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Exploring the influence of gender and gaming competence on attitudes towards using instructional games

Philip Bonanno and P. A. M. Kommers

Philip Bonanno is presently reading for a PhD in Instructional Psychology and Technology at University of Joensuu, Finland, focussing on the use of digital games for learning. He coordinates the 'Programme in Educational Technology, Design and Innovation' and lectures in Educational Technology, at the Faculty of Education, University of Malta. This paper is based on a 'work-in-progress' investigating collaborative gaming through an interactions-oriented approach. Piet Kommers is associate professor at the University of Twente. His specialities are new media technologies for education and society, Knowledge representation, teacher education and virtual reality. Based on his earlier work on conceptual media design he is one of the founders of structural graph equations for predicting user access in hypertext. Currently he is involved in restructuring large scale programs for ICT in teacher training. Address for correspondence: Philip Bonanno, Faculty of Education, 231, Old Humanities, University of Malta, Msida MSD06, Malta. Email: philip.bonanno@um.edu.mt

Abstract

Digital games are evolving beyond the solitary context into a ubiquitous, social and collaborative experience. Addressing beliefs about technology and attitudes towards technology-mediated processes is fundamental to the successful implementation of any innovation. In collaborative gaming, attitude towards gaming influences learners' interactions along the domain, technology and community dimensions. Building on various seminal works, an instrument was developed for measuring four components of attitude towards gaming—affective components, perceived control, perceived usefulness and behavioural components. The survey, including 21 statements each scored on a 5-point Likert scale, was used with a sample of college students to investigate the influence of gender and gaming competence on attitude towards gaming. The pedagogical implications of the different attitude components are discussed in relation to game design and to the different interactions triggered by the gaming context.

Introduction

Beyond the solitary context, gaming is evolving into a highly stimulating, interactive, social experience based on an ambient gaming paradigm that merges the virtual with the real. The Stellenbosch Declaration (2005) solicits innovative approaches that integrate games with learning: 'Computer games are a neglected but very important area of computer supported learning, which can promote critical thinking, strategic and logical skills, as well as cooperative and negotiation capabilities' (p. 6).

Merging gaming with learning is not a straightforward task. Notwithstanding the degree of technological sophistication and the widespread utilisation of information and communications technology (ICT) for information retrieval, knowledge construction and communication, the use of digital games for learning presents a very novel context that can trigger mixed reactions. Teachers' and students' beliefs about gaming and about digital technologies determine the outcome of any innovative pedagogical initiatives. In his 'Innovation Decision Process Theory', Rogers (1995) maintains that people's attitudes towards a new technology are a key element in its diffusion. Promoting a pedagogy that integrates gaming with learning is a gradual process that takes time and that passes through various stages involving a process of attitudinal change.

Attitudes are 'states that are based on aggregates of beliefs and that develop into patterns of stable individual differences' (Snow, Corno & Jackson, 1996, p. 290). Changing individuals' behaviour is possible once their attitudes have been identified, (Zimbardo, Ebbesen & Maslach, 1977). The 'Theory of Reasoned Action', Ajzen and Fishbein (1980), contends that social behaviour can be predicted if attitudes are understood. They point to the fallacy of assigning attitudes towards objects, in this case digital games, as this limits the prediction of the overall pattern of behaviour and understanding of particular actions with respect to the object. They claim that 'to predict a single behaviour we have to assess the person's attitude toward the behaviour and not his attitude toward the target at which the behaviour is directed' (p. 27). In this respect any instrument must measure, not attitude to games (as objects), but attitude towards gaming (the behaviour). 'Individuals will intend to perform a behaviour when they evaluate it positively and when they believe that important others think they should perform it' (p. 6). Because attitudes are a function of beliefs, learners and teachers will only use games for learning if they come to believe that gaming leads to positive task and person-oriented outcomes. Those who believe that gaming leads to negative outcomes, such as decreased academic performance or censorship by significant others, will definitely develop critical attitudes.

