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Students' perceptions about the use the videogames in secondary education

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Abstract

Working with videogames in class is becoming a normal reality which truly depends on the vision that the teacher possesses about it. But what do receptive students really think about the education mediated by videogames? The current paper introduces the assessment that a group of students from Secondary Education has done ($N = 207$) about the usage of videogames in the classes. Also, it allows drawing the user profile that the direct-grant schools present. The method used has been descriptive and correlated developed by means of a questionnaire composed by 37 items. The main result obtained shows that the students from the first courses in this educational level are more given to the usage of videogames for their curricular development. Also, we found significant differences in the use of video games in favour of men. Moreover, it is highlighted the profile of low videogames consumer that these students have, questioning whether this will be determined by the type of school in which this research has been carried out. Thus, we present a line of study that links the vision of the videogames and the type of school in which they are studied, since this, among other aspects, is determined by the family purchasing power.

Keywords Videogames · Secondary Education · Curriculum · Students · Learning

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1 Introduction

The interactivity of games today is greater than 30 years ago as we can check in the games found in the market, allowing, for example, the gamer to develop relationships with other players from their distant homes. On the contrary, we find a greater number of consoles or formats with which the action can be developed, according to the report AdeSe (2012), what has also caused that a great number of people from all ages come closer to this field.

Given this boom we find the existence of a line of research considering that video games in general promote active learning, the development of critical thinking skills, knowledge building, collaboration, effective use and access to electronic information; they improve the development of strategies in order to acquire knowledge and to solve problems, improve their responsiveness (Badia et al. 2015; Soto et al. 2019); they can change attitudes, face new challenges; they increase the capacity of coordination and the spatial perception (Marín and Martín 2014); they can emphasize pro-social behaviour (Greitemeyer and Mügg 2014; Soutter and Hitchens 2016; Malinverni et al. 2017); inductive reasoning increases as well as the visual attention (Blumberg and Randal 2015).

Moreover, all these aspects are shared both by those video games specifically designed for the educational scope and those having nothing to do with it (Marín 2014). In this sense, we believe that talking about gamification, understood as the use of a videogame non designed for the educational field as a tool or resource for developing or reinforcing the learning, provides with the necessary opportunities to enhance the development of basic skills the students are asked to have achieved when having completed primary and secondary education (Marín and Figueroa 2015; Marín and Martín 2014; Marín-Díaz et al. 2019). Their interactive nature makes the player (in this case the student) is in a continuous process of brain activity and according to the type of game, also of motor activity.

Consequently, as noted by García et al. (2014), this has allowed video games to have been emerging in the classroom becoming an element more of the methodologies designed either to reinforce or to bring in a more friendly way the curriculum contents, motivating children, youth and adolescents in their learning process as Nand et al. (2019) indicate.

An example of their educational value has already been found in 2008 in the Tomorrow Proyect, which stated that 65% of the 25,000 American teachers surveyed were interested in including them in their classrooms; 50% would like to learn how to do so; and 11% stated that they had already incorporated videogames in their class dynamics. In the work carried out by Williamson in Williamson 2009 it is reflected how 35% of the 1600 British teachers participating in the study had already included them and 60% were considering doing so. In this line we also find the report AdeSe (2012), which states that 65% of the Spanish primary teachers surveyed confirmed to use them in class. As we can check that the data that the studies carried out by Barr (2017), Ibraim and Hmaid (2017) and Marín and Martín 2014have revealed, are confirmed.

However, although we believe in the educational and social potential of the use of video games in the classroom, it is necessary to emphasize some drawbacks that they can throw into abusive or problematic use such as isolation, aggressiveness, confusion between reality and play, among others (Reyes-Hernández et al. 2014).

As we have previously stated the initial position of the teachers is closer to joining them to their teaching methodologies than to rejecting them, but what about the students? Do they think the same as their teachers? According to Shale et al. (2008), students of medicine who participated in their study and had some kind of experience as gamers, learnt faster and in a more efficient way the handling of sophisticated surgery and imaging equipment. Consequently, we consider appropriate to know the opinion that students have about video games, as elements of curricular and educational development.

2 Method

The current research has been carried out by means of a method of ex-post-facto research type, and within it, using a descriptive correlational study (Mateo 2012). Its main objective has been to determine the employability of video games to develop the curriculum for Secondary Education students. From this general objective, we have designed the working hypotheses, which have been grouped in statistics and research, the latter formulated in terms of questions, whereas the first ones were formulated in the form of mathematical analysis.

As regards the questions we have raised:

- Can videogames be used for the curriculum development?
- Do students have a positive attitude towards this resource in the classroom?

With respect to the hypotheses outlined in a mathematical way we have designed:

- There are significant differences according to the gender in favour of men
- There are significant differences according to the course in favour of first year secondary education students.

2.1 Data collection instrument

The instrument for data collection was a questionnaire designed ad hoc and composed by 37 items, in which the first 10 items correspond with socio-demographic aspects that will characterize the sample as regards gender, age, study course, common game device, hours spent playing during the week, hours spent playing during the weekend, usually playing alone or with others, usually playing online and usually playing online with their high school partners. The first 9 items, grouped in the dimension called *Addictive attitude towards videogames*, take into account the indications made by Morales (2011) for the development of scales and measuring instruments, which are measured through a Likert scale of five options, where 1 means ‘Strongly disagree’ and 5 means ‘Strongly agree’. The second dimension called *Games and secondary education* consists on 18 items. In response to the construct validity we have taken into account the theoretical approaches by Hernández et al. (2006), who considered more important the construct validity rather than the content validity, since that indicates whether the instrument represents and measures the theoretical concepts treated in it.

This requirement has been studied by means of a previous factorial analysis and in order to check its relevance, we have carried out the sphericity test by Barllett (Chi-square approximately 502.489 and meaningfulness values 0.000) and we have also calculated the Kaiser-Meyer-Olkin index (KMO = 0.732).

As regards reliability presented by the instrument it is revealed that this is high, since the resulting Cronbach Alpha parameter is 0.849. After having conducted the study, if the item is removed, we check that reliability is between 0.794 and 0.886, so it is again considered as a medium-high value, what reflects a considerable degree of internal consistency (Mateo 2012).

