Sid Meyer´s Civilization and Simulating Technology-Society Policy Making: A Case Study of Using Computer Game in Public Administration Education

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Abstract

In this paper we explore how Civilization, and - in a more general approach - computer games can enhance public administration (PA) education for entry level students. We pose the research question, how computer games at the early stage of PA studies aligned with systematic curriculum design make educational experiences and the learning process more successful than standard teaching.

Sid Meyer´s Civilization series is one of the most popular turn based strategy games, illustrating the complex causalities of economic development, geographical expansion, technology innovation, government structure and warfare. The players experience historical development through the ages of human civilization – starting to build simple ancient huts all the way to modern space exploration – and able to choose different strategies to guide their civilization through the challenges of allocating resources, managing conflicts or deploying technological innovations. Civilization has been used in several classroom experiences for teaching history and complex system analysis. Methodologically, we present an experiment ran at the National University of Public Service in Budapest during the academic year of 2017/18 written in a case study format. We describe the learning objectives of the Government Studies program in general and the objectives of the Information Society and System Analysis courses in particular, where the students had been exposed to playing Civilization. Our findings suggest promising results using computer games in four aspects of PA:

a) Effectiveness and efficiency of learning

We show that students have acquired the learning objectives – knowledge and skills – of technology-society relationships and system thinking in an effective and efficient manner. We show that the concept of Civilization has proven an effective method to demonstrate the comprehensive approach in PA – showing how the interplay of event, structure and behavior works on a grand scale.

b) Implications of advanced technologies in government studies

Our experiment has revealed that if students are presented with the historical contexts of technology and society relationship, their aptitude for the technology-society relationship becomes creative, sensitive, and opens up for appreciating the importance of public policies in the better functioning of governments.

c) Further applications of computer games (different uses of Civilization and others)

Based on the experiment we developed recommendations how computer and video games can be used in PA education. This is essential given the feedback of our students, given the fact that the genre of PA education needs to be modernized for retaining astute talents for improving the future staffing of PA experts.

d) PA problems that can be solve by games: reception of the idea

Finally, we have suggested ideas beyond the class room learning for understanding complex PA problems by using simulation games based on our observations. “Games”, in this context, are the popularized versions of complex dynamic simulations of cause-effect relations which often reveal non-intuitive behavior of systems, understanding of which is essential for future public leaders.

Points for Practitioners

Firstly, the results of our research have implications for the practice of teaching public administration. As it is getting a more and more problematic to reach out to students of the millennium generation and convey concepts of complex social systems, roles of government and functions of public administration (PA) but – probably most

importantly – to raise their interest in these topics at the early stages of their studies. Application of commercial computer games is a relatively untapped area in this endeavor, therefore teaching administration, instructors and curriculum designers might find it interesting how to integrated computer games into PA curricula.

Secondly, we show in our paper that innovative combinations of theoretical concepts of the "information society" discipline and "system theory" create a pragmatic framework to simulate complex relationship of technology-society duality. With this, the impact of information communication technologies and other R+D initiatives on public administration can be analyzed, and even some of the public policy challenges of government can be simulated.

Keywords

Sid Meyer´s Civilization, Government Studies Program, Information Society, System Theory

1. Introduction

Knowledge and skills in public administration areas have been changing rapidly. There is a more dominant need for analytical, decision making, complex system thinking skills, and especially understanding the implications of technology for social policies. Education of PA is struggling with these issues.

A new generation of students have entered PA programs, and with that, a more ICT astute generation have appeared in PA organizations as well. The challenge is twofold; firstly, at the output of education they have to understand new complexities of how society is shaped by technology and being able to contribute to seizing hew opportunities with PA policies, secondly, at the input phase they have to be addressed with content and methodologies which maintain their educational needs – and more importantly retains talented individuals to pursue their studies.

In this paper we explore how the application of computer games combined with system thinking and science-technology studies can enhance PA education and contribute to solving these educational challenges. We pose the research question, how computer games at the early stage of PA studies aligned with systematic curriculum design make educational experiences and the learning process more successful than standard teaching.