In response to the widespread use and ever-changing nature of ICT, various investigations were carried out regarding attitudes towards computers and the relationship between attitudes and behaviour. Lee (1970) used a 20-item questionnaire to measure the attitudes of the American public towards computers according to two dimensions: the extent to which computers are seen as a beneficial tool and the extent to which computers are seen as independent thinking machines. Morrison (1983) surveyed the attitudes of Australians towards computers, finding much concern over possible disemployment and dehumanising effects caused by computers, and their control over personal life. Lloyd and Gressard (1984) attempted to describe the attitude towards computers in more than two dimensions. They developed the computer attitude scale, which measured computer anxiety, computer confidence and computer liking as key dimensions. In another study, Byrd and Koohang (1989) added the dimension of perceived usefulness. Shaft and Sharfman (1996) proposed an instrument to assess the attitude towards computers. Building on Kay's (1993) framework for assessing attitudes towards computers and Davis' (1993) technology acceptance model, Selwyn

(1997) developed a scale that integrates the four distinct constructs identified by Kay—*affect* (feelings towards computers), *cognition* (perceptions and information regarding computers), *conation or behavioural* (behavioural intentions and actions with respect to computers) and *perceived behavioural control* (perceived ease, or difficulty, of using computers)—and Davis' *perceived usefulness* (the degree to which an individual believes using computers will enhance their job performance). Zhang (in press) developed a 40-item 'Internet Use Attitude Scale'.

Considering the fact that no research investigation into learners' attitude to gaming could be traced, and that a number of different instruments to measure 'Attitude to Computers' (as objects and not ICT-related behaviours) have been developed but no process-oriented instrument was developed for measuring attitude towards gaming, it was decided to develop an appropriate instrument. Building on Selwyn's model, a survey was developed by the author to identify the different attitudinal components to gaming and explore their pedagogical implications. This survey is described in the 'Procedure' section further in the text.

Experimental validation

Using a process-oriented approach, this investigation is part of a broader research project that explores collaborative gaming by analysing the type, frequency and directionality of interactions. Building on constructionist principles, the author developed a model (Bonanno, 2005), to organise interactions along three fundamental dimensions—subject matter, technology and community. According to Dillenbourg, Baker, Blaye and O'Malley (1996), three major factors influence interactions in collaborative learning environments along these dimensions: individual characteristics, group composition and task (game) features. Individual characteristics relevant to collaborative gaming include personality dimensions influencing social comportment, gender-related neuro-cognitive and affective propensities and gaming competence. This paper focuses on 'attitude towards gaming' as a personal characteristic emerging from the interaction between gender-related affective propensities and individual gaming competence.

Gaming competence was established by combining time dedicated to playing games with the repertoire of preferred games (those played over and over again). It is assumed that enthusiastic gamers dedicate more time to play and have wider repertoires of preferred games. The three gaming categories are: *enthusiastic*—play more than 8 hours per week and name more than five preferred games; *moderate*—play 2–7 hours per week and name two to four preferred games; *non-gamers*—play up to 1 hour per week and name only one preferred game.

Research questions

RQ I: Is there any gender-related difference regarding the identified four attitudinal components making up general attitude towards gaming?

RQ II: Is there any gender-related difference regarding general attitude towards gaming?

RQ III: Is there any relation between gaming competence and attitude towards gaming?

Subjects

This investigation involved 170 Maltese, college students (16–18 years old) enrolled for a 2-year course in Biology at an advanced level. The gender distribution of the respondents was 66.5% female ($n = 113$) and 33.5% male ($n = 57$).

Instruments

The survey 'My feelings when playing games' comprises 21 statements. Six statements related to the *affective component*, five statements about *perceived usefulness*, six statements about *perceived control* and four statements about *behavioural components.* All statements describe behaviours while using games. Twelve statements describe situations with positive feelings, while nine other statements describe negative feelings such as fear, lack of control and hesitation. Statements were scored using a 5-point Likert scale. Data about gaming competence was obtained in the form of two covariates—time dedicated to playing games and the repertoire of preferred game titles.

