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Student attitudes to games-based skills development: Learning from video games in higher education

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ABSTRACT

Qualitative interview data is presented in support of previously-published quantitative evidence that suggests commercial video games may be used to develop useful skills and competencies in undergraduate students. The purpose of the work described here was to document the attitudes of those students involved in the quantitative study and to explore how the game-based intervention was perceived. To this end, student attitudes to the use of specified games to develop communication skill, resourcefulness and adaptability are examined. A broadly positive perception of the games' efficacy for skills development is revealed, and the aspects of game play that students believe contribute to skills development are discussed. These aspects include the need to communicate with team mates in order to succeed, and the fluid, unpredictable nature of in-game challenges. It is suggested that while the games played an important role in skills development, interaction between students, facilitated by game play, was also a significant factor.

1. Introduction

In Barr (2017), quantitative evidence is presented to suggest that commercial video games may be used to develop in students a number of useful skills and competencies: communication, resourcefulness and adaptability. Such skills are referred to as 'graduate attributes' (Barrie, 2006; Hughes & Barrie, 2010) and are generally associated with the employability of higher education graduates. The rationale behind the work described by Barr was that commercial video games are designed to exercise such skills. In that study, a randomised controlled experiment was used to measure the effects of playing selected games on the attainment of the specified graduate attributes. Undergraduate students were randomly assigned to either an intervention or a control group and previously validated, self-report instruments to measure adaptability, resourcefulness and communication skill were administered to both groups. The intervention group played specified, high quality video games under controlled conditions over an eight-week period.

The selected titles comprised: *Portal 2* (Valve Corporation, 2011), *Team Fortress 2* (Valve Corporation, 2007), *Gone Home* (The Fullbright Company, 2013), *Minecraft* (Mojang, 2009), *Papers, Please* (Lucas Pope, 2013), *Borderlands 2* (Gearbox Software, 2012), *Lara Croft and the Guardian of Light* (Crystal Dynamics, 2010), and *Warcraft III* (Blizzard Entertainment, 2002). The games were selected by presenting a panel of games scholars and games industry personnel with a list of the specified attributes and asking these experts to suggest games that might exercise such attributes. The suggested titles were then filtered based on logistical concerns, including hardware constraints (the specification of the computers used in the study) and network restrictions (availability of the ports required for online play). For example, both *Minecraft* and *World of Warcraft* (Blizzard Entertainment, 2004) were suggested as candidates for developing communication skills. However, while *Minecraft* was included in the study, the MMORPG (Massively Multiplayer Online Role-Playing Games) *World of Warcraft* was not, due to the technical challenges involved (an internet connection is essential to play, and the university infrastructure did not permit such a connection) and the steep learning curve associated with the game. With just 2 h of play per game, novice players would barely scratch the surface of *World of Warcraft*, and not experience the collaborative team-based questing that might exercise their communication skills.

A large effect size was observed with mean score change 1.1, 1.15, and 0.9 standard deviations more positive in the intervention group than the control on the communication, adaptability, and resourcefulness scales respectively ($p = 0.004$, $p = 0.002$, and

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$p = 0.013$ for differences in groups by unpaired *t*-test). The large effect size and statistical significance of these results supported the hypothesis that playing video games can improve graduate skills, and suggested that such game-based learning interventions have a role to play in higher education.

However significant, these quantitative results do not explore the vitally important human implications of the work – put simply, research-led educational interventions can only be effective if they are received positively by the students involved. Students may resist learning activities that do not align with their preconceived notions of education, which are often rooted in the didactic, instructor-led forms of teaching to which they are exposed at school and college (Seidel & Tanner, 2013). Johnson et al. (2009), for example, describe student resistance to moving from traditional (teacher-centered) to non-traditional (learner-centered) approaches to learning. Henderson and Dancy (2007) list student resistance to active, research-led learning as one of several barriers to educational reform, also noting that students "do not like to interact with each other and are often not prepared to think independently". Perhaps most pertinent here, given the experimental, game-based nature of this intervention, is the recommendation of Felder and Brent (1996):

> …to minimize resistance to any student-centered method, try to persuade the students from the outset that you are neither playing a game nor performing an experiment, but teaching in a way known to help students learn more and understand better.

Looking specifically at game-based learning inventions, there is evidence that these may not be accepted by all students. Egenfeldt-Nielsen (2007, pp. 146–150), for example, documents a high degree of student resistance to the very idea of learning from a game, again related to their expectations – in this case, expectations of the manner in which the 'serious' academic subject of history should be taught. Students have also been revealed to be resistant to the idea of developing their graduate attributes by means of additional, stand-alone activities. The expectation is that such skills development should be embedded in their regular classes, and there is little appetite for 'non-core activities' in the face of, for example, increased part-time working commitments (Swingler et al., 2016; O'Leary, 2016; Gbadamosi, Evans, Richardson, & Ridolfo, 2015). As described below, playing video games could develop skills other than those considered in this study (see also Granic, Lobel, & Engels, 2014, for an overview of the cognitive, emotional, educational and social benefits associated with playing video games). However, the focus on graduate attributes here is motivated by a desire to address the problem of how such important skills may be developed in higher education. Barrie (2004, p. 263), has noted that "university teachers charged with responsibility for developing students' generic graduate attributes do not share a common understanding of either the nature of these outcomes, or the teaching and learning processes that might facilitate the development of these outcomes". Therefore, despite institutional best intentions, the lack of a shared understanding of graduate attributes, and how to cultivate them, is one barrier to their development. Similarly, Green, Hammer, and Star (2009) note that graduate attributes can be difficult to develop due to the confusion that surrounds their definition and implementation, a problem exacerbated by institutional resistance and under-estimation of the resources required to embed related practices. Thus, a potentially engaging and low-cost game-based approach to the development of graduate attributes was trialled to address this specific problem.

The literature includes accounts of several studies designed to test games' efficacy for skills development or education. Shute et al. (2015), for example, showed by means of a robust randomised design that playing P*ortal* 2 – one of the games used in the study described here – could improve players' problem solving, spatial skill, and persistence. This is an influential and well-designed quantitative study but it is not possible to determine from the published work *why* the participants felt their problem solving and other skills were improved. Similarly, Adachi and Willoughby (2013), demonstrated by means of a four-year longitudinal study that playing strategy and role-playing games predicted self-reported problem-solving skills among a sample of 1492 high school-aged participants. Again, however, some account of the students' attitudes is lacking, and we do not know what aspects of the games participants felt had exercised the requisite skills.

That is not to say that attitudes cannot be measured by quantitative means. Hamari et al. (2016) used survey instruments to measure participants' subjective experience of playing educational games, asking questions such as "How interesting was the game?" and "Did you feel bored with the game?". Ruggiero (2015) used a survey instrument to measure students' affective learning and attitude after they had played a game designed to affect players' attitude towards homelessness. Shin and Ahn (2013) also used a survey instrument, in this case to explore the negative association between game use and cognitive empathy. However, these studies were designed to measure specific aspects of participants' attitudes. For more exploratory studies, qualitative methods such as interviews can yield rich data that are less influenced by the preconceptions of the researcher, whilst remaining grounded within a particular framework (such as the stated graduate attributes described here). Bourgonjon et al. (2016), for example, used qualitative means to explore player perspectives on the positive impact of video games, analysing a body of data drawn from online discussion forums in terms of a pre-existing framework of potential impacts. Ortiz de Gortari, Aronsson, and Griffiths (2011) used qualitative interviews to investigate what the authors term 'game transfer phenomena', wherein players appear to integrate elements of their game-playing experience into real life. Exploring somewhat similar territory to that described here, this example serves to highlight the usefulness of qualitative interviews in understanding the effects of video games on those who play them.

