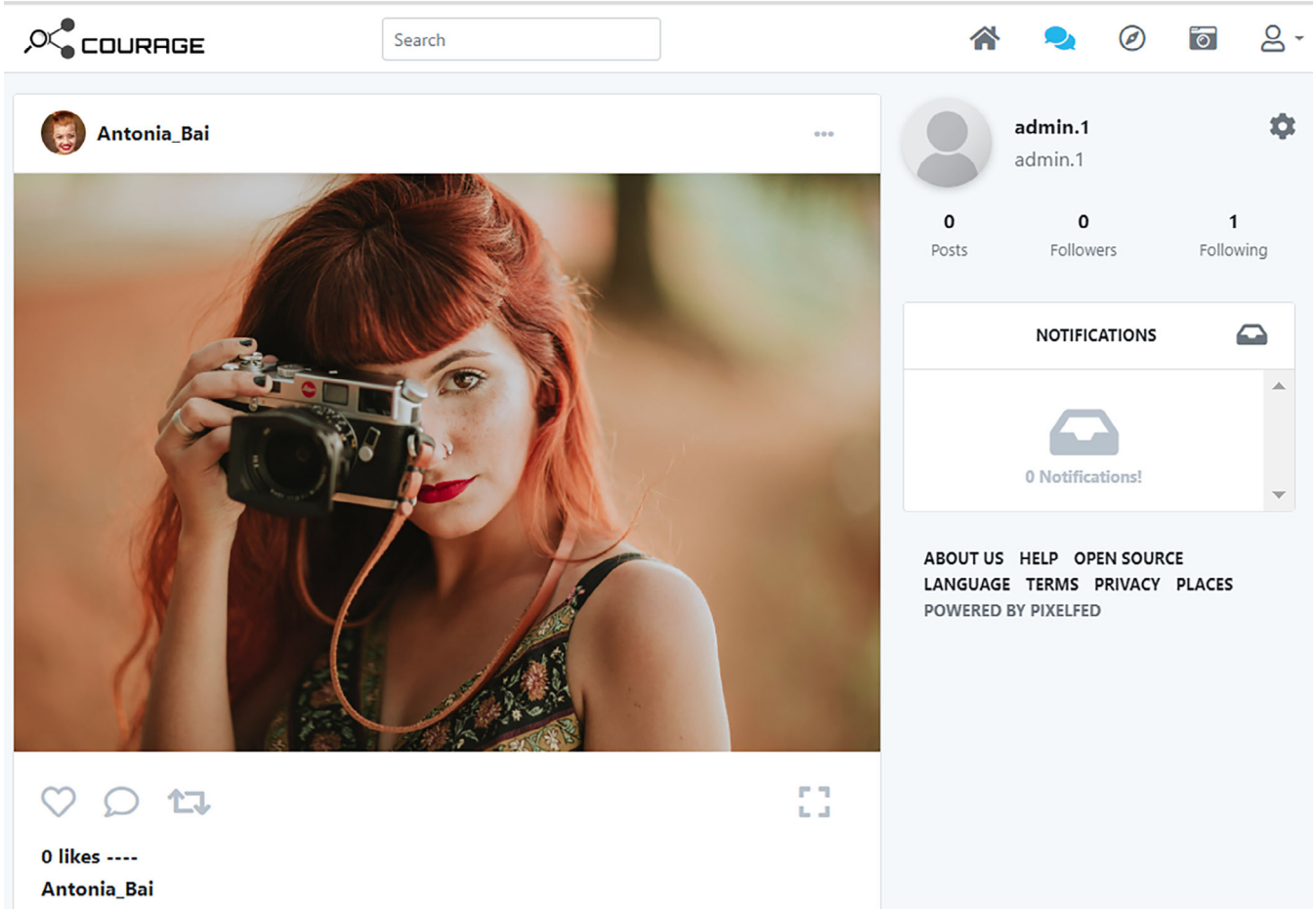


FIGURE 1 Screenshot of the educational social media platform mirroring social media features of Instagram. The platform offers students the ability to engage in various actions such as liking, commenting, and following profiles. This design aims to provide students with an authentic social media platform while incorporating educational elements (The image of the model was taken from pexels.com).

