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In Stable Orbit: An Initial Assessment of Dispositional Changes arising from Learning using the Citizenship Education Videogame *Space Station Leonis*

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Abstract: This paper presents an initial analysis of data obtained from an implementation of citizenship education using the videogame *Space Station Leonis* in two Singapore classrooms. The paper highlights the importance of citizenship education today and describes how game environments can be used to foster identity construction as part of the broader agenda of citizenship education in Singapore. The data presented comprises a series of t-tests which were run between pre- and post-test questionnaires on attitudes related to civic consciousness and citizenship administered to seventy-seven students who participated in the design intervention. Analysis of the results suggests that such participation can result in significant and positive changes in attitudes of relevance to various aspects of citizenship.

Keywords: Game-based learning, citizenship education, identity, *Space Station Leonis*

Introduction

Citizenship education, broadly defined, has long been a feature of formal educational curricula in many countries. This has been especially so during the latter half of the twentieth century, in concurrence with the post-colonial independence movements precipitated by the end of the Second World War.

Marshall [1], for instance, was one of the first to attempt a delineation of the scope of the concept of citizenship. He characterized it as “encompassing a civil sense of basic rights and protections, political rights (voting and public assembly) and right to social citizenship (employment, housing, healthcare and other social-welfare benefits).”

During the 1990s, citizenship education has been made a mandatory component of school curricula in countries such as Australia and the United Kingdom. In Singapore, the launch of the *Thinking Schools, Learning Nation* (TSLN) vision in 1997 led to a revamp of the national curriculum toward greater emphasis on critical thinking skills and Information & Communication Technologies (ICT) literacy. Closely associated with the TSLN vision was National Education, which made its debut a year later. Although not the first manifestation of citizenship education in Singapore, National Education was directed at deliberately developing knowledge, values, and attitudes of Singaporean students that would foster a sense of national cohesion, the instinct for survival, and confidence in the future of Singapore [2]. Crucially, National Education was conceptualized to develop in students “an awareness of facts, circumstances and opportunities facing Singapore, so that they will be able to make decisions for their future with conviction ... [as well as nurture]

a sense of emotional belonging and commitment to the community and nation, so that they will stay and fight when the odds are against us” [3].

The research reported in this paper explores students’ dispositional changes arising from learning using the citizenship education video game *Space Station Leonis* and offers preliminary discussion on students’ attitudes, values, and beliefs with respect to functioning as members of society at large, and within their local communities. What follows is first a brief overview of technology-mediated citizenship education initiatives, which provides the backdrop for a discussion on game-based learning and the construction of player-cum-learner identities. The paper then focuses specifically on the research intervention that was enacted and considers how learning from the game world might be assessed, particularly through analysis of a pre-/post-test instrument administered to the research subjects. Results are presented and discussed. The paper closes with a conclusion that points to future work.

1. Citizenship Education and ICT

Selwyn [4] identified four broad ways in which ICT might be applied to citizenship education. Briefly, these are using ICT:

- as a source of citizenship information
- as a means of engendering citizenship discussion
- to help learners produce citizenship materials
- for whole-school citizenship activities and practices

The work reported in this paper forms part of a broader research investigation into the use of computer and video games to support student learning at the Learning Sciences Lab, National Institute of Education [5]. In terms of the scope of the present paper, the focus is on the use of games—specifically the video game *Space Station Leonis* (hereafter referred to as *Leonis*, for the sake of brevity)—to engender citizenship discussion and reflection as part of a more fundamental developmental trajectory of identity construction. *Leonis* is by no means the first software package designed, or employed, to facilitate citizenship education through discussion. Selwyn [4] describes how such games typically involve the presentation of various scenarios, with learners required to make decisions that then influence the course of the developing narrative. He goes on, however, to criticize the lack of specific research on the effectiveness of such interventions in citizenship education. He cites the research of Wegerif, Mercer, & Dawes [6] which, as the exemplar of “the most relevant study to present software development” for discussion, was crippled by its small-scale.

Reporting on data obtained from a sample population five-times larger than that used in Wegerif’s study, we hope, in part, to address the weakness in the cited research.

2. Video Games and Identity Construction

As espoused by Selwyn [4], one mode commonly used to engender citizenship discussion involves the protagonist-player actively navigating a branching narrative. One of the two primary modes of game play in *Leonis* employs such a narrative structure. In the case of *Leonis*, the decision to provide such a structure was deliberate, and it is grounded in a well-established corpus of research literature on fostering identity construction through game play.