The purpose of the work described here is to explore student attitudes to a game-based intervention intended to develop graduate skills, which might be considered as important as the previous quantitative results. While quantitative means, such as Likert-type scales, may be used to measure attitudes, there are limitations to such an approach. As Karavas-Doukas (1996) notes, middle-of-the-range scores may be obtained where the respondent's attitude is uncertain or inconsistent. Qualitative designs, however, allow for more nuanced data collection, capturing respondents' doubts, caveats and rationale, rather than reducing attitudes to unidimensional variables. As Sofaer (1999, p. 1102) suggests, "qualitative methods help provide rich descriptions of phenomena. They enhance understanding of the context of events as well as the events themselves". Furthermore, the qualitative approach taken here provides indications of *how* and *why* students believe video games may help develop the skills in question, providing insight that is not readily obtained by the quantitative means employed in the earlier study. As such, efforts to examine the attitudes of the participants in a quantitative study go some way towards addressing a perceived gap in the literature, where quantitative results are reported with little context.

2. Method

Each of the participants in the intervention group who saw the study through to its conclusion, and played all of the specified games, was interviewed, an exercise which comprised 20

interviews in total. Since all of the intervention group participants were interviewed, the qualitative sample includes all of the perspectives of the population under study and thus meets the requirement for saturation.

Eighteen of the interviews were conducted face-to-face in a room adjacent to the lab in which the games were played, while two interviews were completed by email, where participants had pre-existing end-of-semester travel arrangements. Audio recordings of face-to-face interviews were made and subsequently transcribed.

The interview protocol was structured primarily around the host university's stated graduate attributes,[1] with participants asked if they felt the games played in the lab had helped develop any of these. A modest lunch was provided for participants taking part in the interviews, if they so wished. The interview protocol was based on the following outline, with interviews lasting an average of between 15 and 16 min:

- Do you think the games we played might have helped develop any skills or competencies? Did you gain any valuable experience?
- What about the following 'graduate attributes' [Effective Communicators, Adaptable, etc.] – do you think any of the games we played might have developed any of these?

Organisation and examination of the data was conducted in line with a classical approach to content analysis (Bauer, 2000, pp. 132–152), as follows. Following transcription, interviews were read through quickly to begin familiarisation with the content, and to correct any outstanding typographical errors. Initial notes were taken during this process, with the intention of identifying concepts for coding and recurring themes, whether expected (e.g. relating to a particular graduate attribute) or unexpected (e.g. a useful skill or experience that did not relate directly to a particular graduate attribute). Next, an attempt at coding the data was made by hand, using printed copies of the transcripts and a substantial supply of highlighter pens. Hand-coding served to further familiarise the researcher with the data and the coding of the transcripts could have been considered complete at this stage. However, since the transcripts already existed in digital form and a somewhat significant number of themes and questions were coded for, it was determined that qualitative data analysis software should be used to prepare the data for queries and extraction of quotations relating to particular attributes. NVivo 11 Pro[2] was the software selected to carry out this task, as it is a well-established tool used across the social sciences and was available to install via the host university.

The themes (or 'nodes' to use the NVivo nomenclature) coded for were organised into groups including games and graduate attributes. Games were the most straightforward to code, as mention of a specific game is easily identified. To an extent, the graduate attributes were also straightforward to code, especially where they were discussed in response to the clearly delineated questions pertaining to each attribute. However, as is apparent in the discussion of each attribute that follows, there is often significant overlap between the definitions (as provided by the university or interpreted by participants) of certain attributes. In such cases, care had to be taken to ensure that comments which more closely related to other attributes were coded as such. Certain attributes were also touched upon at other points in the interviews, for example, in the initial open question about the skills and competencies games might help develop in players. More subjectively, an attempt was made to code statements in terms of sentiment, indicating whether the opinion expressed by a participant in relation to a topic was positive or negative in nature. However, overall, there is relatively little margin for ambiguity in the sort of coding performed here.

Given the structured nature of the interviews and an appropriately scoped approach to coding – intended to avoid the pitfalls of over-coding – it was determined that intra-rater reliability checks were sufficient. In order to carry out such checks, a random selection of interview transcripts (N = 5, 25% of the total number of transcripts) was re-coded by the same researcher using a second user account to represent the 'second coder'.

As previously noted, the nature of the data is such that there is relatively little room for disagreement in how responses are coded. In contrast to, for example, a grounded theory approach (Glaser & Strauss, 1967, pp. 28–31) where the object of the exercise is to develop new hypotheses and themes, the coding here was carried out in order to organise the data and facilitate efficient extraction of responses that related to predetermined concepts (primarily the stated graduate attributes). The most subjective aspect of the coding lay in the analysis of sentiment. Where appropriate, responses were coded using NVivo's built-in sentiment nodes: 'Positive' (which includes the more granular 'Very positive' and 'Moderately positive' options) or 'Negative' (including 'Moderately negative' and 'Very negative). Some small disagreements were noted here, where, for example, a response might have been coded simply as 'Positive' in one instance and 'Very positive' in the other. The other form of disagreement (illustrated in Fig. 1 below) related to the quantity of text selected to represent the response being coded. In some cases, for example, only the most relevant portion of a participant's response might have been coded on the initial attempt while the subsequent attempt at coding might have included some of the preceding conversation.

A more significant, albeit isolated, instance of disagreement was found in the following exchange, relating to the communication attribute:

> *I'm not very good at communicating …*
>
> Interviewer: *Well, did you have to communicate in any of the lab sessions?*
>
> *Maybe the first week in the first game, we were four, playing Borderlands.*

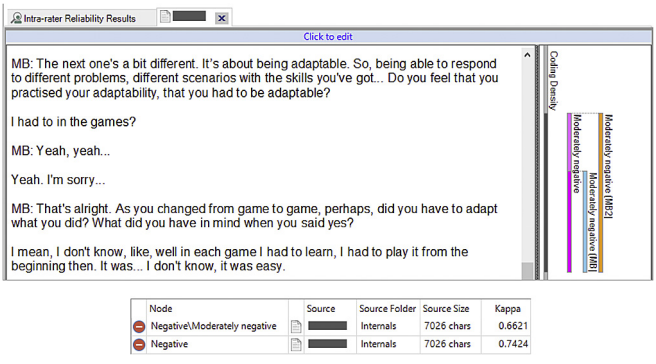

Fig. 1. An example of one of the most significant disagreements between initial and subsequent coding wherein the 'second coder' (MB2) has coded a slightly longer piece of the same interview response as 'Moderately negative' than the 'original coder' (MB). The corresponding portion of the query results that highlight disagreements (including Kappa coefficients) is shown below.

[1] http://www.gla.ac.uk/attributes/(accessed 21st June 2017).

[2] http://www.qsrinternational.com/nvivo-product/nvivo11-for-windows (accessed 21st June 2017).

Table 1
Results of intra-rater reliability analysis, including Kappa coefficients, as calculated by NVivo (sentiment analysis only).

