

# Gender Differences in Italian Teachers' Readiness and attitudes Towards Game Integration in the Classroom

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**Abstract:** This research investigates Italian teachers' game-related competencies and attitudes towards game-based learning (GBL), examining how these relate to teachers' own gaming habits and whether they differ by gender. Teachers' knowledge of games is conceptualised through the Technological Pedagogical Content Knowledge-Games (TPACK-G) framework (Hsu et al., 2015), which distinguishes game knowledge (GK), game pedagogical knowledge (GPK), game content knowledge (GCK) and game pedagogical content knowledge (GPCK). Alongside these four competencies, we assess teachers' game experience (GE), their pedagogical intention to use games (GPI), their frequency of play across four digital and analogue activities, and their use of games in professional practice. Data were collected through a cross-sectional online survey of Italian primary and secondary teachers (N = 2,623). The analysis is descriptive and correlational: we report the distribution of TPACK-G competencies and gaming habits across the sample, the bivariate associations among competencies, gaming habits and professional game use, and gender comparisons using Mann-Whitney U and chi-square tests with accompanying effect sizes. Three findings stand out. First, the TPACK-G constructs are strongly intercorrelated and positively associated with teachers' gaming habits, game experience, pedagogical intention and classroom GBL practice, whereas school grade taught and teaching experience show weak, mostly negative associations. Second, teachers play games only occasionally, and least of all digital and experiential games; analogue board and card games are the only format where players outnumber non-players. Third, several gender differences reach significance owing to the large sample, but effect sizes are small to negligible throughout: male teachers report marginally higher game knowledge and digital-game play, whereas female teachers report a somewhat stronger intention to integrate games and slightly higher use of games in practice. We discuss the implications of these small but consistent gender differences for the design of teacher education strategies that build on teachers' existing relationship with games.

**Keywords:** Game-based learning, TPACK-G, Teacher competencies, Teacher attitudes, Italian education

## 1. Introduction

Game integration in formal education has evolved from a peripheral innovation to a mainstream pedagogical strategy supported by substantial evidence. Meta-analyses demonstrate that well-designed game-based learning (GBL) interventions enhance engagement, motivation, and learning outcomes (Clark et al., 2016; Connolly et al., 2012). Yet actual GBL adoption in K-12 classrooms remains uneven and often superficial (Bourgonjon et al., 2013). Teachers frequently cite barriers ranging from lack of technical competence to uncertainty about pedagogical integration strategies (Andreoletti et al., 2024a, 2024b; Ertmer, 1999). Understanding teachers' readiness for game integration therefore represents a critical research priority.

Teacher readiness for technology integration has been productively conceptualized through the Technological Pedagogical Content Knowledge (TPACK) framework, which posits that effective technology use requires the intersection of content knowledge, pedagogical knowledge, and technological knowledge (Mishra & Koehler, 2006). Recent extensions of this framework have specified game-based learning as a distinct technological domain, yielding the TPACK-G construct that differentiates Game Knowledge (GK), Game Pedagogical Knowledge (GPK), Game Content Knowledge (GCK), and Game Pedagogical Content Knowledge (GPCK) (Hsu et al., 2015). Parallel research has examined teachers' attitudes toward GBL through acceptance models derived from the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB), culminating in instruments such as the Acceptance of Game-Based Learning (AGBL) questionnaire (Bourgonjon et al., 2013; Dicaldo et al., 2025).

Despite these advances, systematic evidence on teachers' game-related competencies and attitudes at scale remains limited, particularly outside Anglophone contexts. Italy's teaching workforce is characterized by high average age, limited pre-service technology training, and institutional constraints on innovation (Andreoletti et al., 2024b). Prior Italian research documented positive attitudes toward GBL but weak predictive power of demographic variables ( $R^2 = .019$ ), suggesting that experiential factors matter more than individual characteristics (Andreoletti et al., 2024b). However, no large-scale study has simultaneously examined both

competencies (TPACK-G) and attitudes (AGBL) in the Italian context, nor investigated which teacher characteristics predict readiness for game integration.

## **2. Theoretical Background**

### **2.1 Foundations of Game-based Learning**

Game-Based Learning (GBL) refers to the use of digital or analogue games – including educational games, board games, and serious games – as instructional tools to support learning objectives (Plass et al., 2015; Prensky, 2001). The theoretical rationale draws on constructivist theories of active knowledge construction and situated learning (Gee, 2007), motivational theories highlighting intrinsic motivation through autonomy and competence (Qian & Clark, 2016), and cognitive theories of scaffolded practice and adaptive challenge (Clark et al., 2016).

Empirical evidence for GBL's effectiveness has grown substantially. Clark et al.'s (2016) meta-analysis of 69 studies found moderate positive effects on learning outcomes ( $d = 0.47$ ), moderated by design features, implementation quality, and alignment with objectives. Connolly et al.'s (2012) systematic review of 129 studies documented positive impacts on knowledge acquisition, skill development, and affective outcomes. Qian and Clark (2016) further emphasized games' promise for 21st-century skills including collaboration, critical thinking, and creativity.