2.2 Sample

The participant population consisted on Secondary School students from Spain. The sampling applied for this study is based on a causal kind (Sabariego 2012), characteristic of research in the field of social and educational sciences, based on the ease of access to individuals under study. Finally, the sample has been made up of 208 students from a Secondary Education School. The reason why the center was selected was basically because of its geographical location. Being in the center of the city, it received students from different social levels, what could indicate a diversity of perspectives when incorporating this resource into the classroom in advance. In order to administer the instrument and carry out the investigation, it was necessary the approval of the management team of the center, which did not put any impediments, since they showed interest in knowing what the profile of its students was like.

From all the students, 48.6% were men and 51.4% women. With regard to the course that they were studying at the moment the instrument was administered, the sample was distributed as reflected in Fig. 1.

As regards the age, the sample is mostly located at the age of 14 (54%), followed by those students who are 13 and 15 respectively (22.1% and 20.7%) (see Fig. 2).

With respect to the game device used, 36.6% reported using the Smartphone, 12.4% used the computer, 37.6% used the game console and finally 12,9% used the Tablet. In terms of gender, except in the case of the Tablet (91.7% vs. 8.3%) and Smartphone (67% vs. 33%), men use more the game consoles and Smartphones while computers were placed at the third place.

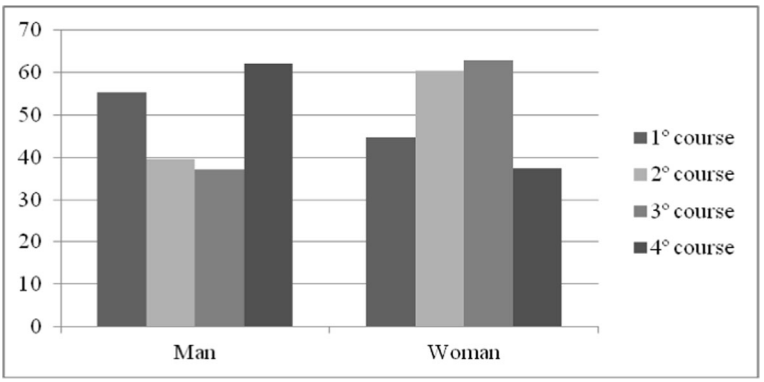

Fig. 1 Distribution of the sample according to the course and gender

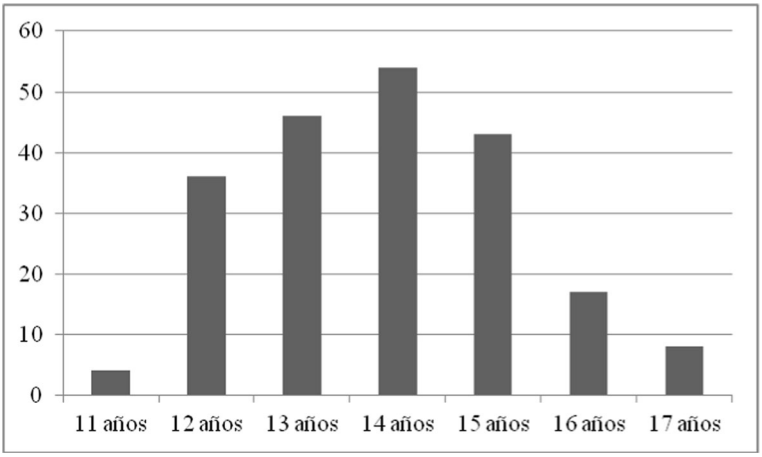

Fig. 2 Distribution of the sample according to the age

If we focus on the number of hours that students spend playing video games both during the week (Fig. 3) and at the weekend (Fig. 4), we find that 25.2% of students do not usually play video games during the week, whereas 15.5% usually plays an average of one hour, and 0.5% uses 48 h a week on them. Regarding the weekend, most students play an average of one hour (16.5%) in comparison with 4.56% who indicates to spend an average of 24 h.

Finally, paying attention to whether they play alone or accompanied and in the case they do the latter, if it is with a partner from the High School or with other playmates, here are the results obtained. As regards whether playing alone, 47.6% indicated they

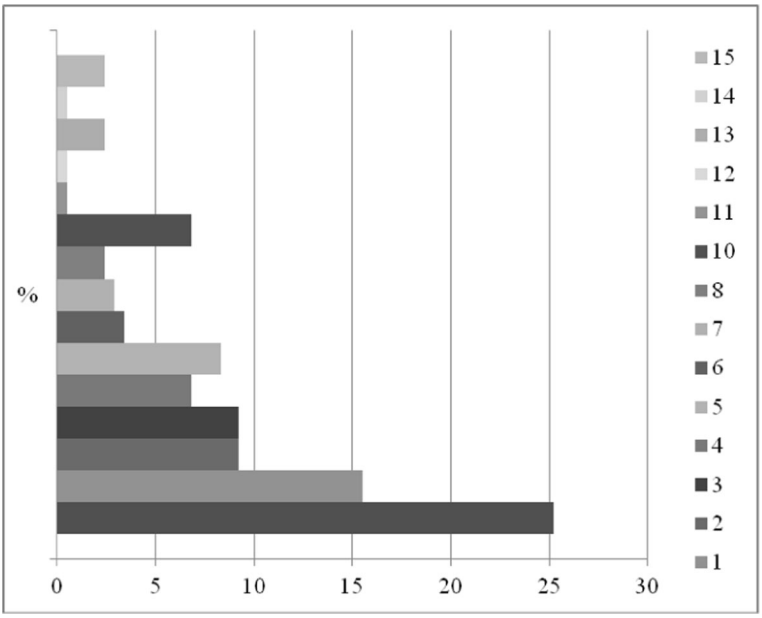

Fig. 3 Hours playing during the week

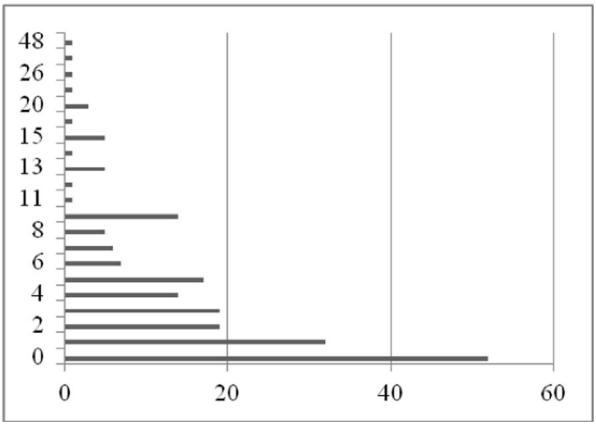

Fig. 4 Hours playing during the weekend

played alone; 33.7% played sometimes accompanied and 15.4% played in both ways. In relation to whether they usually play online, 44.2% of students said 'no', whereas 37.5% said 'yes', and 16.3% said 'sometimes'. Related to this item, we also asked the respondents whether they played online with High School partners: 11.5% said 'yes', while 53.8% and 32.7% answered 'no' and 'sometimes', respectively. Finally, they were asked if they knew players who were on the other side of the net. In fact, it is worrying to note that only 18.3% answered 'yes', 51.9% said 'no' and 26.9% said 'sometimes'.

