Are applicants in favor of traditional or gamified assessment methods? Exploring applicant reactions towards a gamified selection method

Konstantina Georgiou [*], Ioannis Nikolaou

Department of Management Science and Technology, School of Business, Athens University of Economics and Business, Athens, Greece

ABSTRACT

Gamification has been a new trend in hiring and staffing influencing companies' selection procedures. To explore applicant reactions to this new trend two studies were conducted. First, following an experimental design, we explored whether applicants perceived a gamified assessment method (i.e., a gamified Situational Judgement Test-SJT) more favorably in terms of satisfaction, predictive validity and fairness, than its traditional version (i.e., text-based SJT), as well as their levels of organizational attractiveness (study 1). Second, to get further insight into the factors that might influence applicant reactions towards a gamified assessment method, we explored the potential impact of personality (i.e., openness to experience) (study 2). Our findings indicated that applicants report higher levels of process satisfaction and in turn, perceived fairness and organizational attractiveness when the gamified assessment method is used compared to its traditional version, whereas the role of openness to experience was not supported. The role of gamification in employee selection as well as the practical implications of enhancing the assessment methods with game elements are discussed.

1. Introduction

Gamification refers to the inclusion of game elements in non-game contexts (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011), meaning that we can borrow elements from games and apply them elsewhere, such as in the recruitment and selection process, in order to improve candidates' experience and engagement. Recently, a number of studies have started to examine the application of gamification in employee selection contexts, and in particular, the psychometric properties of gamified assessment methods, providing preliminary evidence of their construct and predictive validity beyond what can be achieved with traditional assessment methods (e.g., Georgiou, Gouras, & Nikolaou, 2019; Nikolaou, Georgiou, & Kotsasarlidou, 2019b). But does the addition of game elements to an existing form of assessment yield positive reactions to applicants as well? To the best of our knowledge, there is no published research exploring the type of game elements which, when added to an existing form of assessment, can have a beneficial effect on applicants' perceptions and reactions, such as fairness and process satisfaction. It is proposed that gamifying an existing form of assessment, such as a personality test or a Situational Judgement Test (SJT), might improve its aesthetics and provide a more immersive and

engaging experience to test-takers (Armstrong, Ferrell, Collmus, & Landers, 2016a). Consequently, it is assumed that gamification might create to test-takers positive perceptions about the assessment method and in turn, the recruiting organization (e.g., Armstrong, Landers, & Collmus, 2016b; Chow & Chapman, 2013).

Along these lines, it is conceivable that an exploration of whether the addition of game elements affects applicants' perceptions of assessment methods and increases organizational attractiveness would advance our knowledge on gamification and assessment and its effects on recruitment outcomes, contributing thus to the research on both gamification and applicant reactions. Drawing from organizational justice theory and signaling theory, we aim to explore the role of the "signals" sent to applicants through a gamified assessment method in influencing applicant perceptions of the selection process (i.e., process satisfaction, perceived predictive validity and fairness), and in turn, their attraction to organization. Granted that games have been described as engaging and fun (e.g., Collmus, Armstrong, & Landers, 2016) and the addition of game elements to on line surveys and reading assessments has been reported as enjoyable by test-takers (Downes-Le Guin, Baker, Mechling, & Ruyle, 2012; Reed, Martin, Hazeltine, & McMurray, 2019), candidates might get satisfaction from the selection process and think that an organization

that utilizes a novel, engaging and fun assessment method, instead of a more traditional one, is more attractive than an organization that uses traditional selection methods. However, it is not just the characteristics of the selection procedures that form applicant reactions towards them but the individual characteristics of the applicants as well (Hausknecht, 2013). Personality has been found to influence the applicant perceptions of selection fairness and the hiring organization (e.g., Truxillo, Bauer, Campion, & Paronto, 2006), indicating the usefulness of considering personality traits in applicant reactions research. What may seem fair to some applicants may not seem fair to other applicants that possess different personality traits (Truxillo et al., 2006). This raises another question about the role of personality in forming perceptions of fairness towards a selection method.

Therefore, the purpose of this research is twofold. Study 1 aims to explore the impact of the use of a gamified SJT assessment on applicant reactions (i.e., perceived fairness, perceived predictive validity, and process satisfaction) and organizational attractiveness compared to a traditional version of the assessment, a text-based SJT, via an experimental design study. Study 2 aims to explore the moderating effect of personality (i.e., openness to experience) on the relationship between applicant perceptions of the assessment method and organizational attractiveness.

Our research contributes to both gamification and applicant reactions literature. Questions on how applicants perceive and react to the gamified assessments used in employee selection have not been answered yet, although applicant reactions to selection methods are of paramount importance among researchers and organizations, as they can affect organizational attractiveness and recruitment outcomes (Da Motta Veiga & Turban, 2014). For example, if applicants perceive favorably a selection method employed by an organization, it is likely that more applicants will apply for a job in this organization in the future (Ployhart & Harold, 2004) and might also affect their subsequent performance on the test through test-taking motivation (e.g., Chan, Schmitt, Deshon, Clause, & Delbridge, 1997). In this sense, our research will advance our knowledge into the use and impact of gamified assessment methods on organizational's attractiveness, from the applicants' viewpoint. It will also advance our knowledge on the application of gamification in new contexts (i.e. employee selection), and more specifically, on the characteristics of both the gamified assessment methods and the applicants, which are supported to influence applicant perceptions of the selection process and the hiring organization (e.g., Truxillo et al., 2006). Lastly, our findings will help HR professionals and organizations to employ gamified assessment methods effectively.

2. Gamifying assessment methods and applicant reactions

Although gamification and serious games are growing in popularity among practitioners and organizations, there is barely any research in employee recruitment and selection or any theoretical models linking the design processes followed by researchers to gamify assessment methods with the outcomes of those processes. First of all, to distinguish between the concept of gamification and serious games we should turn our attention to game elements and game design. Gamification refers to the application of certain game elements, such as avatars, points, badges, and progress bars, to non-gaming contexts, whereas serious games utilize several game elements in order to build a whole game for purposes other than pure entertainment (Alhalafawy & Zaki, 2019; Fetzer, McNamara, & Geimer, 2017). Moreover, the term design, in gamification literature, refers to the design elements and not the technologies and programming that are used in developing digital games (Alhalafawy & Zaki, 2019). Therefore, by applying gamification to assessment, we refer to a design process that enhances an existing form of assessment with game elements, such as avatars, scores and progress bars, whereas as a design process it is more similar to scale development (e.g., Attali & Arieli-Attali; Collmus & Landers, 2019).