However, the translation of this research evidence into widespread classroom practice has been slow and uneven. Bourgonjon et al.'s (2010) survey of secondary students found that while students perceived games as engaging and motivating, they rarely encountered games in formal instruction. Subsequent research has identified teachers as the critical bottleneck: teachers' beliefs, competencies, and institutional constraints shape whether and how games enter classrooms (Bourgonjon et al., 2013). This realization has shifted research attention from game design and learning outcomes to teacher readiness and professional development.

### **2.2 The TPACK-G Framework**

The Technological Pedagogical Content Knowledge (TPACK) framework, introduced by Mishra and Koehler (2006), conceptualizes effective technology integration as requiring the intersection of Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK), whose interactions produce integrated knowledge types culminating in TPACK itself. This framework has become the dominant lens for understanding teacher technology competencies (Koehler & Mishra, 2009).

Recognizing that different technologies afford different pedagogical possibilities and require different competencies, researchers have developed domain-specific extensions of TPACK. The TPACK-G framework, proposed by Hsu et al. (2015), specifies the knowledge components necessary for effective game-based teaching. TPACK-G distinguishes four primary dimensions:

1. Game Knowledge (GK): Understanding of game mechanics, genres, platforms, and technical operation - analogous to general TK but specific to games.
2. Game Pedagogical Knowledge (GPK): Knowledge of how games can support pedagogical strategies such as scaffolding, differentiation, assessment, and classroom management - analogous to TPK but game-specific.
3. Game Content Knowledge (GCK): Understanding of how game content aligns with curriculum standards and learning objectives in specific subject areas - analogous to TCK but game-specific.
4. Game Pedagogical Content Knowledge (GPCK): Integrated knowledge of how to select, adapt, and orchestrate games to teach specific content to specific learners in specific contexts - the apex of game-related teacher knowledge, analogous to TPACK.

Empirical research has validated the TPACK-G construct. Hsu et al.'s (2015) study of 345 Taiwanese teachers found TPACK-G dimensions positively associated with intentions to use games, with GPCK showing the strongest relationship. Their (2020) structural equation modelling study revealed that beliefs about game-based teaching predicted TPACK-G perceptions, which in turn predicted GBL implementation intentions. Renati et al. (2025), studying 170 Italian in-service teachers, found TPACK-G positively correlated with digital self-efficacy and AGBL attitudes, with GPCK as a key mediator.

The TPACK-G framework has important implications for teacher education. It suggests that effective professional development must go beyond introducing teachers to game titles (GK) or generic pedagogical strategies (PK) to explicitly address the integration of games with subject-specific pedagogy (GPCK). Cantoia et al.'s (2023) experimental study of a teacher training program found that explicit instruction in game selection, adaptation,

and pedagogical orchestration significantly improved teachers' TPACK-G competencies and their ability to design effective game-based learning activities.

### **2.3 Acceptance of Game-based Learning (AGBL)**

While TPACK-G addresses competencies, a parallel tradition has examined teachers' acceptance of GBL through the Technology Acceptance Model (TAM; Davis, 1989) and Theory of Planned Behavior (TPB; Ajzen, 1991). TAM posits that adoption is predicted by perceived usefulness and ease of use, influenced by system and user characteristics; TPB adds subjective norms and perceived behavioural control as predictors of intentions.

Bourgonjon et al. (2013) adapted these frameworks to model secondary teachers' GBL acceptance. Their survey of 858 Flemish teachers found perceived usefulness as the strongest predictor of acceptance, followed by ease of use and subjective norms. Personal gaming experience significantly predicted both perceived usefulness and ease of use, suggesting that experiential familiarity shapes acceptance. Teachers also perceived significant institutional barriers (time, resources, curriculum fit) constraining intentions to use games even when attitudes were positive.

Building on this work, Dicaldo et al. (2025) developed the Acceptance of Game-Based Learning (AGBL) questionnaire to measure teachers' attitudes toward GBL. From this tradition the present study draws on two dimensions that complement the four TPACK-G competencies:

- Gaming Experience (GE): teachers' personal experience with games, including frequency of play, familiarity with genres, and comfort with game mechanics.
- Game Pedagogical Intention (GPI): teachers' general attitude towards, and stated intention to use, games as legitimate tools for formal instruction.

Dicaldo et al.'s (2025) validation study with 2,752 Italian teachers found excellent psychometric properties for the AGBL instrument ( $\alpha > .88$  for all subscales). Notably, demographic variables (age, gender, seniority) explained only 1.9% of the variance in AGBL attitudes, while school level showed significant effects, with early childhood and primary teachers reporting more positive attitudes than secondary teachers.

#### **2.3.1 The Italian context**

The Italian educational system presents distinctive characteristics that shape teachers' readiness for GBL integration. Italy's teaching workforce is among the oldest in Europe, with an average age exceeding 50 years and limited turnover due to tenure protections and pension structures (Castellano & Vecchione, 2024). Pre-service teacher education in Italy has historically provided limited technology training, and in-service professional development opportunities are often fragmented and under-resourced. These structural factors may constrain teachers' exposure to digital innovations including GBL.

Prior research on Italian teachers' technology attitudes has yielded mixed findings. Some studies document enthusiasm for digital tools, particularly among younger and primary teachers (Andreoletti et al., 2024b). Others highlight persistent gaps in digital competencies, low self-efficacy, and institutional barriers such as inadequate infrastructure (Loperfido et al., 2019).