Procedure

Data about gaming competence was collected as part of another investigation exploring gaming tendencies of college students. The survey was given to a larger sample, 367 Biology students, 126 (34.3%) males and 241 (65.7%) females. From this larger sample, groups of students were selected for game treatment sessions. The survey 'My feelings when playing digital games' was given to be completed at the commencement of these treatment sessions. The scores for the separate statements were coded in SPSS considering also reverse scoring for unfavourable statements. The overall student's attitude, called general attitude, was defined by summing all the individual statement scores. Because 21 statements were included in the survey, the general attitude score ranged between 0 and 84 (0 for all 21 statements scored '*strongly disagree*; 84 for all 21 statements scored '*strongly agree*'). The higher the score, the more favourable is the attitude. To classify participants' general attitude towards gaming, five categories were created along this range (refer to Table 1).

Table 1: Classification of attitude towards gaming by score

Scoring range	*Attitude classification value label*
0–17	Very negative attitude
18–35	Negative attitude
36–51	Neutral attitude
52–68	Positive attitude
69–84	Very positive attitude

Results and analysis

Data about gender, gaming competence and identified attitude components were entered in SPSS using the appropriate codes. A number of variables were constructed by computing individual scores for the different statements related to the affective components, perceived use, perceived control and behavioural components. A compound variable labelled general attitude gives the global measure for attitude to gaming by computing the scores from all the 21 statements of the questionnaire. The main results for the separate statements are given in Table 2.

Statements in Table 2 with reversed scoring are shaded. Values with an asterisk (*) show statistical significance. Results are discussed in the following sections according to the identified research questions.

Table 2: Statistical data for the 21 separate variables

Statement			*Pearson Chi-square*
No	*Code*	*Description*	
1	A_1	Given the opportunity to use a game such as *Empire Earth* or *SIMS*, I am afraid that I might have trouble in navigating through it.	0.016*
2	U_1	Games help me relax and thus do my work better.	0.034*
3	C_1	I could probably teach myself most of the things I need to know about games.	0.004*
4	B_1	I would avoid learning a topic if it involves Games.	0.691
5	A_2	I hesitate to use a game in case I look stupid.	0.659
6	U_2	Games can enhance the learning experience to a degree which justifies the extra effort.	0.154
7	C_2	I am not in complete control when I use a computer for games.	0.064
8	A_3	I don't feel uneasy about using a game.	0.590
9	C_3	I can make the computer do what I want it to do while playing a Game.	0.002*
10	B_2	I only use games when told to.	0.007*
11	C_4	I need an experienced person nearby when I'm using a game.	0.002*
12	A_4	Playing games does not scare me at all.	0.030*
13	U_3	Most things that one can get from a game can be obtained or arrived at through other means.	0.076
14	B_3	I avoid playing games.	0.001*
15	C_5	If I get problems using a game, I can usually solve then one way or the other.	0.002*
16	A_5	I hesitate to use a computer for playing games as I'm afraid of making mistakes I can't correct.	0.006*
17	U_4	Games provide more interesting and imaginative ways for learning.	0.441
18	B_4	I will use games regularly throughout school/college.	0.003*
19	C_6	I do not need somebody to tell me the best way to use a game.	0.075
20	A_6	Games make me feel uncomfortable.	0.007*
21	U_5	Games make it possible to learn more productively.	0.931

RQ I: Is there any gender-related difference regarding the identified four attitudinal components making up general attitude to gaming?
Discussion is organised around the four major attitudinal components. The statistical significance of each statement is discussed in relation to the pedagogical implications. Statements (St) are referred to by number as listed in Table 2.