2. The role of science technology studies and system thinking in PA education – a theoretical and conceptual review

The National University of Public Service (NUPS) is responsible for educating the future leaders and managers of the Hungarian public sector. NUPS launched a five-year master program in Government Studies with the following objectives:

- educating its participants of the complex knowledge involving the tasks, organization and operation of state,
- to provide skills and knowledge for of systematically handling human capital, and performing high-level planning, strategic analysis and leadership tasks,
- to introduce the concept of strategic planning of public policy and analysis,
- to make students capable of creating government models, and understand the techniques, basic legal and public service frameworks,
- to familiarize students with the techniques of efficient management of the changes in state structure and governance,
- to educate students how to organize government activities using comparative methods and international models,

- to introduce the societal, political, economic and human elements which define and influence the function of government.

The Information Society course of this curriculum introduces the cultural, political and economic issues of the information society and the Internet, and reviews the state responses to this challenge by analyzing some information strategies. The strategic approach of the course is emphasized by presenting the strategic incentives of the ICT companies, so it deals with network and microeconomic issues, as well as the macroeconomic impacts by which the information economy has an impact on national competitiveness.

The Systems Theory and Analysis course familiarize students with the basic terms of cause-effect relations, elements of system thinking, and modeling complex legal, organizational and technological problems (positive and negative feedbacks, effects of delays and externalities, dynamic models, cause-effect diagrams). Students supposed to acquire skills to exploring, analyzing and evaluating basic system archetypes.

In order to methodologically enhance the two courses, the authors initiated the introduction of a well known turn-based strategy game series – Sid Meyers´ Civilization. Games, especially strategy simulation games, such as Civilization, are great tools to illustrate system complexity, how and why leaders allocate their resources, and importantly what is impact of technology on social development and vice versa. During the gameplay of Civilization, we can observe how nations expand from ancient times as a result of economic development (see ***Figure 1***.), geographical expansion, warfare and most importantly as the result of technology evolution.

Figure 1. Screenshot of Civilization VI – a modern city with special building and wonders

In the case of the Information Society course Civilization was used primarily to show the dynamic perspective of socio-technical evolution, while during Systems Theory course the game was applied for modelling and analysis as well. used test the methods and tools of the subject.

3. Use of computer games in education – experiences in PA education

The potential to use computer games in education has become relevant as their popularity and availability has grown As the advancements in using video games and simulations for educational purposes in the corporate, government and military worlds have grown a similar change in the world of schools was raised (Schaffer, Squire, Halverson, & Gee, 2005). With the appearance of serious games - games used for purposes outside of entertainment – a vast variety of opportunities have risen (Susi, Johannesson, & Backlund, 2007). For instance, (Squire, 2008) uses an overview of two gaming based research programs in education to make a case for a gaming based future of education either through the specific use of commercial games, or through gamification

and gaming techniques. Another literature review summarizes the effect of video games on students at the age of 14 years, finding links numerous cognitive and other outcomes; the most common of which where the acquisition of knowledge and motivational outcomes (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012)

Civilization, is one of the oldest and most widely known turned based strategy games in the gaming industry. Its use in classrooms has been explored mainly in history education for instance discussing how useful the game is in effectively studying alternate historical events (Burns, 2002). (Pagnotti & Russell III, 2012) explore the use of a specific lesson plan using Civilization IV to teach world history to ninth grade students in the hopes of encouraging high-order thinking. As (Wainwright, 2014) reports after experimenting with the IVth edition of the game series, student feedback indicates that the methods used allow many undergraduates to better understand complex historical concepts, as well as form assumptions based on critical analysis of the historical content of the game. Also, it helps children to learn visual conceptualization (Liu , Chen, Shih, Huang, & Liu, 2011). Using Civilization in classroom is fun, research proves that the enjoyment factor overrules the conceptual scaffolding, indicating that free flow and creativity is essential when video games are deployed in education (Charsky & Ressler, 2011).