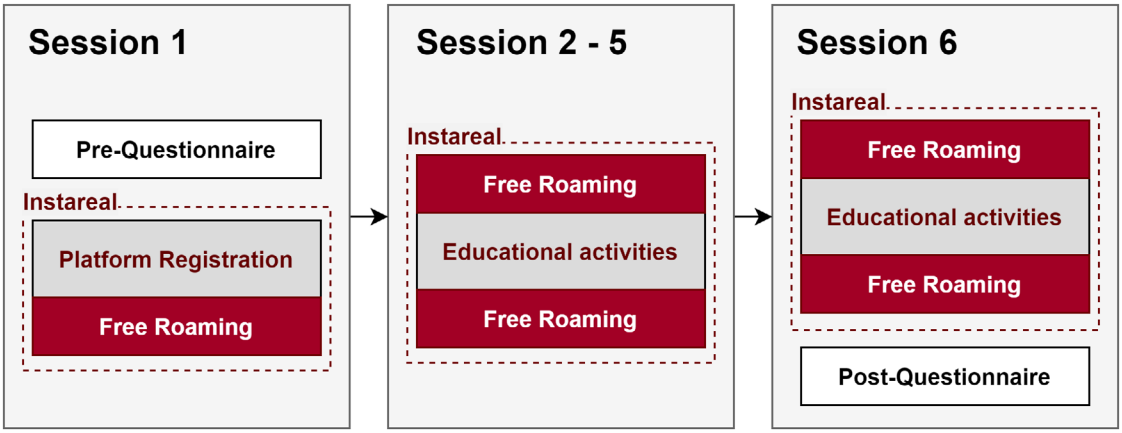


FIGURE 2 Study procedure: the study comprised six sessions, each lasting approximately 90 min.

access their friends profiles, add them to their friends list and browse their friends profiles. On some occasions students also browsed the fictitious profiles that were created by the researchers. There was no specific goal for students to achieve during the free roaming as they were let freely to explore the platform.

Each session was divided into three parts (see Figure 2). The first part involved dedicated free-roaming activities, where students were instructed to explore the platform without any didactical limitations. The second part of the sessions focused on educational activities specifically designed for learning purposes. Finally, in the third part students were once again allowed to roam freely on the platform. In addition to engaging in educational material and free-roaming activities, students completed a questionnaire during both the first and last sessions.

3.3 | Participants

The study was carried out as a part of an initiative to increase awareness of the potential risks and threats of social media with the help of virtual learning companions. A total of 142 adolescents (52.8% male, 47.9% female, mean age = 14.7, SD = 1.62) from high schools across Barcelona, Spain participated in the study. The participants were drawn from a diverse pool of students, representing both private and public high schools in diverse districts of a large city and encompassing a wide range of socio-economic status.

Prior to the commencement of the study, both students and their parents were informed about the research objectives and were informed of the data collection procedures. To participate in the study, both students and their parents were required to sign an electronic consent form.

3.4 | Measures

To measure gender difference in skill development and gender behaviour in an educational social media platform we considered on the following variables and instruments.

3.4.1 | Social media self-protection skills (SMSPS) questionnaire

To measure students' skills an ad-hoc questionnaire was developed to evaluate if the learning objectives of the course were reached. The questionnaire was designed with a focus on assessing the socio-emotional competencies related to social media use and included questions related to social awareness, self-awareness, responsible decision making and social media literacy skills. The questions for each competence were adapted to reflect their value in social media and were inspired by the Socio-Emotional Learning Questionnaire (SELQ) (Zhou & Ee, 2012). Moreover, to measure students' understanding of how SM works, a set of questions from the Internet Skills Scale (ISS) (van Deursen et al., 2016) were also included. This resulted in a collection of 16 items (Table 1) formulated as 5-point Likert scales, where students were asked to indicate their level of agreement. The questionnaire was administered at the beginning of session 1 (pre-questionnaire) and at the end of session 6 (post-questionnaire). A Cronbach's alpha analysis was conducted to assess the questionnaire's consistency, yielding an alpha of 0.65.

3.4.2 | Educational social media behaviour data

Students' activity within the educational social media platform was recorded through the Experience API (xAPI). The data recorded consisted of events related to social media activity including liking, commenting on photos, following friends, publishing photos, viewing photos, and visiting profiles (Table 2). Each of these actions was registered as a JSON object that included information depicting which user performed the action, the action type, the recipient and the time. For the purpose of this study, only the data coming from free roaming activities were utilised in the analysis, data from guided roaming activities were excluded.