2.1. Inclusion of game elements into assessments

To apply gamification to the employee selection context, or any other context, an identification of the game elements added is necessary at first in order to draw valid conclusions on game attributes and their beneficial effects on applicant reactions outcomes. Landers (2014) in an effort to link the research literatures of serious games and gamification, has provided examples of the Bedwell et al.'s (2012) game attribute category as it might be applied in gamification, along with specific recommendations for learning outcomes. It is also worth noting that, although serious games aim to affect learning directly by providing the learner with instructional content, gamification aims to influence the learner's behaviors or attitudes (e.g., engagement) and not learning directly (Landers, 2014). Similarly, the application of gamification to assessment should be carried out gradually by adding one game element at a time and in sync to the objectives of the assessment and the recruitment process in order to influence positively applicants' behaviors or attitudes. Although the conceivable goal of using gamification is to improve test-takers' experience and engagement (e.g., Deterding et al., 2011), an assessment method should also be perceived as fair and valid by candidates in order to positively affect their reactions to organizations (e.g., Lazar, Zinger, & Lachterman, 2007; Nikolaou & Georgiou, 2018).

Turning to the gamification literature, it is supported that the use of game elements, such as avatars, narrative and fantasy, might increase learners' engagement, motivation and fun (e.g., Armstrong, Landers, & Collmus, 2016b; Dicheva; Dichev; Agre, & Angelova, 2015; Malone & Lepper, 1987). Sailer & Homner (2020) in their meta-analysis on effects of gamification on learning outcomes, found that the inclusion of game fiction (i.e., narrative, fantasy) was effective in fostering behavioral learning outcomes. Moreover, Prestopnik and Tang (2015) examined how individuals perceive differences between points-based and story-based gamification approaches; they found that the story-based game was described as more enjoyable and motivating than the points-based game because of the narrative/cover story. Similarly, Armstrong and Landers (2017) demonstrated that enhancing text-based training programs with game fiction alone can improve reactions to training as it was described as more satisfying from trainees than a training that was not enhanced with narrative. Along these lines, the element of game fiction, that is defined as the fictional game world and story (Landers, 2014), could be added to an existing form of assessment in order to make it more engaging and fun.

The existing form of assessment could be a personality test, a cognitive ability test, or a situational judgment test (SJT), as any traditional assessment method may potentially be gamified (Armstrong et al., 2016a). SJTs, in which the test-takers are presented with situations that they would likely encounter at work and multiple ways of handling each, have been around for decades in their traditional text-based form (Weekley & Ployhart, 2006), not surprisingly, as they can predict job-related behaviors above and beyond cognitive ability and personality tests and generate positive reactions to applicants (Lievens, Peeters, & Schollaert, 2008). Research has also supported the applicability of SJTs in high fidelity modes, such as video, multimedia, and interactive formats (Lievens & Sackett, 2006), whereas, it is pointed out that *"gamification provides a toolkit to make SJTs even more gameful"* (Armstrong et al., 2016a, p. 672). Moreover, video-based SJTs have been described as more favorable in terms of enjoyment, acceptance, and job relatedness compared to a paper-and-pencil SJT (Kanning, Grewe, Hollenberg, & Hadouch, 2006). Along these lines, a SJT seems to be an appropriate method to explore whether the addition of the game fiction element generates positive applicant reactions.

2.2. Applicant reactions to gamified assessments

Both researchers and practitioners in the field of employee selection have an interest in applicant reactions as they can have both proximal

and distal effects to the hiring outcomes, from the impression of the organization to the willingness to accept a job offer (e.g., Ryan & Ployhart, 2000). The most influential theoretical approach in the field of applicant reactions has been Gilliland's (1993) organizational justice framework (Truxillo, Bauer, McCarthy, Anderson, & Ahmed, 2016). Moreover, Smither, Reilly, Millsap, ATT, and Stoffey (1993), similarly to Gilliland (1993), indicated that organizational justice perceptions associate the selection procedures to various recruitment outcomes, such as attractiveness and job pursuit decisions.

Gilliland (1993) put increased emphasis on the role of procedural organizational justice (i.e., the fairness of selection processes) - as opposed to distributive organizational justice (i.e., the fairness of selection outcomes) - which has many applications to technology as well (Nikolaou, Georgiou, Bauer, & Truxillo, 2019a). Specifically, the procedural organizational justice "rules" might provide a framework of key factors to organizations with which they can improve candidates' perceptions of the fairness of novel technologies for personnel selection (Langer, König, & Fitili, 2018). For example, by offering information and feedback to candidates, ensuring interpersonal treatment, showing job validity, etc., organizations might improve applicant reactions and positively affect important organizational outcomes, such as organizational attractiveness (Langer et al., 2018).

It is worth noting that the most commonly studied facets of applicant reactions are predictive validity perceptions, fairness perceptions and face validity perceptions (Chan & Schmitt, 2004). Moreover, according to Hausknecht et al.'s (2004) metanalysis, perceived predictive validity (i.e., the extent to which a selection method or test seems to be valid and predict job performance) was one of the most frequently studied procedure characteristics and a strong predictor of procedural justice. Although the role of perceived predictive validity in predicting a method's perceived fairness is well established in the applicant reactions literature (e.g., Bauer et al., 2001; Gilliland, 1993; Hausknecht, Day, & Thomas, 2004), there is no published research examining predictive validity perceptions and test fairness that candidates form towards the use of gamification as an employee selection process.

Moreover, apart from the formal characteristics of the selection process, which is a main component of the procedural justice rules, Gilliland's justice model of applicant reactions opens up the possibility for other procedural rules that may impact fairness perceptions but are not directly linked to organizational justice literature (e.g., ease of faking answers, invasiveness of questions) (Gilliland, 1993). Similarly, apart from perceived validity, Smither et al. (1993) also examined affect (i.e., the degree to which applicants enjoyed the examination), which was related to procedural justice, in other words, to the fairness of the selection processes. Similarly, Barsky, Kaplan, and Beal's (2011, p. 271) theoretical model of organizational justice indicated that *"affect creates the context through which people experience, appraise, and reach conclusions in matters of fairness"*. In other words, the extent to which applicants feel for example satisfied with the selection process might influence the conclusions they draw on the fairness of the selection process.