Affective component
The affective component addresses feelings of fear, hesitation and uneasiness experienced before and during gaming. Males are less apprehensive to gaming than females and feel more confident when using and navigating through games (St 1: $p < 0.016$). Pedagogically, this should be exploited by enticing males for game-based learning (GBL) through promotion of requested navigational skills. With females, the level of navigation demanded should be discussed and clarified, encouraging them to get involved in GBL while assuring assistance and support to overcome perceived difficulty and incompetence.

Both sexes are not inhibited by beliefs arising from negative perceptions of looking stupid with others when playing games (St 5: $p < 0.659$). Gaming is perceived by both as an intelligent and socially accepted activity. Thus, GBL should be promoted as a stimulating academic activity capable of challenging a range of cognitive abilities. Examples of good practice should be used to counteract opinions that consider gaming as a time-wasting activity. Also, gamers, game designers and students using GBL should be promoted as smart, intelligent and sociable people.

Regarding hesitation in the use of hardware (St 16: $p < 0.006$), males show full confidence with gaming devices, while females are more hesitant. In GBL, females should be reassured that there are no irreversible mistakes when playing a game, and that the computer or gaming device are protected from common user mistakes and mishandlings. Gaming actions perceived as causing irreversible effects on gaming devices should be identified and rationalised through clear instructions. Females' gaming biography should be explored to identify what makes them feel uncomfortable regarding different game genres, perceived gaming incompetence and self-exposure in collaborative gaming. Gaming situations that are perceived as less threatening should be identified and used for an initial phase of supported gaming.

Experiencing success builds confidence. For this purpose, when playing a new game or difficult game level, females should be given continual reinforcement and support. Also, because, both sexes do not feel uneasy about using games (St 8: $p < 0.590$) and consider them as an enjoyable experience, teachers should exploit this positive feeling by using GBL to enhance the learning experience while controlling for gender-related differences.

Perceived usefulness
This involves behaviours arising from beliefs about the advantages of using games for learning. Regarding the therapeutic effect of games, male gamers agree that games

relax them more (St 2: $p < 0.034$) so that they could do work better. Most females do not share this belief. Diversion and catharsis are more pronounced in male gamers. GBL should be promoted as an approach based on 'relaxed alertness', an optimal mental condition that predisposes gamers to engage more profoundly in learning as a result of becoming relaxed and promoting positive receptive moods. This complementary affective role should be highlighted in contrast to instructional approaches emphasising cognitive processing.

Females are always more sceptical than males about the instructional potential of games, considering that other means (St 13: $p < 0.076$) provide what can be learned from games. They perceive gaming not as a unique learning and entertaining experience, but just as another way to learn. This contrasts a lot with the perception of boys, who consider games as unique engaging experiences, definitely not provided by other computer applications. Games provide experiences that conflict with female rehearsal-based information processing strategy and their non-competitive social approach. These needs can be better satisfied through other person-oriented computer applications (WWW, chat, instant messaging and online video conferencing). On the other hand, males consider games as more useful learning tools because they accommodate to their neuro-cognitive propensities—a manipulation-oriented information processing approach (Halpern & Wright, 1996; Casey, 1996), a 'command' strategy for executing tasks and a competitive social comportment when using ICT (Turkle, 1988; Turkle & Papert, 1990; Singh, 2001; Rommes, 2002). Because no other computer application can fully satisfy these learning needs, computer games should be designed to control for gender-related neuro-cognitive and affective propensities.

It is interesting to note that both sexes consider gaming as a way to enhance the learning experience to a degree that justifies the extra effort (St 6: $p < 0.154$). Such disposition should be exploited by adopting a games-oriented pedagogy using designed (commercially available) games and promoting learning through designing games. Both males and females agree that gaming provides more interesting and imaginative ways for learning (St 17: $p < 0.441$). Beyond the present male-oriented gaming culture, females accept games as engaging learning experiences, justifying the use of GBL with both sexes.

