

Game at School? Italian Teachers' Perceptions of the Introduction of Games in the Classroom

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Abstract: The growing awareness that games can be a very valuable training support, both as a resource to engage and motivate and to promote acquisition of disciplinary knowledge and skills, has not been accompanied by an effective diffusion of games in Italian schools. From primary school to university, an ambivalent behaviour is manifested: a widespread appreciation of games as a learning environment is contrasted with a limited application, often reduced to the use of games or online software of a behavioural matrix. An analysis of research on the use and diffusion of games in Italian schools and universities highlights the lack of recent studies on the basic didactic-pedagogical knowledge, level of acceptance and confidence of teachers regarding the introduction of games in the classroom. The goal of this contribution is to provide an updated understanding of Italian teachers' competencies related to the formative use of games. To this aim, we developed a survey adapting to the Italian context one of the most established competence frameworks for game-based learning (GBL): the Technological Pedagogical Content Knowledge-Games (TPACK-G), a variant of TPACK specifically modified for the analysis of games. This new tool extends to non-digital games and integrates the sections on aspects related to game-based instructional design, game scenarios, and the role of the teacher in the instructional activity. This research will not only provide an updated look at how the prevalence of play in the classroom is changing, beyond simple manifestations of interest and trends, but also reveal how the approach to games is changing in the design of educational activities and what is the degree of awareness of the game pedagogical-educational skills necessary for the introduction of games in education. This, in turn, is instrumental for the development of new and more focused teacher training programs to promote the use of games in classrooms.

Keyword: Game-Based Learning (GBL), Italian School, Quantitative Research, Teachers' Perceptions of Classroom Game; Teachers' Attitudes toward Classroom Games, Technological Pedagogical Content Knowledge-Games (TPACK-G).

1. Introduction

The relationship between gaming, teaching, and learning has developed over centuries. Just think of games such as Mancala, which has facilitated people in learning the best strategies for counting livestock and food for almost 4000 years, or Chess, which has challenged strategists for centuries (Laamarti et al., 2014; Parlett, 2018).

What has been witnessed in the last two decades is the increasing attention of educational research towards the characteristics and outcomes that play takes on in the educational setting. Games offer an engaging experience, providing essential features for effective learning (Marengo et al., 2018) and language acquisition (Quy, 2019); the integration of games as part of learning increases learner engagement when traditional teaching methods are used (Sanchez et al., 2011; Shute et al, 2017). Game-Based Learning (GBL) and its digital declination (DGBL) have become central to training programs targeting different sectors, such as education, military, transport, communications, and healthcare (Ongoro and Fanjiang, 2024; Ullah et al, 2022). GBL, in a narrow sense, is the use of games, analogue or digital, within the context of learning; in a broader definition, which is the one adopted in this study, it can also be understood as an approach in which learning goals and tasks are integrated into game activities with the aim of linking formative goals with playful objectives (Andreoletti and Tinterri, 2023), so that the pursuit of the latter promotes the achievement of the former.

Research has highlighted how within the school context games can be used to support learning (Beavis et al., 2014; Clark et al., 2016; Stufft, 2018; Stufft and von Gillern, 2021; von Gillern et al, 2022), to promote students' critical thinking and metacognition (von Gillern and Stufft, 2023), game analysis (Bacalja, 2018), multimodal composition (McClay et al., 2007) and collaborative problem solving and design work (Gerber et al, 2014). These different forms of implementation of play within the curriculum have been shown to have a positive impact on student learning (Nash and Brady, 2022): in all contexts, researchers have reported increased student engagement (Gerber et al., 2014), changes in approach to disciplines (Marlatt, 2018), complex analytical thinking (Beavis et al., 2015) and design thinking and multimodal composition (Nash and Brady, 2022, Nash, 2021; Stufft and von Gillern, 2021).