To better understand gender-based interactions on the platform, we categorised the recorded behaviours into two main categories: entertainment-driven and socially driven, following the classifications of social media actions by Hall (2018) and Lee et al. (2015). This

TABLE 1 Social media self-protection skills questionnaire items.

Skill	Item
Social media literacy	I feel confident posting content I have created to social media
	I know which information I should and should not share online
	I feel comfortable deciding who to follow online (e.g., on platforms like Instagram)
	I know how to change who I share content with (e.g., friends, friends of friends)
	I know how to remove friends from my friend's lists
	I know how to adjust privacy settings
	I have control of the content I receive on my timeline
	My social media timeline content is influenced only by my actions
	Social media applications are designed to provide us with a balanced and mentally healthy lifestyle.
Responsible decision making	Asking for consent before posting or sharing content online involving a friend is important to me.
	When sharing content online, I consider the consequences of my actions.
Self-awareness	I understand my moods and feelings when navigating through social media.
	In the past, I unfollowed a social media user for negatively influencing my mood
	The use of social media can influence my mood positively
	The use of social media can influence my mood negatively
Social-awareness	I am careful to make my comments and behaviours appropriate to the situation I find myself in online

TABLE 2 The type of activity recorded in the platform and the corresponding xAPI verb.

Type of action performed in the platform	xAPI verb
User liked a post of another user	Like
User left a comment under a post or replied to a comment	Comment
User clicked on a photo to enlarge it	View
User visited a profile	Visit
User followed a profile	Follow
User published their own content	Publish

allowed us to categorise profile visiting, following and commenting under the socially driven category and likes, browsing and publishing under entertainment driven.

3.5 | Data analysis

To address RQ1, we assessed students' overall performance on the SMSPS questionnaire. To evaluate the score of each socio-emotional competency we aggregated the related Likert items into a single variable for each competency. Prior to conducting the statistical analysis, we performed a normality test, which indicated that the data followed a normal distribution.

To evaluate the impact of the intervention on skill development, we employed a dependent t-test to examine the pre- and post-performance changes of the students. We then employed an independent t-test with unequal variance to compare the means between genders at both pre- and post-intervention time points. This statistical approach enabled us to assess for any significant differences in performance based on gender and to determine whether there were any significant changes in performance before and after the intervention.

To address RQ2, we extracted and organised the data collected through the xAPI on a per-student basis. For each student, we calculated an activity profile that contains the average activities over the sessions in which the student participated, that is, the activity of the s-th student was computed as $\bar{a}(s) = 1/N_s \sum_i a_i(s)$ where N_s is the number of sessions attended by student s and $a_i(s)$ corresponds to the number of actions in a particular activity taken by student s in session i. Table 2 shows the number of different activities, that is, $a \in \{\text{likes}, \text{comments}, \text{views}, \text{visits}, \text{follow}, \text{publish}\}$. We also considered a pairwise activity profile for each student defined as $a_{ij}(s) = \left(\bar{a_i}(s) + \bar{a_j}(s)\right) / \sum_k \bar{a_k}(s)$.

We compared the activity profiles between male and female students using different methodologies: for the single activity profiles, we analysed the differences between the group means of each activity type (Mann Whitney U test) and the differences between the probability distributions between male and female students (Kolmogorov–Smirnov test). For the pairwise activities, we analysed the differences between the group means of each (pairwise) activity type (Mann Whitney U test).

4 | FINDINGS

4.1 | RQ1 – Impact of intervention on skill development by gender

Regarding RQ1, an initial analysis revealed a significant difference ($p < 0.05$) between female students' SMSP skills (mFemale = 59.8, SD = 6.6) and male students' SMSP skills (mMale = 58.13, SD = 6.2) in the pre-questionnaire. Therefore, to investigate if the intervention caused gender differences, a comparison between the knowledge gained was conducted instead (Post – Pre). However, this showed no significant difference between the learning gains of the two genders. In the post-questionnaire, there were no significant differences ($p > 0.05$) between female students' SMSP skills (mFemale = 62.8, SD = 6.7) and male students' SMSP skills (mMale = 61.6, SD = 6.5). However, both female and male students showed significant differences between their pre- and post-test scores (female: pre = 59.8, SD = 5.9, post = 62.8, SD = 6.7, $p < 0.05$; male: pre = 58.13, SD = 6.2, post = 61.6, SD = 6.5, $p < 0.05$).

