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STUDENT EVALUATION OF A DIGITAL LEARNING GAME

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ABSTRACT

Data from 294 post-graduate students studying business administration were analysed to determine perceptions toward digital learning games. This research can be used as a conceptual model of how to react to new methods of instruction. 25 subject (game) related and 21 tutor related attributes made up the course evaluation form. Preliminary findings suggest a Halo effect in form of student's perception of the tutor being influenced by the subject, vice versa. Although the overall evaluation of both, game and tutor, were on average very positive, there were distinct differences between clusters.

Keywords: e-learning, games, business simulation, online assessment.

INTRODUCTION

Digital Learning Games

Digital learning games recreate a situation to solve problems or gain insights [1] in order to facilitate problem-solving, critical thinking, and social skills [2]. Digital learning games are in line with the theory of constructivism [3] and need to be fast, active, and exploratory [4]. Complex games such as Markstrat [5] require time to understand. The advantages of complex games are: motivation of students [6], improvement of attitudes [7], engagement [8], appeal to a wide audience [9], and enhancement of learning outcomes [10]. In summary, digital learning games contribute to better thinking skills [11].

Research Questions and Methodology

Ten business simulation courses at a Singaporean university were analysed. The authors employed a mixed methods research design [12] by analysing quantitative data as well as explicit comments by 294 students posted onto discussion boards (DB). These post-graduate executive MBA students learnt the game on their own, and completed a survey after the game. Markstrat, a strategy based game, was played during a 12 weeks course. Students had to rate subject (game) related as well as tutor related attributes.
Subject related questions:
- Organisation
- Content and Workload
- Assessment
- Usability

Tutor related questions:
- Personality
- Facilitation
- Quality of Feedback

The research questions were:
1. How do students evaluate an educational simulation game and the tutor?
2. Is there a correlation between subject (game) and tutor evaluation i.e. a Halo effect?
3. In this context, what are major dimensions that students look at?
4. Do specific groups differ in their evaluation and level of activity?

Findings

Students anticipated that the game will be interesting. Although the entire course was taught online and students do not physically meet each other, the word spread and created some excitement:
DB Posting *"I have heard that this game is quite interesting so looking forward to a great learning."*
Required reading material, the handbook, covered 76 pages, slowed down the game, and caused some frustration.
DB Posting: *I have a problem with understanding this Markstrat. I went all over in the Markstrat program and I don't have a clue of what to do. I'm really struggling to get into the game. Anyone can enlighten me?*
However, the game propelled the laggards to learn more as they played 'catch-up.' Students experienced cognitively complex yet realistic situations which they had to solve as team. At the final evaluation, results were very positive, see Table 1.

Table 1: Game Evaluation

	N	Mean	Std. Deviation
S_A5	294	4.37	.776
S_B4	294	4.41	.674
S_B6	294	4.29	.864
S_C1	294	4.41	.680
Valid N	294		

Students' assessment whether 'peer interaction in this subject contributed to my learning' (see Table 1, S_A5) was a 4.37 on a 1 (totally disagree) to 5 (totally agree) Likert scale. Students want materials that directly connect to their learning needs [13]. During the game a

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number of readings were given to students such as journal articles. Students were asked whether 'the game was appropriately linked to third party content (e.g. readings)' see Table 1, S_B4. The answer was a very encouraging 4.41. The class schedule and game management are concerns that can interfere with widespread use of simulation gaming [14]. The question whether 'the workload was appropriate for a reputable MBA program' Table 1, S_B6, was given a 4.29. Some games promote learning, but are not enjoyable to play, others are fun but trigger no thoughts. The question whether 'the game was thought-provoking and challenging' got a 4.41 (Table 1 S_C1).

Students got better at playing the game through the total of 12 rounds. Most of them rated themselves positively in areas of self-efficacy and game leadership. After the second round, they believed they could lead game as team leader. Some students commented on their learning outcome.

DB Posting: *It was indeed fun to play and personally I have got sufficient clarity on markets, segments, consumer prefs, internal capabilities of the firm to serve them and allocate scarce resource to gain higher profitability.*

Facilitating a game asks teachers to move from the role of providing information to a constructivist model of instruction. "Students are active learners who construct, interpret, and reconstruct rather than simply absorb knowledge" [15]. Setting a constructive and helpful tone by the tutor is essential [16].

