A Descriptive Study on the Students' Responses to Learning through an On-Line Agricultural Simulation Game

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Abstract. The purpose of this study is to investigate students' responses to learning through an on-line agricultural simulation game. Four hundred and fifty agricultural engineering students, studying at three different universities with four grades in Turkey, participated in the study. The data collected from the questionnaires were analysed by calculating frequencies of responses for the demographics and multiple-choice questions. To determine the differences among universities and grades Chi-square statistics were used. The results reveal that a majority of the surveyed students significantly want to play such a game at least one hour per day and they thought that it may be useful for their educational success.

Keywords: Teaching/learning strategies, On-line game, Agricultural education.

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1 Introduction

Technological developments have been increasingly influencing the perceptions and conceptualizations of both educators and learners. In recent years, several attempts have been made to enhance students' learning experiences by increasing their motivation, by attempting to focus their attention, and by helping them to construct more meaningful and permanent records of their learning. In these attempts, educational computer games gained widespread popularity and acceptance within educational environments (Karakus at al, 2008). Game-based education and training for adult learners has a long history with disciplines such as military science, business and management science, economics, and intercultural communication. Games and simulations have been played to communicate complex dynamics with both large and small audiences. Regardless of the media involved, games are aimed at engendering a variety of cognitive, sensory, and emotional experiences for players (Raybourn, 2007). Game-based education is the use of computer games to enhance teaching and learning. Game-based education enables learners to perform tasks and have experiences which would otherwise be difficult due to cost, time, safety and other reasons. Nowadays, educational games are adopted by most educational systems, not only in early age classes, but also in universities (Vasiliou & Economides, 2007). Both mobile technologies and game technologies are increasingly seen as fertile ground for the development of resources to support learning (Facer at al, 2004). Computer games have potential as a learning environment due to the fact that they can motivate students through entertainment. In addition, computer games have competitive activities that include rules, goals, feedback, interaction, and outcomes (Kim at al, 2009). The underlying idea of game based learning is that students learn better when they are having fun and are engaged in learning process (Smith & Mann, 2002; Ebner & Holzinger, 2007; Moreno-Ger et al, 2008).

Computer game skills have been increasingly applied in almost all areas of human activity within modern societies. As a popular and powerful media, computer games are being considered for use in educational settings to motivate students, to focus their attention, and to help them to construct meaningful and permanent records of their learning. However, before any computer games are adopted for use in an educational environment, learner analysis should be employed to inform instructors of the target audience's expectations, conceptions, and thoughts (Karakus at al, 2008).

The purpose of this study is to investigate students' responses to learning through an on-line agricultural simulation game.

2 Methodology

Data collection instruments used in this study includes ten demographics and eleven multiple choice questions. Open-ended "other" choice was included for each question. It was aimed in this study to determine 1) whether the students play on-line games, 2) their education-related expectations from these games, 3) agriculture-

related jobs which catch students' attention, 4) the properties which these games should have, 5) whether they think that these games can be used in education. A pilot study was conducted with forty agriculture engineering students, and the questions were modified for the main study in accordance with these pretest-participants' responses and comments.

Total of 450 questionnaires were distributed to three agricultural faculties with four grades, in different cities found in different regions in Turkey. All of the questionnaires were returned. The questionnaires were administrated by academic staff of these faculties. Academic staffs provided a guide to implement the questionnaires properly. They were especially requested not to give clues regarding the questions and not to interfere in any way with the students' provision of answers.

The data collected from the questionnaires were analysed by calculating frequencies of responses for the demographics and multiple-choice questions. To determine the differences among universities and grades Chi-square statistics were used (Kim at al, 2009).

3 Results and Discussion

The data In this study, 204 (45.33%) of the participants were in Ondokuz Mayıs University (OMU) , 126 (28%) of the participants were in Çukurova University (CU), 120 (26.66%) of the participants were in Kahramanmaraş Sütçü İmam University (KSU), 162 (36%) of the participants were 1st grade students, 93 (20.66%) of the participants were 2th grade students, 99 (22%) of the participants were 3th grade students, and 96 (21.33%) of the participants were 4th grade students.

Rates of Internet use were found significantly high ($p<0.01$): 18 (4%) students reported that they do not use and 432 (96%) students reported that they use Internet in any way. Frequency of Internet use were found as; 117 (27.08%) (at least two hours daily), 84 (19.44%) (less than two hours in a day), 129 (29.86%) (two days in a week), 51 (11.81%) (one time in a week) , and 51 (11.81%) (more than a week). Differences among Internet usage frequency groups were found statistically significant ($p<0.05$).

87 (19.33%) students reported that they do not have an e-mail account, 150 (33.33%) students reported that they have an e-mail account, 114 (25.33%) students reported that they have two e-mail accounts, and 99 (22%) students reported that they have more than two e-mail accounts ($p>0.05$).

They were asked how often they play computer games. 135 (30%) students reported that they do not play computer games, 150 (33.33%) students reported to rarely play, 102 (22.67%) students reported to often play, and 60 (13.33%) students reported that they play computer games at least 2 hours per day ($p<0.01$).