Node	Source	Kappa	Agreement (%)	A and B (%)	Not A and Not B (%)	Disagreement (%)	A and Not B (%)	B and Not A (%)
Negative	Participant B	0.7424	96.71	5.19	91.52	3.29	2.62	0.67
Negative\Moderately negative	Participant B	0.6621	95.92	4.4	91.52	4.08	3.42	0.67
Negative\Very negative	Participant B	1	100	0	100	0	0	0
Positive	Participant B	0.9251	97.38	21.23	76.15	2.62	0	2.62
Positive\Moderately positive	Participant B	0.8752	96.73	13.88	82.85	3.27	0.65	2.62
Positive\Very positive	Participant B	1	100	0	100	0	0	0
Negative	Participant G	1	100	5.49	94.51	0	0	0
Negative\Moderately negative	Participant G	1	100	5.49	94.51	0	0	0
Negative\Very negative	Participant G	1	100	0	100	0	0	0
Positive	Participant G	0.9637	98.18	49.64	48.54	1.82	0	1.82
Positive\Moderately positive	Participant G	0.8859	95.21	27.37	67.85	4.79	0	4.79
Positive\Very positive	Participant G	1	100	0	100	0	0	0
Negative	Participant K	1	100	7.37	92.63	0	0	0
Negative\Moderately negative	Participant K	1	100	7.37	92.63	0	0	0
Negative\Very negative	Participant K	1	100	0	100	0	0	0
Positive	Participant K	0.9994	99.97	32.9	67.07	0.03	0	0.03
Positive\Moderately positive	Participant K	0.8801	96.93	13.49	83.44	3.07	0	3.07
Positive\Very positive	Participant K	1	100	0	100	0	0	0
Negative	Participant R	0	99.21	0	99.21	0.79	0.79	0
Negative\Moderately negative	Participant R	0	99.21	0	99.21	0.79	0.79	0
Negative\Very negative	Participant R	1	100	0	100	0	0	0
Positive	Participant R	1	100	51.78	48.22	0	0	0
Positive\Moderately positive	Participant R	0.7051	94.95	6.85	88.1	5.05	0	5.05
Positive\Very positive	Participant R	1	100	0.15	99.85	0	0	0
Negative	Participant L	1	100	0	100	0	0	0
Negative\Moderately negative	Participant L	1	100	0	100	0	0	0
Negative\Very negative	Participant L	1	100	0	100	0	0	0
Positive	Participant L	1	100	41.15	58.85	0	0	0
Positive\Moderately positive	Participant L	1	100	6.4	93.6	0	0	0
Positive\Very positive	Participant L	1	100	2.04	97.96	0	0	0

In this case, the response was first coded as 'Moderately negative', but on the second pass, this was deemed a 'Moderately positive' response. In the analysis below, the exchange is treated as one of the more negative responses for this attribute and, certainly, it cannot be characterised as wholly positive. However, the fact that the interviewee concedes – after prompting – that communication took place on at least one occasion may be interpreted as not wholly negative either. On reflection, the negative interpretation seems more reasonable and the infrequent occurrence of such apparently contradictory coding in these limited data is not thought to represent a major problem. However, this example is indicative of the sort of issues that might arise if such a qualitative approach were to be taken to a less focused, more exploratory study. These issues would be addressed by taking a more robust inter-rater approach to checking for reliability.

NVivo offers measures of inter-rater reliability in terms of both Cohen's Kappa coefficient (Cohen, 1960) and percentage agreement Figures[3], and the same facilities may be used to calculate equivalent values for the intra-rater data produced here. Table 1 below shows the results of these calculations for the five participant transcripts that were re-coded, for the nodes associated with sentiment analysis.

As might be expected of a relatively straightforward dataset such as this, coded on two occasions by the same person, both percentage agreement figures and Kappa coefficients indicate strong agreement. Kappa coefficients are considered useful because they take into account the degree to which the data may agree by chance alone, but there is no agreed standard for interpreting the strength of agreement indicated by the figure. The NVivo documentation, for example, suggests that coefficients of 0.75 or greater indicate 'excellent' agreement, whereas Landis and Koch (1977) propose a gradation as follows: ≤0 = poor, 0.01–0.20 = slight, 0.21–0.40 = fair, 0.41–0.60 = moderate, 0.61–0.80 = substantial, and 0.81–1 = almost perfect. However, in medical research, the 0.41 lower bound of acceptability proposed by Landis & Koch and implied by Cohen is not considered acceptable (McHugh, 2012). By any standard, however, the Kappa values obtained here are reassuringly high. So, while the intra-rater reliability checks employed here were less robust than the inter-rater checks that would be expected of a project with a more ambiguous dataset, they nonetheless proved useful and the high degree of concordance between the sampled data suggests that coding of the interview data was sufficiently reliable.

3. Results

Twenty students who had participated in the game-based intervention were interviewed following the conclusion of the experiment. Participants were drawn from the first and second years of their undergraduate degree, with a mean age of 20.65 (median = 19). 12 of the 20 participants (60%) identified as female, and the remaining eight (40%) as male. Most of the participants were enrolled on a degree programme within the College of Arts, although the Scottish university system allows students from other subjects (such as Computing Science) to take courses in the College of Arts. Participants were originally recruited by means of an email invitation sent to all year one and year two students enrolled in courses in the College of Arts. Assignment to either control or intervention group was carried out randomly, and no additional selection criteria were applied. Participants who saw the study through to completion were incentivised by means of entry into a prize draw for an Amazon voucher. The set-up and management of the lab used to conduct the original experiment is described in Barr

[3] http://help-nv10.qsrinternational.com/desktop/procedures/run_a_coding_comparison_query.htm (accessed 24th October, 2016).

(2017). To preserve student anonymity, student identities have been systematically replaced with participant letters and accompanied by a short demographic description. Discussion of these qualitative results is presented in conjunction with the data for each individual attribute.

3.1. Effective communicators

Communication skill was mentioned by two participants in response to the open question that asked if any of the games played might have helped develop useful skills or competencies. For example:

> *I think definitely communication […] And especially stuff like Minecraft and Warcraft and things like that where you did actually have to properly communicate with people and ask, "are you going to go and get this, or should I do it?" Like, that was really, really good.* (Participant M, female, age 17)

Another participant, a self-confessed lone player, found herself enjoying the social aspect of playing together in the same room. Again, before the communication attribute had been discussed specifically, this participant noted the pleasurable and practical advantages of being able to communicate with other players:

> *It was kind of nice obviously because you're sitting in the same room it's easier to communicate, and say, you know, 'go to your left', because I can see on their screen where they are* […] *It was nice just to communicate with other people in the same room which was a bit different than normal* [online] *multiplayer stuff.* (Participant J, female, age 29)

Similarly, another student noted that the study participants had formed something of a community, which was, perhaps, more fun than expected:

> *Yeah, I think it would be more fun to play games with people you know than those you don't but certain times I felt like a little community is building up, for example, Minecraft.* (Participant I, female, age 21)

Responses to the specific question of whether the games played could have helped develop communication skill were positive (21 statements coded as positive, versus two coded as negative). Participants agreed that communication played a significant part in the games played, with many going on to state that this experience helped develop related skills:

> *Definitely, yeah, because they all have like a multiplayer aspect to them, and you're having to work with other people and talk to each other. So, it'd definitely help with that.* (Participant L, female, age 18)

> *Yeah, definitely. Especially, like, negotiating with people, trying to figure out where you were going to go, and stuff like that.* (Participant M, female, age 17)

One of the more cautious comments came from a mature student:

> *I don't know if I communicate very clearly or confidently. I communicated effectively because we got through it but, yeah, I don't know if I was very clear.* (Participant A, male, age 32)

Participant C agreed that effective communication was necessary when playing the games provided but was also unable to say for certain that the experience helped improve his skills:

> *Definitely, it did require communication. I don't know if it helped improve it necessarily but for sure, you notice how you communicate with others. You notice using very much shorter words, more direct, and not necessarily nice as in written and spoken English. But I think, definitely, there was a lot of communication needed. Not necessarily developed, but then we played only two hours per week.* (Participant C, male, age 19)

Participant C was one of the more dedicated game players taking part in the study, however, estimating that he played more than 8 h per week outside of the lab. Considering these playing habits, it is perhaps unsurprising that this participant was unsure if the relatively insignificant time he spent playing games in the lab could have had affected his own communication abilities. More experienced players have been shown to possess attitudes to gaming that differ from those held by less experienced players, or players who play most frequently. For example, Liao, Huang, and Teng (2016) found that for players who play with great intensity, frustration is negatively related to expectancy disconfirmation, while the same did not hold true for experienced players with a long gaming history. Thus, it may be anticipated that dedicated players such as Participant C would exhibit disconfirmed expectancy with regards to the prediction that playing games could result in improved communication performance.