Regarding productivity (St 21: $p < 0.931$), both males and females regard games as efficient and effective learning experiences. Exploiting this perception, GBL should be used to restructure and possibly re-engineer instruction and curriculum. The level of productivity should be assessed, controlling for outcomes in domain knowledge, attitudinal change and efficiency of methodology (through level of engagement: more time-on-task and increased number of tasks).

Perceived control

Perceived control refers to one's feelings and reactive behaviours while manipulating technological tools. This includes the ability to self-teach task-related skills, acquiring control over gaming device and game software, and the degree of reliance on others'

help to execute requested tasks. The Eurydice Report (2005) states that '[w]hatever the country or level of school computerisation, the attitudes of girls and boys vis-à-vis the use of ICT seem to differ in the same way: boys are more attracted to ICT and use it more freely'. Colley (2003) confirms that boys obtain greater experience with computers at home than girls—quoting Comber, Colley, Hargreaves and Dorn (1997) and Shashaani (1994)—and asserts that much of this experience is acquired with computer games, which boys play to a far greater extent than girls (Van Schie and Wiegman, 1997; Yelland & Lloyd, 2001; Bonanno & Kommers, 2005). This extensive exposure to ICT tools and games develops more positive computer attitudes (Kirkman, 1993; Levine & Donitsa-Schmidt, 1998), and higher levels of confidence in boys (Brosnan 1998; Comber *et al*, 1997; Todman & Dick, 1993). It also serves to promote different approaches to computers. Through playing games, boys learn to regard computers as toys (Gailey, 1993) or as technology to be mastered and thus interact with software in a more playful and exploratory manner (Giacquinta, Bauer & Levin, 1993). Girls approach computers differently. They tend to use computers as tools that assist them in producing work, having a preference for using routines they know. These different approaches are also present among adults—women use the Internet as a tool rather than as technology for play or mastery (Singh, 2001; Pew Internet Project, 2005).

In gaming contexts, perceived control and confidence are manifested in different aspects. Whereas males feel much more confident in self-teaching anything related to gaming (St 3: $p < 0.004$), females lack such confidence. Through their mastery approach, males perceive gaming as a situation where they can easily develop task-related skills, something females feel less capable of doing. The pedagogical implication is that whereas males can be granted more freedom to manoeuvre through assigned games, females may need more task-related support to build competence and confidence. In fact, while playing games, females overtly expressed their need for guidance and support from a more competent person (St 11: $p < 0.002$; St 19: $p < 0.075$), something utterly resisted by males. The support provided may take different forms. In solitary gaming, animated prompts and customisable personified tutors can be activated when the 'female' option is selected during the logging-in process. In collaborative gaming, more experienced colleagues can act as guides.

Perceived control is also manifested as a degree of confidence in solving game-related problems, in which males claim more competence (St 15: $p < 0.002$). Females can be helped in boosting their problem-solving skills by offering more guidance and support when facing problems. Gaming problems should be categorised—those related to handling of gaming devices, to game structure, to gaming tactics or to domain knowledge. Support should be offered along these levels through easily accessible, troubleshooting guides that provide feedback for immediate and long-term (strategy) problems. The proposed gender-related design option should activate a more elaborated problem-solving tutoring system that provides more feedback and encouragement when females log in game.

Regarding the sense of control over gaming devices (St 7: $p < 0.064$; St 9: $p < 0.002$), males feel much more in control of the computer or gaming console and thus capable

of performing demanded actions. Through continuous feedback, encouragement and praise from colleagues, female insecurity will be addressed, thus promoting a biography of success. Gaming contexts involving females should be organised in a number of steps, each dealing with a small number of tasks, providing feedback on completion of each. Males may provide support, offer guidance and model gaming actions. The proposed gender-related option in game design will prompt the system to adapt to female users by providing more frequent feedback.