The students were also asked how often they play on-line strategy-simulation (like Ogame) games. 300 (66.66%) students reported that they do not use on-line games. 78 (17.33%) students reported to rarely play, 39 (8.67%) students reported to often play, and 33 (7.33%) students reported that they play computer games at least 2 hour per day ($p<0.01$).

The students were asked whether on-line agricultural simulation game could be useful for their education. 330 (73.33%) students reported that it could be useful, 102 (22.67%) students reported that they were not sure, and 18 (4%) student reported that it could not be useful ($p<0.01$). Answers of the students by grades within universities were given in Table 1.

Table 1. Answers related to usefulness of on-line agricultural simulation game for education (%)

	OMU				CU				KSU			
	1	2	3	4	1	2	3	4	1	2	3	4
Y	58.8	36.4	75	81.8	60	70	90.9	72.7	100	90	100	80
NS	38.2	63.6	16.7	9.1	30	30	0	27.3	0	0	0	20
N	2.9	0	8.3	9.1	10	0	9.1	0	0	10	0	0

Y: Yes, NS: Not Sure, N: No

The highest and least rates of "yes" answers were obtained from KSU (92.5%) and OMU (61.8%), respectively. These differences were found statistically significant ($p<0.05$). The highest and the least "not sure" response were found as 33.8% (OMU) and 5% (KSU), respectively ($p<0.01$). The highest "no" response was obtained from CU 4.8% and the least "no" response was obtained form KSU 2.5%. This differences was found statistically significant ($p<0.05$). These differences were found statistically insignificant ($p>0.05$) among universities with all grades. The other questions were responded only by students who answered this question as "yes" or "not sure".

The students were asked how many hours they can spend for this game without affecting their success on lectures per day. 9 (2.08%) students did not response this question. 147 (34.03%) students reported that they could spend les than an hour, 210 (48.61%) students reported that they could spend one to two hours, 45 (10.42%) students reported that they could spend two to three hours, and 21 (4.86%) students reported that they could spend more than three hours per day. Differences among these answers were found statistically significant ($p<0.01$).

The students were asked how often they could visit such a game based learning system. 9 (2.08%) students did not answer this question. 12 (1.00%), 108 (25.00%), 204 (47.22%) and 99 (22.92%) of the students reported that they visit game based learning system one time per fifteen days, one time per week, two or three days per week and every days, respectively. The differences among responses were significant ($p<0.05$).

The students were asked which agricultural topics should be in such a game with multiple choices. Differences among responses were found statistically significant ($p<0.01$) (Table 2). Also Table 2 shows the rank of the agricultural topics belong to universities. Ranks were evaluated by Spearman's Rank correlation, results showed that ranks given to the agricultural topics were highly correlated (1.00; $p<0.001$) between universities.

Table 2. The responses on agricultural topic occupation preferences.

Occupation	Number (n)	%	Rank		
			OMU	CU	KSU
Animal rearing	414	95.83	1	1	1
Field crops (wheat etc)	288	66.67	2	2	10
Horticulture (apple etc)	339	78.47	3	3	5
Forages (alfalfa etc)	312	72.22	7	6	3
Agricultural machinery	258	59.72	6	5	7
Agricultural structures	339	78.47	4	4	2
Forestry	93	21.53	14	14	14
Aquaculture	123	28.47	11	12	12
Agricultural cooperatives	150	34.72	10	9	13
Bio-diesel	126	29.17	12	11	11
Artificial insemination	201	46.53	9	10	8
Milk processing	312	72.22	5	7	4
Meat processing	294	68.06	8	8	6
Ornament plants and landspace	171	39.58	13	13	9

The students were asked which animal species should be in such a game with multiple choices. Differences among responses were found significant ($p<0.01$) (Table 3). Ranks were evaluated by Spearman's Rank correlation; results showed that correlations between OMU x CU, OMU x KSU and CU x KSU were 0.852^{**}, 0.674^{**} and 0.524^{*}, respectively. These correlation coefficients were positive and statistically significant (**: significant at 1%; *: significant at 5%).

Table 3. The responses on preferences of animal species.

Animal	Number (n)	%
Dairy cattle	393	90.97
Beef cattle	345	79.86
Goat	294	68.06
Sheep	336	77.78
Hen (laying)	348	80.56
Hen (broiler)	327	75.69
Turkey	114	26.39
Quail	87	20.14
Goose	84	19.44
Duck	90	20.83
Ostrich	198	45.83
Rabbit	102	23.61
Pig	66	15.28
Buffalo	99	22.92
Horse	234	54.17
Fur animals (mink etc)	201	46.53

The students were asked which field crops should be in such a game with multiple choices. Differences among responses were found significant ($p<0.01$)

(Table 4). Ranks were evaluated by Spearman's Rank correlation; results showed that correlations between OMU x CU, OMU x KSU and CU x KSU were 0.853^{**}, 0.433^{-} and 0.412^{-} (**: significant at 1%; $^{-}$: insignificant at 5%). All these correlation coefficients were positive but only statistically significant correlation was observed between OMU x CU. The students of KSU prefer the different field crops such as oat and colza while students of OMU and CU prefer maize and beetroots.