GBL-specific research is limited but growing. Andreoletti et al.'s (2024b) survey of 2,752 teachers found that while teachers recognized games' potential, actual classroom use remained limited. School level was the only demographic variable significantly predicting AGBL attitudes ( $R^2 = .019$ ), with early childhood and primary teachers more positive than secondary teachers, possibly reflecting differences in curriculum flexibility and assessment pressures. Renati et al.'s (2025) study found positive correlations between TPACK-G competencies, digital self-efficacy, and AGBL attitudes, suggesting that competence and confidence are mutually reinforcing.

Qualitative research provides additional insights into Italian teachers' perspectives on GBL. Case studies document that teachers often view games through the lens of traditional pedagogical goals (e.g., drill-and-practice for skill reinforcement) rather than as tools for inquiry, collaboration, or creative expression (Andreoletti et al., 2024b). Teachers express concerns about classroom management, assessment alignment, and the perceived frivolity of games in formal education. However, teachers who participate in structured professional development report increased confidence and more sophisticated understandings of games' pedagogical potential (Cantoia et al., 2023).

### 3. Research aim and Research Questions

This study aims to provide large-scale, descriptive evidence on Italian teachers' game-related competencies (TPACK-G), their personal gaming habits, and their attitudes towards game integration, and to examine how these relate to one another and vary by gender. We address three research questions:

*RQ1: What is the profile of Italian teachers' game-related competencies and gaming habits?*

*RQ2: How do Italian teachers' gaming habits relate to their perceived game-related competencies (TPACK-G), game experience (GE) and game pedagogical intention (GPI)?*

*RQ3: Which factors influence Italian teachers' game-related competencies and gaming habits?*

By addressing these questions, we aim to provide evidence that can inform teacher education policy and professional development design and lay the groundwork for future explanatory research on GBL implementation.

### 4. Method

#### 4.1 Research Design

This study employed a cross-sectional survey design. We administered an online questionnaire assessing demographic characteristics, professional game use, TPACK-G competencies, and AGBL attitudes. The survey was distributed through Italian teacher professional networks, social media groups, and educational organizations between September 2023 and March 2024. Participation was voluntary and anonymous.

#### 4.2 Sample

The final sample comprised 2,623 Italian teachers who provided complete responses on all TPACK-G and AGBL items. Table 1 presents sample demographics.

**Table 1: Sample Demographics (N = 2,623)**

| Characteristic        | Category                  | n     | %     |
|-----------------------|---------------------------|-------|-------|
| Gender                | Female                    | 2,308 | 81.9% |
|                       | Male                      | 510   | 18.1% |
| School Level          | Early Childhood           | 198   | 7.0%  |
|                       | Primary                   | 603   | 21.4% |
|                       | Lower Secondary           | 1,095 | 38.7% |
|                       | Upper Secondary           | 924   | 32.9% |
| Geographic Region     | Northern Italy            | 1,098 | 39.0% |
|                       | Central Italy             | 364   | 12.9% |
|                       | Southern Italy & Islands  | 1,356 | 48.1% |
| Professional Game Use | Regularly                 | 631   | 22.4% |
|                       | Occasionally              | 1,578 | 56.0% |
|                       | Rarely                    | 451   | 16.0% |
|                       | Never                     | 158   | 5.6%  |
| Age                   | M = 44.7 years (SD = 7.9) |       |       |
| Teaching Experience   | M = 16.8 years (SD = 9.2) |       |       |

The sample is predominantly female (81.9%), consistent with the gender distribution of the Italian teaching workforce. The sample is heavily weighted toward lower and upper secondary teachers (71.6%), with smaller representation from early childhood (7.0%) and primary (21.4%) levels. Geographic distribution shows overrepresentation of Southern Italy (48.1%) relative to national proportions. The mean age of 44.7 years is slightly below the national average for Italian teachers.

Professional game use shows a positively skewed distribution: 22.4% of teachers report using games regularly in their teaching, 56.0% occasionally, 16.0% rarely, and only 5.6% never. This distribution suggests that while complete non-use is uncommon, sustained regular use remains a minority practice.

### 4.3 Instruments

#### 4.3.1 TPACK-G questionnaire

The TPACK-G instrument assessed four dimensions of game-related teacher knowledge, adapted from Hsu et al. (2015) and translated into Italian. The instrument comprised 13 items rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree):

- Game Knowledge (GK): 3 items assessing familiarity with game mechanics, genres, and technical operation (e.g., "I am familiar with different types of digital games and their characteristics").
- Game Pedagogical Knowledge (GPK): 3 items assessing knowledge of pedagogical strategies for game integration (e.g., "I know how to use games to support different learning styles").
- Game Content Knowledge (GCK): 4 items assessing understanding of how games align with curriculum content (e.g., "I can identify games that are appropriate for teaching specific topics in my subject area").
- Game Pedagogical Content Knowledge (GPCK): 3 items assessing integrated knowledge of game-based teaching (e.g., "I can design learning activities that effectively integrate games with my teaching objectives").