A closer look at the independent variables, showed a significant difference in the social awareness variable between female and male students in the pre-questionnaire ($p < 0.05$). Female students exhibited higher social awareness skills (mFemale = 4.35, SD = 0.8) compared to male students (mMale = 4.04, SD = 0.9). This difference was present also in the post-questionnaire (mFemale = 4.5, SD = 0.6, mMale = 4.2, SD = 0.9, $p > 0.05$) even though both genders had an improvement in the social awareness skill. A similar trend was observed in the variable of social media literacy, where female students scored significantly higher than male students in the pre-questionnaire (mFemale = 31.1, SD = 4.3, mMale = 29.73, SD = 3.9, $p < 0.05$). However, the difference between the two genders was reduced in the post-questionnaire (mFemale = 36.5, SD = 4.1, mMale = 35.4, SD = 4.1, $p > 0.05$). There were no significant differences between the genders in regards to the skills of responsible decision making (female: pre = 8.5, SD = 1.2, post = 8.9, SD = 1.3, $p < 0.05$; male: pre = 8.5, SD = 1.5, post = 8.7, SD = 1.3, $p < 0.05$) and self-awareness (female: pre = 11.3, SD = 2.8, post = 12.8, SD = 2.9, $p < 0.05$; male: pre = 11.3, SD = 2.63, post = 13.3, SD = 2.6, $p < 0.05$).

4.2 | RQ2 – Behavioural differences in the use of the platform by gender

In total, students engaged in 9913 social interactions within the platform, with females contributing 4486 interactions and males contributing 5427 interactions. An initial analysis of the gender differences revealed no significant differences in the average activity between female students (mFemale = 65.9, SD = 58.6) and male students (mMale = 70.9, SD = 65.1) ($p > 0.05$). A further look into the student activity profiles found significant differences in the variables of viewing images and publishing content. In particular male students (mMale = 6.71, SD = 8.36) viewed on average significantly more images than female students (mFemale = 4.15 SD = 5.47) ($p < 0.05$). Moreover, significant differences were found under 'publishing', with male students publishing significantly more content than female

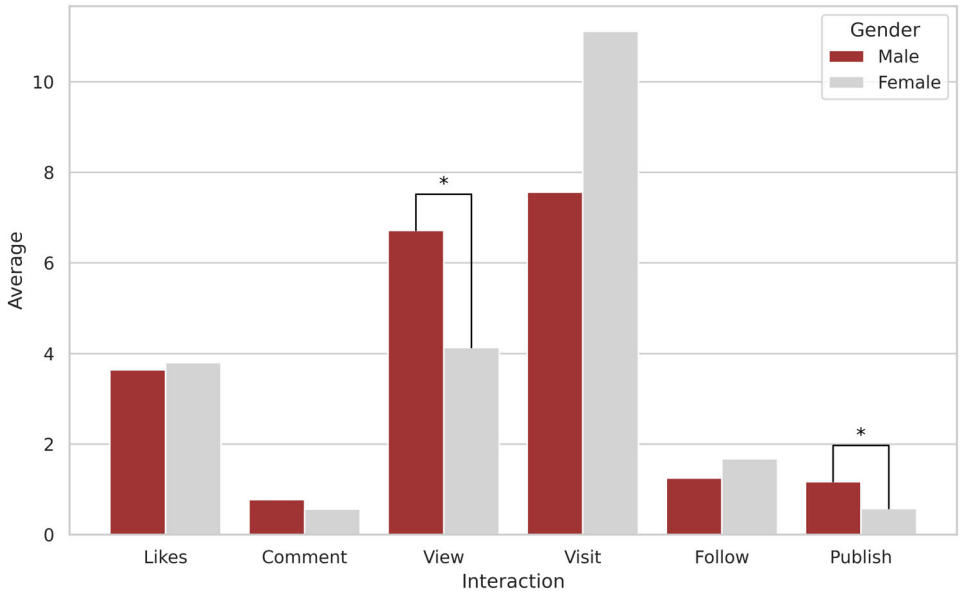


FIGURE 3 Average social media interactions per gender.