The extent to which applicants are satisfied with the selection process is also relevant to gamified assessment methods, since gamification has been described as a new and more enjoyable approach to recruitment (Collmus et al., 2016). It is supported for example that even the labeling of an ability test as a "game" might improve applicant reactions, such as enjoyment and motivation by making test-takers perceive that time moves quickly (Collmus & Landers, 2019). However, the enjoyment or satisfaction that applicants get from the selection process, when a gamified assessment method is used, has not been tested yet, neither its effect on perceived test fairness. Building on previous research (e.g., Barsky, Kaplan, & Beal, 2011; Collmus & Landers, 2019; Smither et al., 1993), we assume that, in addition to the perceived predictive validity of the assessment, the satisfaction that applicants get from the assessment method will positively affect their perceptions of test fairness.

Moreover, previous findings on applicant reactions indicated that individuals might show a preference for assessments that include

multimedia components (e.g., Drew, Lamer, Bruk-Lee, LeVine, & Wrenn, 2012; Motowidlo, Dunnette, & Carter, 1990; Richman-Hirsch, Olson-Buchanan, & Drasgow, 2000). For example, computerized video-based tests have been described as more content valid and more likely to predict future job performance than paper-and-pencil and computerized text-based formats (e.g., Motowidlo et al., 1990; Richman-Hirsch et al., 2000). Whereas, video-based SJT seem to generate higher enjoyment and acceptance than a paper-and-pencil SJT (Kanning et al., 2006). Also, as previously discussed, research has indicated that using narrative or game fiction makes the training process more satisfying compared to a training not enhanced with these game elements (e.g., Armstrong & Landers, 2017; Prestopnik & Tang, 2015). Taking all the above into consideration we assume that a SJT, enhanced with the element of game fiction, might positively affect the experience that applicants get from the selection process (i.e., process satisfaction) and their perceptions of predictive validity. In turn, these positive perceptions might create a more positive context through which applicants reach conclusions in matters of test fairness, than a traditional online SJT.

Hypothesis 1. Participants in the experimental group will demonstrate higher levels of perceived test fairness than participants in the control group and this relationship will be mediated by a) perceived predictive validity and b) process satisfaction.

Moreover, as a new trend in employee selection, the use of gamification cannot be considered independently of the impact of perceptions of satisfaction, validity and fairness on applicants' intentions and behaviors, such as organizational attractiveness.

Whichever the approach to gamifying an assessment is, recruiters need to ensure that negative reactions are minimized whereas the beneficial psychometric properties are maximized for legal, ethical and business reasons (Armstrong et al., 2016b). Otherwise, the fairness perceptions and organizational attractiveness, which are detrimental for positive recruitment and organizational outcomes, are likely to be harmed (e.g., Highhouse; Lievens, & Sinar, 2003; Truxillo et al., 2006). Especially since the formation of negative reactions towards the assessment methods is plausible when advanced technology is applied to them (Langer et al., 2018). Applicants might be relatively unfamiliar with novel selection methods which are not widely employed yet affecting thus their reactions in relation to negative word of mouth, organizational image, etc. (Nikolaou, Bauer, & Truxillo, 2015, pp. 92–108; Ryan & Ployhart, 2014).

The addition of the game fiction element to a SJT, by turning its scenarios into an adventure story, might make the assessment more game-like without adding complex mechanisms or advanced technology that might negatively affect fairness perceptions, as individuals unfamiliar with them might face difficulties in using it or not understand how and why it is used for employee selection (e.g., Wiechmann & Ryan, 2003). In addition, game-like experiences are by nature enjoying, motivating and engaging. According to signaling theory, candidates that obtain ambiguous or incomplete information, make use of this provision of information as "signals" related to the job in question and the organizational characteristics (Spence, 1973). Similarly, the use of a gamified assessment method during the selection process might provide "signals" to candidates about the organization's values and attributes, as other selections process (e.g., interviews, Celani & Singh, 2011). Therefore, positive predictive validity perceptions and process satisfaction and consequently, test fairness that candidates might form following the completion of a gamified assessment method might signal to them that the organization they apply for is a fair organization increasing thus company's attractiveness and the chance of a positive outcome. Moreover, it has been supported that procedural justice perceptions mediate the relationship between the usage of new technologies in selection and applicant reactions outcomes, such as organizational attractiveness (e.g., Bauer et al., 2006). Consequently, building on our 1st hypothesis, we propose that adding the element of

game fiction to a traditional text-based SJT will generate positive perceptions of perceived predictive validity and process satisfaction among applicants, affecting their perceived test fairness, which in turn leads to higher levels of organizational attractiveness. Therefore, we propose the following hypothesis.

Hypothesis 2. Participants in the experimental group will have greater levels of organizational attractiveness than participants in the control group and this relationship will be mediated by a) perceived predictive validity and b) process satisfaction and then, perceived test fairness.

3. Study 1

3.1. Method

3.1.1. Procedure and sample

We adopted an experimental design to compare the applicant reactions between a gamified assessment method and a traditional selection method (e.g., Landers & Armstrong, 2017; Langer et al., 2018). More specifically, we used the on-line SJT and its gamified version used in Georgiou, Nikolaou, and Gouras (2019) as these two assessment methods differ only in the addition of game elements. The gamified SJT assessment that Georgiou et al. (2019) developed, is based on a SJT assessment, the work-related scenarios of which, were converted into an adventure story (see Fig. 1). In the beginning of the assessment, test-takers must choose a play hero/avatar. Every hero/avatar has a backstory which follows the journey of play heroes in four islands, one for each soft skill assessed. Storytelling/narration takes place using visual and voice overs while taking the assessment. In each island, test-takers have to select the best and the worst option in each scenario that is narrated orally and visually in their screens. "*There is also a visual progression bar showing the progress in the assessment as well as story troubleshooting mechanisms and voice overs to remind users what the interface does and how to complete the assessment. There is also a world map showing the islands the players progress through*"(*Georgiou* et al., *2019, p. 94).*

Our sample consisted of employees working in a multinational company in the field of information technology. We followed a between subjects' design with half of participants completing the gamified assessment (experimental group) and the other half the on-line SJT (control group). In the beginning of the study, participants in both groups were asked to consider themselves applying for a job in a company employing a gamified assessment method or a SJT questionnaire. Those in the experimental group received an email inviting them to complete the gamified assessment by logging in a gaming platform (Georgiou et al., 2019). Following the completion of the assessment,

they received an invitation to complete an online questionnaire measuring their reactions to the assessment method, demographics (gender, age, educational level) and previous experience with video games. Similarly, those in the control group received an email inviting them to complete an online questionnaire. The questionnaire included the SJT questionnaire and the questions measuring individuals' reactions, demographics and previous experience with video games, as in the experimental group.