Table 4. Student responses on field crop preferences.

Field crops	Number (n)	%
Wheat	405	93.75
Barley	369	85.42
Colza	198	45.83
Rye	258	59.72
Oats	285	65.97
Triticale	129	29.86
Corn (grain)	357	82.64
Corn (ensiled)	255	59.03
Potatoes	195	45.14
Tobacco	144	33.33
Cotton	276	63.89
Sunflower	288	66.67
Soybean	189	43.75
Lentil	168	38.89
Chickpea	213	49.31
Sugar beet	225	52.09
Broad beans	168	38.89

The students were also asked which forages should be in such a game with multiple choice. 402 (93.06%) of the students reported that alfalfa, 297 (68.75%) of the students reported that sainfoin, and 345 (79.86%) of the students reported that pasture grass should be in the game. Differences among these crops were found insignificant ($p>0.05$).

The students were asked which horticultural plants should be in such a game with multiple choices. Differences among responses were found significant ($p<0.01$) for horticultural plants (Table 5). Ranks were evaluated by Spearman's Rank correlation; results showed that correlations between OMU x CU, OMU x KSU and CU x KSU were 0.896^{**}, 0.343^{-} and 0.359^{-} (**: significant at 1%; $^{-}$: insignificant at 5%). All these correlation coefficients were positive but only statistically significant correlation was observed between OMU x CU. The students of KSU prefer the different horticultural plants such as walnut while students of OMU and CU prefer apple and grape. These differences should be originated from the regional agricultural production style.

Table 5. The responses on horticultural plant preferences.

Plants	Number (n)	%
Apple	372	86.11
Pear	270	62.50
Peach	273	63.19
Apricot	198	45.83
Grape	303	70.14
Cherry	297	68.75
Plum	150	34.72
Hazelnut	219	50.69
Walnut	252	58.33
Olive	279	64.58
Strawberry	249	57.64
Vegetable (tomato, pepper etc.)	294	68.06

The other traits were not evaluated by Spearman's Rank correlation because of insufficient sample size to avoid statistical errors.

They were asked that how much the animal houses and agricultural structures should be detailed. 27 (6.25%) of the students did not answer this question, 9 (2.08%) students reported that animal houses and structures should not be detailed, 84 (19.45%) students reported that they should be detailed but not much, and 312 (%72.22) students reported that they should be more detailed that player could affect all items in the building such as amount of trough and water bowls. Differences among preferences were found significant ($p<0.01$).

They were also asked how much agricultural machines should be detailed. 15 (3.47%) students did not answer this question, 15 (3.47%) students reported that agricultural machines should not be detailed, 177 (40.97%) students reported that agricultural machines should be detailed, and 225 (52.09%) students reported that agricultural machines should be more detailed such as fuel consumption, breaking down etc. Differences among preferences were found significant ($p<0.01$).

The students were asked to how cooperatives should work in such a game. 18 (4.17%) of the students did not answer this question, 96 (22.22%) students reported that cooperatives should be managed by the computer system and 318 (73.61%) students reported that cooperatives should be directed by players for buying and selling equipments and goods. Differences among preferences were found significant ($p<0.01$).

The students were asked whether fertilizers and treatments should be detailed in such a game. 12 (2.78%) of the students did not answer this question, 366 (84.72%) students reported as "YES" and 54 (12.50%) students reported as "NO". Differences among preferences were found significant ($p<0.01$).

They were also asked to how rations should be given to the animals. All the students answered this question. 396 (91.67%) and 36 (8.33%) students reported that rations should be prepared by players and fixed rations should be used, respectively. Differences between preferences were found statistically significant ($p<0.01$).

As a last question, they were asked whether they play such a game. All the students answered this question. 408 (94.44%) of the students reported that they

would want to play and 24 (5.56%) of the students reported that they would not want to play. Differences between preferences were found significant ($p<0.01$).

4 Conclusion

It was aimed to investigate students' responses to learning through an on-line agricultural simulation game. The results reveal that a majority of the surveyed students significantly want to play such a game at least one hour per day without affecting their success on their lectures and they thought that it may be useful for their education.

Preferences on agricultural topics of surveyed students showed that they mostly interested on animal rearing, horticulture, field crops, agricultural structures, milk and meat processing, forages, and agricultural machinery. According to this some topics such as forestry could be eliminated from such a game.

Surveyed students mostly interested on dairy and beef cattle, hens, sheep and goats. Preferences on pig rearing is quite small, it must be the cause of religion. For the field crops, they mostly interested on wheat, barley, oats, cotton and sunflower. In terms of horticulture they interested on apple, grape, olive, vegetables, peach and pear.

For the other agricultural areas such as agricultural equipments and structures they wanted detailed properties.

Most of the students (94.44%) declared that they want to play such a game to help their education on agricultural engineering.

When the on-line agricultural simulation game is prepared, findings mentioned above should be taken into consideration.

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