Computer games are also used in PA and related fields. For instance, noteworthy applications are documented by (Kolson, 1996) using SIM CITY, or (Mayer, 2009) how to use games in politics. There are accounts also how to conceptually integrate games in civil service education (Raphael, Bachen, Lynn, Mckee, & Baldwin-Philippi, 2010). Civilization is used how to learn about power games, and (Valdre, 2007) claims that players of Civilization through their play get used to various theoretical tools, such as the concept of cultural, social and economic capital, and how they influence modern social practices and learning process.

Methodologically, most research in the field uses case study based approaches similar to (Watson, Mong, & Harris, 2011), who also give a detailed guideline on how to design and execute research of this kind.

4. Research Methodology

Prior to the start of the Information Society course at the first session we surveyed students in order to form an image of their experience as gamers, their specific experience with strategy video games or the Civilization series in particular, and the level of their digital literacy in a general sense. Based on the information obtained we then organized the volunteers into groups of 3 or 4 members, which we would be sure to balance out in terms of player experience. The controlled division of the groups was meant to avoid certain teams getting a clear advantage over the others that would have made the game experience seem unfair. **Table. 1**. depicts how students assessed their skills and willingness to join the gaming seminar on a 1 (worst) to 4 (best) scale.

Table. 1 . Students´skills in digital literacy and gaming – Kahoot survey before the experiment

		DigiLit	Games	StratGames	Civ	Willingness
N	Valid	97	97	97	97	97
	Missing	0	0	0	0	0
Mean		2,49	2,76	2,07	1,58	2,61
Minimum		0	0	0	0	0
Maximum		4	4	4	4	3

Students perceived their own digital literacy skills lower than experience with computer games, but knowledge of strategy games and particularly Civilization had been the lowest. It is important to underline what ***Table 2***. shows about correlations between these variables. Willingness to participate in the gaming experiment was only moderately correlating with the experience of using Civilization earlier (Spearman rho=0,269, p>0,99) and we only found medium-strong correlations between gaming, strategy gaming and Civilization use after the non-parametric correlation test (see ***Table 2***). What we found slightly surprising that the perceived assessment of digital literacy and gaming experience did not correlate with the willingness to learn the course through playing

Civilization. We assume that a main reason for this had been the uncertainty of the new method and the requirements which had been only easily attainable to those who had experience in computer games.

Table 2. Correlation between digital literacy, gaming experience and willingness to participate

			DigiLit	Games	StratGames	Civ	Willingness
Spearman's rho	DigiLit	Correlation Coefficient	1,000	,246*	**,334****	**,296****	,170
		Sig. (2-tailed)	.	,015	**,001**	**,003**	,096
		N	97	97	**97**	**97**	97
	Games	Correlation Coefficient	,246*	1,000	**,419****	**,559****	,087
		Sig. (2-tailed)	,015	.	**,000**	**,000**	,394
		N	97	97	**97**	**97**	97
	StratGames	Correlation Coefficient	,334**	,419**	1,000	**,567****	,226*
		Sig. (2-tailed)	,001	,000	.	**,000**	,026
		N	97	97	97	**97**	97
	Civ	Correlation Coefficient	,296**	,559**	,567**	1,000	**,269****
		Sig. (2-tailed)	,003	,000	,000	.	**,008**
		N	97	97	97	97	97
	Willingness	Correlation Coefficient	,170	,087	,226*	,269**	1,000
		Sig. (2-tailed)	,096	,394	,026	,008	.
		N	97	97	97	97	97

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Our assumption was verified after the second semester when students enrolled to the System Theory course and the Civilization bases seminar was offered to continue. As we can see in **Table. 3**. during the first semester in the Information Society course we could form 7 groups with 19 students, while during the second term the number of students grew to 35 which we organized into 13 groups. Correlation tests have not shown any difference between these groups in gender or any other variable.