In the control group, of the 154 employees that have received the online SJT assessment 88 have completed the assessment with the online questionnaire assessing their reactions and demographics (response rate of 57%). Most of the participants were males (54.5%), with a mean age of 29.26 years (SD = 6.75). As far as their education level is concerned, 47.7% were university graduates, 48.9% had a postgraduate degree and 3.4% had a doctoral degree. In the experimental group, of the 154 employees that have received the gamified assessment, 73 have completed the assessment with the online questionnaire measuring their reactions and demographics (response rate of 47%). Participants in the experimental group were males (57.5%) and (42.5%) females with a mean age of 28.74 years (SD = 4.89). As far as their education level is concerned, 50.7% were university graduates, 47.9% had a postgraduate degree and 1.4% had a high school degree.

3.1.2. Measures

Perceived test fairness was measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) using Kluger and Rothstein's (1993) three items of test fairness scale. A sample item is "*I think the test is fair*" ($\alpha = 0.68$).

Predictive validity perceptions were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), using Chan, Schmidt, Sacco and DeShon's (1998) two items of predictive validity perceptions. A sample item is "*I am confident that the test can predict how well an applicant will perform on the job*" ($\alpha = 0.74$).

Process satisfaction was measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), using Sylva and Mol's (2009) one item of overall process satisfaction: "*Overall, I was satisfied with this application process*". The original wording "application process" was replaced by 'employee selection method' for consistency.

Organizational Attractiveness was assessed using the General Attractiveness Scale developed by Highhouse, Lievens, and Sinar (2003) including 5 items, e.g., "*For me, this company would be a good place to work*" on a 1–5 Likert scale (1 = strongly disagree to 5 = strongly agree) ($\alpha = 0.94$).

In order to control for demographics and prior experience with video games, the gender, age, and highest level of education were assessed, and the scale of video game experience was also used (Bourgonjon,

Fig. 1. Screenshot of one of the scenarios of the gamified assessment presented to the participants.

Valcke, Soetaert, and Schellens, 2010). The video game experience scale included four items, e.g., *"I often play video games"* and was measured on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (α = 0.96).

3.2. Results

3.2.1. Preliminary analyses

Although the assignment of participants into the two groups was random, we checked for differences between the experimental group and the control group in the demographics and control variables, before testing our hypotheses. As far as demographics are concerned, the initial analyses demonstrated that the two groups were statistically similar as there were no significant differences in gender $F(159, 154) = 0.565$, $p = .70$, age $F(159, 156) = 9.93$, $p = .57$ and educational level $F(159, 156) = 0.61$, $p = .29$ between the two groups. However, the results indicated a significant difference on video games experience $F(159, 153) = 1.13$, $p < .05$ between groups, in favor of the experimental group. As a result, we controlled for video games experience in our analyses.

Before proceeding to our hypotheses testing, we also explored for differences on the level of applicant perceptions and reactions between the two groups that experienced the different assessment methods. We run a multivariate analysis of covariance (MANCOVA) to explore whether participants in the experimental group demonstrate higher levels of applicant perceptions and reactions than participants in the control group. MANCOVA revealed a statistically significant effect of group to process satisfaction ($F = 5.929$, $p < .05$) but a nonsignificant effect to the perceived fairness and perceived predictive validity ($p > .05$). Therefore, our findings indicated that those completing the gamified SJT assessment have higher levels of process satisfaction ($M = 3.495$, $SD = 0.11$) than those completing the online text-based SJT ($M = 3.135$, $SD = 0.10$). Moreover, our results demonstrated a statistically significant difference ($F = 29.221$, $p < .001$) for the levels of organizational attractiveness between the two groups, in favor of the experimental group, as well as a large size effect $\eta^2 = 0.156$ (see Table 1).

3.2.2. Hypotheses testing

To test Hypothesis 1, indicating that participants in the experimental group will demonstrate higher levels of perceived test fairness than participants in the control group and this relationship will be mediated by a) perceived predictive validity and b) process satisfaction, we run a regression analysis using the PROCESS macros for SPSS (Hayes, 2018). Our findings provided partial support for Hypothesis 1. Specifically, using Model 4 of Hayes (2018) PROCESS macro v3.4, we found a full mediation between the assessment method and test fairness through the process satisfaction perceptions, since the direct effect of method to test fairness contained zero (CI between −0.02 and 0.31) but the indirect effect of group to test fairness via individuals' perceptions of process satisfaction (effect = .12, SE = 0.05, p < .01; CI between 0.03 and 0.23) did not contain zero (see Table 2). Therefore, our findings indicated that those completing the gamified SJT assessment have higher levels of perceived fairness through their perceptions of process satisfaction than those completing the online text-based SJT, when controlling for video

games experience, providing support for Hypothesis 1b. Hypothesis 1a was rejected as results did not support a significant indirect effect of the group to perceived fairness through applicants' predictive validity perceptions.

Our 2nd hypothesis, indicating that participants in the experimental group will have greater levels of organizational attractiveness than participants in the control group and this relationship will be mediated by a) perceived predictive validity and b) process satisfaction and then, perceived test fairness, was tested using the PROCESS macros for SPSS (Hayes, 2018) as well. Our findings provided partial support for Hypothesis 2. Specifically, using Model 6 of Hayes (2018) PROCESS macro v3.4, we found a partial mediation between the assessment method and organizational attractiveness through the process satisfaction perceptions and then fairness perceptions, since the direct effect of group to organizational attractiveness (effect = 0.45, SE = 0.09, p < .01; CI between 0.27 and 0.63) and the indirect effect of group to organizational attractiveness via individuals' perceptions of process satisfaction and then, fairness (effect = .02, SE = 0.01, p < .01; CI between 0.00 and 0.06) did not contain zero (see Table 2). Therefore, our results demonstrated that the gamified assessment method had a stronger indirect effect on organizational attractiveness via individuals' perceptions of process satisfaction and fairness compared to the traditional assessment method while covariate of video game experience was non-significant, supporting thus Hypothesis 2b. However, non-significant indirect effect was found of the assessment method to organizational attractiveness through the path predictive validity and fairness perceptions, rejecting thus Hypothesis 2a.