Gee [7, 8] explains that there are three distinct identities that emerge in the context of game play. The player always brings to the game his or her *real world identity*. This is the person as he or she is known in the real world. The game also offers a *virtual identity*, represented by the character one plays in the game. As elaborated upon below, such a character can be implied; it does not necessarily have to be explicitly rendered on the screen. Third, and most intriguing from the perspective of research into citizenship education, is the *projective identity*. This represents the projection of the player, with his or her goals and intentions, onto the game character. The result is a so-called *blended character* constituted by the player's intentions but constrained by the repertoire of actions associated with the game character. This conflation between the player and his or her virtual persona as they jointly enact a trajectory of experience within the game space creates not only a sense of 'being there' (embeddedness), but—most importantly in the context of citizenship education—a sense of *being* (first-person embodiment in the world). An extended discussion on the embedded and embodied nature of identity construction through game play is presented in an earlier paper related to the *Leonis* project (see [5]).

Writing a decade before Gee, Turkle [9] had already made a compelling case that “[w]hen we step *through* the screen into virtual communities, we reconstruct our identities on the other side of the looking glass. This reconstruction is our cultural work in progress” (p. 177, emphasis added). It is especially facilitated in immersive game environments, because the 3D game space supports the protagonist-player in his or her explorations, goal setting, and decision-making processes. In such game spaces, decisions and their consequent actions, or inactions, have direct and near palpable consequences on the protagonist-player and, therefore, on the ongoing process of identity reconstruction.

Even in game play characterized by the simulation genre, which forms the second of the two game play modes in *Leonis*, it is important to note that there is an implied character with an associated role to play. This is often gubernatorial in nature, as is indeed the case in *Leonis*. The representation of self is implicit, supported by a third-person point of view, with the player having access to controls determining how the community resident in Space Station Leonis develops and evolves.

3. The *Leonis* Learning Environment

Taking place as it does onboard an orbital space station, game play in *Leonis* is a metaphor of the Singapore milieu. Set in the 23rd century, at a time when Earth's moon and Mars have been colonized by humans, Space Station Leonis is a colony in Earth orbit.

As mentioned in the preceding section, there are two modes of game play: *scenario mode* where students play the role of a character in the game and *simulation mode* where students control game play from a macro, overseer level. The player is taken through these modes in alternating sequence. For each scenario, the player takes the role of a character (which varies from scenario to scenario) and plays the game from a first-person perspective. The characters are residents of Leonis, and they range from students to security officers, and even a diplomat. In the simulation mode, the player takes the role of the president of the station and makes decisions pertaining to land-use planning and community-building. Such a simulation allows students to directly explore the consequences of different strategies and policies related to nation-building, such as (but not limited to) racial harmony, resource sustainability, economic well-being, and international relations when playing the game.

The implementation of *Leonis* in selected schools in Singapore has been complemented by a variety of supporting structures for both teachers and students. These include professional development workshops and supporting curricular materials for

teachers and an activity book and online blog for students to post their reflective pieces. Together with discussion that takes place in the classroom, they constitute the *Leonis* learning environment.

The goal therefore is that the experiential learning involving the student's projective identity (Type 1) in the *Leonis* game world would be complemented by teacher-facilitated dialog and reflection in the classroom. Students' engagement in these learning activities places them on a developmental trajectory of learning where they learn to become "good" citizens via participatory appropriation [10]. As a result of participating in this learning process, it is hypothesized that students' values and beliefs become internalized in such a way as to make them more sensitive to issues that relate to civic conscious and active citizenship and, more importantly, predispose them to *behaviors* consistent with developed attitudes that become manifested in the real world (Type 2 projective identity). This model of game-based learning is reflected in Figure 1 (reproduced from [5] with permission). The total playing time for the game itself is around fifteen hours. For the particular intervention reported in this paper, the figure was six hours, as the entire game had not yet been completed.

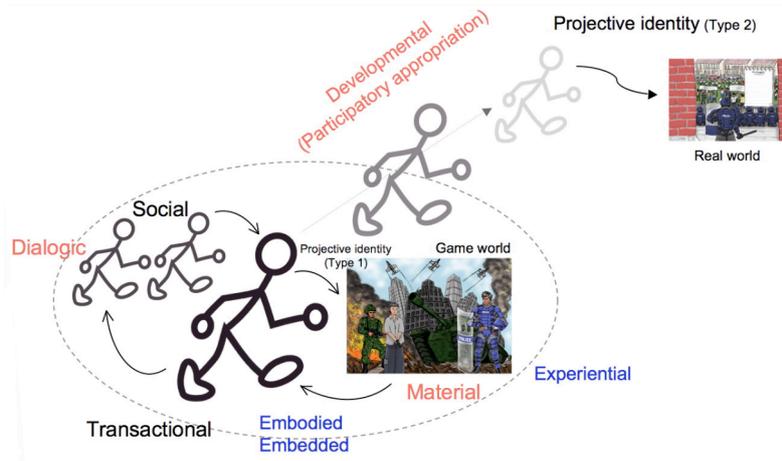


Figure 1. Conceptual framework for the *Leonis* citizenship research

4. Assessing Student Learning

The game writer, producer, and consultant Chen [11] has identified three ways by which to assess learning from the use of video games in education. These are:

