

# Pre-service Teachers' Player Types and Their Relation to Self-efficacy With Digital Media

Nathalie Barz, Pauline Arndt, Laura Dörrenbächer-Ulrich, Manuela Benick and Franziska Perels

Saarland University, Saarbrücken, Germany

[nathalie.barz@uni-saarland.de](mailto:nathalie.barz@uni-saarland.de)

[s8paarnd@stud.uni-saarland.de](mailto:s8paarnd@stud.uni-saarland.de)

[laura.doerrenbaecher@uni-saarland.de](mailto:laura.doerrenbaecher@uni-saarland.de)

[manuela.benick@uni-saarland.de](mailto:manuela.benick@uni-saarland.de)

[f.perels@mx.uni-saarland.de](mailto:f.perels@mx.uni-saarland.de)

**Abstract:** Gamification in educational contexts is often used to increase learners' intrinsic motivation and their self-efficacy beliefs, two constructs which are positively related with each other as well as to scholastic outcomes. As self-efficacy beliefs are conceptualized context-specific, it is important to consider various users' needs by adapting the learning environment to their corresponding gamification player types (GPT). Studies show that different GPT are characterized by different motivational aspects (intrinsically motivated, extrinsically motivated, disruptive GTP). Therefore, the aim of the present study is the examination of six different GPT according to the HEXAD typology (Tondello et al., 2016) for pre-service teachers regarding their distribution and their relation to self-efficacy with digital media. Altogether N = 75 pre-service teachers were assessed in terms of their GPT and their self-efficacy with digital media. It was hypothesized that the GPT distribution for pre-service teachers is comparable to the distribution reported by Tondello et al. (2016). Additionally, it was exploratively examined to what extent the different types of players differ in their self-efficacy with digital media. Results show that the GPT distribution in the current sample differs significantly from the expected distribution. Pre-service teachers seem to show specific GPT characteristics due to their profession. Concerning self-efficacy with digital media, pre-service teachers show a high subjective perception of their self-efficacy with digital media, but contrarious to the hypothesis no significant relation was found between GPT and self-efficacy with digital media. The results indicate that pre-service teachers feel confident to the use of digital media in class and that pre-service teachers form a group with a specific distribution of player types and therefore have specific needs in gamified learning environments. Due to the reported high amount of intrinsic player types, game design elements which promote intrinsic motivation should be in the focus of prospective analyses.

**Keywords:** gamification, player types, self-efficacy, digital media, pre-service teachers

---

## 1. Introduction

Current development shows a rapid digitalisation in the school sector, also as a result of the pandemic situation. Using digital media in class is becoming more relevant for teachers, but some feel overwhelmed by those demands because of lacking resources (Weißenfels, Benick and Perels, 2022). To ensure that teachers can meet the requirements of using digital media in class, it is important to promote trust in their own competencies using digital media (self-efficacy with digital media), starting during teacher education. One way of implementing this are digital educational games, i.e. digital games that set clear learning goals and are devised to promote learning (Erhel and Jamet, 2013). Educational games can be very exciting for learners (Dickey, 2011). They are therefore an easy way to enhance intrinsic and extrinsic motivation of pre-service teachers during their university education (Klock et al., 2015) and in a consequence to enhance self-efficacy with digital media as well. Game elements, such as proceeding into higher levels, or the playful environment can enhance extrinsic motivation and help achieve a higher intrinsic motivation (Blohm and Leimeister, 2013). Extrinsic rewards could promote, for example, mastery experiences which fulfil the need for competency and therefore promote intrinsic motivation and foster self-efficacy. Studies show that compared to traditional lesson plans equal learning achievements can be achieved with educational games (Rachels, 2016). To provide an adequate learning environment and to allow for optimal learning, users' needs must be considered. It seems beneficial to look at different player types that are distinguished by differential motivational aspects and interests when it comes to the use of educational games (Marczewski, 2015). For college students, results on the distribution and characteristics of the individual player types are already available (Tondello et. al., 2016), but for the special group of pre-service teachers, player types have not yet been studied in detail. Furthermore, it is still unclear what influence the different player types have on pre-service teachers' self-efficacy with digital media. Therefore, the present study takes a closer look at pre-service teachers' player types and their differences regarding self-efficacy with digital media to derive recommendations for better suited educational games for teachers.