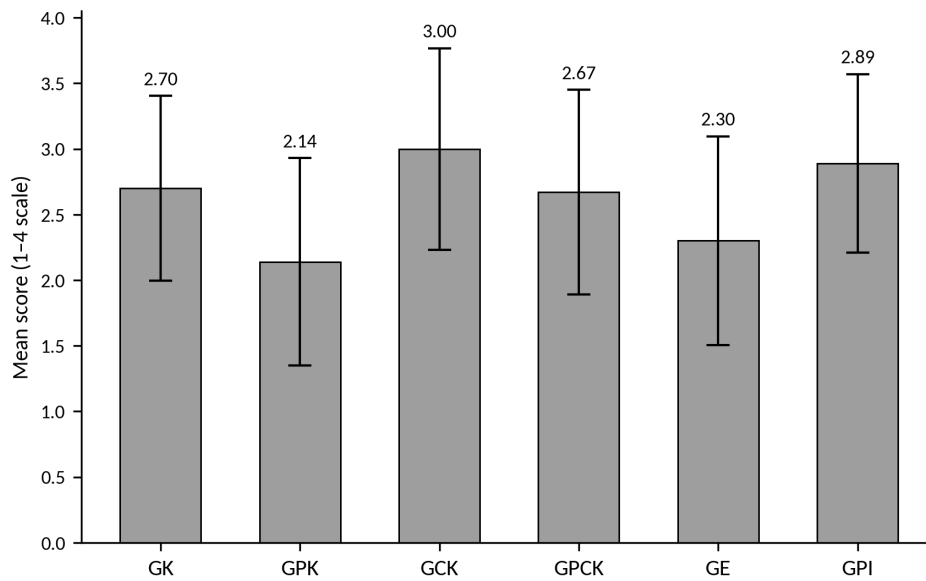
#### 4.3.2 AGBL questionnaire

From the AGBL instrument (Dicataldo et al., 2025) we retained the two dimensions used in the present analysis, each rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree):

- Game Pedagogical Intention (GPI): 5 items assessing teachers' general attitude towards and intention to use games as tools for formal education (e.g., "Games are legitimate tools for formal education").
- Gaming Experience (GE): 5 items assessing personal gaming experience (e.g., "I regularly play digital games in my personal time").

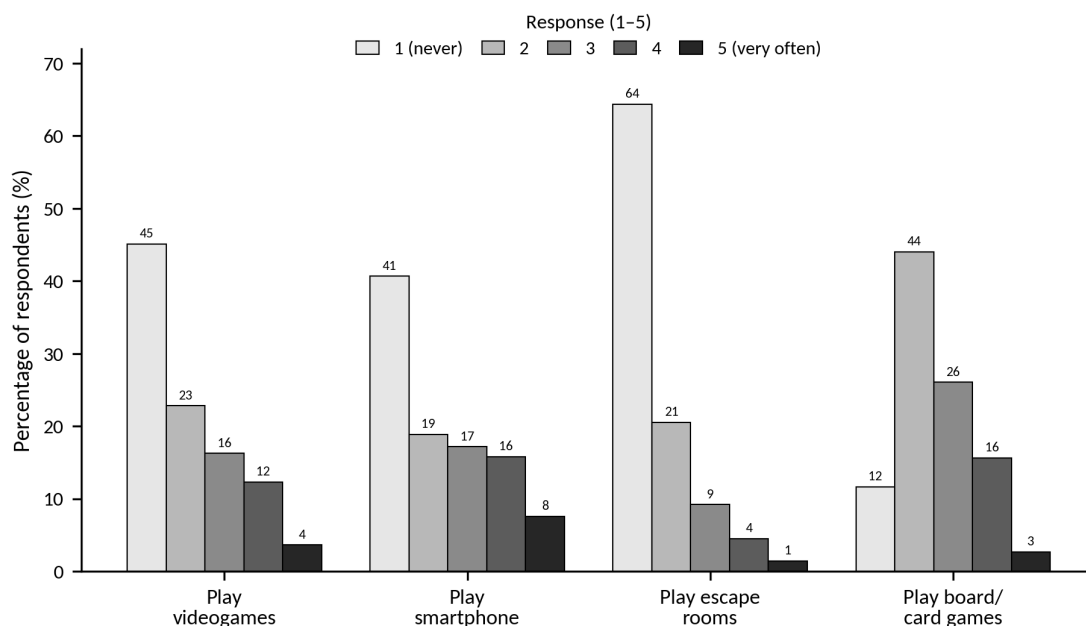
## 5. Results

First, we sought to understand teachers' perception of their own game-related competencies, intention to use games in educational settings and general gaming experience. Figure 1 presents the distribution of TPACK-G and select AGBL items across the entire sample. On the 1–4 scale, Game Content Knowledge (GCK) is the highest-rated construct ( $M = 3.00$ ,  $SD = 0.77$ ) across the TPACK-G, followed by Game Knowledge (GK;  $M = 2.70$ ,  $SD = 0.70$ ) and Game Pedagogical Content Knowledge (GPCK;  $M = 2.67$ ,  $SD = 0.78$ ). , whereas Game Pedagogical Knowledge (GPK;  $M = 2.14$ ,  $SD = 0.79$ ) is the lowest. In parallel, the relatively high pedagogical intention ( $M = 2.89$ ,  $SD = 0.68$ ) coexists with low gaming experience (GE;  $M = 2.30$ ,  $SD = 0.80$ ). Taken together, these data suggest that teachers, in general, feel most confident about the content of games and least confident about the pedagogical knowledge required to use them in teaching, while their personal experience with games is correspondingly limited, suggesting a willingness to adopt games that is not yet matched by the competencies to do so.