3 Results

3.1 Descriptive study

Here the valuation of the questionnaire items based on the two dimensions in which the instrument is structured is shown (Table 1).

As regards dimension 1 (Addictive attitude towards videogames), we can check that students report they do not like much to play videogames (Item 1) (M = 3.01; SD = 1.308), although there is a considerable percentage indicating that they like very much to do so (23.1%). It is significant to note that they present a medium-low attitude towards issues such us reading online everything that comes new about videogames (Item 3) (M = 2.05; SD = 1.303); reading the information on the videogame cover its classification before using it (Item 4) (M = 2.03; SD = 1.339) or commenting the videogames with their friends or acquaintances (Item 5) (M = 2.69; SD = 1.488). Neither it seems interested in playing video games intended for adult audiences (Item 9) (M = 2.57, SD = 1.466). Likewise, they do not seem to be interested in those videogames intended for adults (Item 9) (M = 2.57; SD = 1466).

With regard to reading specialized magazines (Item 2) (M = 1.41: SD = .796), participating in chats (Item 6) (M = 1.38; SD = .925) or participating in online parties on the subject (Item 7) (M = 1.94; SD = 1.427) or imitating the characters of the videogames the students play (Item 8) (M = 1.47; SD = 0.954), it stands out their zero interest to these items.

Table 1 Descriptive study

		1		2		3		4		5			
		f.	%	f.	%	f.	%	f.	%	f.	%	M	D.T:
Dimension 1. Addictive attitude towards videogames	Ítem 1	28	13.5	58	27.9	40	19.2	48	23.1	34	16.3	3.01	1.308
	Ítem 2	148	71.2	41	19.7	10	4.8	4	1.9	3	1.4	1.41	.796
	Ítem 3	102/	49	45	21.6	28	13.5	15	7.2	18	8.7	2.05	1.303
	Ítem 4	106	51	41	19.7	24	11.5	14	6.7	20	9.6	2.03	1.339
	Ítem 5	65	31.3	40	19.2	33	15.9	34	16.3	36	17.3	2.69	1.488
	Ítem 6	169	81.3	18	8.7	7	3.4	9	4.3	5	2.4	1.38	.925
	Ítem 7	129	62	20	9.6	19	9.1	13	6.3	24	11.5	1.94	1.427
	Ítem 8	151	72.6	33	15.9	11	5.3	5	2.4	7	3.4	1.47	.954
	Ítem 9	71	34.1	40	19.2	37	17.8	26	12.5	33	15.9	2.57	1.466
Dimension 2. Videogames and secondary education	Ítem 10	45	21.6	81	38.9	39	18.2	23	11.1	17	8.2	2.44	1.189
	Ítem 11	179	86.1	19	9.1	8	2.9	1	.5	3	1.4	1.22	.659
	Ítem 12	83	30.3	58	27.9	37	17.2	20	9.6	28	13.5	2.48	1.371
	Ítem 13	48	23.1	84	40.4	38	18.3	22	10.6	12	5.8	2.34	1.127
	Ítem 14	86	41.3	60	28.8	21	10.1	10	4.8	31	14.9	2.23	1.416
	Ítem 15	19	9.1	16	7.7	38	18.3	67	32.2	67	32.2	3.90	3.060
	Ítem 16	43	20.7	16	7.7	69	33.2	55	26.4	24	11.5	3.00	1.283
	Ítem 17	32	15.4	30	14.4	51	24.5	59	28.4	32	15.4	3.14	1.296
	Ítem 18	25	12	17	8.2	47	23.6	64	30.8	52	25	3.49	1.284
	Ítem 19	18	8.7	16	7.7	44	21.2	55	26.4	72	34.6	5.31	22.907
	Ítem 20	21	10.1	19	9.1	54	26	67	32.2	45	21.6	3.47	1.220
	Ítem 21	21	10.1	22	10.6	66	31.7	48	23.1	44	21.2	3.36	1.233
	Ítem 22	16	7.7	9	4.3	25	12	86	41.3	71	34	3.90	1.153
	Ítem 23	10	4.8	11	5.3	34	16.3	63	30.3	89	42.8	4.01	1.117
	Ítem 24	17	8.2	18	9.7	45	21.6	67	32.2	59	28.4	3.65	1.216
	Ítem 25	53	25.5	22	10.6	54	26.	48	23.1	28	13.5	2.88	1.385
	Ítem 26	20	9.6	21/	10.1	56	26.9	69	33.2	37	17.8	3.40	1.188
	Ítem 27	13	8.3	21	10.1	37	17.8	59	28.9	78	37.5	3.81	1.220

Regarding their opinion about the possibility of using video games for the curriculum development in Secondary Education (dimension 2 -Games and Secondary Education-), we check that they completely agree with the fact that using videogames in the High School classes will allow the development of the "heuristic" thought (trial and error) (Item 19) (M = 5.31; SD = 22.907). They also agree that it will let them understand the concepts of success-failure; up-down; inside-outside; before-after; front-back (Item 23) (M = 4.01; SD = 1.117), necessary elements for the students' curriculum development. In general, the students find themselves in an indifferent position in relation to the other aspects which can link the curriculum with the use of video games in the classroom. However, they disagree in the facts that they can be educational (Item 10) (M = 2.44; SD = 1189) and that there are more educational games (Item 12) (M = 2.48; SD = 1.371). Also, they show a low use of educational video games (Item 13) (M = 2.34; SD = 1.127), they neither think that playing videogames negatively affects

their studies (Item 14) (M = 2.23; SD = 1.416) nor that videogames help them to have a lower school failure (Item 25) (M = 2.88; SD = 1.385).