Table 2
Regression analyses.

Variables	B	SE	t	p
Predictive validity perceptions regressed on group	.38	.05	0.70	.00
Process satisfaction perceptions regressed on group	.34	.05	7.20	.00
Video game experience regressed on group	.00	.03	0.13	.90
Bootstrap results for direct effect of group to perceived fairness	**Effect**	**SE**	**L95% CI**	**U95% CI**
Perceived fairness	.02	.08	-.02	.31
Bootstrap results for indirect effect of group to perceived fairness	**Effect**	**SE**	**L95% CI**	**U95% CI**
Predictive validity	.03	.05	-.07	.13
Process satisfaction	.12	.05	.03	.23
Bootstrap results for direct effect of group to org. attractiveness	**Effect**	**SE**	**L95% CI**	**U95% CI**
Organizational attractiveness	.45	.09	.27	.63
Bootstrap results for indirect effect of group to org. attractiveness	**Effect**	**SE**	**L95% CI**	**U95% CI**
Predictive validity → Fairness	.01	.01	-.01	.03
Process satisfaction → Fairness	.02	.02	.00	.06

Note. Unstandardized regression coefficients reported. Bootstrap sample size 5000. L = lower limit; U = upper limit, CI = confidence interval.

Table 1
Descriptive statistics and tests of between-subjects effects.

Dependent variables	Group	N	M	SD	F	p	η^2
Perceived fairness	control	88	3.33	.68	2.499	.116	.016
	experimental	73	3.53	.73			
Perceived predictive validity	control	88	3.00	.77	.445	.505	.003
	experimental	73	3.10	.83			
Process satisfaction	control	88	3.11	.96	5.929	.016	.036
	experimental	73	3.52	.88			
Organizational attractiveness	control	88	3.47	.71	29.221	.000	.156
	experimental	73	4.07	.62			

Note. M = mean, SD = standard deviation, η^2 = partial eta squared.

3.3. Discussion

To better understand the underlying mechanisms behind the effects of gamification in cognitive assessment methods, such as SJTs, we examined how the addition of the game fiction element affect applicants' perceptions of the assessment method and organizational attractiveness. Specifically, we tested the differences in applicant perceptions that go through a SJT assessment that is gamified, in particular enhanced with the element of game fiction, compared to those that go through a traditional SJT assessment, an on-line text-based SJT.

We found that there are statistically significant differences for the levels of process satisfaction between groups and in particular, in favor of the gamified assessment method. Moreover, a greater difference was found for the levels of organizational attractiveness between groups, in favor of the gamified assessment method. In other words, individuals who completed the gamified SJT described the assessment method as more pleasant – they were more satisfied with the assessment method - than those completing the online text-based SJT. The beliefs, the subjective judgments in regard to an object or method that individuals have, shape the attitudes they hold towards an object or method and consequently affect their behavioral intentions (Fishbein & Ajzen, 1975). Similarly, the positive evaluation of the attributes of the gamified assessment (e.g., game fiction) generates the feeling of favorableness towards the assessment method, which is of primary interest in personnel selection research (e.g., Hausknecht et al., 2004), since the positive perceptions towards the selection methods lead to positive perceptions towards the organisation and positive recruitment outcomes as well (e.g., Chapman, Uggerslev, Carroll, Piasentin, & Jones, 2005).

We also found a full mediation between the assessment method and test fairness through the process satisfaction perceptions. It seems that the higher levels of process satisfaction that the individuals who completed the gamified assessment had, positively affected their perceptions of test fairness, compared to those completed the traditional assessment. Drawing from applicant's justice frameworks (Gilliland, 1993; Smither et al., 1993), we found that process satisfaction may be related to procedural justice, in other words, to the fairness of the selection process. Therefore, it is likely that the higher perceptions of process satisfaction caused by the addition of game elements to the SJT assessment, created a context through which test-takers experienced, assessed, and reached more positive conclusions in relation to the test fairness (Barsky et al., 2011).

In this sense, the current findings contribute to both gamification and personnel selection research. First, our findings extend gamification literature, which so far is mainly focused on educational settings, by testing the use of gamification and positive outcomes in personnel selection settings. Second, our study addresses calls to identify the game elements that might be applied to assessment and explore the beneficial effect they might have (e.g., Armstrong et al., 2016b). More specifically, previous research has provided evidence on the application of game fiction to educational programs and positive reactions among students (e.g., satisfaction) (Armstrong & Landers, 2017; Sailer & Homner, 2020). To the best of our knowledge this is the first study exploring the inclusion of game elements, such as narrative and fantasy, into employee selection methods and applicant perceptions of fairness, validity and satisfaction. Consequently, our study extends gamification literature by indicating that game fiction is an element that can be effectively employed not only in educational settings but also in selection settings, as the assessment method is then perceived as more satisfying and in turn, as more fair from applicants than an assessment method that is not enhanced with narrative and fantasy.

Moreover, in line with previous research on employee selection methods and applicant reactions (e.g., Hausknecht et al., 2004), we found that the more favorable perceptions towards a selection method lead to more favorable perceptions towards the organization. Specifically, our findings indicated a partial mediation between the assessment method and organizational attractiveness through process satisfaction and test fairness perceptions. According to signaling theory, individuals that go through a selection procedure obtain information about organization's characteristics via the signals they get for the selection process. Our results indicated that completing an assessment method enhanced with game fiction as part of the employee selection process, increased applicant's satisfaction with the selection method and in turn, fairness perceptions, which might has signaled to them an organization that may be more fair and pleasant to work in, as their organizational attractiveness levels were higher from those completing a traditional assessment method. As such, applicant perceptions of assessment procedures are an important consideration for organizations interested in fostering their employer branding.

Our findings also contribute to research in personnel selection methods and in particular SJTs. The advantages of using SJTs in employee selection have been well established as prior research has shown that such measures can predict a wide range of criteria and create positive applicant reactions (Lievens et al., 2008). Previous research has found that online avatar-based SJTs generate more positive perceptions among candidates than online text-based versions (e.g., Drew et al., 2012), and so do video-based SJTs leading to higher enjoyment than a paper-and-pencil SJT (Kanning et al., 2006). Along these lines, our findings extend research in SJTs by supporting that gamification may be used to SJTs in order to make them more game-like and as a result, more satisficing as an assessment process, which may also positively affect applicants' perceptions of test fairness.