Table 2: Evaluation of Teacher

	N	Mean	Std. Deviation
T_A2	294	4.54	.699
T_A3	294	4.53	.733
T_A5	294	4.53	.694
Valid N	294		

Students were asked whether 'the professor was enthusiastic' (see Table 2, T_A2), 'helpful' (T_A3), and 'well organised' (T_A5).

Table 3: Overall Ratings (sig. at 0.01 level)

		S_E1	T_D1	T_E1
Correlation	S_E1	1.000	.882	.876
	T_D1	.882	1.000	.946
	T_E1	.876	.946	1.000

On average, the game was extremely well received. There seems to be some interdependence between subject (S) and tutor (T). Students who liked the game, gave the tutor a high overall grade, vice versa, see Appendix and

Table 3. The next question was whether there are some major dimensions that students look at. For this purpose a factor analysis was conducted.

Table 4: Rotated (Varimax) Factor Loadings

	Factor 1	Factor 2
T_A5	0.839	
T_A3	0.838	
T_A2	0.820	
T_A4	0.807	
S_C2		0.840
S_C7		0.835
S_C6		0.824

The factor analysis resulted in 2 factors explaining 87.1% of variance. Both factors contributed roughly the same (43.8% & 43.3%). Considering loadings above 0.8 we get a tutor personality dimension (factor 1) and a subject assessment dimension (factor 2); variables see appendix. The only personality attribute that is not included is the tutor's knowledge which may be a consequence of the game's team character and less focus on the teacher.

With 7 high loading variables of table 4 a cluster analysis was conducted, see Table 5.

Table 5: Evaluation Cluster Centroids

	T_A2	T_A3	T_A4	T_A5	S_C2	S_C6	S_C7
	Mean	Mean	Mean	Mean	Mean	Mean	Mean
C 1	2.96	2.78	3.04	2.96	2.57	2.83	3.00
2	4.02	4.01	4.05	3.96	3.86	3.89	3.86
3	4.86	4.89	4.98	4.89	4.02	4.09	4.00
4	4.99	5.00	5.00	5.00	4.94	4.92	5.00
M	4.54	4.53	4.57	4.53	4.31	4.34	4.37

There are 4 distinct clusters. Cluster 1 (N: 23) may be described as not enthusiastic about the subject as well as tutor. Cluster 2 (N: 83) more positive; expectation are met but not exceeded. Clusters 3 (N: 44) and Cluster 4 (N: 144) are very positive. Again, this result shows that there is a Halo effect in the form that student's perception of the tutor is influenced by the subject, vice versa. Unfortunately it is not possible to analyse the profile of Clusters 1 and 4 further because student's evaluations were submitted anonymous out of fear that a tutor may penalise a specific person for poor feed-back. Although it is impossible to make a direct link between a person's course evaluation and actual online activity it is possible to analyse the latter, see Table 6.

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Table 6: Online activity

	N	Min	Max	Mean
Sessions	294	2	528	130.09
Total Time	294	0:01	8:19	1:53
Mail_Read	282	1	379	59.93
Mail_Sent	239	1	88	8.96
DB_Read	294	3	17290	6053.29
DB_Post	294	0	524	76.67
Chat	82	1	69	7.49
Organizer	294	13	739	192.16
N	294			

The minimum number of total logins during the 12 rounds of the game was 2 i.e. this particular student did not retrieve all game results nor participated in team discussions. The minimum time spent online on the game per day stood at 1 minute, the longest 8 hours and 19 min. There are equally huge differences between incoming emails read, emails sent out to others, discussion board postings read and posted as well as participating in chats and viewing the organiser (tool for tracking assignments, game deadlines etc). The high number of DB_Read is a result of around 3,000 postings per course i.e. each person reads on average each posting twice. In a similar pattern as the evaluations have been analysed, the factor analysis shows two factors, see Table 7.

Table 7: Activity Factors

	Factor	
	1	2
Sessions	.918	-.119
Organizer	.773	-.197
DB_Read	.760	.072
Total Time	.655	-.352
DB_Posted	.638	-.336
Mail_Read	.321	.727
Mail_Sent	.565	.685
Chat	.049	.634

Factor 1 shows high loadings of number of sessions, organiser viewed and DB postings read whereas factor 2 shows a mail dimension.
A cluster analysis, see Table 8, resulted in four clusters.