- completion assessment: measures the extent to which the player has successfully completed the game
- in-process assessment: examines the player's decision-making during game play
- teacher evaluation: involves teacher input with regard to an assessment of the degree of content mastery

In terms of the *Leonis* learning environment, the primary instrument through which in-process assessment can be carried out is the activity books which have been designed to accompany use of the game. However, in terms of the scope of data reported in this paper, the focus of subsequent sections will be with respect to students' dispositional changes that arise from participating in the game-based learning environment.

Don Rowe (unpublished) from the Department for Education and Skills National Strategy for Continuing Professional Development in Citizenship, United Kingdom, suggests that, using aspects of written and oral work, assessment for citizenship education should address:

- the knowledge and understanding that underpins citizenship education through a variety of contexts (both explicit instruction and infused)
- active citizenship in school and the wider community
- citizenship skills and values, including enquiry, debate, and participation.

Taken together, these three aspects correspond respectively to what Blyth [12] has identified as the three facets of citizenship education, namely:

- education *about* citizenship: providing students with sufficient knowledge and understanding of national history and the structures and processes of government and political life
- education *through* citizenship: learning by doing through experiences in and out of school
- education *for* citizenship: developing skills and values as a means to encourage active citizens, through focusing on an appropriate balance between what the individual gives to and expects from society.

As a corollary of its abstraction from the real world, the game world of *Leonis* learning does not directly address education *about* citizenship. Instead, it affords students vicarious opportunities to experience education *through* citizenship, thereby leading to education *for* citizenship.

Given the critical contribution of an effective citizenship education program to nation-building, it is not surprising to find that such programs are being given increasing prominence in formal school curricula. For example, Barr, Barth and Shermis [13] have concluded that the “primary, overriding purpose of the Social Studies is citizenship education.” In Singapore, Sim and Print [14] argue that “Social Studies was conceived as a major vehicle for NE, with a focus on the nation, common culture and shared values” (where NE refers to National Education).

Given this centrality of National Education in the Social Studies program in Singapore, assessment of student learning from the *Leonis* learning environment could potentially be evaluated in terms of several data sources, including interviews with the students, their work done in the activity books, their reflective blog entries, as well as their performance in the curriculum subjects Social Studies and Civics & Moral Education.

In this paper, however, we shall focus on data obtained from pre- and post-test attitudinal questionnaires administered to students who participated in the intervention. The questionnaires have been adapted from a similar instrument used by the Ministry of Education in British Columbia, Canada. The questionnaires were designed to allow pre-versus post-intervention comparisons on a set of identical attitudinal questions. In addition, during the post-test, participants were asked to re-code the first 17 questions in a retrospective manner, to reflect their retrospective positions related to the pre-test. This procedure was undertaken in order to offset any potential ‘ceiling-effect’—what Howard [15] terms a response shift bias—that might have occurred during the administration of the actual pre-tests.

5. Results

Thirty-five students—between the ages of 14 and 15—in the first school were administered the pre-test on 5 February 2007 and the post-test on 2 April 2007. These students were nominally of higher academic ability, as they are in the so-called Express stream in Singapore. Forty-two students from the same age cohort in the second school

were administered the pre-test on 7 February 2007 and the post-test on 18 April 2007. These latter students are in the so-called Normal (Academic) stream.

The questions were categorized to reflect key strands in the national Social Studies syllabus in Singapore. These categories are:

- social ethics and responsibilities
- civic and political responsibilities
- environmental responsibility
- belief in meritocracy
- appreciation of multiculturalism and social diversity

Of the strands listed above, page constraints permit only data pertaining to the first two to be presented and discussed in this paper. In the results of the one-tailed t-tests that follow, all questions were scored according to a five-point Likert scale (strongly disagree, disagree, unsure, agree, strongly agree) with answers having been recoded to reflect a higher mean as a more positive response.