## 2. Theoretical background

### 2.1 Gamification

Gamification refers to the “use of game design elements in non-game contexts” (Deterding et al., 2011, p.10). Non-game contexts are for example clinical or occupational as well as educational contexts. Gamification in the context of education is a combination of game components (like points, challenges or stories) and a learning goal (Deterding et al., 2011). Users are supposed to be motivated by the game elements thus attaining higher learning accomplishments (Muntean, 2011). Klock et al. (2015) mentioned multiple game elements for gamification in their work (e.g. narrative, virtual goods, points), which can be used for an effective application of gamified learning environments. When telling a story, for example, users can be immersed by creating a sense of community. Virtual goods can be bought with collected coins and could be used, for example, to buy new clothes for the own avatar which leads to an in-depth personalization. A very important and motivational factor for a lot of users are points and high scores. They contribute to the visualization of achievements and facilitate a comparison with other players which can spur on ambition and intrinsic motivation (Marczewski, 2015). One of the most important fields of application for gamification is in the context of education. Gomez-Carrasco and colleagues (2020) evaluated a gamified training for prospective elementary teachers from Spain. The used game elements used were experience points, classification, rewards, competition and feedback. The training consisted of two sessions per week and used learning videos to convey the theoretical content. Results reveal that most prospective elementary school teachers show positive values regarding their perceived intrinsic motivation, satisfaction, and their learning progress. In addition, a literature review by Hamari, Koivisto and Sarsa (2014) found that gamification mostly leads to an increase in intrinsic motivation and to higher engagement with the learning task and an increased enthusiasm during performance. To enable an increase of intrinsic motivation and more effective learning, it is important to implement a user-centered gamification (Klock et al., 2015) which addresses users’ needs. One approach to this could be the consideration of different gamification player types, because they consider players’ different types of motivation.

### 2.2 Gamification player types

Marczewski (2015) developed different player types to categorize users regarding their motivational needs. His model refers to aspects of intrinsic and extrinsic motivation and distinguishes between three player groups: intrinsically motivated, extrinsically motivated, and disruptor player types (see below). Marczewski’s (2015) player types have been analysed for reliability and have been validated by Tondello and colleagues (2016) with correlation analyses as well as exploratory and confirmatory factor analyses for college student samples from different countries. It was detected that some player types overlap regarding their underlying motivation which could cause the simultaneous categorization of a player to different player types. Tondello and colleagues (2016) found the following percentages for the individual player types in a student sample: philanthropist (24%), achiever (24%), socializer (19%), free spirit (22%), player (10%), and disruptor (1%). The individual player types will be explained in more detail in the next section.

#### 2.2.1 Intrinsic player types

Marczewski (2015) postulates four intrinsically motivated player types which are motivated by their own activities: philanthropist, socialiser, achiever and free spirit. (1) *Philanthropists* are described as players with altruism and the feeling of serving a higher purpose. They interact with and help other players without making demands and want to contribute to society without expecting a reward. (2) *Socialisers* are equally motivated to interact and communicate with other players but here it’s more about the social aspect and less about helping others. (3) *Achievers* are motivated by their own performance and competencies. The interaction with other players is less about social connections and more about challenging each other. (4) *Free spirits* prefer to have the freedom to explore the game and develop their own creative ideas (Marczewski, 2015; Tondello et al., 2018).

#### 2.2.2 Extrinsic player types

In contrast to intrinsic player types, (5) extrinsically motivated player types are motivated by external stimuli and game elements such as rewards and achievements (Johnson et al., 2016). Extrinsic player types are usually not divided into further subcategories and referred to as players. (Bovermann and Bastiaens, 2020; Tondello et al., 2016; Tondello et al., 2018). Players act comparably to intrinsic player types except for the extrinsic motivation. They are helpful and social, but only if there is a worthwhile benefit for themselves.