**Figure 1: Mean scores on the six constructs (1–4 scale). Error bars represent  $\pm 1$  standard deviation (N = 2623)**

Next, our aim was to better understand how often teachers play games and their favourite game types. Figure 2 shows the percentage distribution of self-reported gaming-habit frequencies (1 = never to 5 = daily or more than once per day; N = 2623) across the four activities. What emerges is a strong skew towards low frequency, more pronounced for the digital and experiential activities. Escape rooms are the least practised: 64% of respondents chose "never" and a further 21% the next-lowest level, leaving barely 6% at the two highest points combined. Videogames follow a similar shape, with 45% at "never" and only 3.6% reporting engaging with videogames daily. Smartphone gaming is the most evenly spread of the four — although "never" is still the modal response (41%), the distribution flattens out and retains the largest quote of daily gamers (7.5%). Board and card games are the only activity whose distribution does not peak at "never": 44% of the interviewed teachers reporting playing once a year or less, with just 11.7% reporting "never" and roughly 44% clustered at levels 3–5. This makes them the most habitually played format, although engagement with games remains occasional overall.



**Figure 2: Percentage distribution of self-reported gaming-habit frequencies (1 = never to 5 = daily or more than once per day; N = 2623)**

To understand the potential relationship between teachers' gaming habits and their perceived competencies and intention towards educational use of games, we checked for correlations across the different variables. Figure 3 displays the lower-triangle correlation matrix of the study variables for the entire sample. Several patterns stand out.

First, the TPACK-G sub-constructs show strong correlation between each other ( $p < .001$  for all correlations); the strongest correlation is between GCK and GPCK ( $r = .65$ ), followed by GPCK–GPK ( $r = .54$ ) and GK–GPK ( $r = .53$ ). This supports the constructs belonging to a single underlying framework but remaining empirically distinct.

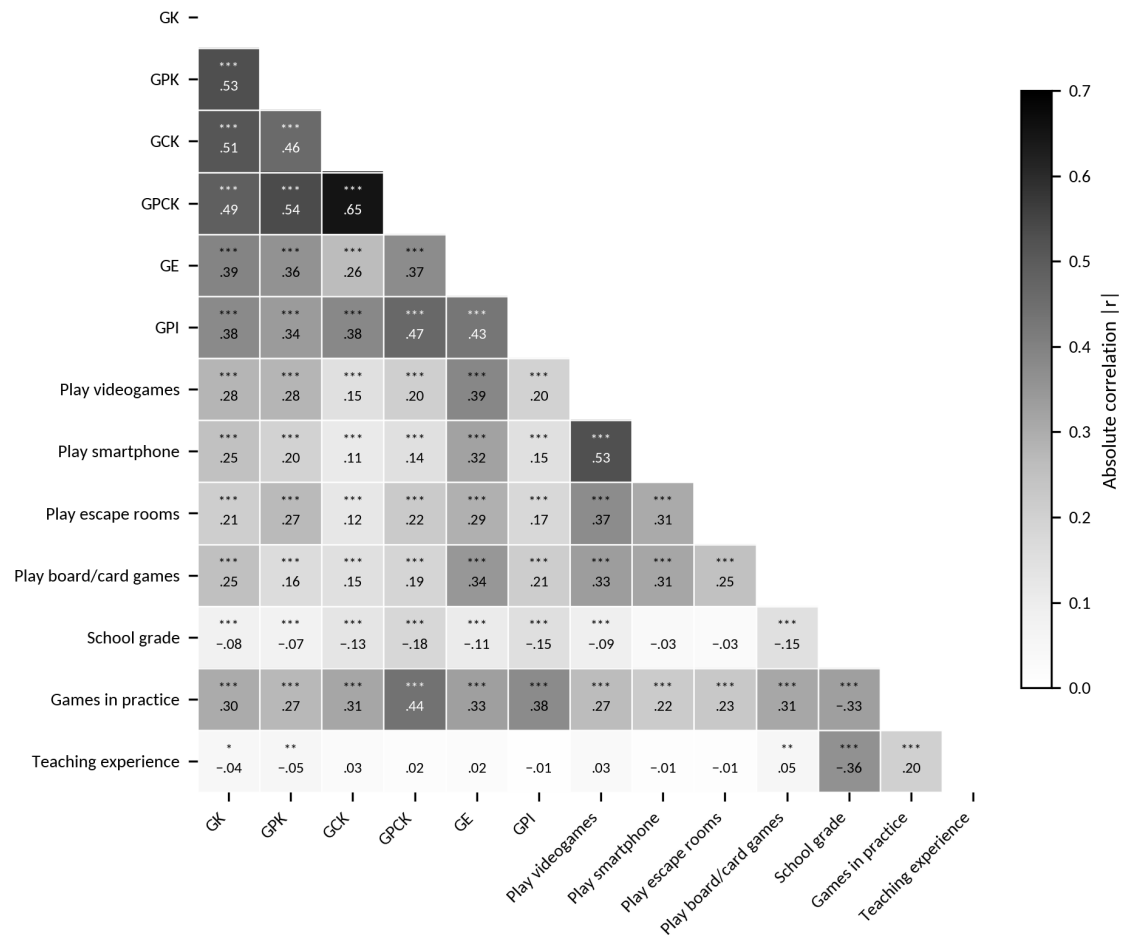
Second, select AGBL items Game Experience (GE) and Game Pedagogical Intention (GPI) are significantly and positively correlated between each other ( $r = .43$ ) and TPACK-G constructs, with medium-to-strong correlations, the highest being between GPI and GPCK ( $r = .47$ , perhaps indicating that being strongly motivated in using games drives better knowledge of the pedagogical content of games, and vice versa).