3.2 Inferential study: Student's T test and Analysis of Variance (ANOVA)

Carried out the inferential Student's *T* test (Table 2) and taking as discrimination variable the gender, we find significant differences in favour of the male students in all the Items except in the Items 11, 12, 13 and 19, which are in favour of women participating in the study.

Table 2 Student's *T* test regarding the gender

	Gender	M	SD.	F	Sig.
Item 1	man	3.81	1.017	.056	.812
	woman	2.25	1.082		
Item 2	man	1.67	.991	53.778	.000
	woman	1.16	.419		
Item 3	man	2.58	1.373	19.060	.000
	woman	1.54	1.003		
Item 4	man	2.16	1.405	3.665	.057
	woman	1.90	1.267		
Item 5	man	3.35	1.396	2.280	.133
	woman	2.07	1.301		
Item 6	man	1.58	1.151	35.418	.000
	woman	1.19	.585		
Item 7	man	2.53	1.586	63.244	.000
	woman	1.38	.974		
Item 8	man	1.61	1.049	8.063	.005
	woman	1.34	.838		
Item 9	man	3.39	1.355	9.954	.002
	woman	1.79	1.105		
Item 10	man	2.61	1.246	4.997	.026
	woman	2.29	1.116		
Item 11	man	1.21	.668	.221	.639
	woman	1.23	.653		
Item 12	man	2.11	1.278	2.744	.099
	woman	2.82	1.372		
Item 13	man	2.29	1.157	.045	.832
	woman	2.39	1.101		
Item 14	man	2.29	1.388	.022	.882
	woman	2.18	1.446		
Item 15	man	4.35	4.148	.301	.584
	woman	3.49	1.299		
Item 16	man	3.13	1.222	1.942	.165

Table 2 (continued)

	Gender	M	SD.	F	Sig.
	woman	2.89	1.333		
Item 17	man	3.33	1.289	.236	.628
	woman	2.96	1.283		
Item 18	man	3.67	1.266	.063	.802
	woman	3.31	1.283		
Item 19	man	3.81	1.309	2.654	.105
	woman	6.75	32.069		
Item 20	man	3.67	1.141	.856	.356
	woman	3.27	1.265		
Item 21	man	3.58	1.192	.072	.789
	woman	3.15	1.240		
Item 22	man	4.03	1.105	.641	.424
	woman	3.79	1.190		
Item 23	man	4.20	.974	3.864	.051
	woman	3.84	1.214		
Item 24	man	3.80	1.137	3.105	.080
	woman	3.50	1.274		
Item 25	man	3.00	1.421	.105	.746
	woman	2.77	1.346		
Item 26	Man	3.63	1.184	.456	.500
	Woman	3.20	1.158		
Item 27	Man	4.10	1.100	3.555	.061
	Woman	3.53	1.269		

Regarding the possibility of finding differences on the course we are analyzing, and making reference to the dimension 1 (Table 2), we have checked that there is a statistically significant effect between the fact of playing video games and the course in which these students are enrolled: F (3.204) = 4.680 and $p = 0.003$ $n^2 = 0.06$. The multiple comparisons indicate that there are statistically significant differences in the taste for playing video games among students from the first and second course: t (204) = 3.277 and $p = 0.015$; and the students from the third course: t (204) = 3.079 and $p = 0.026$; whereas such a difference is not appreciated among students from the fourth course. However, the comparison with the rest of courses does not have significant differences within the Bonferroni values.

Multiple contrast indicates that there are statistically significant differences in the action of reading online everything that comes new about videogames among students from the first and third courses t (204) = 3.458 and p = 0,009; and the fourth course t (204) = 2.895 and $p = 0.041$. On the contrary, there is no significance among students from the second course. However, the comparison among the rest of courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the action of reading online

everything that comes new about videogames and the course to which these students belong F (3.204) = 4.693 and $p = 0.003$ $n^2 = 0.06$.

The fact of reading its classification on the videogame cover before using it and the course to which the students belong has a statistically significant effect F (3.201) = 7.203 and $p = 0.000$ $n^2 = 0.10$. Multiple comparisons indicate that there are significant differences among students in the first and third courses t (201) = 3.766 and p = 0,003; and the fourth course t (201) = 4.182 and $p = 0.001$; whereas there is no significance among students from the second course. However, the comparison among the rest of courses does not have any significance in the values obtained with the applied post hoc tests.

Similarly, there is a statistically significant effect on the fact of discussing videogames with friends and acquaintances and the course in which these students are enrolled F(3.204) = 4.417 and $p = 0.005$ $n^2 = 0.06$. Multiple comparisons indicate that there statistically significant differences in the taste for commenting videogames with friends and acquaintances among students from the first and third courses t (204) = 3.509 and $p = 0.003$, while the ccomparison with the rest of courses does not have significance within Bonferroni values.

Multiple comparisons indicate that there are statistically significant differences in the action of taking part in forums or chats on video games among students from the first and third courses t (204) = 2.719 and $p = 0.043$, and the fourth course t (204) = 3.147 and $p = 0.011$. On the contrary, there is no significance among students from the second course. However, the comparison among the rest of courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the action of participating in forums or chats on videogames and the course in which these students are enrolled F (3,204) = 4.098 and p = 0.008 $n^2 = 0.06$,

Also, although there a statistically significant effect on the fact of imitating the characters of the videogames students play with and the course in which these students are enrolled F(3.203) = 2.953 and $p = 0.034$ $n^2 = 0.04$, applied post hoc tests reflect no significance in any of the of the multiple contrasts performed (Tables 3 and 4).

Students' wish for having more educational videogames and the course in which they are enrolled has a statistically significant effect F (3.202) = 3.533 and $p = 0.016$ $n^2 = 0.05$. Multiple comparisons indicate that there are significant differences among students from the second and third course t (202) = 3.172 and $p = 0.010$. However, there is no significance with the students from the first and fourth courses. Similarly, the comparison with the rest of courses does not present any relevant significance within Bonferroni values.

Multiple contrast indicates that there are statistically significant differences in the action of sometimes playing educational video games among students from the first and third courses t (200) = 3.047 and $p = 0.016$. On the contrary, there is no significance among the students from the second and fourth courses. However, the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the action of sometimes playing educational videogames and the course in which these students are enrolled F (3.200) = 3.573 and p = 0.015 $n^2 = 0.05$.