A second strand of investigation has focused on teachers' readiness, willingness and competence to introduce play within their instructional activities (Assaf et al., 2021; Bourgonjon et al., 2010; Chang and Tsai, 2014; Hamari and Nousiainen, 2015; Hayak and Avidov-Ungar, 2020; Hsu et al., 2013, 2017; Jesmin and Ley, 2020; Kaimara et al., 2021; Kenny and McDaniel, 2011; Koh et al., 2013; Lee and Tsai, 2010; Loperfido et al., 2019; Martín-del-Pozo et al., 2019; Matić et al., 2023; Palha and Matić, 2023; Rulyansah et al., 2023; Takeuchi and Vaala, 2014; Zhonggen, 2019). Teachers are the main agents of change in GBL (Bourgonjon et al., 2011; Li and Huang, 2016; Proctor and Marks, 2013). Therefore, their perceptions and beliefs have a crucial effect on their decisions on how, when and for what purpose to integrate GBL into their lessons (Andreoletti and Tinterri, 2023; Beavis et al., 2014; Ertmer, 2005; Ertmer and Ottenbreit-Leftwich, 2010). Several factors influence a teacher's predisposition to use GBL; for instance, when teachers perceive GBL as highly useful, their attitude towards digital games tends to be more positive (Sánchez-Mena et al., 2017). Other aspects include the level of play culture (game literacy), the presence of prejudices about the role and meaning of play in society and culture, the difficulty in translating curricular learning goals within the play activity and/or in the game, the difficulty in identifying and selecting the most appropriate game and integrating it effectively and efficiently within the educational activity, the difficulty in identifying the appropriate assessment methods for learning goals and play objectives (Andreoletti, 2023; Andreoletti and Tinterri, 2023; Hanghøj, 2013) and the limited availability of curriculum-aligned games is an obstacle that teachers identify as hindering the implementation of GBL in the classroom (Takeuchi and Vaala, 2014). Other factors that hinder the adoption of games are the rigidity of curricula, fixed class schedules and their short duration (An and Cao, 2017; Baek, 2008; Kaimara et al., 2021).

In general, what emerges is that:

- teachers' level of pedagogical experience in using games as a teaching resource seems to be a crucial factor in understanding their inclination towards game-based pedagogy (Andreoletti, 2023; Palha and Matić, 2023)
- teachers' attitudes towards new teaching methods such as GBL contribute to their subsequent implementation and influence students' learning motivation (Martín-del-Pozo et al., 2019);
- teachers use informal means to gain knowledge about ways of teaching with games, e.g. through trial and error, seeking ideas from colleagues (Takeuchi and Vaala, 2014) or suggestions, directions and online tutorials (Andreoletti and Tinterri, 2023);
- the chances of achieving educational goals and facilitating students' acquisition of any academic skills or knowledge increase if teachers consider games as legitimate teaching tools (Bonanno and Kommers, 2008; Kenny and McDaniel, 2011);
- games and GBL can only be effective in K-12 education if teachers and students regard them as valid teaching and learning tools (Andreoletti, 2023; Bourgonjon et al., 2010).

Overcoming these critical issues requires adequate training for future and in-service teachers (Andreoletti, 2023). However, there is a lack of professional development opportunities to guide teachers in the systematic use of games for teaching, learning and assessment (Matić et al., 2023; Martín-del-Pozo et al., 2019).

Equipping teachers with specific knowledge about the pedagogical activities involved in teaching with requires knowledge and skills that are not intuitive for most teachers (Nousiainen et al., 2018). Hébert and Jensen (2019) note that a comprehensive understanding of the barriers teachers face in implementing GBL is "important to ensure not only that the benefits of GBL are translated into practice, but also that teachers receive the support they need to make GBL a possibility within their classrooms" (p 308). It is thus essential to understand what these needs are to design meaningful play-based pedagogy curricula that meet the needs of (future) teachers.

In the Italian landscape, apart from the research by Alsop and Jessell (2015) and Loperfido et al. (2019), there is no recent research investigating teachers' perceptions in relation to the introduction of GBL methods within their training practice.