Table. 3. Group distribution by semesters and genders

	S1Group (Semester 1) Information Society							S2Group (Semester 2) System Theory												
Group Number	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9	10	11	12	13
Male	2	2	3	0	2	2	0	2	1	2	0	2	3	1	3	1	3	2	0	1
Female	1	1	1	1	1	2	1	0	2	0	3	1	0	2	0	2	0	0	3	1

Courses would be held on a weekly or bi-weekly basis. This would give us a set of regular opportunities to play the game as a group and discuss possible difficulties that arise throughout the semester. The sixth game in the series, Civilization VI, would be the version used in the classroom, but any of the previous games would do for use at home. Limitations of the computer hardware at our disposal meant that the latest game in the civilization series, Civilization VI, was not a reasonable choice. The chosen version then became Civilization IV, the latest of the games that would reliably run on our systems, and the one receiving the some of the best critical acclaim. During the classes the game would be used to provide simulated examples useful in helping the student grasp the otherwise theoretical concepts in practice.

Figure 2. Introductory video prepared by authors to demonstrate basics of gameplay www.youtube.com/watch?v=bii4hNBtGCI

The first class in the Information Society course would be dedicated to the introduction to the game Civilization IV itself. For this purpose a short clip was created by the third author of our paper and published on-line in order to familiarize students with the major concepts of the game (***Figure 2***.) After assigning the students to their respective groups we would begin teaching them the primary game mechanics, making sure that by the end of the first class they would possess all knowledge necessary to initiate, save and load their own games, to issue commands to their units, manage the production cues of their cities, assign technologies to research, and be able to find any additional relevant information on their own if need be. Assignments would be handed out via the E-learning systems in between classes.

A second class would be scheduled half way through the semester to provide the students an opportunity to address any concerns that arise along the way in person. Additionally, if time permitted, this class would also be used to start a multiplayer game session, where the groups would play competitively against each other. Practicing particular techniques connecting to the course material were focusing on the technology tree and exploring technology, and focusing on decisions, causality, teamwork and generalization.

The third and final class would be dedicated to discussing the completed tasks, and reflecting on the semester as a whole using a group interview format. The discussion would also be focused on gathering feedback to judge the overall effect of the program and to identify areas where it can be improved.

Over the course of the semester the groups would document the games they played and the tasks they completed in journals. These would contain the major decisions made during their gameplay, the reasoning and thought processes behind them, and the effects they had on the outcome compared and contrasted to their expectations. Solutions and answers to the assigned tasks and optionally any desired feedback would also be included in these journals.

The second semester of the course was different in many ways. Some of the limitations on us in the first semester were not present this time around, and we also made several changes based on feedback gathered from the students on our last session. The bi-weekly sessions became a reality this time. During the lecture hours a computer laboratory was made available, allowing us to organize regular sessions. A key difference was a much closer collaboration with the lectures and the connection of assignments with the topics presented during the lectures. Conceptually, the gaming sessions of the System Theory class used Civilization as an illustration for the topic starting with a presentation followed by team discussion and summarizing the previous and the upcoming home assignment.

First class had little difference compared to Information Society: students played Civilization and newcomers had to familiarize with the mechanics of the game. Topics of the second class were system attributes and system

control. In the third modelling was discussed along with organizational use: students had to play with “Stanley’s Parable” for demonstrating the limitation of system models and how to apply flowcharts.

The fourth class dealt with system dynamics; students were introduced to the “beer game” and the “Surviving Mars” simulation. In the fifth class MIT´s Moral Machine was brought in and topically students discussed the process of decision making, which was further extended in the sixth session with complex networks. Here two new games were introduced Democracy 3 and Europa Universalis. Finally, in the last class the topic of scale-free networks was covered: here we returned to using Civilization.

In between classes students would be assigned tasks involving further gameplay to complete with their group.

Group assignments were restructured to feature a task list with individual point amounts assigned to each sub-task to allow the students an easier understanding of the weight of each element. We also made the decision to allow the students to form groups based on their own choosing. This was done based on the feedback from the students, where group dissonance was the most common difficulty experienced. New players were more likely to learn the game well if they worked together with others they were comfortable with, regardless of the other players´ skills. Groups were only formed by us in such cases where students did not form groups of their own, or where groups did not have enough members. It is worth mentioning though, that these were freshmen students who did not yet know each other well in the first semester.

The product at the end would be a log of the events that occurred in the sessions, with specific attention dedicated to answering questions posed by the teachers.