There is a statistically significant effect on the fact of thinking that playing video games negatively affects their studies and the course in which these students are

Table 3 Anova of Dimension 1. Addictive attitude towards videogames

	Course	N	M	DT	F and p
I like playing videogames	First	58	3.48	1.260	F = 4.680 and $p = 0.003$
	Second	48	2.67	1.226	
	Third	54	2.74	1.320	
	Fourth	48	3.08	1.285	
I read specialised magazines about videogames	First	57	1.63	1.011	F = 2.561 and $p = 0.056$ (no significant)
	Second	47	1.45	.746	
	Third	54	1.26	.732	
	Fourth	48	1.29	.544	
I read online everything that comes new about videogames	First	58	2.55	1.524	F = 4.693 and p = 0.003
	Second	48	2.02	1.422	
	Third	54	1.72	1.054	
	Fourth	48	1.83	.953	
I read on the videogame cover its classification before using it	First	56	2.68	1.491	F = 7.203 and p = 0.000
	Second	47	1.98	1.327	
	Third	54	1.76	1.132	
	Fourth	48	1.63	1.123	
I like to comment on the videogames with my friends or acquaintances	First	58	3.22	1.623	F = 4.417 and p = 0.005
	Second	48	2.52	1.337	
	Third	54	2.26	1.443	
	Fourth	48	2.71	1.352	
I participate in forums or chats on videogames	First	58	1.72	1.322	F = 4.098 and p = 0.008
	Second	48	1.31	.829	
	Third	54	1.26	.678	
	Fourth	48	1.17	.476	
I have participated in online parties	First	55	2.29	1.663	F = 2.401 and $p = 0.069$ (no significant)
	Second	48	1.71	1.288	
	Third	54	1.67	1.289	
	Fourth	48	2.08	1.350	
I imitate the characters of the videogames I play with	First	58	1.78	1.140	F = 2.953 and p = 0.034
	Second	47	1.34	.962	
	Third	54	1.43	.903	
	Fourth	48	1.29	.651	
I like to play videogames for adults	First	58	2.71	1.622	F = 0.569 and $p = 0.636$ (no significant)
	Second	48	2.38	1.331	
	Third	53	2.49	1.463	
	Fourth	48	2.67	1.419	

enrolled F (3.204) = 3.581 and p = 0.015 $n^2 = 0.05$. Multiple comparisons indicate that there are statistically significant differences in thinking that playing video games negatively affects their studies among students from third and fourth courses t (204) = 3.239 and $p = 0.008$. However, there is no significance with the students from

Table 4 Anova of Dimension 2. Videogames and secondary education

	Course	N	M	SD	F and p
Videogames can be educational	First	57	2.51	1.197	F = 0.566 and $p = 0.638$ (no significant)
	Second	47	2.38	1.226	
	Third	53	2.30	1.202	
	Fourth	48	2.58	1.145	
The teacher uses videogames in class	First	58	1.14	.605	F = 0.615 and $p = 0.606$ (no significant)
	Second	48	1.31	.776	
	Third	54	1.22	.502	
	Fourth	48	1.23	.751	
I wish there were more educational videogames	First	58	2.52	1.367	F = 3.533 and p = 0.016
	Second	48	2.96	1.570	
	Third	54	2.11	1.093	
	Fourth	46	2.35	1.337	
I have sometimes played educational videogames	First	57	2.74	1.247	F = 3.573 and p = 0.015
	Second	47	2.28	1.015	
	Third	53	2.09	1.043	
	Fourth	47	2.21	1.082	
Playing videogames negatively affects my studies	First	58	2.16	1.335	F = 3.581 and p = 0.015
	Second	48	2.25	1.509	
	Third	54	2.69	1.600	
	Fourth	48	1.79	1.031	
Learning how to work cooperatively and collaboratively through teamwork	First	58	4.76	5.371	F = 2.175 and $p = 0.092$ (no significant)
	Second	48	3.44	1.457	
	Third	54	3.63	1.263	
	Fourth	48	3.65	1.021	
They allow to ddistinguish body parts	First	58	2.88	1.365	F = 3.427 and p = 0.018
	Second	47	2.72	1.246	
	Third	54	3.46	1.239	
	Fourth	48	2.92	1.164	
They allow to learn the synchrony between the upper and lower limbs	First	57	3.39	1.411	F = 5.332 and p = 0.001
	Second	47	2.53	1.248	
	Third	54	3.43	1.207	
	Fourth	46	3.13	1.108	
They allow recognize primary and secondary colours	First	58	4.07	1.106	F = 7.594 and p = 0.000
	Second	47	3.02	1.327	
	Third	54	3.54	1.397	
	Fourth	48	3.19	1.045	
They allow the development of "Heuristic" thought (trial-error)	First	58	4.50	.922	F = 1.099 and $p = 0.351$ (no significant)
	Second	48	3.13	1.393	
	Third	53	3.53	1.234	
	Fourth	47	10.55	47.919	
They allow self-regulation of self learning (continuous assessment)	First	58	4.31	.883	F = 19.094 and p = 0.000
	Second	47	2.79	1.215	
	Third	53	3.42	1.117	
	Fourth	48	3.17	1.136	
They allow the development of inductive thought	First	58	3.67	1.330	F = 5.625 and p = 0.001
	Second	46	2.87	1.240	
	Third	52	3.65	1.083	

Table 4 (continued)

	Course	N	M	SD	F and p
	Fourth	45	3.11	1.071	
They allow the development of visual and retentive memory	First	57	4.02	.991	F = 5.238 and p = 0.002
	Second	48	3.38	1.438	
	Third	54	4.22	.945	
	Fourth	48	3.94	1.080	
They allow to understand the concepts of success-failure; up-down; inside-outside; before--after; front-back	First	57	4.51	.869	F = 8.553 and p = 0.000
	Second	48	3.46	1.184	
	Third	54	4.02	1.000	
	Fourth	48	3.98	1.194	
They allow to respect the socially accepted standards of conduct in order to regulate the group	First	57	3.91	1.154	F = 6.648 and p = 0.000
	Second	48	3.04	1.458	
	Third	54	3.96	.990	
	Fourth	47	3.57	1.037	
Videogames used in class can help to have a lower school failure	First	58	2.66	1.528	F = 1.345 and $p = 0.261$ (no significant)
	Second	48	2.77	1.356	
	Third	54	3.00	1.414	
	Fourth	45	3.16	1.147	
They allow to develop processes of reflection	First	57	3.77	1.165	F = 4.351 and p = 0.005
	Second	48	2.96	1.368	
	Third	53	3.36	1.128	
	Fourth	45	3.47	.919	
They allow to learn new vocabulary	First	58	4.12	1.010	F = 4.850 and p = 0.003
	Second	48	3.27	1.284	
	Third	54	3.94	1.309	
	Fourth	48	3.81	1.142	

the first and second courses. Similarly, the comparison with the rest of the courses does not present any relevant significance within Bonferroni values.