2. Aims of the Research

The aim of this research is to understand in the Italian landscape the perception of GBL by teachers, both in training and in service, in relation to their teaching experience with GBL. Specifically, this study investigates teachers' perception of their competence in four key dimensions of GBL; to this aim, we developed and distributed a questionnaire aimed at in-service and in-training teachers at all school levels. The overarching hypothesis of this study is that teachers with less or more experience of play and GBL will view the implementation of GBL differently and have different concerns about aspects of the learning environment.

Understanding the concerns and the factors that encourage and hinder them can provide a valuable contribution to the development of a meaningful curriculum. Therefore, the following research questions were formulated:

RQ1: what are the perceived skills with GBL of Italian teachers?

RQ2: which demographic factors influence teachers perceived GBL skills?

3. Methods

The development of the survey started from the analysis of the literature, identifying the instruments that investigated the factors that influence the teacher in the adoption of GBL (Hsu et al., 2013, 2017, 2020; Loperfido et al, 2019); subsequently, on the basis of those identified, a new instrument was defined that integrated new areas and items to adapt them to the Italian context and, at the same time, extends the investigation also to non-digital gaming, aspects related to game-integrated instructional design, game scenarios and the role of teachers in teaching activities (Andreoletti and Tinterri, 2023).

3.1 Literature Analysis

Hsu, Liang, Chai and Tsai (2013), having focused on analysing pre-school teachers' experience with digital games and their attitudes towards game-based learning, derived the Technological Pedagogical Content Knowledge-Games (TPACK-G) from the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra and Koehler, 2006), which is structured into four factors:

1. *Game knowledge (GK)*: knowledge about the *general use of games*: knowing how to play and possessing technical skills to play games effectively, e.g. 'I can learn to use games easily'.
2. *Pedagogical Game Knowledge (GPK)*: knowledge on the *use of games with various pedagogical features for teaching without specific reference to content knowledge*: knowing how to use a game with collaborative features to promote player collaboration during play, e.g. 'I know how to use the features of games to support teaching'.
3. *Game Content Knowledge (GCK)*: knowledge *about how the content can be represented by the game without considering the implemented pedagogy*, it is the combination of game and content knowledge and excludes the pedagogical element: using games specifically created for learning a certain subject, e.g. "I can identify games to use in my class that fit with the topics covered in the discipline/subject I teach".
4. *Knowledge of the Pedagogical Content of the Game (GPCK)*: knowledge of the *use of games to implement teaching methods for any targeted content*: if you have sufficient GPCK, you can select appropriate games to improve what you teach, how you teach and what students learn in class; e.g., "I can select games to use in my class that improve what I teach, how I teach and what students learn".

3.2 The new Tool

The new survey integrated and expanded on previous studies, to better fit the entire game context, to integrate with the findings of more recent research (Andreoletti and Tinterri, 2023, p 37), and extend the topic of the survey to the entire analogue gaming sector (board games, exergames, etc.). To this aim, the survey was structured in three sections: the first included questions linked to participant demographic information (gender, age, school level, years of teaching experience, etc.), a second section with the ADGBL questionnaire (not included in this study) and a reworked version of the TPACK-G. For the latter, several items were rewritten and the GC dimension, which was removed from the work of Hsu et al. (2013), was reintroduced. The initial formulation for the new TPACK-G questionnaire included 4 questions for each dimension (GK, GPK, GCK, and GPCK), each answered through a 1-4 Likert scale (Joshi et al., 2015). The survey underwent a series of preliminary tests using Cronbach's Alpha, a commonly employed measure to test consistency of the items within the same category (Tavakol and Dennick, 2011); this led to several iterations of the questionnaire before the version that was ultimately submitted to participants, which included 15 items (three items for GCK and four each for the other factors). The survey was administered in CAWI format, using Google Modules, to teachers undergoing training to achieve teaching qualification (DPCM 4 agosto 2023). Data was collected via Google Modules and analysed using R (R Core Team, 2023).