Third, the four gaming-habit variables correlate positively with all constructs but more modestly ( $r \approx .11-.39$ ). As expected Game Experience (GE) shows the tightest links to actual play — especially videogames ( $r = .39$ ) and board/card games ( $r = .35$ ). On the other side, GPI and TPACK-G have weak correlation with gaming habits, suggesting that gaming habits in everyday life have a limited influence on the development of game-related pedagogical competencies.

Fourth, gaming-habit variables cluster together, indicating that teachers who play games more often tend to play different kind of games. Whereas board and card games have a medium correlation with other types of gaming, videogames and smartphone games show a strong correlation ( $r = .53$ ), indicating that teachers who play digital games tend to do so across different platforms.

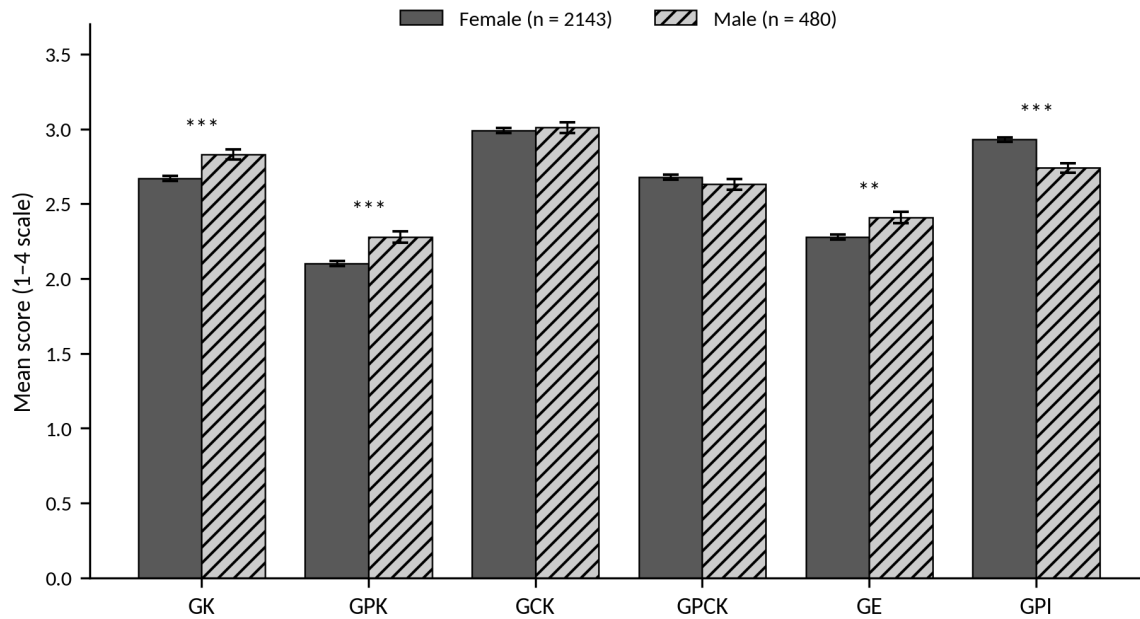
Fifth, school grade taught and teaching experience show weak, mostly negative associations with TPACK-G constructs and gaming habits; at the same time, they correlate negatively with professional game use ( $r = -.33$  and  $-.36$ , respectively), indicating that respondents at higher school grades and with more teaching experience report using games somewhat less.

Finally, professional use of games ("Games in practice") is the covariate most consistently associated with the constructs, correlating positively with every dimension and most strongly with GPCK ( $r = .44$ ) and GPI ( $r = .38$ ), suggesting that GBL knowledge goes hand in hand with actually deploying games in teaching. Taken together, these observations indicate that teachers' perceived GBL competencies show strong internal cohesion and are positively associated with their gaming habits, be they digital or analogue, with game experience and pedagogical intention, and with classroom GBL practice, while being largely independent of professional variables. This profile confirms previous observations (e.g. Persico et al., 2019) that teachers' relationship with GBL depends on the individual teacher's relationship with games and is basically independent of school grade and teaching experience.