Another participant was very positive about the relationship between the games played and certain aspects of the supplied definition of effective communication:

> *I think communicating confidently, definitely, because you don't want to lose the game. So, you have to be able to tell people, even if you've just met them, "excuse me, sir, don't be such a fool, defend this base" and such. And negotiating, for sure, is another one because, again, the game itself becomes priority, so you do have to communicate quite well.* (Participant T, male, age 19)

However, while the games might have required confident communication and deft negotiation, Participant T was less certain that his in-game communication possessed clarity:

> *…communicating clearly, that's different, because you are just shouting at people, often. You know, you'd like to be a calm and collected individual who can clearly articulate in a calm manner what you'd like to happen but instead you go, you know, you just scream at each other – by name – you're hoping that if, by me just* shouting [another participant's name], *she'll understand what I'm trying to get her to do.* (Participant T, male, age 19)

The idea that communicating with fellow players in a pressurised gaming scenario might result in a successful outcome despite a lack of clarity was echoed by another participant:

> *…it kind of depended on the game because some of them where, you know, if there's people coming at you, it's kind of hard to communicate clearly and confidently. It ends up being "ahh, someone's over there to your left, kind of, sort of… oh, is that where you are? Oh God, oh God …" Um, so that's maybe not as clear and confident as one would normally like in a standard job situation but at least communication was there. So, I think that was helpful.* (Participant G, female, age 22)

Another participant suggested that necessity was the mother of

effective communication when faced with time-sensitive in-game challenges:

> *A lot of the games, especially like* Portal, Team Fortress, Warcraft, *they had that element of needing to communicate with someone. So, when you have to communicate with someone, you'll learn how best to communicate with someone because you know when you have to do it … in those sort of team-based games where you have to be able to say "you do this and I'll do this".* (Participant R, female, age 18)

Some participants offered ideas about what aspects of the experience were most valuable in terms of improving communication skill. For example, Participant H pointed to the disparity in her fellow participants' game-playing ability enriching the experience:

> *I definitely think that especially the game sessions we played in the lab helped with communication because we did co-op.* […] *Because we get to do it with people that have different levels of experience. Because we get to do it with people that are experts at the game, or people who are completely new to it, people who have played it sometimes, so they have a general grasp, and you get to compare yourself to them but also learn from them or help others.* […] *The game sessions here do a whole lot to develop communication skills.* (Participant H, female, age 23)

While she did not necessarily enjoy playing with less experienced players, another participant alluded to the need to adapt the nature of their communication in order to progress, which might be thought of as useful experience:

> *… you kind of have to communicate if you're doing a team game but it just depends on who I'm playing with. Like, I think it was* Borderlands *I was playing, at first, we were playing with a few girls who were pretty decent at it, you know, it was the first time they'd played it but they knew what to do. Whereas someone else came in and they obviously hadn't played anything before and I was just like, "ah, ffff … "* [sound of frustration] *Like, just, "that's how you walk forward."* (Participant G, female, age 22)

For another participant, the fact that many of the games involved "communication with others in the room, many of whom [are] complete strangers who you are now relying on for the success of your goal" (Participant F, male, age 19) was part of what made the experience interesting. He pointed to the procedurally-generated world of *Minecraft*, in particular:

> Minecraft *especially surprised me with the amount of communication involved. I was willingly taking advice from a person I'd never met, allowing him to guide me and give me tips for success. Whilst at other times I was placed in his position, giving others advice on how to play. […] When random strangers are dropped together in an unknown and sometimes dangerous world, they bond together and have to have clear communication in order to get their points across and survive together. It was great!* (Participant F, male, age 19)

One less enthusiastic opinion was expressed by Participant B (female, age 21) who responded by first stating that "I'm not very good at communicating …" before conceding, following a prompt from the interviewer, that some communication had taken place: "Maybe the first week in the first game, we were four, playing *Borderlands*." It is perhaps worth noting that English was not this participant's first language, and it may be that her experience at an English-speaking university (the interview was conducted during her second year at the institution) had influenced how she perceived her communication ability. On reflection, it might have been interesting to explore with the participant how her experience of *Borderlands 2* differed from, say, *Team Fortress 2*, which features similar team-based game play.

Only one participant entirely rejected the notion that the game-related communication was useful:

> *Not really, the communication was more about sharing feedback with each other ("Dammit! I thought I killed you!") than trying to communicate effectively in order to solve problems.* (Participant Q, male, age 18)

Overall, then, participants felt that the experience of playing the selected games – most of which featured some form of multiplayer component – was likely to have had a positive effect on their ability to communicate. Such an outcome is supported by the quantitative data obtained via the instruments described in Barr (2017), and so these interview data help shed some light on what aspects of the experience the participants felt were most relevant to improving communication skill. Chief among these factors, based on participant interviews, is the simple fact that multiplayer video games require players to communicate in order to succeed. This is hardly a revelation: Teng, Chen, Chen, and Li (2012), for example, found that gaming challenge is positively correlated with interdependence between players, suggesting that players increasingly work together in the face of increased in-game challenge. However, what is interesting to note here is that the players' intuition about such games' utility for developing communication ability is supported by the quantitative data. Another relevant factor identified by participants is the time-sensitive, high-pressure nature of the scenarios presented by video games that require players to communicate efficiently to make progress. Again, this seems entirely plausible on paper, and very much the kind of experience an employer might seek in a potential employee: the issue is that the experience is gained by means of playing a video game, a means that may not be recognised by employers as legitimate. A final factor that is revealed in the participants' responses is that of being required to communicate with players of differing ability and experience. This necessitates more experienced players to adapt their approach to communicating with their teammates. Furthermore, in this case, the experienced players' teammates are students with whom they often have no existing rapport or comparable experience on which to draw, as might be the case when playing with their own friends. Less experienced players, too, must learn to listen to their more knowledgeable peers if the team is to achieve its in-game goals, and be ready to ask questions in a clear and efficient manner, as well as make sense of the answers received.