Behavioural components

Positive behaviours are manifested as willingness to use games for learning. Negative behaviours involve avoidance tendencies. Both sexes declare that they do not avoid using games for learning (St 4: $p < 0.691$), thus showing their disposition to engage in GBL using games both as a medium and as a pedagogical approach for learning. A highly statistically significant gender effect was obtained in relation to avoidance of playing games that are not in the context of learning, (St 14: $p < 0.001$). While males are indiscriminate in their gaming engagements, females tend to avoiding gaming solely for entertainment. This avoidance behaviour must be considered from the perspective of age and related demands. College conditions impose a demanding academic and socio-emotional environment. Females in the 16–18 age range may perceive gaming as socially restrictive (limits contexts of interaction) and less person-oriented and thus emotionally intense. Consequently, GBL should be promoted as an experience that facilitates communication, collaborative learning and social interaction providing contexts rich in human relations.

Regarding their willingness to use games, more females declare using games when asked to do so, while males are more autonomous in their approach (St 10: $p < 0.007$). In line with the Eurydice Report, gaming tends to form part of males' natural routine, not a supplementary activity proposed by others. Females need more guidance to acknowledge game availability and to appreciate the instructional advantages and relevance of games for learning. When asked if they will continue to use games in the future (St 18: $p < 0.003$), males show greater determination to get engaged in gaming while in college compared to females who manifest a more vigilant approach in allocating time for gaming. Considering the male-dominated entertainment-oriented gaming culture, females may perceive gaming as less compatible with the academic demands of college life. Thus, while being very restrictive in allocating time to entertainment-oriented games, they may consider integrating serious games for learning. Such a positive tendency should be encouraged through the use of instructional games specifically designed to complement and renovate domain learning at college level.

RQ II: is there any gender-related difference regarding general attitude towards gaming?

The scores for each statement related to the various attitudinal components were summed forming four computed variables, computed affective components, computed perceived use, computed perceived control and computed behavioural components. Another variable, labelled as general attitude, was created by summing these four computed variables.

Table 3: Statistical data for the five computed variables

	p-*value*	*Mean (males)*	*Mean (females)*	*Mean (total)*
Computed affective variable	0.001	19.36	17.27	17.96
Computed components for perceived use	0.046	12.93	11.99	12.30
Computed components for perceived control	0.000	12.32	10.42	11.05
Computed behavioural components	0.000	12.32	10.42	11.05
General attitude	0.000	62.70	54.53	57.24

Table 3 gives these five computed variables and related statistical data. Using GLM statistical analysis for each component, with gender as fixed factor and computed variables for each attitudinal component as dependent variable, the means and *p*-value were obtained. The *p*-values for all five variables were statistically highly significant, with males showing higher means and thus manifesting an overall more positive attitude for all attitudinal components.

Using the values for the general attitude variable, another scale variable—attitude classification—was created.

Table 1 gives the scoring range for the different variable categories. Using cross-tabs, the attitude classification variable was analysed in relation to gender. A highly significant $p < 0.000$ for Pearson Chi-square was obtained. Figure 1 represents the interaction between 'categories of attitude towards gaming' as independent variable and the 'percentage frequencies for males and females' as dependent variable. From the figure it is evident that males show a very positive attitude towards gaming while females show a less positive or neutral attitude towards gaming.

RQ III: is there any relation between gaming competence and attitude to gaming?
Using GLM statistical analysis to investigate possible interaction between Individual gaming competence as fixed factor and computed attitude as dependent variable, a highly significant $p < 0.000$ was obtained. Using cross-tabs, the attitude classification variable was analysed in relation to individual gaming competence. A highly significant $p < 0.001$ for Pearson Chi-square was obtained. Figure 2 represents the interaction between 'attitude classification as independent variable' and 'the percentage frequencies for the individual gaming competence' as dependent variable. From the figure it is evident that enthusiastic gamers show very positive to positive attitude to gaming, moderate gamers show positive attitude, while most non-gamers show neutral or negative attitude towards gaming.