5. Discussion of results

In Table 3. we summarize the number of students who provided feedback on their learning experience. Altogether, from the 54 students who acquired the material of the two semesters by using the Civilization game experience 49 responded

Table. 4. Group distribution by semesters and genders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NOT PLAYED	77	61,1	61,1	61,1
	PLAYED	49	38,9	38,9	100,0
	Total	126	100,0	100,0	

In the following discussion section we give a general summary of these reports, our observations and juxtaposition of other sources such as colleagues´ opinions.

5.1. Effectiveness and efficiency of learning

Attendance of classes varied greatly between the first and second semester. Requirements were different, while in the first term grades were given only based on the homework submission class attendance was not required for all the sessions only two of them had been mandatory. After drawing the conclusions we required the presence of at least one team member to be at the seminars and at the lectures. It was interesting to note, that the 24 seated Computer Lab occasionally proved to be too small and extra places needed to be created.

The 7 Study Groups during the first semester of the Information Society course reported that they enjoyed playing the game and working on the exercises but they did not value the content any higher than the lectures. From the course assessments we know, that our students had a great time in the first semester, but don’t get much new information from our alternate method, they gain most of the subject’s content from the lectures. During the second semester the 13 Study Groups although still enjoyed the gameplay they had to work on more assignment which were more tightly connected to the topics of the lectures in System Theory.

The following basic knowledge concepts have been the learning objectives in the two programs:

Information Society

- To understand the impact of technology on society and how technology development is impacted by social developments.
- Technological determinism and diffusion theory.
- Gartner's Hype cycle.
- Social Construction of Technology and technorealism.

System Theory

- System approach, system attributes, target predicates and decision making attributes.
- Complex cause and casual loop diagrams, modelling, participation modelling.
- Supply-chain management, flowcharts, Critical Path Method, and principles of process mapping.
- Basics of system dynamics and team dynamics.

In summary, the students had to acquire the view points and methodological frameworks of system analysis and technology-society relationship. The key objective was to convey a comprehensive approach to study PA, and to understand how structure determines behavior and results in specific events. Students´ feedback on the learning experience is summarized in ***Table. 5***.

Table. 5. Students´ feedback on the learning experience categorized by participation.

			EXPERIENCE	EASINESS	KNOWLEDGE	ATTENDENCE
CIV_PLAYED	NOT PLAYED	Count	77	77	77	77
		Mean	8.03	8.52	6.14	6.86
		Standard Deviation	2.08	1.57	2.25	2.66
	PLAYED	Count	49	49	49	49
		Mean	7.78	8.87	6.83	7.09
		Standard Deviation	2.94	1.22	2.19	2.19
			EXPERIENCE	EASINESS	KNOWLEDGE	ATTENDENCE
PARTICIPATION	REGULAR	Count	77	77	77	77
		Mean	8.03	8.52	6.14	6.86
		Standard Deviation	2.08	1.57	2.25	2.66
	INFOSOC	Count	10	10	10	10
		Mean	7.50	6.50	6.50	8.50
		Standard Deviation	.71	2.12	.71	2.12
	SYSANAL	Count	21	21	21	21
		Mean	7.57	9.00	6.86	6.36
		Standard Deviation	3.65	.96	2.38	2.34
	BOTH	Count	18	18	18	18
		Mean	8.29	9.29	6.86	8.14
		Standard Deviation	1.50	.76	2.27	1.35

Apart from the learning experience those how had chosen the Civilization gameplay valued easiness, acquired knowledge better and their class attendance was also more frequent (grey area in ***Table. 5***). If, however we take a closer look at these differences – depicted in the lower sections of ***Table. 5***. – we see that those 18 students, who took the Civilization seminars in both semesters (variable BOTH) did value all four questions higher than

those students who took only one Civilization seminar or none. There might be several explanations for these variations, some of them could be the uncertainty at the beginning of the Information Society course, some – especially in the second semester – the lower willingness to attend classes (there is a drop from 8.5 to 6.36) while the easiness was assessed gradually higher (fisrt semester 6.5 second semester 9.00 while the two together 9.29). What is very promising, however, is that knowledge acquisition seems to be consistently viewed more effective with the Civilization seminar than amongst those students, who had not taken that path. Unfortunately, with this sample we were not been able to conclude more, since the difference has not proven significant by any variation of means testing, so our case did not prove that this difference is not random.