### 2.2.3 Disruptor player types

Another category of player types are so called (6) *disruptors*. As the extrinsic player types, disruptors are also usually summarized into a common disruptor type and not viewed individually (Bovermann and Bastiaens, 2020; Tondello et al., 2016; Tondello et al., 2018). The main characteristic of disruptors is the motivation to modify a game. The results can be both positive as well as negative. The game system is either directly or indirectly changed or disrupted by other users. Like the free spirit type, disruptors get motivated by autonomy and creativity. For example, disruptors are looking for gaps or bugs in the system to destroy or improve the game. Even if the disruptor player types only make up a small amount of existing player types (Bateman, Lowenhaupt and Nacke, 2011; Tondello et al., 2018; Trojanek, Fischer and Heinz, 2019), they shouldn't be underestimated. They can influence the game in many ways, by their own actions, their influence on other players or by manipulating the game itself.

The introduced player types could be useful to create adequate digital games for users, in our case pre-service teachers. This would enable adaptive games (e.g., collaborative levels for socialisers or badges for player types), which could improve teacher education because students' needs are considered while learning. As mentioned above, one important variable that influences teachers' use of digital media in the classroom and which should be promoted during their studies, is their self-efficacy with digital media which is further describes in the next section.

### 2.3 Self-efficacy with digital media

Social cognitive theory describes humans as proactive, self-regulated agents who "influence intentionally [their] functioning and life circumstances" (Bandura, 2006a, p. 164). The core of the theory lies in the interactive triadic reciprocity between personal factors, the environment, and the executed actions (Bandura, 1989). Among the personal factors, Bandura assumes that "people's beliefs about their capabilities to exercise control over events that affect their lives" (Bandura, 1989, p. 1175) are central, naming those beliefs "perceived self-efficacy." For Bandura (1977), self-efficacy beliefs determine behavior directly as well as indirectly through cognitive (e.g., elaboration), motivational (e.g., effort), and affective (e.g., stress), and processes. People with adequate self-efficacy beliefs sets more challenging goals, persevere longer in difficult tasks, and is more resilient (Bandura, 2006b).

In the context of teaching, self-efficacy has been investigated and empirically validated in students (e.g., Joët, Usher and Bressoux, 2011) as well as in teachers (e.g., Usher and Pajares, 2009) and it was mainly confirmed that mastery experiences play the major role in the formation of self-efficacy beliefs (Pfitzner-Eden, 2016). Once established, Bandura (1977) assumes that self-efficacy beliefs for a specific context should be relatively stable which has been empirically validated for teacher self-efficacy several times (e.g., Künstling, Neuber and Lipowsky, 2016). Regarding school closures due to the COVID-pandemic, teacher self-efficacy with digital media played a central role, especially considering that the use of digital media has been shown to be predicted by the specific self-efficacy (Lee and Lee, 2014). Teacher self-efficacy with digital media therefore means that teachers feel confident they can effectively use digital media in class and overcome its technical difficulties and challenges. Moreover, teacher self-efficacy with digital media is closely related to teachers' competence about actually using digital media (Abbitt, 2011).

As different gamification elements can affect specific motivation types by offering external (e.g. points) or intrinsic incentives (e.g. emotional engagement through narrative; Ryan and Rigby, 2020) and therefore foster self-efficacy through mastery experiences, the interesting question arises whether persons with different demands on a game experience have a different development of self-efficacy with digital media. This leads to the aim of the study to analyze different player types and their relationship with self-efficacy with digital media.

### 2.4 Research question and hypotheses

The following study examines (RQ1) whether the distribution of player types reported by Tondello and colleagues (2016) is replicable in a sample of pre-service teachers. In the present study we assume that the philanthropist player type appears more frequently than other player types (H1.1) whereas the disruptor player type is the least common (H1.2). Moreover, the distribution of player types does not significantly differ from the sample of Tondello and colleagues (2016) in terms of frequency (H1.3).

In addition, it will be (RQ2) exploratively examined to what extent the different types of players differ in their self-efficacy with digital media.