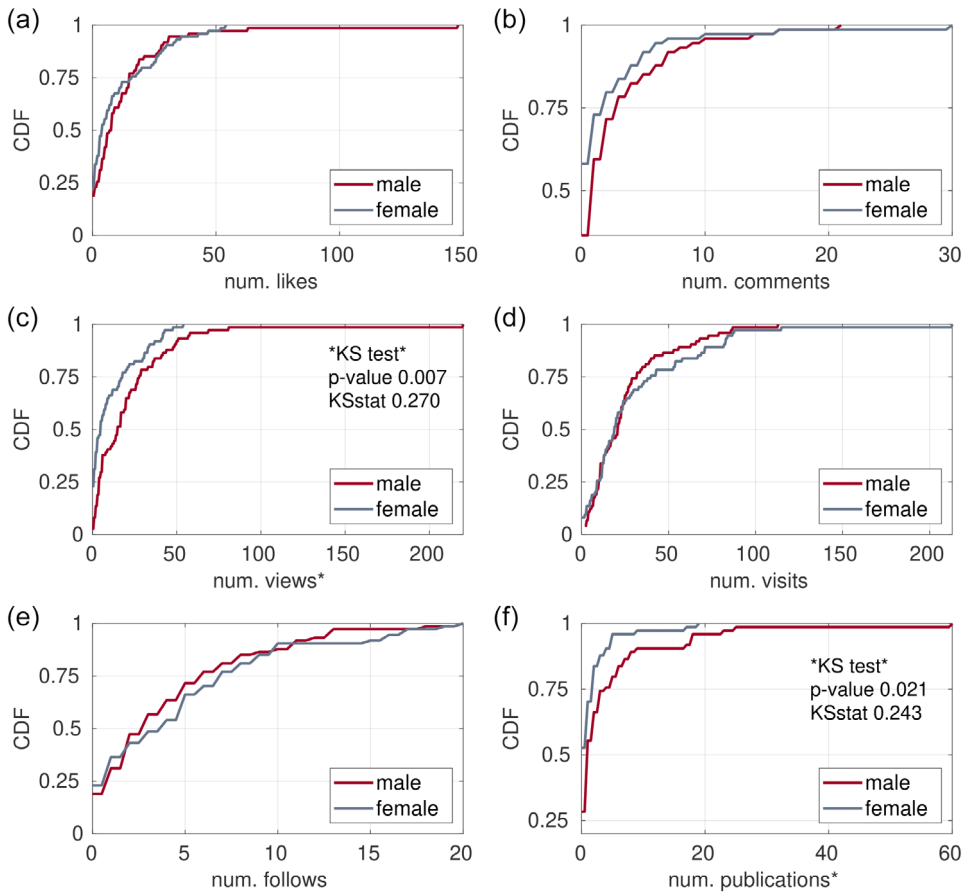


FIGURE 4 CDF graphs per gender and activity. The probability distributions of the number of views and published (a) and (f) were significantly different between male and female students. The other types of activity did not differ significantly in their distributions.

students (mFemale = 0.57, SD = 1.09, mMale = 1.17, SD = 2.26, $p < 0.05$). There were no significant differences in the variables of liking (mFemale = 3.8, SD = 6.09, mMale = 3.64, SD = 5.2, $p > 0.05$), commenting (mFemale = 0.57, SD = 1.13, mMale = 0.77, SD = 1.13, $p > 0.05$), following (mFemale = 1.67, SD = 1.75, mMale = 1.25, SD = 1.31, $p > 0.05$) and visiting profiles (mFemale = 11.12, SD = 12.32, mMale = 7.56, SD = 6.44, $p > 0.05$). Figure 3 summarises these results in the form of aggregated bar plots. Figure 4 shows the Cumulative Distribution Functions (CDFs) of each activity type for both males and females. The two-sample Kolmogorov–Smirnov test revealed only significant differences in viewing and publishing content, in agreement with the aggregated results.

To uncover additional patterns in social media interactions, we conducted an analysis of pairwise activities based on gender. This