We get more insight into students´ perceptions if we analyze their written comments about two questions: a) description of concrete knowledge and skill areas acquired during the course, and b) sharing any comment about the course both positive and negative. ***Table. 6***. shows results of the keyword analysis using the responses from the first set of answers, and ***Table. 7***. shows the keywords from the second. For the analysis we used AntConc 3.4.4., a freely available but robust multiplatform tool for carrying out corpus linguistics research and data-driven learning, developed by Anthony Laurence at the Faculty of Science and Engineering at Waseda University in Japan.

The keyword analysis has been executed in two steps. Firstly, we created a text corpus from the students responses about the two topics – the first file consisted of 450 words (on the knowledge content of the course) and the second consisted of 559 words (on the experience being in the course). These two lists then were used as the keyword list range, or as a corpus reference, compared to which I calculated the so called keyness variable for the three groups of students – who took the regular sessions (REGULA), who only took part in the information society course (INFOSOC), and who took part in the system theory class (SYSANAL). The analysis goes beyond a simple word count, since it shows which words are unusually frequent (or infrequent) in comparison with the words in a reference corpus. This allows us to identify characteristic words – hopefully unique to the three student groups.

Table. 6. Keyword analysis of students´ response on concrete knowledge areas they learnt

	W.c.	Keyness	REGULAR		W.c.	Keyness	INFOSOC		W.c.	Keyness	SYSANAL
1	94	13.116	was	1	4	3.163	game	1	3	4.429	which
2	22	8.937	enjoyable	2	5	3.140	about	2	3	3.485	box
3	36	8.817	lectures	3	3	2.372	civ	3	3	3.485	these
4	14	5.687	only	4	4	2.370	different	4	6	3.055	we
5	14	5.687	opinion	5	6	2.139	many	5	2	2.953	applicable
6	50	5.344	more	6	7	1.939	things	6	2	2.953	network
7	12	4.874	found	7	3	1.611	has	7	3	2.759	most
8	12	4.874	kahoot	8	2	1.581	civilization	8	2	2.067	elements
9	12	4.874	one	9	2	1.581	essential	9	2	2.067	help
10	12	4.874	teacher	10	2	1.581	helps	10	2	2.067	helped
11	12	4.874	them	11	2	1.581	lot	11	2	2.067	liked
12	12	4.874	there	12	2	1.581	managing	12	2	2.067	really
13	24	4.740	good	13	2	1.581	see	13	3	1.725	decision
14	24	4.740	would	14	2	1.581	semester	14	5	1.478	what
15	10	4.062	attend	15	2	1.581	significance	15	1	1.476	analyzed
16	10	4.062	difficult	16	4	1.279	decision	16	1	1.476	became
17	10	4.062	like	17	6	1.057	this	17	1	1.476	causes
18	10	4.062	somewhat					18	1	1.476	choice
19	8	3.250	attending					19	1	1.476	choices
20	8	3.250	basically					20	1	1.476	components

Keyness is calculated using the Log Likelihood method (Rayson, 2008). When using either Log Likelihood or Chi-squared as the statistical measure, the following significance values apply

- 95th percentile; 5% level; $p < 0.05$; critical value = 3.84
- 99th percentile; 1% level; $p < 0.01$; critical value = 6.63
- 99.9th percentile; 0.1% level; $p < 0.001$; critical value = 10.83
- 99.99th percentile; 0.01% level; $p < 0.0001$; critical value = 15.13

Taking this into consideration, in ***Table. 6***. we can see that the keyness of listed 14 words for the regular group is significant on a 5% level, and two relevant words "lectures" and "enjoyable" on 1% level. All these words show a positive assessment of the whole course, "teacher" is very relevant, since in the second semester and excellent professor ran the lectures who used "Kahoot" exercises at the end of each session. In the other two categories we mostly see conjunctions and pre-positions on any significant level, but the word count column indicates the frequency of the unique phrases in each group. These – not significantly though – express the difference using words like "Civ, game, Civilization", and "applicable, network, elements" etc.