### 3. Method

#### 3.1 Sample and procedure

Data of  $n = 75$  voluntarily participating pre-service teachers ( $n = 66$  female) was collected at a German university. They were 23.95 years old on average ( $SD = 4.17$ , range = 22-44 years) and in semester 7 of their studies ( $SD = 2.19$ , range = 1-14), but only 69 of them disclosed latter information. The anonymous survey was carried out at the beginning of the summer term 2020 in an online lecture at a German university. The presentation of the items was randomized, and participation was unpaid and voluntary.

#### 3.2 Measurement instruments

##### 3.2.1 Gamification User Types Hexad scale

The „Gamification User Types Hexad Scale“ measures the expression of player types on a scale from 1 = “Not true at all” to 7 = “Exactly true”. The subscales distinguish between player, philanthropist, achiever, socialiser, free spirit, as well as disruptor. Each player type is measured with four items each, the entire scale therefore consists of 24 items (e.g., “I like mastering difficult tasks”). The scale was translated into German. Tondello and colleagues (2018) conducted three studies to validate the English and Spanish version and found acceptable reliabilities (Cronbach’s alpha) of  $\alpha = .70$  for the philanthropist,  $\alpha = .71$  for the achiever,  $\alpha = .79$  for the socialiser,  $\alpha = .60$  for the free spirit,  $\alpha = .75$  for the player, and  $\alpha = .70$  for the disruptor. In the present study, reliability is  $\alpha = .73$  for the philanthropist,  $\alpha = .77$  for the achiever,  $\alpha = .91$  for the socialiser,  $\alpha = .38$  for the free spirit,  $\alpha = .56$  for the player, and  $\alpha = .66$  for the disruptor. As in Tondello and colleagues (2018), the reliability for the player type of free spirit is the lowest.

##### 3.2.2 Self- efficacy with digital media

The scale used to measure self-efficacy with digital media comprised five adapted items from Lin and colleagues (2015; e.g., “I feel secure using basic functions of digital media”) and two items from Hung (2016; e.g., “I confidently answer questions in online discussions”). A 5-point Likert scale was used, where a 5 means high and 1 means low self-efficacy with digital media. The reliability of the scale is  $\alpha = .81$ .

#### 3.3 Statistical analyses

Analyses were conducted using IBM SPSS Statistics 25 and the statistical threshold of  $\alpha = .05$  was used. To categorize participants into different player types, the highest value of each participant for the different player type was taken into consideration. To do that, a sum value for each participant for the six subscales was calculated. This method is based on the study on player types by Trojanek and colleagues (2019). It is possible that students are assigned to multiple player types at the same time if they have equally high values for different player types. We identified  $N = 101$  expressions of player types in our sample with  $n = 75$  due to multiple classification of participants to different player types. The  $N = 101$  player types were considered independently in all analyses.

To test hypothesis 1.3, a one-dimensional Chi-Square test (Goodness of fit test) was calculated, to compare the observed distribution of the six player types with the expected distribution of Tondello and colleagues (2016). We transferred the percentages of their sample for our sample of  $N = 101$  player types.