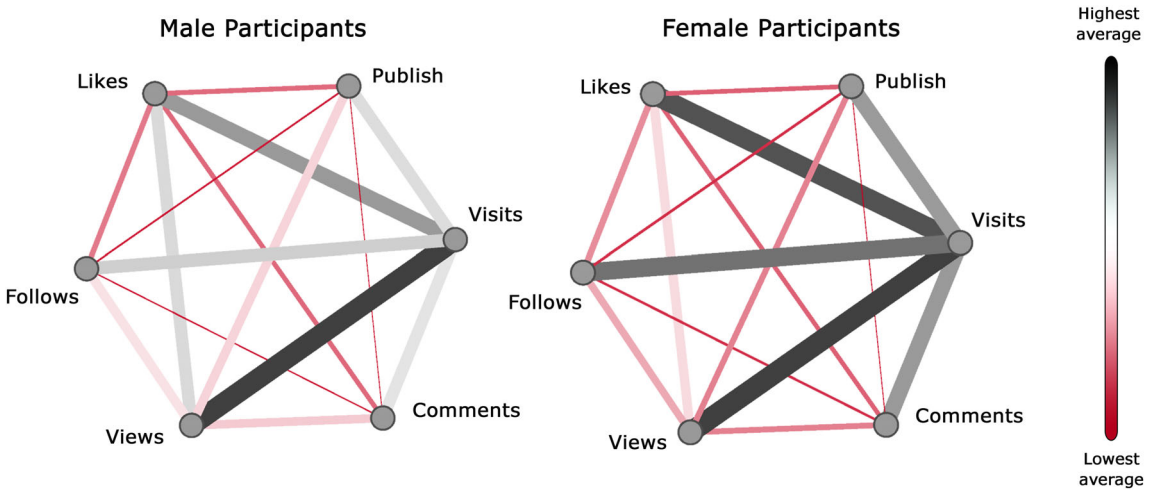
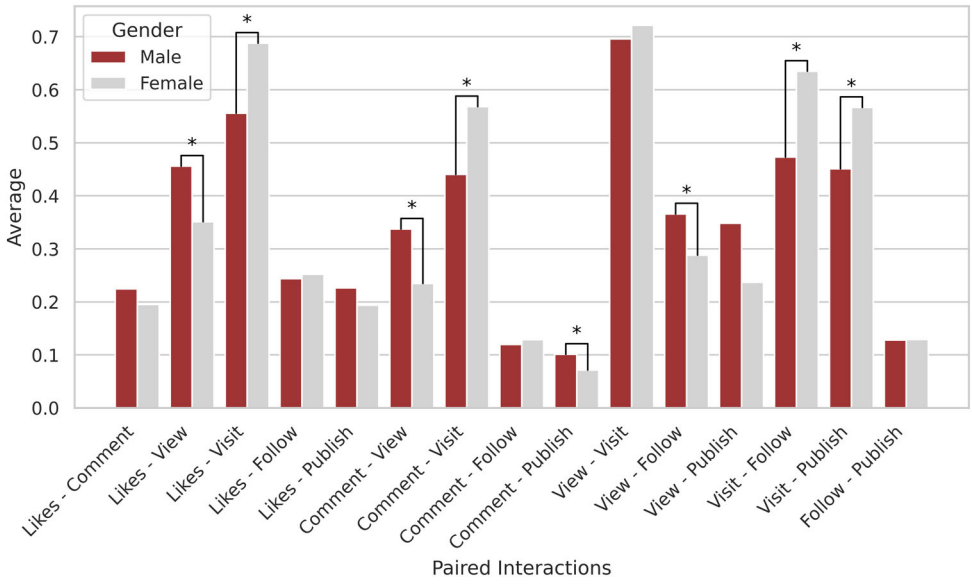


FIGURE 5 Pairwise analysis for each combination of types of activity for male (left) and female (right) students.

FIGURE 6 Pairwise analysis for each combination of types of activity for male and female students. Significant differences are depicted with an asterisk (*).



analysis provided additional insights into the behaviour of the students on their average session interactions (Figure 5).

Specifically, our findings revealed that female students were more inclined to engage in visiting profiles and liking posts compared to their male counterparts (Female = 0.69, Male = 0.56, $p < 0.05$). On the other hand, male students were found to view and like more photos compared to females (Female = 0.35, Male = 0.46, $p < 0.05$). Additionally, female students demonstrated a higher frequency of comments and profile visits (Female = 0.57, Male = 0.44, $p < 0.05$), while male students engaged more in commenting and viewing images (Female = 0.23, Male = 0.34, $p < 0.05$). The analysis also revealed that female students were more active in visiting profiles and following other users (Female = 0.63, Male = 0.47, $p < 0.05$), as well as visiting profiles and publishing content (Female = 0.57, Male = 0.45, $p < 0.05$). In contrast, male students exhibited a higher level of engagement in comments and publishing (Female = 0.07, Male = 0.101, $p < 0.05$), as well as viewing images and following other users (Female = 0.29, Male = 0.37, $p < 0.05$) (Figure 6).