4. Results

4.1 Characteristics of the Sample

From April 9 to April 16, 2024, 2752 participants (83.1% females, 18.4% males, 0.3% unspecified) were recruited for the study. Mean age of participants was 44.6 (s.d. 7.81, N=2236). 49.2% of participants were curricular teachers, 48.8% were special need teachers and 2% of participants played different roles within the school system (e.g. pedagogist, school psychologist, educators). Out of all participants, only 2.5% were not actively teaching and were therefore excluded from current analysis (Table 1).

Table 1: Distribution of participants according to school level

School Grade	Frequency	% of Total
Not teaching	68	2.5 %
Kindergarten	99	3.6 %
Primary school	601	21.8 %
Secondary School (I grade)	1067	38.8 %
Secondary School (II grade)	917	33.3 %
Total	2752	100%

The participants differed in their teaching experience, which ranged from less than a year to more than 20 years; Table 2 shows aggregated values that has been used for analysis.

Table 2: Teaching experience distribution of participants

Teaching Experience	Frequency	% of Total
Up to 2 years	353	13.2 %
3 to 5 years	614	22.9 %
6 to 15 years	1144	39.2 %
More than 16 years	662	24.7 %
Total	2683	100%

4.2 Analysis of the TPACK Questionnaire

To validate the factorial structure of the questionnaire, we ran a Confirmatory Factor Analysis (CFA) (Harrington, 2009). The first CFA returned values within the limits that are considered acceptable in the literature for the questionnaire ($\chi^2(84 \text{ df})=894$, $p<0.001$); CFI (0.976), TLI (0.970), SRMR (0.0346), RMSEA (0.058)). Still, based on the analysis of factor loads and our interpretation of the constructs, we decided to modify the factorial structure of the questionnaire. We removed item GK4 ("I can recognize the differences between games and other media like books, films, photographs, graphic novels...") and item GCK4 ("I can distinguish game content from game objectives") from it, reducing the revised version to 13 items. The revised questionnaire shows a better factorial profile; all factor loads are moderate to strong and statistically significant (Table 3). The new version, despite retaining significant chi-square value ($\chi^2(59 \text{ df})=362$, $p<0.001$), indicating a less than ideal fit, has better values overall for CFI (0.989), TLI (0.986), SRMR (0.0216) e RMSEA (0.0437) indicating a good correspondence between the data and the factorial structure of the questionnaire.

Table 3: Confirmatory Factor Analysis of the TPACK-G questionnaire

Dimension	Item no.	Item	Estimate	SE	Z	p
GK	1	I know the main typologies of games (analogue versus digital and their categories) in the market	0.597	0.015	38.9	<0.001
GK	2	I know how to search for and setup board games and/or install digital games.	0.771	0.015	52.2	<0.001
GK	3	I can recognize game mechanics (e.g. roll dice and move, area control, point and click, etc.).	0.697	0.016	43.2	<0.001
GPK	4	I can tell the difference between Gamification, Game-Based Learning, Playful Learning.	0.680	0.015	44.9	<0.001
GPK	5	I can tell the difference between Serious Game, Educational Game, and commercial game.	0.776	0.015	51.2	<0.001
GPK	6	I can tell the differences in how board and video games promote learning.	0.740	0.015	48.8	<0.001
GCK	7	I can identify knowledge related to my discipline in games.	0.774	0.012	62.7	<0.001
GCK	8	I can identify skills related to my discipline in games.	0.795	0.012	68.4	<0.001
GCK	9	I can identify competencies related to my discipline in games.	0.786	0.012	66.1	<0.001
GPCK	10	I can design learning activities that integrate appropriately games with the subject matter.	0.755	0.014	55.2	<0.001

Dimension	Item no.	Item	Estimate	SE	Z	p
GPCK	11	I can choose games to use in the classroom to improve teaching and learning processes.	0.768	0.013	59.9	<0.001
CPCCK	12	I can choose game to represent real world situations.	0.724	0.014	53.3	<0.001
GPCK	13	I can modify the game experience to better fit the individual needs of the students.	0.756	0.014	53.6	<0.001

4.3 TPACK-G Values and Demographic Factors

Once the factorial structure of the questionnaire has been verified, we pooled individual answers to obtain the aggregate values for the four dimensions of the TPACK-G (Table 4). Overall, the self-attributed competence levels were tilted towards the average, with game pedagogical competencies having the lower mean value and game content knowledge the highest.