Van Lier (2004), in his discussion of the "ecology of language learning", frames Bruner's concept of pedagogical scaffolding (1960, p. 44) as occurring on three time scales: macro, meso and micro. The last of these timescales refers to the "interactional unfolding of learning activities" rather than the premeditated, structured approach to scaffolding that a teacher or tutor may take. Van Lier defines this unfolding as comprising the "contingent interactional processes of appropriation, stimulation, give-and-take in conversation, collaborative dialogue and so on" to which several of the interviewees here appear to allude. Van Lier also suggests that the learning of language "crucially relies on how the learner, as an active participant in meaningful activity, learns to perceive activity" and is a process that takes place within a semiotic context. There are clear links here to Gee's broader theories of learning in games, wherein the game is the semiotic context (or

domain) and the learners/players are active participants in constructing meaning, here understood to be a shared language or means of communicating (Gee, 2007, pp. 26–30). Players learn through activity that is not limited to the spoken word, but encompasses the deixes or contextual knowledge that players of the same game share, as well as gestures and utterances that, in a different context, might be meaningless.

Participant T appears sceptical that merely shouting his co-player's name is effective, but given the context in which he is doing so – and the shared nature of their experience – this may be a sufficiently clear and efficient means of communicating with his partner. Ineloquent shouts are not a form of communication this participant has been taught to value but it is arguable that brevity is an important component of successful communication in many time-limited, real-world domains (for example, the military, or air traffic control). There are also echoes here of Grice's (1969) distinction between what is uttered and what is intended to be understood by the utterer. The idea of communicative intention has been taken up by relevance theorists (see Stojanović-Prelević, 2011) and described in terms of explicature and implicature. Here, explicature consists of causal and temporal conclusions about what is said, e.g. the shouting of a fellow player's name, a description of an enemy or obstacle that makes sense only within the context of the game, at that moment. Implicature consists of implicated premises and conclusions about what is meant, e.g. the identity of the person best placed to help, and the nature of the problem at hand. So, while the participant's chosen mode of communication is far from sophisticated, there may a useful lesson to be learned here if players were to reflect on the efficacy of their in-game communication, and to consider if the message they intended is being communicated.

Of course, many activities may provide a context in which communication may be developed. Video games, however, offer a means of creating shared and dynamic contexts that are not readily matched – in terms of fluidity, complexity, and authenticity – by conventional classroom experiences.

3.2. Adapatability

The response to this attribute was also broadly positive (19 statements coded as positive, versus four coded as negative), with several participants highlighting that the variety of games played in the study required some adaptability on the part of the player.

> *Although I'd never played any of those games before, so … for me it's all about being in a foreign environment and also those games, just not so familiar also in language for me. So, I definitely had to be adaptable.* (Participant S, female, age 18)

Participant K (male, age 18) also felt that the variety of games played was the important factor here: "To an extent, I imagine the games did [improve adaptability], but getting a variety of games probably helped more than the individual games themselves". Another participant described the feeling of being "dropped into it" with each successive game, a term that seems to speak to the definition of adaptability rather succinctly:

> *I mean, most of the games were kind of like, especially Borderlands, were we were just kind of dropped into it, 'I don't know what this does' and you kind of figure it out relatively quickly. So, I think that kind of shows adaptability in a way that, you know, you have to learn how to navigate the game …* (Participant J, female, age 29)

Another participant agreed that the variety of games was important but, in contrast to Participant K, noted diversity within the games, too:

> *Yeah, I do think that the game sessions helped because we not only played a variety of different games like shooters or adventures but in the same game you can have lots of different tasks that require different skills.* (Participant H, female, age 23)

Participant E (female, age 20) agreed that diverse missions (or levels) within the same game required the player to adjust their response: "Yeah, I think if you do different missions every time you need to find a new approach to solve the mission […] so I think that helps as well". She cited *Portal 2* as an example of a game that required this form of serial adaptability. Participant O (female, age 18) suggested that the dynamic scenarios presented by *Team Fortress 2* were also relevant: "when things would go really bad, you just had to get through it, adapt to the changing situations". Another participant referred to the need to adapt the approach taken to successive scenarios presented by *Team Fortress* 2. She did so by varying her choice of character class, which would dictate the skills available to her:

> *…if you'd chosen maybe a class or a character that isn't particularly helpful in that scenario if you then die and have to respawn you can make another choice which I thought was quite helpful because there were some times when I had made the wrong decision. And then being able to choose a different approach I thought was quite helpful. So, in that case it was a little bit reflective, a bit more on-the-go, I suppose. So, that's just about applying different skills in different situations and again that sort of goes into adaptability as well.* (Participant J, female, age 29)

Continuing the theme of dealing with ever-changing scenarios, Participant F (male, age 19) highlighted the procedurally-generated worlds of *Minecraft*, "for the unfamiliarity of the vast world with new explorations and findings causing change in goals and priorities". Smith, Ford, & Kozlowski (1997) note that the modern workplace requires less in the way of what may be termed "routine" expertise (required to solve familiar problems), and more adaptive expertise. Adaptive experts can recognise when to try alternative approaches when faced with novel problems, exactly as Participant J describes above, and closely related to the common observation that the variety of games played was important here.

Another participant suggested that playing the games challenged her lack of adaptability when it came to making plans:

> *I think that* [adaptability was improved] *definitely as well. I'm just kind of one of these people when they have a plan, I really hate things being changed. So,* […] *where I've got a plan already fixed in my head, if someone changes it, I'll just freak out about it and be like "no, I can't do that". But I think it's different with video games because obviously you have to … it's all about reaction times, about the really quick decision making.* (Participant M, female, age 17)

Participant B (female, age 21), however, was less certain that the games required adaptability on her part, as she took each new challenge in her stride: "… in each game I had to learn, I had to play it from the beginning. It was … I don't know, it was easy". Participant B's confidence, however, was not shared by all participants. The following exchange with Participant I (female, age 21) demonstrates the importance of providing the necessary guidance and support – the scaffolding – to ensure that less experienced players are not overwhelmed:

Participant I: *Yes, a little, but I feel if you didn't explain [to] me the games before it would be worse.*

Interviewer: *So, it needed that little introduction?*

Participant I: *Yes, and like the paper with the controls and everything.*

The point made by Participant S – that participants were required to adapt to a "foreign" environment, including the lab and the other participants – was echoed by a number of other interviewees. For example, one participant noted the need to adapt to unfamiliar cultural norms:

> *Well, I think it does [require adaptability when playing] with another person, because of how they are used to do things is not the same. Probably because they are from here, or England, or from other countries and I'm from Spain, it's very different from every culture*. (Participant P, male, age 27)

Another participant highlighted the need to adapt to the differing levels of gaming experience in the room:

> *To be honest, it was probably more other people responding to my lack of experience with games but, yeah, I think just working with other people with different abilities probably helps*. (Participant D, female, age 18)

Another, more experienced, player noted that a disparity in game play ability required her to adopt a certain role – that of a teacher – while playing, supporting Participant D's idea that more able players had to adapt to working with novices:

> *I think there was a lot of people who weren't as 'gaming literate' as me. And so, it was sort of about being able to pull them along because […] it became obvious that most people hadn't played the games before and didn't really know what they were doing.* (Participant R, female, age 18)

Interaction between novice and expert players remains unexplored in the game-based learning literature, although Dankbaar (2017) notes the presence of an "expertise reversal effect" (p. 28) wherein the rich learning environment offered by a serious game is effective for experts but counter-productive in the case of novices. The data discussed here suggest that the role of peer tutoring in game-based learning should be examined more closely to determine if the pairing of novices and experts can accelerate the development of transferable skills. As Topping (1996) notes, definitions of peer tutoring should acknowledge "the gains accruing from the tutoring process to *the tutor*" (p. 322, emphasis in the original). This implies, as the data discussed here suggest, that the interaction is beneficial to the expert player as well as the novice.