5 | DISCUSSION

This study had a two-fold objective: first, to investigate the role of gender on skill development within an educational social media platform intervention (RQ1), and second, to explore the behavioural differences between male and female adolescents' social interactions within the platform (RQ2). In the following paragraphs we proceed to interpret the findings of the study.

RQ1 indicated that initially, female students demonstrated a higher level of SMSPS compared to male students. However, after the intervention, the disparity between the genders in terms of SMSPS diminished. Suggesting that the intervention had a levelling effect, reducing the initial difference between the genders in terms of SMSPS. Skill improvement was not significantly different between female and male students, consistent with prior research that found no gender-based differences in the effect of social media interventions (Gradinger et al., 2016; Rodríguez-de-Dios et al., 2021). This finding suggests that

using a controlled educational social media platform as a social media intervention tool does not disadvantage either gender in terms of skill development and can benefit both genders similarly.

Findings from RQ2 shed light on distinct interaction patterns observed between female and male students within the controlled educational social media platform. Overall, females and males were equally engaged in social interactions within the platform, with nearly 10,000 interactions recorded between them. An initial look into each individual interaction, revealed that male students published a significantly greater amount of content and viewed a significantly larger volume of content compared to female students. In our study, the act of viewing an image indicated that a photo was clicked with the aim to enlarge a thumbnail. On the contrary, female students had visited their peers' profiles significantly more often compared to male students. However the frequency of posting or viewing content did not significantly impact skill development, with both genders demonstrating similar skill growth consistent with previous studies that examined the impact of off-task behaviour on learning (Rowe et al., 2009).

To further identify gender-based interaction patterns, we performed a pairwise analysis of the different types of activity per gender. We found further significant differences between the two genders. Some interesting findings were that male students who published content were also more likely to engage with their peers' content by commenting on it, compared to female students. Moreover, male students who viewed content had a significantly higher frequency of leaving likes, commenting and following their peers. This suggests that male students were not only focused on self-expression through content creation but also sought to participate in the discussions and interactions happening within the platform. Nevertheless, the lower profile visiting behaviour suggests that male students were primarily drawn to the timeline section of the page, where they could consume and engage with visual content uploaded by their peers. Their behaviour suggests a desire to contribute to the ongoing conversations, fostering a sense of community.

Conversely, female students who published content were more inclined to visit their peers' profiles, compared to male students. Moreover, female students who visited profiles, demonstrated a higher frequency of leaving comments, following profiles and liking images compared to male students. This suggests that female students showed an interest in getting a broader understanding of the person behind the content and establishing connections beyond the specific post or interaction. Their behaviour suggests a desire to seek additional context through profile exploration, indicating a tendency for more thorough analysis of the information they interacted with.

After reviewing these findings, we proceeded to classify the recorded behaviours into two main categories: entertainment driven and socially driven, following established conventions in social media research (Hall, 2018; Lee et al., 2015). This categorisation placed profile visiting, following, and commenting in the socially driven category, while likes, browsing, and publishing were categorised as entertainment driven actions. Following this classification, our findings suggest that male students engaged significantly more into entertainment driven actions (view, publish) than female students. In contrast, female students engaged in more socially driven actions (visit, follow). This finding is aligned with previous findings of gender-based behaviours in social media that saw females being more socially driven than males (Lu & Hsiao, 2009; Lu et al., 2010; Narasimhamurthy, 2014; Noguti et al., 2019). This finding holds significant importance as it demonstrates that adolescents' behaviour within an educational social media platform mirrors gender-based behaviours observed on real social media platforms.

To summarise, our findings reveal that both male and female students engaged in social interactions on the platform, with distinct approaches. Female students exhibited a keen interest in exploring their peers' profiles, while male students relied more heavily on the content that appeared on their timelines. This suggests that male students adopted a more content-centric approach to their interactions, focusing primarily on the immediate content presented to them. In contrast, female students exhibited a greater tendency to seek additional context through profile exploration, indicating a preference for a more thorough analysis of the information they interacted with. Interestingly, our findings suggest that students exhibit similar behaviour patterns on the educational platform as they do on real social media platforms, indicating that the controlled educational environment does not significantly alter their interactions. This observation can be valuable for future research exploring human interactions on real social media platforms.