Table 4: Aggregate values of for the TPACK-G dimensions

N=2684	GK	GPCK	GCK	GPCK
Mean	2.56	2.14	2.98	2.67
Median	2.67	2.00	3.00	2.75
St. Dev	0.755	0.792	0.800	0.782
Minimum	1.00	1.00	1.00	1.00
Maximum	4.00	4.00	4.00	4.00

All four factors positively correlate with one another, with correlation indexes (Spearman's Rho) spanning from a minimum of 0.459 for GK and GCK to a maximum of 0.636 for GCK and GPCK. All correlations were statistically significant at the <0.01 level. Next, we sought to understand which demographic factors influenced self-attribution of TPACK-G competencies. To this aim, we analyzed the distribution of answers according to teacher gender, to school level, and teacher experience, using nonparametric rank-based tests. We found that gender was a factor, as males declared higher competence values for Game Knowledge and Game Pedagogical Knowledge compared to female; however, No. statistically significant difference was observed for Game Content Knowledge and Game Content Pedagogical Knowledge (Table 5).

Table 5: Values of TPACK-G by gender

	Group	N	Mean	SD	U	p-value
GK	Female	2183	2.52	0.741	459591	< .001
	Male	493	2.72	0.796		
GPK	Female	2183	2.11	0.779	477088	< .001
	Male	493	2.27	0.834		
GCK	Female	2183	2.97	0.798	527469	0.475
	Male	493	3.00	0.810		
GPCK	Female	2183	2.68	0.781	521177	0.270
	Male	493	2.63	0.785		

We also observed that TPACK-G competencies tend to decrease with the increase of school level, indicating that, on average, teachers that operate with younger students tend to report higher GBL skills than their colleagues working with older students (Table 6). Nonparametric Kruskal-Wallis test reported significant effect of school grade for all dimensions (GK $\chi^2(3 \text{ df})=22.0$, $p<0.001$; GPK $\chi^2(3 \text{ df})=15.1$, $p=0.002$; GCK $\chi^2(3 \text{ df})=52.3$, $p<0.001$; GPCK $\chi^2(3 \text{ df})=87.4$, $p<0.001$).

Table 6: Values of TPACK-G by school grade

School grade	GK		GPK		GCK		GPCK	
	Mean	St. dev	Mean	St. dev	Mean	St. dev	Mean	St. dev
Kindergarten	2.69	0.789	2.33	0.823	3.10	0.783	3.01	0.794
Primary	2.60	0.722	2.18	0.782	3.05	0.812	2.84	0.758
Secondary I grade	2.60	0.738	2.16	0.800	3.06	0.762	2.70	0.753
Secondary II grade	2.47	0.785	2.06	0.779	2.82	0.816	2.50	0.789

There is also a small, albeit significant, difference in TPACK-G competencies according to teaching experience of the participants for Game Knowledge (GK $\chi^2(3 \text{ df})=12.32$, $p=0.006$, Game Content Knowledge (GCK $\chi^2(3 \text{ df})=8.97$, $p=0.03$), and Game Pedagogical Knowledge (GPK $\chi^2(3 \text{ df})=8.97$, $p=0.03$; the significant pairwise comparisons (Dwass-Steel-Critchlow-Fligner test) are between group 2 (From 3 to 5 years) and group 4 (more than 16 years) for GK ($W=-4.69$, $p=0.005$) and GPK ($W=-3.979$, $p=0.025$), and between group 1 (Up to 2 years) and group 3 (from 6 to 15 years) for GCK ($W=4.240$, $p=0.014$). Overall, it seems that teacher with very little experience and those

with longer experience are those that report lower values for TPACK-G values compared to colleagues, with the notable exception of GPCK values (Table 7).