However, we didn't find any significant differences in the levels of perceived fairness and predictive validity between the gamified and the traditional assessment method. Neither an indirect effect of the assessment method to perceived fairness or organizational attractiveness through predictive validity perceptions was found. It seems that whether applicants go through an online text-based SJT or a SJT enhanced with the game element of fantasy and narrative does not have a differential impact on the predictive validity of the assessment. Although, most of the previous experimental studies supported different levels of perceived predictive and face validity and fairness among different types of SJTs (e.g., Chan & Schmitt, 2004; Kanning et al., 2006; Richman--Hirsch et al., 2000), there are exceptions to the rule. Lievens and Sackett (2006) did not find significant differences between the face validity perceptions of the video-based and written SJTs. Similarly, our findings indicated that applicants perceived the text-based and gamified SJT to be equally able to predict how well an applicant will perform on the job.

A possible explanation for this might be that factors that are outside the organization's control, such as individuals' dispositional factors, might play a role in the formulation of applicant perceptions (Truxillo et al., 2006). A selection produce that seems fair or valid to some people might not seem fair or valid to other people having different personality traits (Truxillo et al., 2006). Since personality has been found to influence applicant perceptions (e.g., Bernerth; Feild, Giles, & Cole, 2006; Hausknecht, 2013), we may gain further insight into the factors affecting applicant perceptions, such as perceived predictive validity and fairness, by considering the personality characteristics of the applicants.

3.4. The role of personality

Previous research supports the role of individual differences and personality (e.g., Bretz & Judge, 1994; Truxillo et al., 2006) in applicant reactions, indicating that it is important to understand which personality traits form applicants' reactions when designing selection processes. For example, Truxillo et al. (2006) suggested that openness to experience may influence the way candidates approach novel testing procedures, and in turn, how they perceive the organization employing these procedures. It is conceivable that gamification is a new trend in the employee selection settings (e.g., Armstrong et al., 2016b), which has started to make the assessment methods look fresher and more innovative, as they include elements and designs that come from games.

Candidates that join an organization's selection process are nowadays likely to face assessment methods that they might have not experienced in the past, such as a cognitive test enhanced with the game attributes of interaction, cover story or animations explaining how to complete the assessment (Siemsen, 2019). This means that for candidates to react positively to the use of gamified assessments, they should possibly be open to this novelty.

Individuals high on openness to experience are more willing to actively seek out new and varied experiences, they are curious and behave flexibly in their attitudes and values (Costa & McCrae, 1992). On the contrary, individuals who are less open to new experiences may react negatively to computer-based selection methods (Oostrom, Born, Serlie, & Van Der Molen, 2010), as they are afraid of the unknown and the ambiguity in being evaluated during a selection process (Bernerth, Feild, Giles, & Cole, 2006). Moreover, it is supported that applicants that are open to new experiences may have a more positive attitude towards the adoption of technology and innovative selection methods (e.g., Ryan & Ployhart, 2000). For instance, it is supported that school and college students who had higher levels of openness to new experiences reported higher levels of video gameplay than students lower on openness (e.g., Chory; Goodboy, 2011; Witt, Massman, & Jackson, 2011). Therefore, the trait of openness to experience is chosen in order to explore its potential effect on the application of a gamified assessment in employee selection and applicant reactions.

Individuals open to new experiences have been described among others as imaginative, fond of diversity, hungry for knowledge, strongly curious, unbiased and independent in their thinking and judgments (e. g., Barrick & Mount, 1991; Chen, Tu, & Wang, 2008; Thoms, Moore, & Scott, 1996). The independence of judgment that individuals with high levels of openness possess is associated with justice perceptions suggesting that individuals possessing certain characteristics may be more inclined to accept the selection procedures as fair (e.g., Bernerth et al., 2006; Skarlicki, Folger, & Tesluk, 1999; Wiechmann & Ryan, 2003). As such, individuals open to new experiences being unbiased and independent in their judgments may be unbiased towards an assessment method that is used for the purpose of employee selection. Moreover, these people like the freshness of the unknown, enjoy trying new experiences and are inclined to aesthetics. Therefore, an assessment enhanced with game elements might be attractive to them as a new and fresh experience in selection settings.

Bernerth et al. (2006) found that openness to experience was positively related with procedural justice perceptions, which were assessed by questions about the fairness of the test, such as, *"Overall, I believe using the Organizational Leadership Test was fair"* as in our study 1. Similarly, Van Vienen et al. (2004) supported that openness to experience positively influenced candidates' test beliefs and job attractiveness and suggested that individuals who score relatively high on openness to experience are more likely to perceive the selection as fair in the final stage of the selection process. Along these lines, we assume that applicants with high levels of openness to experience might report higher levels of organizational attractiveness when they perceive the test/selection method as fair. In other words, we expect openness to moderate the relationship between test beliefs and organizational attractiveness, as it refers to attributes such as unbiased judgment and inclination to new experiences and the unknown, associated with justice perceptions (e.g., Bernerth et al., 2006; Skarlicki et al., 1999; Wiechmann & Ryan, 2003). Whereas the higher levels of perceived test fairness might lead to higher levels of attractiveness towards the recruiting organization, through signaling of organizational attributes. For example, applying signaling theory to interviews, Celani and Singh (2011) indicated that the way interviews are conducted impacts whether applicants are attracted to organizations. Moreover, personality has been found to account for significant variance in perceptions of the hiring organization beyond that accounted for by fairness perceptions (Truxillo et al., 2006). Therefore, we formulate the following hypothesis.

To explore the role of openness to experience in the formulation of applicant perceptions, we conducted Study 2.

Hypothesis 3. Openness to experience will moderate the relationship between test beliefs (i.e., perceived predictive validity and test fairness) and organizational attractiveness in that those who are higher in openness will experience higher rates of perceived predictive validity and test fairness, and organizational attractiveness.

4. Study 2

4.1. Method

4.1.1. Procedure and sample

To explore the applicant's reactions towards the use of a gamified assessment method into employee selection, we recruited N = 131 students and alumni from a South-European University's career office. Participants were 65% females, with an average age of 26 years old (SD = 5.2), and at the moment of the study, they were university students (29%), graduates (35%) and post-graduates (36%). Having voluntary handled their email address to researchers, participants received an email asking them to assume that they are going through an organization's selection process and as a part of this process they have to complete a gamified SJT assessment (Georgiou et al., 2019). As soon as they completed the assessment, they received an online questionnaire assessing applicant reactions (i.e., perceived test fairness, perceived predictive validity, organizational attractiveness) and demographics.