5.1 | Implications for future designs

Building upon the insights gained from this study we provide a set of recommendations for the future inclusion of social media aspects in educational platforms and the development of educational interventions for social media literacy.

5.1.1 | Inclusion of social media features in educational platforms

Our study's integration of social media features, such as creating posts, liking and commenting on others' content, and following peers, was embraced by students, fostering a sense of community through peer-to-peer interactions. Students actively created and shared their own content, and they eagerly explored the profiles of their classmates. These social media features did not hinder skill development and were utilised equally by both male and female students. However, it is important to note that it might be necessary to employ mechanisms to block social media features when learning modules are enabled as it can be distracting for students.

5.1.2 | Gender-based suggestions for social media education

Catering to students' observed behaviours within the platform, we propose a set of gender-tailored educational activities for social media education. By offering both types of activities in the classroom, we can

leverage the preferred interaction styles of both genders. For female students, incorporating activities that guide them to analyse a fictitious problematic profile and then provide opportunities for them to respond through relevant content reflection, likes, or follows can be particularly engaging. Whilst for male students, including activities within a timeline that depict different types of posts or images, followed by opportunities to reflect through posts, likes, or follows can be equally engaging. These suggested activities are aligned with the behavioural patterns of the students seen in this study.

5.2 | Limitations

Our study is subject to several limitations that should be acknowledged. First our results are based on an educational social media platform that was used during school hours. This controlled setting may have influenced students' behaviour, as they might have felt the presence of teachers and external observers, potentially leading to altered interactions. The interactions analysed had no connection to the educational activity; instead, they were recorded during students' free time during the intervention. These interactions could have been products of curiosity. Additionally, the restricted session times limited the possibility of collecting more data as students did not interact with the platform beyond the designated session times. In addition, the small sample size in our study limited our ability to conduct in-depth analyses and identify potential clusters of student behaviours within the data. This constraint restricted our ability to uncover more nuanced patterns or variations among students, and further research with larger sample sizes would be valuable in this regard.

Moreover, the participants in our study came from diverse socioeconomic and cultural backgrounds. Prior work has demonstrated that social media users from diverse backgrounds can influence intentions to use social media (Hsu et al., 2015; Oyeboade, 2017; Willekens et al., 2022), and this could have been a potential factor influencing their interactions within the platform. Further work in this line is needed to explore whether the socioeconomic backgrounds of the students have indeed influenced their interaction patterns within the simulated educational social media platform, as has been shown in real-world contexts.

Finally, it is important to note that the educational social media platform used in our study had limited features, focusing primarily on six social interactions. This restricted scope may have overlooked other important social media interactions, such as content re-sharing, messaging, and notification checking, which could have provided valuable insights into adolescents' overall social media behaviours. Future research could consider the analysis of a broader range of social media interactions to gain a more comprehensive understanding of student behaviours in a social media driven educational environment.

6 | CONCLUSION

In conclusion, our study examined gender-based skills development within an educational social media platform and explored adolescents' behaviour. Findings of this work have revealed several insightful findings. To begin with, both male and female students benefited from the intervention and an initial disparity between the genders in terms of social media self-protection skills was diminished after the intervention. Students' behavioural patterns showed that male participants adopted a more content-centric approach to their interactions, primarily focusing on the immediate content presented to them. Conversely, female participants exhibited a stronger tendency to seek additional context through profile exploration, indicating a preference for a more thorough analysis of the information they engaged with.

Moreover, our findings on user behaviour aligns with the observed behaviours of social media users, holding significant importance as it demonstrates that adolescents' behaviour within an educational social media platform mirrors gender-based behaviours observed on real social media platforms. However, it is important to note that these observations are specific to the context of our study and may not be generalised to all educational social media platforms, learning activities, or user populations. Further research is needed to explore the underlying factors and motivations driving these gender-based behaviour patterns. Understanding these distinct patterns can inform the design and implementation of educational interventions and social media platforms, taking into account the diverse needs and preferences of different user groups.

AUTHOR CONTRIBUTIONS

Emily Theophilou: Investigation; writing – original draft; formal analysis; data curation; conceptualization; methodology; visualization; software; resources. **Davinia Hernández-Leo:** Conceptualization; supervision; writing – review and editing; funding acquisition. **Vicenç Gómez:** Formal analysis; supervision; visualization; writing – review and editing.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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