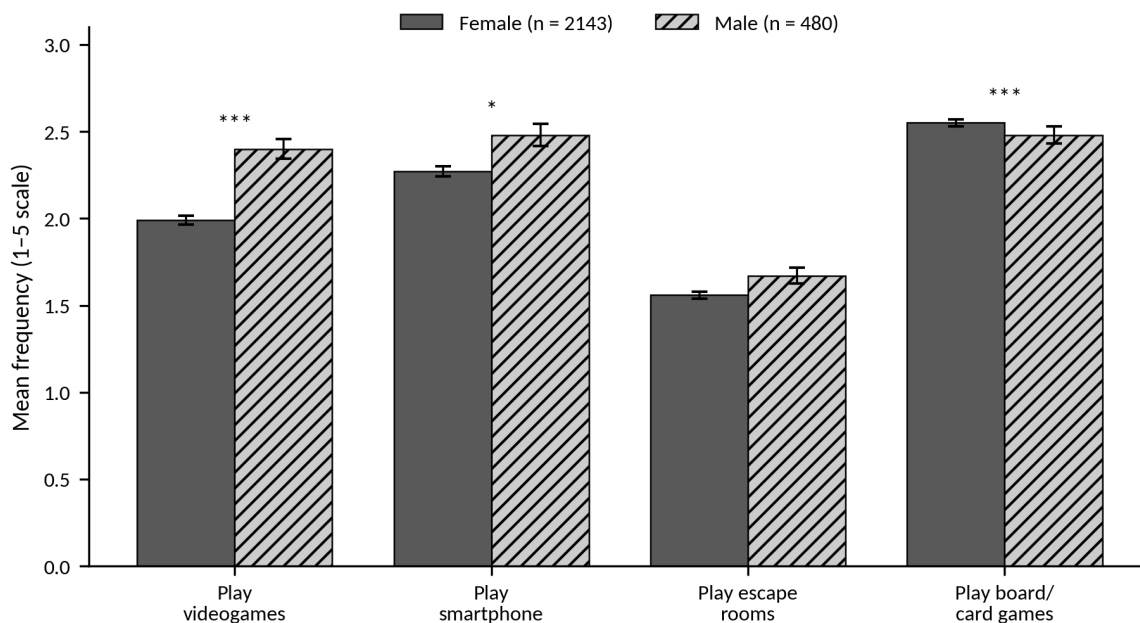
**Figure 3: Lower-triangle correlation matrix of the study variables using Spearman's Rho. Cell shading represents the absolute correlation magnitude. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$  (two-tailed)**

The correlation analysis above accounts for school grade and teaching experience, but not for gender. The sample collected presents, as is often the case in Italy, a majority of female teachers (81.9% across all school levels); however, the sample is large enough to allow comparison of construct means by gender. Notably, male and female teachers do not differ significantly in mean age ( $p = .27$ , Mann–Whitney U), although female teachers tend to have, on average, slightly more teaching experience (2.78 vs 2.64,  $p = .002$ ). When compared on the six constructs (Figure 4), slight but significant differences emerge. Male teachers report higher Game Knowledge (GK; 2.83 vs 2.67,  $p < .001$ ), Game Pedagogical Knowledge (GPK; 2.28 vs 2.10,  $p < .001$ ) and Game Experience (GE; 2.41 vs 2.28,  $p = .002$ ). No significant differences were found for the two content-oriented constructs: Game Content Knowledge (GCK; 2.99 vs 3.01,  $p = .663$ ) and Game Pedagogical Content Knowledge (GPCK; 2.68 vs 2.63,  $p = .253$ ), where the two groups scored almost identically. The pattern is reversed for Game Pedagogical Intention (GPI), where female teachers scored higher (2.93 vs 2.74,  $p < .001$ ). Crucially, although several of these differences reach statistical significance, their effect sizes are small to negligible (rank-biserial  $r \leq .10$ ), so they should be read as slight tendencies rather than substantial divides: a modest male advantage in general game knowledge and personal game experience, and a modest female advantage in the intention to integrate games pedagogically.



**Figure 4: Mean scores on the six constructs by gender. Error bars represent  $\pm 1$  standard error. \*\*  $p < .01$ , \*\*\*  $p < .001$  (Mann–Whitney U)**

Lastly, we compared gaming habits by gender (Figure 5). Because the bars display group means whereas the chi-square tests assess distributional association, means are reported here for descriptive purposes and the significance markers refer to the chi-square tests. Significant gender differences emerged for three of the four habits. The largest concerned videogames (2.40 vs 1.99,  $p < .001$ ), followed by smartphone gaming (2.48 vs 2.27,  $p < .05$ ), both more frequent among men. Board/card games also differed significantly ( $p < .001$ ), but here the direction was reversed and the gap minimal, with women reporting marginally higher frequency (2.55 vs 2.48); escape rooms showed no significant difference ( $p = .082$ ). Here too the effect sizes are small (Cramér's  $V \leq .14$ ). Overall, men report playing digital games more often than women, whereas the two groups converge on the analogue formats.