The data also reflect the existence of a statistically significant effect on the fact of thinking that videogames let distinguish the body parts and the course in which these students are enrolled F (3.203) = 3.427 and $p = 0.018$ $n^2 = 0.05$. Multiple comparisons indicate that there are statistically significant differences in the idea that video games let distinguish the body parts among students in the third and second courses t (203) = 2.948 and $p = 0.022$, whereas the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests.

Multiple comparisons indicate that there are statistically significant differences in the idea that video games allow you to learn the synchrony between the upper and lower limbs among the students from the first and second courses t (200) = 3.443 and $p = 0.004$; and between the third and second courses t (200) = 3.561 and $p = 0.003$. However, the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the action of thinking that video games allow you to learn the synchrony between the upper and lower limbs and the course in which these students are enrolled F (3.200) = 5.332 and p = 0.001 $n^2 = 0.07$.

The thought that video games can recognize the primary and secondary colours and the course to which the students belong has a statistically significant effect F (3.203) = 7.594 and p = 0.000 $n^2 = 0.10$. Multiple comparisons indicate that there are statistically significant differences among students from the first and second courses t (203) = 4.348 and $p = 0.000$, and from the fourth course t (203) = 3.686 and $p = 0.002$. However, there is no significance with the students from the third course. Similarly, the comparison with the rest of the courses does not present any relevant significance within Bonferroni values.

There is a statistically significant effect on the fact of thinking that playing videogames allows self-regulation of self learning (continuous assessment) and the course in which these students are enrolled F (3.202) = 19.094 and $p = 0.000$ $n^2 = 0.22$. Multiple comparisons indicate that there are statistically significant differences in thinking that playing video games allows self-regulation of self learning (continuous assessment) among students from the first and second courses t (202) = 7.150 and $p = 0.000$; from the third course t (202) = 4.344 and p = 0.000; and from the fourth course t (202) = 5.396 and $p = 0.000$. The same happens to the students from third and second courses t (202) = 2.894 and p = 0.026, whereas the comparison with the rest of the courses does not have any relevant significance within Bonferroni values.

Multiple contrast indicates that there are statistically significant differences in the belief that playing video games allows the development of inductive thought among students from the first and second courses t (197) = 3.417 and p = 0.005; and among students from the third and second courses t (197) = 3.253 and $p = 0.008$. However, the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the action of thinking that video games allow the development of inductive thought and the course in which these students are enrolled F (3.197) = 5.625 and $p = 0.001$ $n^2 = 0.08$.

Also, multiple comparisons indicate that there are statistically significant differences in the idea that playing video games allows the development of visual and retentive memory among students from the first and second courses t (203) = 2.936 and $p = 0.023$; and from the third and second courses t (203) = 3.815 and $p = 0.001$. However, the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the thought that playing video games allows the development of visual and retentive memory and the course in which these students are enrolled F (3.203) = 5.238 and p = 0.002 $n^2 = 0.07$.

The idea that playing video games can make understand the concepts of success-failure; up-down; inside-outside; before-after; front-back and the course to which these students belong has a statistically significant effect F (3.203) = 8.553 and $p = 0.000$ $n^2 = 0.11$. Multiple comparisons indicate that there are statistically significant differences among students from the first and second courses t (203) = 5.048 and p = 0.000, whereas these differences do not exist among students from the third and fourth courses Likewise, the comparison with the rest of the courses does not have any relevant significance within Bonferroni values.

There is a statistically significant effect on the fact of thinking that playing video games can respect the socially accepted standards of conduct in order to regulate the group and the course in which these students are enrolled F (3.202) = 6.648 and $p =$

0.000 $n^2 = 0.09$. Multiple comparisons indicate that there are statistically significant differences in thinking that playing video games can respect the socially accepted standards of conduct in order to regulate the group among the students from the first and second courses t (202) = 3.803 and $p = 0.001$. On the contrary, there is no difference among students from the third and fourth courses but it does with the students from the third and second courses t (202) = 3.969 and p = 0.001, while the comparison with the rest of the courses does not have any relevant significance within Bonferroni values.

Multiple contrast indicates that there are statistically significant differences in the idea that playing video games allows to develop processes of reflection among students from the first and second courses t (199) = 3.585 and p = 0.003. However, the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the idea that playing video games allows the development of processes of reflection and the course in which these students are enrolled F (3.199) = 4.351 and $p = 0.005$ $n^2 = 0.06$.

Finally, multiple comparisons indicate that there are statistically significant differences in the idea that playing video games allow to learn new vocabulary among students from the first and second courses t (204) = 3.663 and p = 0.002; and among students from the third and second courses t (204) = 2.855 and $p =$ 0.028. However, the comparison with the other courses does not have any significance in the values obtained with the applied post hoc tests, since the data show that there is a statistically significant effect on the idea that playing video games allows to learn new vocabulary and the course in which these students are enrolled F (3.204) = 4.850 and $p = 0.003$ $n^2 = 0.06$.

3.3 Correlational study

Carried out the r Pearson test, we check that in both dimensions there are significant relationships among all the items, being the level of significance in the case of the first dimension of $n = 0.001$ in all cases and in the second dimension both $n = 0.005$ and $n =$ 0.001.

As regards the first dimension (Table 5), we can note that this correlation varies from low (item 7 x item 8, r = .209**), medium (item 5 × item 1, r = .734**) and high (item 1 x item 1, item 2 x item 2, item 3 x item 3, item 4 x item 4, item 5 × item 5, item 6 x item 6, item 7 x item 7, item 8 x item 8, item 9 x item 9, all with r = 1), based on the classification made by Pérez et al. (Pérez et al. 2009, p, 134).

Regarding the second dimension, (Table 6), we appreciate that although the correlations are significant both in $n = 0.01$ and $n = 0.05$, they are low. However, it is important to highlight item 19 (Development of "Heuristic" thought [trial-error]) which only has a significant correlation with item 17 (Learning the synchrony between the upper and lower limbs) ($p = .000$ and r = .301**).