5.1 Social Ethics and Responsibilities

This strand showed the clearest improvement across the entire student sample. Questions in this strand assessing attitudes that showed significant change include:

- (2) “I think about how my decisions will affect other people.”
- (7) “No matter how angry someone makes me, I am still responsible for my own actions.”
- (1) “Problems between people are best handled by working together to find a solution.”
- (5) “Other people’s problems don’t bother me.”
- (11) “The poverty of others is not a problem that is important to me.”

Ranked in the above sequence, they reflect, in descending order, the significance of change between the results obtained from the retrospectively applied pre-test (denoted by the column heading ‘Pre-test mean (retro)’ in Table 1) and the post-test.

Table 1. Pre- and post-test results for Social Ethics and Responsibilities

Qn	Pre-test mean	Post-test mean	n	t	Significance
2	3.91	4.21	76	3.052	0.002
7	3.92	4.18	76	2.549	0.007
1	4.12	4.33	76	2.008	0.024
5	3.53	3.57	76	0.505	0.308
11	3.46	3.55	76	0.708	0.241
Qn	Pre-test mean (retro)	Post-test mean	n	t	Significance
2	3.73	4.21	77	5.274	0.000
7	3.78	4.18	77	5.110	0.000
1	3.88	4.33	77	4.772	0.000
5	3.18	3.57	77	3.972	0.000
11	3.25	3.55	77	3.294	0.001

5.2 Civic and Political Responsibilities

This strand includes the following questions that were associated with a significant attitudinal change:

- (15) “I feel that I can make a difference in my community.”

- (13) "I don't care what's happening in politics."
- (16) "People should discuss social and political problems that affect the future of Singapore."
- (12) "As teenagers, my friends and I should find ways to help others in the community."
- (17) "The world would be a better place if people were free to do what was best for themselves."

The respective results are shown in Table 2.

Table 2. Pre- and post-test results for Civic and Political Responsibilities

Qn	Pre-test mean	Post-test mean	n	t	Significance
15	3.58	3.77	76	1.630	0.054
13	3.28	3.48	76	1.539	0.064
16	3.79	3.75	75	0.241	0.405
12	3.82	3.92	76	0.956	0.171
17	3.07	3.36	75	1.775	0.040
Qn	Pre-test mean (retro)	Post-test mean	n	t	Significance
15	3.39	3.77	77	4.669	0.000
13	3.05	3.48	77	4.509	0.000
16	3.42	3.75	76	4.095	0.000
12	3.58	3.92	77	4.023	0.000
17	3.05	3.36	76	2.659	0.005

6. Discussion

The pre vs. post results relating to Social Ethics and Responsibilities indicate that, as a results of playing the game and participating in the Leonis learning environment, students were more sensitive to how their personal decisions might affect others, to how they were always responsible for their own actions, and the need to work together to find solutions to problems (questions 2, 7, and 1 respectively). The results pertaining to questions 5 and 11 indicate that, given the opportunity to reflect on what their standards of self-assessment had been only two months' earlier, students' affective and cognitive domains were so extended that they realized they actually ranked lower on the scale than they actually reported. This improved self-awareness also manifests learning in the preferred direction. With respect to Civic and Political Responsibilities, we notice a similar phenomenon. Other than question 17, which shows significance in the pre-post comparison, all the other questions also show a significant change on a retrospective pre vs. post comparison. In a society where social and political apathy is often seen as a hallmark of teenagers, these attitudinal shifts hold special significance for developing more socially and politically aware students.

We believe that the positive shifts reported above can be directly attributed to particular aspects of game play in *Leonis*. For example, the game-embodied and embedded persona of the player-protagonist had to make decisions within scenarios of military occupation under a somewhat benign regime, as well as of sustaining the morale of a heterogeneous group during an arduous trek through a de-populated area. Having navigated their personal trajectories through such branching narratives, the data suggests that students emerged with a stronger understanding of how their individual decisions can have wider, longer-term consequences and of the value of consensus building. This hypothesis is supported by analyses of students' written work in the activity book which was designed to facilitate learning from gameplay [16].

7. Conclusion

This paper has outlined the theoretical grounding for, and key features of the learning environment designed around the citizenship education videogame *Space Station Leonis*. The preceding discussion has suggested strongly that—even from a selective analysis of a couple of measures in just one instrument associated with the design—significant and positive attitudinal shifts can be brought about through participation in the intervention. Much remains to be further explored in the *Leonis* learning environment. At the time of writing, at least three more schools in Singapore are preparing to participate in the intervention, this time playing through the entire game space. A raft of data sources will therefore form the basis of subsequent research papers, and these could then be triangulated against similar programs in other parts of the world, originating from different cultures. For now, at least, *Space Station Leonis* does indeed appear to be in a stable orbit, pedagogically speaking.

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