4.1.2. Measures

Gamified assessment: We used Owiwi's gamified SJT described in Georgiou et al. (2019) measuring the soft skills of adaptability, resilience, flexibility, and decision-making.

Perceived fairness: To measure the perceived fairness of the gamified assessment method we employed the Test Fairness scale developed by Kluger and Rothstein (1993) including 3 items, e.g*., "Most people would say that this game is fair",* on a 1–5 Likert scale (1 = strongly disagree to 5 = strongly agree) (α = 0.61).

Perceived predictive validity: To measure the perceived predictive validity of the gamified assessment method we employed the Perceived Predictive Validity scale developed by Chan, Schmitt, Sacco, and DeShon (1998) including 2 items, e.g*., "I am confident that the game can predict how well an applicant will perform on the job",* on a 1–5 Likert scale (1 = strongly disagree to 5 = strongly agree) (α = 0.68).

Organizational Attractiveness was assessed using the General Attractiveness Scale developed by Highhouse et al. (2003) including 5 items, e. g., *"For me, this company would be a good place to work"* on a 1–5 Likert scale (1 = strongly disagree to 5 = strongly agree) (α = 0.94).

Openness to Experience was assessed using the Openness to Experience scale from the IPIP questionnaire, including 10 items on a 1–5 Likert scale (1 = strongly disagree to 5 = strongly agree) (0.70).

4.2. Results

Table 3 shows means, standard deviations and correlations between the study variables. We observe that there is no relationship between demographics (gender, age, educational levels) and applicant reactions. But there is a positive relationship between applicants' perceptions of fairness (r = .40, p < .001) and organizational attractiveness as well as perceptions of predictive validity (r = 0.43, p < .001) and organizational attractiveness. Moreover, openness to experience is related only to fairness perceptions at a significant level (r = 0.20, p < .05).

Our 3rd hypothesis, indicating that openness to experience will moderate the relationship between test perceptions (i.e., perceived test fairness, predictive validity) and organizational attractiveness was tested using the PROCESS macros for SPSS (Hayes, 2018). Specifically, using Model 1 of Hayes (2018) PROCESS macro v3.4, results from regression analysis indicate that both model 1 (without the interaction

Table 3
Descriptive statistics, reliabilities and correlations.

	Mean	SD	1	2	3	4	5	6	7
1. Gender	.65	.48	–						
2. Age	26.11	5.21	-.188*	–					
3. Education	4.04	.91	.155	.012	–				
4. Openness to experience	3.79	.44	-.078	.165	.252**	(.70)			
5. Predictive validity	3.13	.82	.019	-.041	-.022	.120	(.68)		
6. Fairness	3.62	.67	-.064	-.035	.100	.201*	.659**	(.61)	
7. Org. Attractiveness	3.87	.66	.104	-.100	.032	.140	.425**	.400**	(.94)

Note. *p ≤ .05, **p ≤ .01.

term) $F(2, 128) = 10.03$, $p < .001$ and model 2 (with the interaction term) are significant $F(3, 127) = 6.83$, $p < .001$. However, model 2 with the interaction between fairness perceptions and openness to experience did not account for additional variance at a significant level, R^2change $= 0.003$, $p > .05$, indicating the lack of moderation between fairness perceptions and openness to experience on individuals' organizational attractiveness and predictive validity perceptions, rejecting thus Hypothesis 3.

4.3. Discussion

Applicants that go through a selection procedure may form perceptions regarding the predictive validity and fairness of the selection methods used and consequently, the attractiveness of the organization and job position (e.g., Chapman et al., 2005; Hausknecht et al., 2004). Past research generally shows a moderate positive relationship between applicant perceptions of the recruitment process and organizational attractiveness (Chapman et al., 2005). Extending recent research on the role of gamification in recruitment and selection, our findings indicated, in line with prior studies in personnel selection, that applicant reactions (i.e., perceptions of predictive validity and fairness) towards a gamified SJT are moderately related to organizational attractiveness. Since the findings of our first study did not support a significant difference between the levels of applicant perceptions and organizational attractiveness when the gamified versus the traditional version of the SJT assessment is used, we subsequently explored the potential role of personality. More specifically, we examined whether openness to experience accounts for a difference in the levels of applicant perceptions and organizational attractiveness. Our findings did not provide support for a moderating effect of openness to experience to the relationship between perceived test fairness, predictive validity and organizational attractiveness. The association of perceived test fairness and perceived validity with organizational attractiveness does not dependent on openness to experience.

However, openness to experience is positively related to perceived test fairness, in line with prior studies (e.g., Bernerth et al., 2006; Oostrom et al., 2010) supporting that openness to experience was positively related to perceptions of procedural justice. Consequently, certain individuals, in particular those that are intellectually curious and behaviorally flexible in their attitudes (Costa & McCrae, 1992), may be more predisposed to react positively to selection methods, such as a gamified assessment method. As far as the relationship between openness to experience and perceived validity is concerned, the results of previous studies are mixed. Whereas, Oostrom et al. (2010) or Wiechmann and Ryan (2003) found a positive relationship between openness to experience and face validity, Honkaniemi, Feldt, Metsäpelto, and Tolvanen (2013) supported that personality type does not affect face validity or predictive validity perceptions, as our findings indicate. Similarly, Nikolaou and Judge (2007) found only a few weak relationships between Core-Self Evaluations, a second order personality factor bringing together the traits of self-esteem, self-efficacy, locus of control, and neuroticism, and fairness reactions towards the different selection methods. Summing up, it may not matter whether an applicant is open to new experiences in forming positive perceptions towards a gamified

assessment and the prospective employer. However, personality has been shown to affect applicant reactions (Truxillo et al., 2006) and seems to have an influence on game-based training. For example, trainees with higher openness to experience had an advantage in performing to video-based training as they are better able to explore and be creative while learning (Bauer, Brusso, & Orvis, 2012). So, further research is needed to understand how and under what conditions different types of personality react to gamified assessment and more specifically, to the addition of different types of game elements to existing forms of assessments.