On the other hand, observing Table 7, when relating item 1 to the remaining items of dimension 2, related to video games and secondary education, we verify that there is, for the most part, a low and positive relationship between most of them (item 1 × item 17, r = .328 ** and p = .000).

Table 5 Correlational study Dimension 1. Addictive attitude towards videogames

		1	2	3	4	5	6	7	8	9
1	R	1	.499**	.621**	.382**	.734**	.325**	.492**	.278**	.659**
	P		.000	.000	.000	.000	.000	.000	.000	.000
2	R	.499**	1	.597**	.341**	.465**	.295**	.412**	.325**	.420**
	P	.000		.000	.000	.000	.000	.000	.000	.000
3	R	.621**	.597**	1	.394**	.576**	.358**	.527**	.354**	.512**
	P	.000	.000		.000	.000	.000	.000	.000	.000
4	R	.382**	.341**	.394**	1	.335**	.255**	.217**	.293**	.374**
	P	.000	.000	.000		.000	.000	.002	.000	.000
5	R	.734**	.465**	.576**	.335**	1	.226**	.370**	.317**	.523**
	P	.000	.000	.000	.000		.001	.000	.000	.000
6	R	.325**	.295**	.358**	.255**	.226**	1	.420**	.336**	.341**
	P	.000	.000	.000	.000	.001		.000	.000	.000
7	R	.492**	.412**	.527**	.217**	.370**	.420**	1	.209**	.536**
	P	.000	.000	.000	.002	.000	.000		.003	.000
8	R	.278**	.325**	.354**	.293**	.317**	.336**	.209**	1	.385**
	P	.000	.000	.000	.000	.000	.000	.003		.000
9	R	.659**	.420**	.512**	.374**	.523**	.341**	.536**	.385**	1
	P	.000	.000	.000	.000	.000	.000	.000	.000	

**. The correlation is significant at the 0.01 level (bilateral)

*. The correlation is significant at the 0.05 level (bilateral)

Likewise, if we relate dimension 1 to dimension 2, by means of Pearson's statistic r with a level of bilateral significance of 0.01, we observe that the magnitude of this relationship becomes moderate and in a positive sense, contributing that when one increases the other does the same too (see Table 8).

4 Discussion and conclusions

Secondary Education teenagers are today fascinated no doubt by three cardinal elements in their process of social and educational development, namely Internet, mobile and videogames (Sonlleva et al. 2017). Based on the results obtained in this research, we can confirm that the current student profile at this educational level is far from having or presenting addictive behaviours around one of these elements, the video games (Granie et al. 2014; Navarrete-Cardero and Molina-González 2015; Sánchez and Silveira 2019). Based on the scarce number of hours that they say to spend on videogames, −an average of 2 h during the week and the weekend-, we check that these data do not correspond with the data obtained from research made by authors such as Soto et al. (2019) among others. However, our data are close to those achieved by Lauchers et al. (2014) who indicate that students play an average of 5 h a week. This aspect contradicts the results obtained in other studies: Fundación Telefónica 2009; Granie et al. 2014; Navarrete-Cardero and Molina-González 2015. Therefore, we dare

Table 6 Correlational study Dimension 2. Videogames and secondary education

		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
10	R	1	−.006	.205**	.293**	−.102	.048	.042	.069	.129	.044	.232**	.168*	.252**	.297**	.129	.028	.169*	.173*
	P		.931	.003	.000	.145	.496	.555	.331	.066	.529	.001	.018	.000	.000	.066	.691	.017	.013
11	R	−.006	1	.160*	.184**	.111	−.040	.010	.068	.060	−.022	.088	.075	.009	.016	.109	.141*	.027	.077
	P	.931		.022	.009	.111	.569	.884	.331	.387	.758	.208	.292	.902	.825	.118	.044	.706	.268
12	R	.205**	.160*	1	.344**	.084	−.042	−.122	−.001	−.004	−.073	−.020	−.008	−.027	.053	.036	.029	−.113	−.097
	P	.003	.022		.000	.228	.547	.082	.993	.958	.299	.779	.916	.705	.453	.606	.685	.111	.164
13	R	.293**	.184**	.344**	1	−.065	.017	−.039	.066	.075	−.072	.132	.063	.172*	.193**	.036	−.012	.196**	.134
	P	.000	.009	.000		.352	.812	.583	.350	.287	.306	.060	.376	.014	.006	.611	.866	.006	.056
14	R	−.102	.111	.084	−.065	1	−.022	.253**	.296**	.145*	−.018	−.021	.215**	.038	.022	.053	.082	−.060	.079
	P	.145	.111	.228	.352		.757	.000	.000	.037	.792	.769	.002	.588	.749	.449	.241	.394	.257
15	R	.048	−.040	−.042	.017	−.022	1	.159*	.238**	.126	.015	.152*	.184**	.256**	.070	.074	.062	.088	.159*
	P	.496	.569	.547	.812	.757		.022	.001	.070	.836	.029	.009	.000	.317	.291	.381	.212	.022
16	R	.042	.010	−.122	−.039	.253**	.159*	1	.535**	.464**	.005	.232**	.147*	.271**	.237**	.197**	.217**	.027	.178*
	P	.555	.884	.082	.583	.000	.022		.000	.000	.938	.001	.037	.000	.001	.005	.002	.701	.010
17	R	.069	.068	−.001	.066	.296**	.238**	.535**	1	.564**	.301**	.300**	.415**	.420**	.269**	.192**	.230**	.260**	.298**
	P	.331	.331	.993	.350	.000	.001	.000		.000	.000	.000	.000	.000	.000	.006	.001	.000	.000
18	R	.129	.060	−.004	.075	.145*	.126	.464**	.564**	1	−.011	.407**	.357**	.372**	.334**	.205**	.182**	.256**	.295**
	P	.066	.387	.958	.287	.037	.070	.000	.000		.880	.000	.000	.000	.000	.003	.009	.000	.000
19	R	.044	−.022	−.073	−.072	−.018	.015	.005	.301**	−.011	1	.004	−.056	.093	−.168*	.037	.064	−.006	−.085
	P	.529	.758	.299	.306	.792	.836	.938	.000	.880		.950	.427	.187	.016	.601	.361	.929	.225
20	R	.232**	.088	−.020	.132	−.021	.152*	.232**	.300**	.407**	.004	1	.385**	.395**	.432**	.354**	.120	.333**	.397**
	P	.001	.208	.779	.060	.769	.029	.001	.000	.000	.950		.000	.000	.000	.000	.087	.000	.000
21	R	.168*	.075	−.008	.063	.215**	.184**	.147*	.415**	.357**	−.056	.385**	1	.448**	.223**	.196**	.200**	.384**	.366**