**Figure 5: Self-reported gaming frequency by gender. Bars show group means and error bars represent  $\pm 1$  standard error; significance markers refer to chi-square tests of the association between gender and the full response distribution (1–5), not to the difference in means. \*  $p < .05$ , \*\*\*  $p < .001$  (chi-square)**

## 6. Discussion

This study puts in relationship Italian teachers' self-reported knowledge and attitudes towards games and game pedagogy (TPACK-G) with their own gaming habits, professional and individual variables. The emerging picture is that, game-related pedagogical competence, experience with using games (GE) and pedagogical intention of using games (GPI) are all intercorrelated and positively correlated with gaming habits, teachers within the sample play very occasionally, and even less with digital and experiential games. These findings corroborate, although with a more robust tool and a much larger sample, previous studies on Italian teachers' relationship with GBL and gaming (Cantoia et al., 2023; Loperfido et al., 2019; Persico et al., 2019). What this study adds to the state of the art is a consistent, if modest, difference in attitudes towards GBL and gaming habits between male and female teachers. It should be stressed that, although several of these gender differences reached statistical significance, this is largely a function of the large sample: effect sizes were small (rank-biserial  $r \leq .13$ ; Cramér's  $V \leq .14$ ), so the differences should be read as slight tendencies rather than substantial divides. The most robust differences concerned videogame play ( $r = .13$ ), pedagogical intention to use games (GPI,  $r = .10$ ) and professional game use ( $r = .10$ ). Within these limits, female teachers report marginally lower confidence in Game Knowledge (GK) and Game Pedagogical Knowledge (GPK) while appearing somewhat more inclined to integrate games in their classroom activities (GPI) than their male colleagues. The gaming diet of female and male teachers also differs, with women playing digital games (both smartphone and videogames) less frequently and analogue board/card games slightly more. Taken together, these indications are consistent with a somewhat different orientation towards GBL: male teachers appear more accustomed to digital games but no more inclined — and possibly slightly less — to translate this into classroom activity, whereas female teachers report less familiarity but a marginally stronger intention to bring games, especially analogue ones, into teaching. Because these effects are small and the design is cross-sectional, we advance the following as hypotheses for future work rather than as established prescriptions. Understanding the interplay between teachers' individual experience with games and their professional attitudes towards GBL may help design more effective teacher education programmes — a longstanding challenge, as many GBL training programmes fail to achieve long-lasting uptake (Andreoletti et al., 2024b; Cantoia et al., 2023) — for instance by expanding teachers' gaming habits in line with their existing preferences and attitudes, and by helping them reflect on the educational potential of the games they already engage with. In this perspective, the small gender differences observed here suggest that mixed teacher groups might be explored as a resource for peer learning, tentatively pairing male teachers' greater familiarity with digital gaming and female teachers' greater readiness to translate personal experience into classroom practice. More broadly, the central implication of these findings is that teachers' engagement with GBL is shaped substantially by individual differences — their personal gaming habits, their experience with using games in educational settings, their pedagogical intention, and, as shown here, their gender. Precisely because these individual factors weigh more heavily than professional variables such as school grade or teaching experience, one-size-fits-all training, which treats teachers as an undifferentiated audience, is unlikely to be effective. The evidence instead points towards the need to design personalised professional development that starts from each teacher's existing profile — valuing the inclinations, preferences and competencies they already bring — and builds on them, rather than imposing a uniform model of what game-based teaching should look like. Gender, in this reading, is not a category to design separate programmes around, but one of several individual dimensions that a well-designed, adaptive training pathway should be able to accommodate.

The results of this study, although novel and based on a methodologically sound survey and a large sample, should be treated as indicative rather than conclusive. First, the study is based on a convenience sample, which limits the generalisability of the findings. Second, being based on teachers' self-reports, it captures perceptions that may not accurately mirror actual classroom practice or competence. Third, the sample is markedly unbalanced by gender, comprising 81.9% women and 18.1% men. This imbalance is, however, a common and largely unavoidable feature of survey research with teachers, since it reflects the strong female majority of the Italian (and wider European) teaching workforce; rather than a flaw specific to this study, it mirrors the population itself. Importantly, the overall size of the sample means that even the smaller male subgroup ( $n = 480$ ) is large enough to support statistically meaningful comparisons, which is a genuine strength relative to most previous studies in this area. Nonetheless, the estimates for male teachers are necessarily less precise than those for their female colleagues, and the gender comparisons should be read with this asymmetry in mind. Fourth, several gaming-habit variables show a pronounced floor effect (particularly videogames and escape rooms), which compresses their variance and may attenuate their correlations with the other constructs; the modest associations reported here should therefore be regarded as conservative. Finally, the cross-sectional design precludes any causal interpretation: the associations we report are compatible with several underlying

processes, and the training implications we advance are hypotheses to be tested in future intervention and longitudinal research.

**Ethics Declaration:** The data collected through the questionnaire comply with ethical standards for the treatment of personal data. All participants were informed about the purpose of the study, and their participation was entirely voluntary. Informed consent was obtained, and all responses were anonymized to ensure confidentiality. The study adheres to relevant data protection regulations and ethical guidelines governing research involving human participants.

**AI Declaration:** Artificial intelligence (AI) tools were used to support the preparation of this manuscript. Specifically, AI language models were employed to assist in the revision and refinement of certain sections of the text, including improving clarity and coherence. Additionally, SciSpace was utilized to aid in the literature search and bibliographic exploration. The authors maintained full responsibility for the final content, interpretation, and conclusions presented in the paper.

**Authors' Contributions:** The article is the result of a joint work of all the authors. The sections 1 and 2 ("Introduction" and "Theoretical background") were written by Massimiliano Andreoletti, sections 3, 4 and 5 ("Research aim and research questions", "Method" and "Results") were written by Andrea Tinterri and the section 6 ("Discussion") was written by Anna Dipace.

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