Table 7: Values of TPACK-G by teacher experience.

School grade	GK		GPK		GCK		GPCK	
	Mean	St. dev	Mean	St. dev	Mean	St. dev	Mean	St. dev
Up to 2 years	2.53	0.724	2.16	0.774	2.86	0.820	2.59	0.784
From 3 to 5 years	2.62	0.746	2.19	0.782	2.99	0.800	2.70	0.757
From 6 to 15 years	2.58	0.775	2.14	0.800	3.01	0.774	2.68	0.763
More than 16 years	2.48	0.744	2.07	0.795	2.97	0.826	2.68	0.830

5. Discussion

In this study, we developed and analyzed a new survey using the TPACK-G framework to explore the perception of competence concerning GBL by Italian in-service teachers at all school levels. The first research question concerned the perceived levels of skills in GBL by Italian teachers. We found that our version of the TPACK-G effectively captures the four key dimensions of the framework. On average, participants report average knowledge of games (GK), relatively low knowledge of pedagogical concepts related to games (GPK), while at the same time reporting good ability to identify learning content in games (GCK) and higher than average skills in incorporating games in their teaching activity (GPCK). The evolutionary structure of the TPACK-G framework suggests that a lower element (GK) is more general and fundamental and that the more specific knowledge factors (GPK, GCK and GPCK) build on this (GK). In other words, to develop a specific GPCK, one should first possess an adequate knowledge of the game in general (GK) and, subsequently, a pedagogical knowledge of the game (GPK) and the content of the game (GCK). Conversely, if one has no knowledge of games (GK), one might not have adequate pedagogical knowledge of games (GPK), let alone adequate knowledge of the pedagogical content of the game (GPCK). Hsu et al. (2013, p. 464) research also pointed out that, when it comes to using games to represent content (GCK), teachers might automatically incorporate this knowledge into teaching activities and might not have a clear idea of what (GCK) it is. Thus, these results suggest that participants might overestimate their ability to identify learning opportunities in games and incorporate them in their teaching practice despite lacking fundamental knowledge related to games, possibly due to a high and generalized belief in games' effectiveness as learning environments (Cantoia, Clegg and Tinterri, 2023). The second research question investigated whether perception of competence with GBL might be related to demographic factors. In this study, we observed that gender has an impact, as male teachers report significantly higher values for GK and GPK. Further analysis is required to understand whether this difference is linked to different gaming habits for male and female teachers, as a largely confuted but persisting social stigma in Italy sees games, and video games in particular, as primarily male occupation. Furthermore, we observed that all TPACK-G levels decrease with the progression of school level, i.e. teachers working with younger students tend to perceive themselves as more competent with GBL than teachers working with older students. Again, further investigation is required to verify whether there is a link between this perception and actual implementation of game activities. Finally, we observed a rather complex distribution of TPACK-G values according to teacher experience. For instance, the teachers that report lower game knowledge are the less experienced (less than 2 years of experience) and the most experienced (more than 16 years); it is plausible that the reasons might be different for the two categories, but a more in-depth analysis is required to identify potential explanations for the data observed. Currently, the study has a few limitations: First, despite the good sample size, which makes it the most extensive study on GBL in Italy to date, participants have been recruited from a specific subset (teachers training to change discipline or special need teachers switching to curricular teaching), which might not reflect the general population of teachers at large. Second, the survey only concerns self-reported attributions by teachers which might not accurately represent actual GBL skills. Taken together, this study presents a new tool to investigate teachers' perceptions of their GBL skills, built according to a well-established frameworks (TPACK) and starts to shed light on the perception of Italian teachers concerning the use of games in their teaching and learning activity, a crucial first step towards the building of evidence-informed teacher training programs to effectively (re)introduce games as proper learning environment in formal education.

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