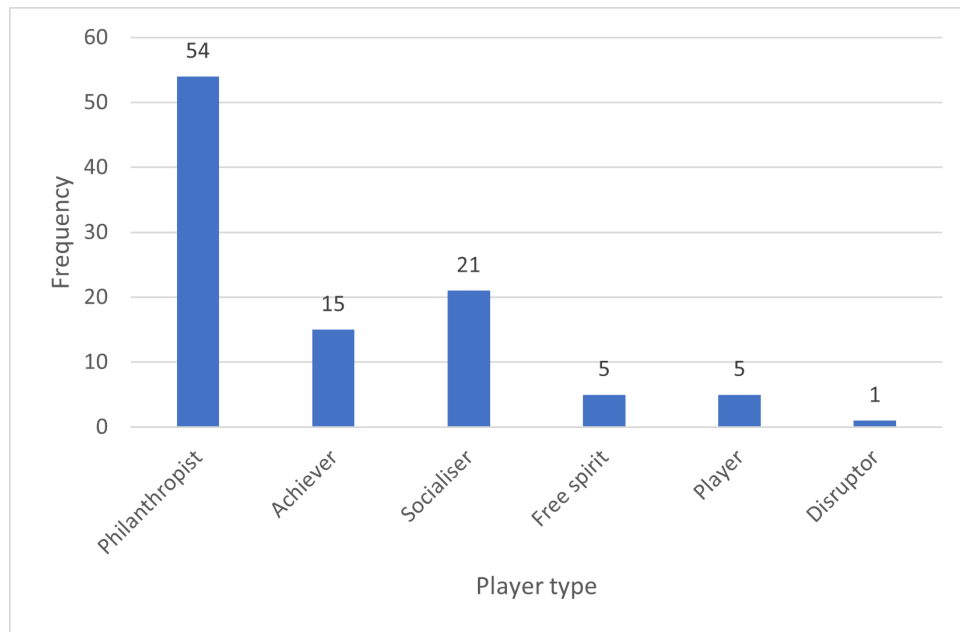
A one-sample t-test and a one-factor ANOVA are used to exploratively examine the extent to which the player types differ in their means for self-efficacy with digital media. In the case of calculating the differences in self-efficacy with digital media regarding the player types, the four intrinsic player types are summarised. The effect sizes of the one-factor ANOVA for the explorative investigations of self-efficacy with digital media are given as partial eta squared ( $\eta_p^2$ ).

### 4. Results

#### 4.1 Frequency of player types

Based on the frequencies of each player type in the present sample ( $N = 101$ ) hypothesis 1.1 und 1.2 could be confirmed. The philanthropist was the most common player type ( $n = 54$ ) while the disruptor was the least common with  $n = 1$  (see figure 1).

When assigning test subjects to player types, a distinction was made between pure and mixed forms. In our sample ( $N = 75$ )  $n = 18$  participants showed characteristics of more than one player type, while  $n = 57$  participants classified as pure forms. Among the mixed forms,  $n = 8$  subjects showed three different player types. The philanthropist was also the most common player type among mixed form subjects.



**Figure 1:** Frequencies of player types including all mixed forms

#### 4.2 Distribution of player types

Referring to H1.3, the Chi-Square test showed a significant difference between observed and expected frequencies ( $\chi^2(1,101) = 56.15, p < .001$ ) in comparison to Tondello and colleagues (2016). The present sample contains significantly more philanthropists and significantly less achievers, free spirits, and players than expected (see table 1). Hypothesis 1.3 was therefore rejected.

**Table 1:** Comparison between observed and expected frequencies of player types including mixed forms

	observed	expected (Tondello et al., 2016)
Philanthropist	54	24,24
Achiever	15	24,24
Socialiser	21	19,19
Free Spirit	5	22,22
Player	5	10,1
Disruptor	1	1,01

#### 4.3 Self-efficacy with digital media

To test RQ2, a median of 3 for the test instrument and a one-sample  $t$ -test was calculated. The average self-efficacy with digital media ( $M = 3.71, SD = 0.70$ ) was higher than the median of 3 ( $t(100) = 10.23, p < .001$ ), why a high self-efficacy with digital media can be assumed in the present sample. A one-way ANOVA revealed no significant difference between the player types regarding their self-efficacy with digital media ( $F(5,95) = 2.01, p = .085, \eta^2_p = 0.10$ ). Furthermore, there were no significant differences regarding self-efficacy with digital media between intrinsic, extrinsic and disruptor player types ( $F(1,98) = 1.38, p = .257, \eta^2_p = 0.03$ , see table2).

**Table 2:** Descriptive statistics for self-efficacy with digital media

	Mean	SD
Philanthropist	3.56	0.70
Achiever	4.07	0.60
Socialiser	3.67	0.71
Free Spirit	3.94	0.72
Player	4.20	0.58

	Mean	SD
Disruptor	3.43	.
Intrinsic player types	3.69	0.70
Extrinsic player types	4.20	0.58
Disruptor player types	3.43	.

## 5. Discussion

The goal of the present study was to take a closer look at the player types according to Marczewski (2015) in a sample of pre-service teachers regarding their frequencies and their differences in self-efficacy with digital media.