Some participants were uncertain about the transferable value of the experience, indicating that while they were required to adapt their game-based skills from game-to-game, this was not relevant beyond gaming. Participant G (female, age 22), for example, had this to say:

I mean, obviously again it depends what sort of job I'd be doing, like, outside of gaming but I suppose it could help with some things, like systems, and I think there were a couple of games that were quite strategic, so, I guess it makes you think.

Other participants referred to adaptability only in terms of video game play ("I think so, the more games I played the least [*sic*] time it took me to learn new gameplay mechanics" – Participant Q, male, age 18), although this kind of response does not preclude the notion that the experience was more generally useful. One participant made a connection between skills acquired in the real world and applying them within a game, a reversal of the idea being explored here:

> Papers, Please *was a good example of using previously acquired information and time management skills to complete a virtual and unknown task. Every single game in some way required you to take things you have learnt elsewhere and enforce them in new situations, therefore allowing the brain to understand new ways of applying those skills*. (Participant F, male, age 19)

Experienced players expressed some scepticism, suggesting that their knowledge of a wide variety of games resulted in few "unfamiliar situations" to which they had to adapt ("Em, well the thing is I've played most of the games before, so it was all kind of all familiar to me" – Participant N, male, age 18). Another experienced player elaborated:

> *They were not necessarily unfamiliar situations, so I don't feel I adapted much, because that's what I do a lot of the time anyway … I play quite a bit. The only game I didn't play was … well, I didn't play Warcraft III but I played plenty of StarCraft and the same with Lara Croft*. (Participant C, male, age 19)

Participant A (male, age 32) was the only interviewee who was certain that the games did not require adaptability on his part, responding to the question of whether they did so as follows: "Hmm … [long pause] No, no."

The transferable dimension of the university's attribute definition states that graduates should "demonstrate resilience, perseverance, and positivity in multi-tasking, dealing with change and meeting new challenges" [4] and there is evidence in the responses of several participants to suggest that many, if not all, of these criteria have been touched upon in their experience of playing these games in the lab.

The contention of the experienced players that they were not faced with unfamiliar situations may be challenged. As indicated by one participant above, the games and their mechanics might be familiar, but the circumstances under which they were played did require adaptation on even the experienced players' part. For example, the experienced players were required to adapt to playing with people with whom they did not normally play. Furthermore, adapting to playing with – or working with – a diverse range of unfamiliar individuals and cultures, as mentioned by several participants, is arguably an increasingly important form of adaptability, due to the effects of globalisation on the job market (Lord & Smith, 1999, pp. 192–239). It might also be argued that Participant B (a moderate game player, engaging in 1–4 h of game play per week), who described the games' various challenges as "easy", is simply displaying adaptability.

Pulakos et al. (2000) developed an eight-dimension taxonomy of adaptive job performance by analysing over 1000 "critical incidents" in workplace environments. Many of these eight dimensions – which are cited by Ployhart and Bliese (2006, pp. 3–39) in their development of the I-ADAPT measure used in Barr (2017) – are evident in the interview data. For example, several participants referred to the need to cooperate with a variety of unfamiliar people, which is encapsulated in the "demonstrating interpersonal adaptability" (Pulakos et al., 2000, p. 614) component. The discussion of participants adapting to the cultural norms of their fellow

[4] http://www.gla.ac.uk/students/attributes/yourattributes/adaptable/, accessed 22nd June 2017.

players clearly relates to the "demonstrating cultural adaptability" (Pulakos et al., 2000, p. 614) component. The unpredictability of *Minecraft's* procedurally-generated worlds, and the unfamiliar scenarios presented by games that participants had never played before, have clear parallels to the "dealing with uncertain and unpredictable work situations" component of adaptability identified by Pulakos et al. (p. 613).

White et al. (2005, p. 2) suggest that "behavior change is at the core of the definition" of adaptability. Based on this definition, and the various components of adaptability described above, the qualitative evidence strongly supports the notion that video games – particularly when played under the circumstances described here – can exercise a player's adaptability.

3.3. Resourcefulness

A feature of this particular attribute worth noting before describing the data was the participants' understanding of the word 'resourcefulness'. In most cases, the meaning of the word was adequately understood, but a few participants were clearly uncertain about the true meaning (for example: "I don't know what resourceful, whether it means what I think it means …", or "…in what I think resourcefulness means …"). In a small number of cases, the term was taken to have a more literal meaning than perhaps intended by the university, as participants associated the word with collecting resources (such as gold or lumber in *Warcraft III*) rather than with, say, making independent decisions. For example: "Well, when you said resourcefulness, I just thought of *Warcraft* [laughs], because of all the resources, yeah" (Participant N, male, age 18) or, more subtly, "In some games you're put in situations in which you don't have much to use and you had to just make use of what you had to continue" (Participant K, male, age 18). However, all interviewees were presented with the university's definition, the transferable dimension of which reads: "Are motivated, conscientious and self-sufficient individuals capable of substantial independent work".[5]

It should also be noted that although the perception of the games' relevance to this attribute was also broadly positive (16 statements coded as positive, versus four coded as negative), the university definition of the attribute somewhat confusingly combines resourcefulness with responsibility. Participants were less certain of the relevance of this latter aspect of the attribute, which may have negatively impacted perceptions of the former.

However, resourcefulness, as understood by the participants, was frequently described as being related to how they responded to the often unfamiliar games.

> *…a lot of them I had absolutely no clue what I was doing, so I would have to make things up as I went along. And just sort of work with the little knowledge of games I had and just try and patch something together with that. It worked most of the time.* (Participant L, female, age 18)

> *…you know, when you get dropped into* Minecraft *or* Portal *or something you've got to kind of figure out what on earth you're doing and, whoever you're playing with, you kind of help each other out and stuff like that.* […] *So, I suppose in that sense you were kind of resourceful in that you're kind of looking for what on earth you do and how the game works and sort of tricks to get you through the next puzzle.* (Participant G, female, age 22)

Specifically, the constraints imposed by the limited amount of time spent on each game in the study, and the challenge associated with a relative lack of instruction were cited as factors which required resourcefulness. This observation connects with the work of Hamari et al. (2016), which found that perceived challenge in games was a strong predictor of positive learning outcomes. Several of the participants' statements reflect on the challenge presented by the games, while echoing some of the sentiments expressed in relation to adaptability above:

> *Probably. Just because … you don't [get] much in the instructions, so if you haven't done it before, you kind of have to figure it out for yourself.* (Participant D, female, age 18)

> *Normally when you get a game you spend the first three hours walking around the tutorial map and learning how to shoot the gun. But because we only had two hours, you really wanted to make something of the game in the two hours, so you kind of hit the ground running. And that meant you had to be resourceful […] in that you kind of have to be good, you have to do what you can do to be good, and try and get other people to also be good so you can make something of it.* (Participant T, male, age 19)

Some of the discussion around this aspect of the attribute was at the edges of what might constitute resourcefulness; in fact, there is a significant degree of commonality between this attribute and adaptability. However, ideas relating to meeting fellow players' expectations and demonstrating drive and determination in the face of the unfamiliar are clearly articulated. In addition, some participants could provide individual examples that align exceptionally well with the university definition of resourcefulness. For example, one participant spoke directly to the motivation required of players:

> *I think mainly the fact that a lot of games have very clear objectives, and it's impossible to go further if you don't complete those tasks. So, you definitely have to be motivated* […] *even if it's a difficult task, even if it implies having a good sense of direction that you don't have, you just develop it along the way because you have to do it.* (Participant H, female, age 23)

Another participant made the connection between carrying out independent work – also a component of the university's definition of resourcefulness – and the single-player nature of the final two games played (*Gone Home* and *Papers, Please*):

> *When it says "independent work", like, I can manage to do everything I have to do by myself? Well, in the last two games - because those were the only two where we played by ourselves - yes, it does.* (Participant P, male, age 27)

A couple of participants suggested that they felt they should manage in-game resources in a responsible manner, an idea which perhaps connects with a more literal interpretation of what it means to be resourceful. Participant S (female, age 18), for example, suggested that "in *Minecraft*, you have to like think about … which things you are going to use and which you are going to save [for others]". *Minecraft* was also cited by another participant, who similarly linked responsibility with sharing resources with others:

> *Like going around and having to find resources and having to collaborate with people to make sure you've got enough stuff to make weapons and armour and things like that, but that would be the only one I can think of.* (Participant M, female, age 17)

[5] http://www.gla.ac.uk/myglasgow/students/attributes/yourattributes/resourcefulandresponsible/, accessed 22nd June 2017.