Table 6 (continued)

		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	P	.018	.292	.916	.376	.002	.009	.037	.000	.000	.427	.000		.000	.002	.005	.004	.000	.000
22	R	.252**	.009	−.027	.172*	.038	.256**	.271**	.420**	.372**	.093	.395**	.448**	1	.442**	.338**	.270**	.408**	.428**
	P	.000	.902	.705	.014	.588	.000	.000	.000	.000	.187	.000	.000		.000	.000	.000	.000	.000
23	R	.297**	.016	.053	.193**	.022	.070	.237**	.269**	.334**	−.168*	.432**	.223**	.442**	1	.362**	.104	.263**	.365**
	P	.000	.825	.453	.006	.749	.317	.001	.000	.000	.016	.000	.002	.000		.000	.140	.000	.000
24	R	.129	.109	.036	.036	.053	.074	.197**	.192**	.205**	.037	.354**	.196**	.338**	.362**	1	.145*	.199**	.372**
	P	.066	.118	.606	.611	.449	.291	.005	.006	.003	.601	.000	.005	.000	.000		.039	.005	.000
25	R	.028	.141*	.029	−.012	.082	.062	.217**	.230**	.182**	.064	.120	.200**	.270**	.104	.145*	1	.415**	.178*
	P	.691	.044	.685	.866	.241	.381	.002	.001	.009	.361	.087	.004	.000	.140	.039		.000	.011
26	R	.169*	.027	−.113	.196**	−.060	.088	.027	.260**	.256**	−.006	.333**	.384**	.408**	.263**	.199**	.415**	1	.501**
	P	.017	.706	.111	.006	.394	.212	.701	.000	.000	.929	.000	.000	.000	.000	.005	.000		.000
27	R	.173*	.077	−.097	.134	.079	.159*	.178*	.298**	.295**	−.085	.397**	.366**	.428**	.365**	.372**	.178*	.501**	1
	P	.013	.268	.164	.056	.257	.022	.010	.000	.000	.225	.000	.000	.000	.000	.000	.011	.000	

**. The correlation is significant at the 0.01 level (bilateral). *. The correlation is significant at the 0.05 level (bilateral)

Table 7 Correlational study between item 1 and items from dimension 2

		1	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	R	1	,364**	-,025	-,094	,143*	,014	,226**	,193**	,328**	,273**	-,042	,309**	,188**	,223**	,293**	,235**	-,002	,220**	,268**
	P		,000	,721	,178	,042	,836	,001	,005	,000	,000	,553	,000	,007	,001	,000	,001	,976	,002	,000

**. The correlation is significant at the 0.01 level (bilateral). *. The correlation is significant at the 0.05 level (bilateral)

Table 8 Correlational study between item 1 and items from dimension 2

		Dimensión 1	Dimensión 2
Dimensión 1	R	1	,480**
	P		,000
Dimensión 2	R	,480**	1
	P	,000	

**. The correlation is significant at the 0.01 level (bilateral)

to suggest that this may be caused by the type of center where the research has been carried out, in a state-subsidised school, what implies a socioeconomic and cultural reality of the environment in which they socialize academically as well as an internal center scene with defining characteristics; without forgetting that the socio-economic, cultural and educational level of the families or parents may be determining these data (Valero et al. 2013).

It is significant to note that those students who do play and play online do not know their allies or adversaries (Soutter and Hitchens 2016), depending on the type of game they are playing. Hence, we can affirm, as Navarrete-Cardero and Molina-González (2015), the existence of a scarce or no presence of a parent supervising who their children are playing with.

As regards the gender, we check that the male students are the ones who spend more time playing than girls (Espejo et al. 2015) however, studies as De Castel et al. (2019) refer that the girls have more discernible benefits on the experience with videogames. It is also worthy to note their lack of interest towards videogames, which is brought to light before the meager search for information about them in Internet, journals or parties unlike the result reached by Hamlen (2011), who noted that students are inclined to look for information in chats (Internet) in order to advance in the game.

Focusing our attention on the educational aspect of the game, the surveyed students believe that videogames can be used for the curriculum development of this educational period (Barr 2017; Tamayo and Tamayo 2018).

In accordance with the work by Greitemeyer and Mügg (2014) and Martin del Pozo (2014), students, especially from the first year, consider allowing the skill development of attitudes such as respect or processes of reflection for troubleshooting (Del Castillo et al. 2012; Soto et al. 2019). These students also highlight that videogames have power or can develop learning through trial-error, differentiate human body parts, colours, inductive thinking and self-learning, as well as visual and retentive memory and the possibility of learning new vocabulary (Blumberg and Randal 2015; Calvo-Ferrer and Belda-Medina 2015; Watson et al. 2011; Tamayo and Tamayo 2018; Soto et al. 2019).

However, we want to note that the students who are enrolled in the last year of Secondary Education believe that video games can affect their academic performance and they are contrary to using them.

Finally, towards the question ‘Can the curriculum of Secondary Education be developed through videogames?’ we can affirm paying attention to the results obtained that this is possible. As regards the question concerning whether students have a positive attitude towards this resource in the classrooms, we can positively confirm

this fact. On the other hand, the study shows that there is a moderate relationship between the preference of playing with video games and the perception of allowing content to be learned from the secondary education stage, being this knowledge of a globalizing and comprehensive nature and favouring all subjects from the curriculum of this stage, such as inductive thinking (item 21) or heuristic strategies (item 19) typical of Mathematics and Science, or the reflection processes (item 26) appropriate for all the areas, as stated in the experience of Arufe-Giráldez (2019) or the research by Hamari et al. (2016).

To conclude, focusing on the two initial proposed hypotheses, we have been able to confirm that both are achieved. In the case of the former, there are significant differences regarding the gender in favour of men (Espejo et al. 2015), except on issues related to the use of video games in the classroom, to the fact that there are more educational videogames, that students have played more educational videogames and to the fact that videogames allow the heuristic development (trial-error) in which women are openly more favourable.

5 Limitations

This paper presents the sample size as the main limitation. However, we believe that it is helpful to validate the usefulness of the instrument for collecting the Secondary School students' opinions.

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