### 5.1 Comparability of pre-service teachers' player type distribution with prior findings

Hypotheses 1.1 and 1.2 could be confirmed as philanthropist was the most common and disruptor the least common player type. This finding matches the results of the study by Trojanek, Fischer and Heinz (2019). In addition, the philanthropist player type also shows characteristics, e.g. helpfulness and interaction, which could be transferred to personality traits of a teacher, e.g., openness to interactions with students (Kim, Jörg and Klassen, 2019). In the study by Tondello et al. (2016), the player type philanthropist correlated with extraversion, conscientiousness, and neuroticism. Likewise, the philanthropists' altruistic actions during a game match the behaviour of a teacher towards pupils that is desirable and promotes the intention to share knowledge (Chen, Fan and Tsai, 2014). The philanthropist's matching characteristics with teacher personality could be an explanation for the high amount of this player type in the current sample.

Disruptor player types are least common among student teachers. As confirmed in multiple studies (Bovermann and Bastiaens, 2020; Tondello et al., 2018) the disruptor player type is also the least common in the general population. In addition, the description of the disruptor as a destroyer and blaster of boundaries does not fit the characteristics of a teacher, as they should be a role model for students.

Regarding the distribution of player types, hypothesis 1.3 could not be confirmed. The observed distribution does not correspond to the expected distribution from literature (Tondello et al., 2016) as the present study examined a special population instead of the general college student population.

### 5.2 Relation of player types and self-efficacy with digital media

The surveyed sample shows a high self-efficacy with digital media. One reason could be the age of the participants. Compared to working teachers the present sample is younger in age. Teachers with less working years show a higher self-efficacy with digital media (Hung, Huang and Hwang, 2014). Compeau and Higgins (1995) can confirm that a high self-efficacy goes hand in hand with a higher digital media usage. Because of their high self-efficacy, pre-service teachers are more likely to use a digital approach during a lesson than older teachers with a lower self-efficacy with digital media. There were no differences found in self-efficacy with digital media between the different player types. The reason could be that all participants undergo mastery experiences. The study by Li and colleagues (2017) found a positive relationship between computer self-efficacy and intrinsic motivation. However, no difference between intrinsic, extrinsic and disruptor player types can be found in the sample studied. This may be due to the generally high self-efficacy with digital media of the surveyed sample. In addition, the sample comprises only six persons with a non-intrinsic player type, which makes it difficult to compare the groups.

### 5.3 Limitations

One problem of the present study is the sample size of  $N = 75$ , which lowers the probability of finding an effect in the present sample. Likewise, the observed sample only consists of pre-service teachers from one German university. Therefore, it is not possible to draw general conclusions about pre-service teachers in other countries.

Furthermore, the player type distribution in the current sample cannot be seen as generally representative for college students, because of the discrepancy between the expected and observed player type distribution. However, first indications arise for the group of pre-service teachers specifically. The existence of only one disruptor type is problematic for statistical calculations. Additionally, the disruptor player type also belongs to a participant with a mixed form. It is therefore difficult to make reliable statements about the distribution of player types.

Due to the classification into mixed forms, the interpretation of the results is complicated. Furthermore, the player and disruptor subtypes are not considered in a more differentiated way in the instrument used. The different group sizes pose a problem especially when calculating the ANOVA for the exploratory analysis of self-efficacy with digital media. In terms of reliability, there is a discrepancy between the literature ( $\alpha = .60$ ) and the sample studied for the free spirit player type ( $\alpha = 0.38$ ). Especially the reliability in the considered sample can be estimated as low regarding the free spirit and can represent a further problem of the study. Prior experiences and competencies of the pre-service teachers in dealing with digital media were not assessed and could also influence results, as experiences with digital media and attitudes towards e-learning, for example, may have an influence on self-efficacy with digital media.

#### 5.4 Implications and future research

Regarding the results of the present study, the different player types have no effect on self-efficacy with digital media. Future studies should take the aspects mentioned into account and the reported results should be verified with a larger sample. As many participants were intrinsic player types, the results can only be interpreted for this group. Comparing intrinsic player types with extrinsic and disruptor player types provides material for future research. Nevertheless, a high level of self-efficacy with digital media was demonstrated among the pre-service teachers tested in the present sample. To make educational games appealing to every type of player, further research should be conducted (e.g., the relation of player types and personality traits) to enable individualization in teacher training and a suitable educational offer.