And, while her response was framed in terms of resourcefulness, the pooling of resources Participant J (female, age 29) described was similarly responsible (and collaborative) in nature:

> *Oh, well I think* Minecraft *is good for like resourcefulness, especially, at least when I was playing, I kind of was looking around like 'what can I make, what do we need?' I say 'we' as in the collective group of whoever is going to be playing after me as well – what might they need? – and we came up with that idea of having a chest of stuff.*

Extending the collaborative theme, the same participant elsewhere noted that one's teammates might be considered a resource to be managed, collectively:

> *…for example, in* Lara Croft *you kind of have to, you know, almost use each other's skills to navigate certain puzzles and issues so I think that kind of demonstrates resourcefulness.* (Participant J, female, age 29)

It is perhaps not surprising that participants identified collaboration and cooperation in relation to the games played here – as several studies have shown, cooperation is a natural part of multiplayer gaming (Morschheuser, Riar, Hamari, & Maedche, 2017; Scharkow, Festl, Vogelgesang, & Quandt, 2015; Teng & Chen, 2014). Again, however, the qualitative data here suggest that the participants *valued* the cooperative experience afforded by the games. While most participants had something positive to say about one or other aspect of this attribute, there were those who – possibly as a result of not fully understanding the meaning of the word 'resourcefulness' – could not make any connection between the games played and being resourceful ("Mmm … I don't know"). Others, however, were more confident in their dismissal of the idea: "Yeah, I'm not sure that this one would be helpful, like from the games" (Participant E, female, age 20); "Yeah, I think there is room for it but I don't think I experienced it" (Participant R, female, age 18).

Finally, a wry comment from one participant, which certainly appears to speak to the university definition of 'resourcefulness':

> *Well at some point I played co-op Lara Croft with two controllers on my own which I had never done before, and developed strategies to do well anyway. I think that demonstrates a good amount of self-sufficiency and motivation … ?* (Participant Q, male, age 18)

Lara Croft and the Guardian of Light is a cooperative game that requires two players. There are, however, challenges associated with running a drop-in lab with multiplayer games: it is not always possible to guarantee the availability of the required number of players. In this case, the participant has undoubtedly displayed a form of resourcefulness in progressing through the cooperative game on his own, by alternating his control of the two on-screen characters. That an opportunity for resourcefulness arose not by design of the game or the experiment is interesting in itself and arguably represents a particularly authentic – if faintly comical – example of this attribute being exercised.

Recalling the conceptualisation of resourcefulness on which Zauszniewski, Lai, and Tithiphontumrong (2006) based their Resourcefulness Scale (used to quantitatively measure resourcefulness here – see Barr, 2017), this attribute comprises two dimensions: personal resourcefulness (maintaining independence in the face of challenging circumstances) and social resourcefulness (knowing when to seek help from others). Broadly speaking, the former of these dimensions is more evident in interview responses. When participants refer to being able to advance despite a lack of instruction or a limited amount of time, they are demonstrating independence in the face of challenging circumstances. Evidence of participants seeking help from other players – of social resourcefulness – was lacking. However, it should be noted that interview questions were based on the university definitions of the relevant graduate attribute, not the definition of resourcefulness offered by Zauszniewski et al. Social resourcefulness naturally underpins much of Zauszniewski et al.'s Resourcefulness Scale, and, given that the intervention group demonstrated a significant increase on resourcefulness as measured by this scale, it might be assumed that many of the interviewees were socially resourceful. So, while participants are certainly capable of exercising social resourcefulness, it is not reported here in relation to game play. However, this is not unexpected, given that the university definition for this attribute – to which respondents had access during interviews – does not make reference to seeking help when required. Indeed, the phrase "self-sufficient individuals capable of substantial independent work" seems to preclude this aspect of resourcefulness.

3.4. Limitations

While the participants interviewed here include all those involved in the game-based intervention, this approach ignores the attitudes of those experimental participants who did not complete the study. It is important to note, then, that the students who took part in the interviews were those that saw the study through to its conclusion, and played all the games over the course of the eight-week experiment. The views of those students lost to follow up – those who dropped out of the study – are not reflected here. So, it is with this caveat in mind that the data must be interpreted. Subsequent work might explore the attitudes of those students who did not see sufficient value in the game-based intervention to see it through, asking those students who dropped out of the study why they did so.

Other limitations relate to the nature of qualitative interviews. As Opdenakker (2006) notes, face-to-face interviews of the sort conducted here are susceptible to the effects of social cues, whereby the interviewer may inadvertently guide the interviewee's responses. However, as Opdenakker also suggests, these effects can be ameliorated by the use of "an interview protocol and by the awareness of the interviewer of this effect" (2006, para. 7), as was the case here. Participant interviews are also susceptible to demand characteristics, or the "good subject effect" (Nichols & Maner, 2008), wherein the participant seeks to provide a response that is pleasing or beneficial to the researcher. In terms of this study, it is possible that interviewees might have modified their responses to reflect what they perceived as the interviewer's preferred answer. However, such effects are largely confined to questions of sentiment – the positive or negative attitudes revealed in interviewees' answers – and are less relevant when considering the more complex questions of *how* and *why* the games might have developed player skills.

4. Conclusion

The quantitative data presented in Barr (2017) offer compelling evidence for the potential of commercial video games to aid in the development of graduate skills such as communication, resourcefulness and adaptability. However, the qualitative data described here provide important insights into *why* the students involved felt the games might have helped develop these skills, and the extent to which they believe this to be the case. That the respondents here are broadly positive about the efficacy of games in developing the relevant attributes is an encouraging indication for any future

interventions of this nature, bearing in mind the limitations outlined above. Future interventions might apply and build upon the findings described here by running similar game-based drop-in sessions for students, using this work as evidence for the potential usefulness of the sessions. The quantitative results described in the earlier paper provide statistical evidence of the efficacy of the game-based intervention. However, the qualitative data presented here provides insight that is more readily understood by students for whom statistics are not the most natural means of describing the world. Instead, they may look to the words of their peers to understand the potential benefits. The same may also be said for educators and policy makers who seek answers to the questions of how and why game-based interventions may be deployed. The research findings described here contribute to the game-based learning literature by revealing that students see value in playing games at university, and that, given the opportunity to reflect upon such game play, they believe that games can improve their graduate attributes. As stated in the introductory paragraphs, this belief is important, not only in terms of how it influences the efficacy of the intervention, but in suggesting that students – normally resistant to 'non-core activities' – may be persuaded to take part. This is where the wider implications for university management lie: games may offer a means of extracurricular development that is more amenable to the student body, should management be willing to explore the possibility.