4.4. General discussion

The purpose of this study was to explore whether the use of gamification in employee selection creates positive perceptions about the selection procedure among applicants and as a result, to the recruiting organization. We conducted Study 1, using the organizational justice framework (Gilliland, 1993), in order to get insight into the game elements that generate more favorable perceptions about the assessment method and increase organizational attractiveness, when added to traditional assessment methods. Specifically, with respect to the procedural justice rules, we assumed that the addition of the element of game fiction to a text-based SJT assessment would enhance applicants' perceptions of predictive validity and process satisfaction, since games are by nature fun, engaging and hard to fake (e.g., Armstrong et al., 2016b; Fetzer et al., 2017), and in turn, perceptions of fairness, since positive affect creates a context in which more favorable perceptions of fairness are likely to emerge (Barsky et al., 2011). However, a statistically significant indirect effect from the assessment method to fairness perceptions was found only for the mediator of process satisfaction, indicating that the addition of the game fiction element to an assessment makes the selection procedure look more pleasant and in turn, fair, extending thus research on gamification and employee selection. Also, applicants that go through a selection process including a gamified assessment view the recruiting organization as more attractive compared to an organization using a traditional assessment method. More specifically, there is an indirect effect from the assessment method to organizations attractiveness through process satisfaction and test fairness. Drawing from signaling theory (Spence, 1973), our findings supported that the use of gamification in assessment might signal to applicants a more attractive employer through the selection process's satisfaction and fairness, extending thus research on applicant reactions.

In addition, the non-significant findings regarding predictive validity and fairness perceptions, led us to explore the role of personality in Study 2, since an important element of applicants' reactions, apart from the characteristics of the selection method and the outcome of the process, are the individual characteristics of the applicants (Hausknecht, 2013). Granted that gamification is a new and modern trend in recruitment and selection, we focused on the personality trait of openness to experience. Since *"individuals low in openness are likely to react more negatively and view the process and the outcome as more unjust than those individuals who are open to new and novel experiences"* (Bernerth et al., 2006, p. 549), we assumed that for candidates to react positively to the use of gamified assessments, they should possibly be open to this

novelty. However, we didn't find support for a moderating effect of openness to experience on the relationship between applicant perceptions and organizational attractiveness. Concluding that, although personality has been found to affect applicant reactions (Truxillo et al., 2006), it may not matter whether an applicant is open to new experiences in forming positive perceptions towards the use of gamification in employee selection. Future research should explore other factors that might affect applicant reactions to the addition of different types of game elements to existing forms of assessments.

4.4.1. Practical implications

Technological advances have changed the way that people live and work (e.g., virtual, mobile work) and as a result, the skills that apply to jobs. These changes have also an impact on the design of selection and assessment methods, since technologically advanced methods able to measure the desirable skills, while employing new features (e.g., different design, look and feel) and autonomous scoring and administration (e.g., computerized, delivery on internet, cellphone and tablet) are now needed (Ryan & Derous, 2019).

The classical psychological assessments have evolved to online testing, digital interviews and gamified cognitive assessments offering to human resource management professionals various forms of technological tools to use in employee selection in order to decide who the best candidate is (Nikolaou et al., 2019a). However, as Kanning et al. stated (2006, p. 169), "*if more than one valid instrument is available, one should choose the one that is assessed most positively by the applicants, as long as the instruments measure the same feature in terms of content*". Therefore, we believe that our findings contribute to practice since the comparison of a gamified SJT assessment with an online text-based SJT, measuring the same constructs (Georgiou et al., 2019), with regards to applicant reactions showed that the gamified assessment is perceived more positively by test-takers.

Organizations, HR professionals and recruiters may use gamification in order to provide a more game-like and pleasant experiences to candidates, to increase both perceptions of test fairness and organizational attractiveness. Favorable candidate perceptions of the assessment process are an important consideration for organizations in order to increase organizational attractiveness, displaying new and modern practices in employee selection and possibly benefit from the outcomes of positive applicant reactions, such as job pursue intentions, recommendation intentions and job offer acceptance.

4.4.2. Limitations and future research

A number of limitations of this study should be taken into consideration. First, our samples consisted of employees (study 1) and students/graduates (study 2) who were asked to assume that they had applied for a job at an organization. Therefore, the hypothetical environment of the process might have influenced the outcomes of our research. Second, applicant reactions were assessed one-off via self-report measures. A direction for future research is to assess applicant reactions to gamification in real employee selection settings and examine applicant reactions over time following a longitudinal design. Moreover, future research could examine additional applicant reaction outcomes, such as recommendations intentions, job offer acceptance intentions and others in order to further explore the outcomes of gamification for organizations. It is also important to note that the current study focused on a SJT assessment method and the inclusion of the element of game fiction. So, the generalization of our findings should be made with caution as the use of different assessment methods and/or different game elements might have different effects on applicants' perceptions. As far as the non-significant results are concerned, we believe that future research should explore further the characteristics of the gamified assessments as well as the dispositional characteristics of applicants to get greater insight into applicant reactions towards the use of gamification in employee selection settings. Last but not least, a limitation of our study is the barely acceptable level of internal

consistency of the perceived fairness measure. However, the authors that developed this scale reported also a low Cronbach alpha ($\alpha = 0.66$) (Kluger & Rothstein, 1993) as well as other researchers (Richman-Hirsch et al., 2000) that used very similar scales to test fairness, such as procedural justice ($\alpha = 0.68$), and to predictive validity ($\alpha = 0.63$). Consequently, we think that it is an issue future research on this topic should deal with.

5. Conclusion

The effect of using gamification in employee selection settings is more complex than expected. The current study showed that the addition of the game fiction element to a traditional text-based SJT assessment increases applicants' perceptions of process satisfaction and in turn, perceptions of fairness and organizational attractiveness but it does not affect the perceptions of predictive validity. Moreover, just because individuals are open to new experience does not mean that they are in favor of gamified assessment methods forming, as a result, positive reactions towards the assessment method and the recruiting organization. However, organizations may decide to include game elements in employee selection methods in order to make the assessment method look more pleasant and in turn, fair, and themselves more attractive as prospective employers.

CRediT authorship contribution statement

Konstantina Georgiou: Conceptualization, Data curation, Formal analysis, Methodology, Writing - original draft, Writing - review & editing. **Ioannis Nikolaou:** Conceptualization, Project administration, Resources, Supervision, Writing - review & editing.

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