Based on the present findings, pre-service teachers seem intrinsically motivated and preferably belong to the philanthropist player type. Therefore, the aspect of intrinsic game elements should be in the foreground for the use of learning games for pre-service teachers. Above all, communication and social interaction are important to them. This can increase the players' motivation and is reflected in their choice of profession.

#### Acknowledgements

This project (SaLUT, 01JA1906A) is part of the "Qualitätsoffensive Lehrerbildung", a joint initiative of the Federal Government and the *Länder* which aims to improve the quality of teacher training. The programme is funded by the Federal Ministry of Education and Research. The authors are responsible for the content of this publication.

#### References

- Abbitt, J.T. (2011) "An investigation of the relationship between self-efficacy beliefs about technology integration and technological pedagogical content knowledge (TPACK) among preservice teachers", *Journal of Digital Learning in Teacher Education*, Vol. 27, No. 4, pp 134-143.
- Bandura, A. (1977) "Self-efficacy: Toward a unifying theory of behavioral change", *Psychological Review*, Vol. 84, No. 2, pp 191-215.
- Bandura, A. (1989) "Human agency in social cognitive theory", *American psychologist*, Vol. 44, No. 9, pp 1175.
- Bandura, A. (2006a) "Toward a psychology of human agency", *Perspectives on psychological science*, Vol. 1, No. 2, pp 164-180.
- Bandura, A. (2006b) "Guide for constructing self-efficacy scales", *Self-efficacy beliefs of adolescents*, Vol. 5, No. 1, pp 307-337.
- Bateman, C., Lowenhaupt, R., and Nacke, L.E. (2011) "Player Typology in Theory and Practice", *Proceedings of DiGRA*.
- Blohm, I., and Leimeister, J. M. (2013). "Gamification", *Wirtschaftsinformatik*, Vol.55, No.4, pp 275-278.
- Bovermann, K., and Bastiaens, T.J. (2020) "Towards a motivational design? Connecting gamification user types and online learning activities", *Research and Practice in Technology Enhanced Learning*, Vol. 15, No. 1, pp 1-18.
- Chen, H.-L., Fan, H.-L., and Tsai, C.-C. (2014) „The Role of Community Trust and Altruism in Knowledge Sharing: An Investigation of a Virtual Community of Teacher Professionals", *Educational Technology & Society*, Vol. 17, No. 3, pp 168-179.
- Compeau, D.R., and Higgins, C.A. (1995) "Computer self-efficacy: Development of a measure and initial test", *MIS Quarterly*, Vol. 19 No. 2, pp 189-211.
- Deterding, S., Dixon D., Khaled, R., and Nacke, L. (2011) "From Game Design Elements to Gamefulness: Defining "Gamification", *In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, *MindTrek '11*, pp 9-15.
- Dickey, M. D. (2011). "Murder on Grimm Ilse: The impact of game design in an educational game-based learning environment", *British Journal of Educational Technology*, Vol. 42, No. 2, pp 456-469.
- Erhel, S., and Jamet, E. (2013) "Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness", *Computers & education*, Vol. 67, pp 156-167.