Conclusion

The survey 'attitude to gaming' is a useful instrument from a pedagogical perspective because it enables the design of instruction through a process-oriented approach addressing the different gender-related attitudinal components. Besides serving as a

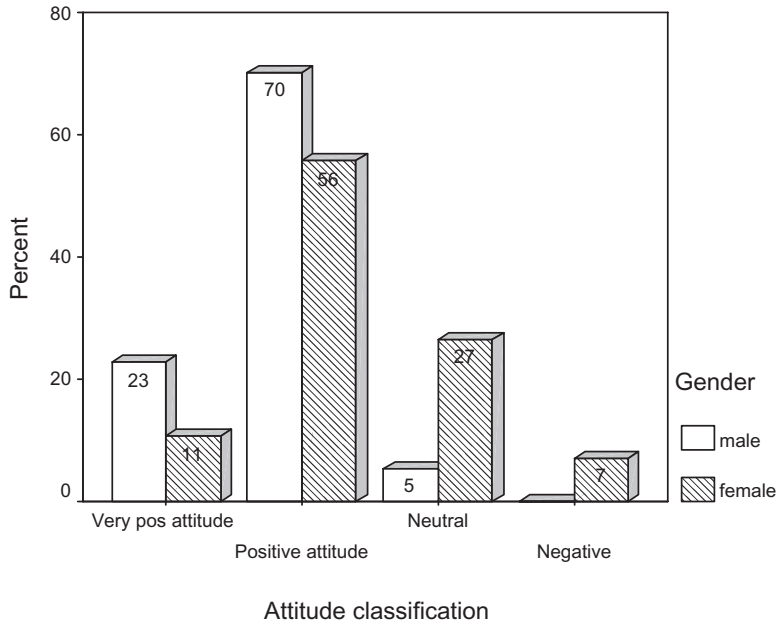

Figure 1: Attitude classification by gender

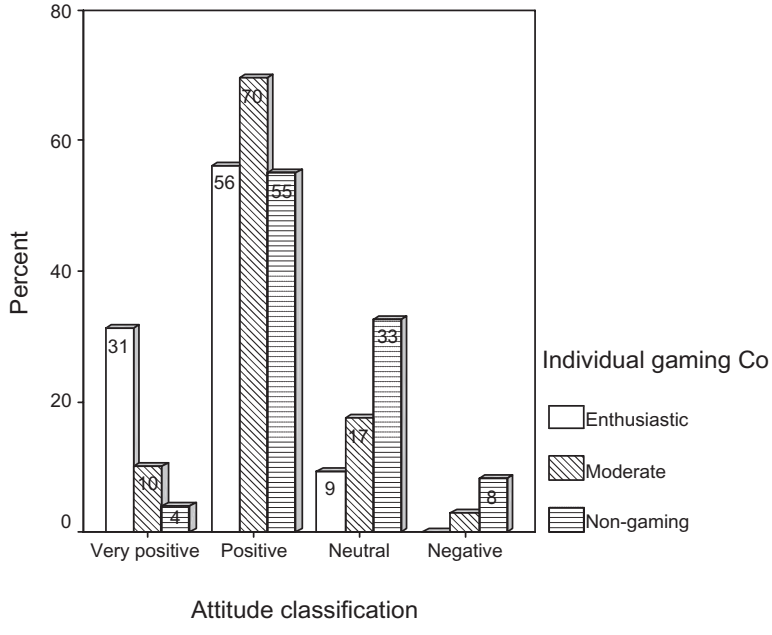

Figure 2: Attitude classification by individual gaming competence

tool for learner/gamer analysis, and thus to develop individualised gaming experiences, the instrument can be used in collaborative settings for organizing groups according to attitudinal characteristics.

The instrument needs further refinement and validation in order to ensure reliability and construct validity. It has to be extended and refined to include the social dimension for collaborative gaming. Presently it is being used to identify the attitude towards gaming of different age groups and educational levels. Longitudinal surveys will determine change of attitude along a time axis. Future investigations will be carried out to determine how such analysis of attitude towards gaming can be used for front-end analysis of gamers by integrating an adapted version of this instrument in the design of serious games.

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