Table. 7. Keyword analysis of students´ response on learning experience during their courses

	W.c.	Keyness	REGULAR		W.c.	Keyness	INFOSOC		W.c.	Keyness	SYSANAL
1	13	2.248	lectures	1	6	2.521	tasks	1	4	4.606	using
2	6	2.015	teacher	2	4	1.681	all	2	8	3.253	more
3	15	1.429	subject	3	4	1.681	been	3	5	2.839	enjoyable
4	4	1.343	assignment	4	4	1.681	civ	4	2	2.783	decision
5	4	1.343	basically	5	5	1.469	assignments	5	2	2.783	games
6	4	1.343	exam	6	5	1.469	from	6	2	2.783	impression
7	4	1.343	his	7	5	1.469	game	7	2	2.783	talking
8	4	1.343	lecturer	8	3	1.261	into	8	2	2.783	these
9	4	1.343	no	9	3	1.261	previous	9	2	2.783	you
10	24	1.284	was	10	3	1.261	will	10	4	2.186	my
11	3	1.007	am	11	4	1.069	alternative	11	2	1.913	about
12	3	1.007	experience	12	4	1.069	way	12	2	1.913	life
13	3	1.007	fair	13	28	1.043	to	13	2	1.913	most
14	3	1.007	humor					14	4	1.468	would
15	3	1.007	liked					15	1	1.391	aspects
16	3	1.007	overall					16	1	1.391	beer
17	3	1.007	than					17	1	1.391	ber

When in ***Table. 7***. we examine the keyness indicators for the students´ experience – that is a general opinion about how they had felt during the courses – we find similar words in the regular cohort although none are significantly "key". The situation is the same when we look at the INFOSOC and SYSANAL columns with quite large number of words describing the typical genres of the different experiments. After running a concordance analysis with the four occurrences of the only one significant keyword "using" we confirmed that three of these were reflecting the instructor´s skills to use Kahoot, interesting examples and the famous beer game, and only one referred to the use of gaming and related exercises. Running concordance analysis with the 2nd most frequent word "enjoyable" it has become apparent that the second semester System Analysis course was highly rated because it was better organized, there were more team assignments and students could choose more options how to meet requirements.

5.2. Technologies

Civilization models the impact of technology on society by using the "technology tree". Players choose the route how they climb this tree, that is in what sequence they explore and deploy new technological innovations. In order to facilitate discourses on the complex technology-society relationships we asked our students to discuss interesting technologies and their potential impact on society. The recommended technologies were included:

Space technologies, new materials, cloning (future based):

- Cloning and Genetic modification: For improvements in military and population control, as well as increasing the quality of life.
- Extra-terrestrial bases: To add the ability to construct bases on other astral bodies for a large boost to scientific research, as well as a great increase in resources.
- Terraforming: To create resource deposits on the map, and to help shape the terrain to the choosing of the player.
- Wormhole theory: Allows fast travel between planets.
- Alternative energy sources: Effects the populations happiness to reflect the reduced environmental impact

Information communication technologies (present, mainstream)

- Nanotechnology: For use in improving medical procedures and furthering scientific research capabilities.
- Artificial intelligence: To improve the effectiveness of mechanical units.
- Automated vehicles: Helps to improve effectiveness of trade and economic growth.
- 3D printing: Helps to reduce production costs in cities, provides cultural and happiness increases.
- LED technology: To reduce power consumption of electronic devices, thus increasing happiness and reducing upkeep costs.
- Retinal scanners: To help provide an extra measure of defense for keeping researched technologies safe from foreign espionage.
- Drone technology: Improves military capabilities and surveillance at the cost of a negative impact on happiness.

Socio-technical concepts:

- Social networking: Effects population growth and the spread of culture.
- Virtual reality: For use in better training military units, with added cultural and entertainment values.
- Universal translation technology: An important tool in aiding relations with foreign civilizations.
- International sports events: Helps to increase the populations health by promoting sports and exercise, as well as provide cultural bonuses to hosting countries.