- Gomez-Carrasco, C.J., Monteagudo-Fernandez, J., Moreno-Vera, J.R., and Sainz-Gomez, M. (2020) "Evaluation of a gamification and flipped-classroom program used in teacher training: Perception of learning and outcome", *PLOS ONE*, Vol. 15, No. 7, pp 1-19.
- Hamari, J., Koivisto, J., and Sarsa, H. (2014) "Does Gamification Work? – A Literature Review of Empirical Studies on Gamification", *47<sup>th</sup> Hawaii International Conference on System Science*, pp 3025-3034.
- Hung, C.-M., Huang, I., and Hwang, G.-J. (2014) "Effects of digital game-based learning on students' self-efficacy, motivation, anxiety, and achievements in learning mathematics", *Journal of Computers in Education*, Vol. 1, No. 2, pp 151-166.
- Hung, M.-L. (2016) "Teacher readiness for online learning: Scale development and teacher perceptions", *Computer & Education*, Vol. 94, pp 120-133.
- Joët, G., Usher, E.L., and Bressoux, P. (2011) "Sources of self-efficacy: An investigation of elementary school students in France", *Journal of educational psychology*, Vol. 103, No. 3, pp 649.
- Johnson, D., Deterding, S., Kuhn, K.-A., Staneva, A., Stoyanov, S., and Hides, L. (2016) "Gamification for health and wellbeing: A systematic review of the literature", *Internet Interventions*, Vol. 6, pp 89-106.
- Kim, L.E., Jörg, V., and Klassen, R.M. (2019) „A meta-analysis of the effects of teacher personality on teacher effectiveness and burnout", *Educational psychology review*, Vol. 31, No. 1, pp 163-195.
- Klock, A.C.T., da Cunha, L.F., de Carvalho, M.F., Rosa, B.E., Anton, A.J., and Gasparini, I. (2015) "Gamification in e-Learning Systems: A Conceptual Model to Engage Students and Its Application in an Adaptive e-Learning System", *Learning and Collaboration Technologies*, pp 595-607.
- Künsting, J., Neuber, V., and Lipowsky, F. (2016) "Teacher self-efficacy as a long-term predictor of instructional quality in the classroom", *European Journal of Psychology of Education*, Vol. 31, No. 3, pp 299-322.
- Lee, Y., and Lee, J. (2014) "Enhancing pre-service teachers' self-efficacy beliefs for technology integration through lesson planning practice", *Computers & Education*, Vol. 73, pp 121-128.
- Li, Y., Yang, H.H., Cai, J., and MacLeod, J. (2017) "College Students' Computer Self-efficacy, Intrinsic Motivation, Attitude, and Satisfaction in Blended Learning Environments", *International Conference on Blended Learning*, pp 65-73. Springer, Cham.
- Lin, H.-H., Lin, S., Yeh, C.-H., and Wang, Y.-S. (2015) "Measuring mobile learning readiness: scale development and validation", *Emerald Group Publishing Limited*, Vol. 26 No. 1, pp 265-287.
- Marczewski, A. (2015) *Even Ninja Monkeys Like to Play. Gamification, Game Thinking & Motivational Design*. CreateSpace Independent Publishing Platform.
- Muntean, C.I. (2011) "Raising engagement in e-learning through gamification", *The 6th International Conference on Virtual Learning ICVL 2012*, pp 323-329.
- Pfitzner-Eden, F. (2016) "Why do I feel more confident? Bandura's sources predict preservice teachers' latent changes in teacher self-efficacy", *Frontiers in psychology*, Vol. 7, pp 1486.
- Rachels, J.R. (2016) "The Effect of Gamification on Elementary Students' spanish Language Achievement and Academic Self-Efficacy" Liberty University.
- Ryan, R.M and Rigby, C.S. (2020) "Motivational Foundations of Game-based Learning", *Handbook of Game-based learning*, pp 153-176.
- Tondello, G.F., Mora, A., Marczewski, A., and Nacke, L.E. (2018) "Empirical Validation of the Gamification User Types Hexad Scale in English and Spanish", *International Journal of Human-Computer Studies*, Vol. 127, pp 95-111.
- Tondello G.F., Wehbe, R.R., Diamond, L., Busch, M., Marczewski, A., and Nacke, L.E. (2016) "The Gamification User Types Hexad Scale", *In Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play*, pp 229-243.
- Trojanek, A., Fischer, H., and Heinz, M. (2019) „Auf die Typen kommt es an. Eine empirische Analyse studentischer Spielertypen", *GENEME'17*, pp 137.
- Usher, E.L., and Pajares, F. (2009) „Sources of self-efficacy in mathematics: A validation study", *Contemporary educational psychology*, Vol. 34, No. 1, pp 89-101.
- Weißenfels, M., Benick, M., and Perels, F. (2022) "Teachers' prerequisites for online teaching and learning: individual differences and relations to well-being during the COVID-19 pandemic", *Educational Psychology*, pp 1-18.