Table 8: Activity Cluster Centroids

	Sessions	Organizer	DB_Read	Mail_Read	Mail_Sent
	Mean	Mean	Mean	Mean	Mean
Cluster 1	272.44	331.78	57964.6	165.89	38.33
2	116.35	176.75	3627.06	103.73	14.29
3	187.52	279.01	7329.58	51.51	7.54
4	76.69	115.57	1493.65	34.37	4.65
M	130.09	192.16	6053.29	59.93	8.96

Cluster 4 shows the lowest and cluster 1 the highest level of activity. Unfortunately it is not possible to match these 4 activity based clusters with the 4 evaluation clusters due to data protection of students. We may hypothesise that there is a strong correlation between the cluster 4 of table 8 and cluster 1 of table 5. Students who do not like the subject including tutor may be the least active, vice versa. However, this analysis has shown again that there are distinct differences between groups of students.

Conclusion

A logical choice for tutors, who want to make their instruction interactive, is a digital game in order to capture the attention of less eager or otherwise uninvolved students. Any simulation, such as Markstrat, needs to be carefully set up, explained, and include references to journal articles. Typically, a tutor will assume that all students are interested in playing a digital game, but this survey indicates that close to 8% (evaluation cluster 1, activity cluster 4) think that games are not appropriate for them and show minimal activity. Furthermore, a Halo effect influences their perception on the tutor and subject.

Appendix: Questionnaire

(coding S: Subject, T: Tutor e.g. first question: S_A1)
SUBJECT
A. Subject Organisation
1. The aims of the subject were clearly articulated.
2. There was a clear overview of the subject segments, readings and assignments.
3. The subject was structured in a way that helped me to understand.
4. The various learning tools were used effectively (e.g. discussion
boards, self-assessment exercises, instant messenger).
5. The peer interaction in this subject contributed to my learning.

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B. Subject Content and Workload
1. The subject content was relevant to my learning needs.
2. The subject content was engaging.
3. The writing style of the online subject content (excluding the readings, cases, and the textbook) was clear and easy to read.

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4. The online subject content was appropriately linked to third party content (e.g. readings, cases, the textbook).

5. The textbook used in this subject was useful for my learning needs.

6. The subject workload was appropriate for a reputable MBA program.

7. The case studies selected for this subject were useful for my learning needs.

C. Subject Assessment

1. The assessment items were thought-provoking and challenging.

2. The relative weightings of assessment items (e.g. discussion boards, case assignments, examination etc.) were appropriate.

3. The ratio of individual to team assignments was appropriate.

4. The formats for assignments and the final exam in this subject were clearly explained.

5. The assessment methods and feedback in this subject helped my learning.

6. The assessment criteria for the assessment items in this subject were clearly delineated.

7. Assessment methods were compatible with the stated learning outcomes.

8. The assessment was sufficiently flexible to accommodate my learning style and non-study related activities (eg. career, family, travel).

D. Subject Usability

1. The subject content was easy to navigate.

2. There was flexibility in terms of how I was able to view the subject content (e.g. printing text when required, viewing certain parts rather than the whole of an animation, changing font size, etc.)

3. The subject content was displayed with an appropriate balance of text, graphics, and animation.

4. The case studies and readings used in the subject were easily accessible.

E. Overall Rating

1. Overall, how would you rate the quality of your learning in this subject (1 = poor, 5 = excellent).
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2. TUTOR

A. Personality

1. The professor was knowledgeable in his/her field.

2. The professor was enthusiastic.

3. The professor was helpful.

4. The professor was fair and unbiased.

5. The professor was well organised.

B. Learning Facilitation

1. The professor added value to the subject matter, increasing my interest.

2. The professor encouraged students to think critically.

3. The professor encouraged students to interact with others using various learning tools (eg. discussion boards, instant messenger, team assignments).

4. The professor gave clear instructions for assignments and other activities.

5. The professor made clear what I needed to do to be successful in this subject.

6. The professor showed genuine concern for student progress and needs.

7. When called upon, the professor explained difficult topics and concepts in easily understood ways.

8. The professor created an environment conducive to learning.

9. The professor used a range of methods to improve student understanding.

C. Quality of Feedback

1. The professor was receptive to student's views and feedback.

2. The professor provided feedback which was helpful and constructive.

3. The professor gave advice that met the individual needs of the students.

4. The professor responded to queries quickly and efficiently.

5. The professor suggested specific ways in which students might improve their academic performance.

D. Overall Rating

1. Overall, how would you rate the performance of the professor in this subject?

E. Overall Satisfaction Level

1. Overall, how would you rate your satisfaction level in this subject?

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