5.3. Further applications of gaming

In order to collect suggestions from students based on their experiences both with computer games and with their government studies we asked them which other video games they believe could be used for other educational purposes in their program. The following is the summation of the recommended games and areas:

For the purposes of better understanding strategical thought-processes and other similar functions, many of the students recommended the use of other well renowned grand-strategy games such as Crusader Kings (***Figure 3***.), Europa Universalis, or Hearts of Iron.

Figure 3. Crusader Kings – grand strategy game illustration

Various MMORPGs (Massively Multiplayer Online Role-Playing Games), such as World of Warcraft and Eve Online (***Figure 4***.), were recommended to help depict the role of a single individual within a larger coherent system.

Figure 4. Eve Online –MMORPG illustration

Several students recommended certain CCGs (Collectable Card Games) as a way to showcase the importance of risk-management, i.e. how to utilize the tools under our control to cope with random occurrences within the system. We show a set of these in ***Figure 5***.

Figure 5. Collectable Card Game illustration

The various games in the city-builder game series Sim City (***Figure 6***.) were recommended for use in showcasing causality, the effects that elements of a system can have on the others, and how to create models and

diagrams of the process. The Sim City games tendency to showcase city information in graphs and charts was also a reason to suggest these games as a way to improve data interpretation abilities. Other city-builder games were also mentioned for this purpose, such as Banished or Zeus and Poseidon.

Figure 6. Sim City – city-builder illustration

The afore mentioned MMORPGs were also commonly grouped together with certain team based tactical action games, such as DOTA 2 (Defense of the Ancients) - ***Figure 7***.- or Heroes of the Storm, to train in team structuring and communication.

Figure 7. Dota-2 – team based tactical action illustration

Numerous games of differing genres were mentioned as ways to help understand system characteristics and the ways to control and influence them. Real-time strategy games recommended here included Age of Empires, Starcraft and the Total War series. Survival/crafting games recommended included titles like Rust, Space engineers and Minecraft – illustrations are shown in ***Figure 8***.

Figure 8. Ages of Empires and Space Engineers – real-time strategy and survival game illustrations

5.4. PA Problems that can be sold by games: reception of the idea

Beyond the learning objectives of the two particular courses students reported other – more general – impacts of the experiment. The groups consisting of three members were introduced to develop teamwork, and reflect in the journals on how they identified together key decision points, assessed alternatives and have come to joint decisions. They reported several learning conclusions and also how these exercises encouraged creativity.

Several feedbacks referred to the fact that after the course it is easier to connect cause-and-effect relationships between the various legal areas, and to grasp how society is impacted as an organic system. This is especially important in central and eastern European PA education which is traditionally employs only the use law and often handles the different legal areas separately barely touching the influence of technology on administrative thinking.

Thanks to our acquired experience and the important feedback from the students our methods during the Systems Theory course in the second semester became much more refined. Due to this our alternative opportunity for course completion became a bolder, more extensive rival to the traditional "lecture path". Education of the subject proceeded along the same goals as before, that is the broad expanding of PA skills through the use of our method while still teaching the material in the curriculum in an enjoyable fashion.

6. Conclusion

System Analysis and Thinking subjects with Information Society topics in PA education help future leaders to understand complexities of our societies in the 21st century.

In the reported experiment at NUPS we tested the use of the turn based strategy game Civilization to identify the effects technology on society and individuals, so that students become more foresightful and empathetic in the choices they make in the future. Information Society also emphasizes the importance of Systems Theory as shown by the university in the course description. However, in order to demonstrate this to students it is not enough to illustrate how culture and technology affect each other in an information society, or what processes occur within society as a system - they must also understand how the mechanics of these dualities work. That is where believe the main contribution of our experiment lies, especially with the deployment methods and practical tools presented to students. Participating students reported that putting technology and complex system thinking with using strategy simulation concepts at the beginning of their Government Studies program raises not only awareness but also the experience factor of their education.

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