The results may also be applicable beyond higher education. Despite being labelled here as 'graduate attributes', communication skill, resourcefulness and adaptability are transferable skills that are widely sought-after in the workplace and at every stage of a career. Interventions such as that described here might be adapted and deployed in contexts other than universities, for example, in the workplace or a training environment.

While the games might be considered instrumental in explaining the generally positive gains in attribute attainment, as measured by the quantitative instruments, the qualitative data suggest a more complex picture. The students interviewed here make frequent reference to the environment in which they played the games – particularly in terms of their interactions with one another – as well as the nature of their interactions with the varied library of titles played. In a sense, the games were acting as a catalyst for social interaction and collaboration, providing students with a shared interest which, in turn, formed the basis for a form of social learning (Bandura, 1971, pp. 39–41). So, while the choice of games was important – there was a heavy emphasis on multiplayer and cooperative titles, for example – a potentially significant proportion of the effects of the intervention might be attributed to the fact that students largely unknown to one another were required to collaborate on a series of tasks that were also, to varying degrees, somewhat unfamiliar. The games may be important in another respect, however, as it is clear from the data presented here that participants largely *enjoyed* the experience, sometimes in unexpected ways. The importance of enjoyment connects to the reason for using high-quality commercial video games in the first instance: these are products expertly crafted to engage and entertain – not to educate or enlighten. Unlike games developed for educational purposes, or training exercises devised by management experts, these games exist with the express intention of being fun. Students, from a young age, are aware of when they are being duped into learning by means of some educational product or activity masquerading as fun. They are not fooled by what Habgood (2009) refers to as "chocolate-covered broccoli". In the case of the commercial games discussed here, there is no broccoli in sight: only delicious game-based chocolate. The important difference, illustrated by the qualitative data presented here, is that students believe the chocolate to be intellectually nutritious. Furthermore, the quantitative evidence, presented in the companion paper, indicates that this belief may be well-founded.

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References

Adachi, P. J. C., & Willoughby, T. (2013). More than just fun and Games: The longitudinal relationships between strategic video games, self-reported problem solving skills, and academic grades. *Journal of Youth and Adolescence, 42*(7), 1041–1052. https://doi.org/10.1007/s10964-013-9913-9.

Bandura, A. (1971). *Social learning theory*. New York: General Learning Press.

Barr, M. (2017). Video games can develop graduate skills in higher education students: A randomised trial. *Computers & Education, 113*, 86–97. https://doi.org/10.1016/j.compedu.2017.05.016.

Barrie, S. C. (2004). A research-based approach to generic graduate attributes policy. *Higher Education Research & Development, 23*(3), 261–275. https://doi.org/10.1080/0729436042000235391.

Barrie, S. C. (2006). Understanding what we mean by the generic attributes of graduates. *Higher Education, 51*(2), 215–241. https://doi.org/10.1007/s10734-004-6384-7.

Bauer, M. (2000). Classical content analysis: A review. In M. W. Bauer, & G. Gaskell (Eds.), *Qualitative researching with text, image and sound: A practical handbook* (pp. 131–151). London: SAGE.

Blizzard Entertainment. (2002). *Warcraft III: Reign of Chaos*. Blizzard Entertainment.

Blizzard Entertainment. (2004). *World of Warcraft*. Blizzard Entertainment.

Bourgonjon, J., Vandermeersche, G., De Wever, B., Soetaert, R., & Valcke, M. (2016). Players' perspectives on the positive impact of video games: A qualitative content analysis of online forum discussions. *New Media & Society, 18*(8), 1732–1749. https://doi.org/10.1177/1461444815569723.

Bruner, J. S. (1960). *The process of education*. Cambridge, Mass: Harvard University Press.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement, 20*(1), 37–46. https://doi.org/10.1177/001316446002000104.

Crystal Dynamics. (2010). *Lara Croft and the guardian of light*. Square Enix.

Dankbaar, M. (2017). Serious games and blended learning; effects on performance and motivation in medical education. *Perspectives on Medical Education, 6*(1), 58–60. https://doi.org/10.1007/s40037-016-0320-2.

Egenfeldt-Nielsen, S. (2007). *Educational potential of computer games (illustrated edition)*. Continuum International Publishing Group Ltd.

Felder, R. M., & Brent, R. (1996, April 1). *Navigating the Bumpy Road to student-centered instruction*. Retrieved 22 June 2017, from http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Resist.html.

Gbadamosi, G., Evans, C., Richardson, M., & Ridolfo, M. (2015). Employability and students' part-time work in the UK: Does self-efficacy and career aspiration matter? *British Educational Research Journal, 41*(6), 1086–1107. https://doi.org/10.1002/berj.3174.

Gearbox Software. (2012). *Borderlands 2*. 2K Games.

Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (2nd ed.). New York: Palgrave Macmillan.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded Theory: Strategies for qualitative research*. Aldine.

Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. *American Psychologist, 69*(1), 66–78.

Green, W., Hammer, S., & Star, C. (2009). Facing up to the challenge: Why is it so hard to develop graduate attributes? *Higher Education Research & Development, 28*(1), 17–29. https://doi.org/10.1080/07294360802444339.

Grice, H. P. (1969). Utterer's meaning and intention. *The Philosophical Review, 78*(2), 147–177. https://doi.org/10.2307/2184179.

Habgood, J. (2009). Wii don't do edutainment. In *Proceedings of game-based learning (pp. 19–20)*. Retrieved from: http://www.gamelearning.co.uk/share/Outnumb3r3d.pdf.

Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2016). Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. *Computers in Human Behavior, 54*, 170–179. https://doi.org/10.1016/j.chb.2015.07.045.

Henderson, C., & Dancy, M. H. (2007). Barriers to the use of research-based instructional strategies: The influence of both individual and situational characteristics. *Physical Review Special Topics - Physics Education Research, 3*(2), 020102. https://doi.org/10.1103/PhysRevSTPER.3.020102.

Hughes, C., & Barrie, S. (2010). Influences on the assessment of graduate attributes in higher education. *Assessment & Evaluation in Higher Education, 35*(3), 325–334. https://doi.org/10.1080/02602930903221485.

Johnson, A., Kimball, R., Melendez, B., Myers, L., Rhea, K., & Travis, B. (2009). Breaking with Tradition: Preparing faculty to teach in a student-centered or problem-solving environment. *PRIMUS, 19*(2), 146–160. https://doi.org/10.1080/

10511970802409164.
Karavas-Doukas, E. (1996). Using attitude scales to investigate teachers' attitudes to the communicative approach. *ELT Journal, 50*(3), 187–198. https://doi.org/10.1093/elt/50.3.187.
Landis, J., & Koch, G. (1977). Measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159–174. https://doi.org/10.2307/2529310.
Liao, G.-Y., Huang, H.-C., & Teng, C.-I. (2016). When does frustration not reduce continuance intention of online gamers? The expectancy disconformation perspective. *Journal of Electronic Commerce Research, 17*(1), 65–79.
Lord, R. G., & Smith, W. G. (1999). Leadership and the changing nature of performance. In E. D. Pulakos, & D. R. Ilgen (Eds.), *The changing nature of Performance: Implications for staffing, motivation, and development*. John Wiley & Sons.
Lucas Pope. (2013). *Papers, Please*, 3909 LLC.
McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica, 22*(3), 276.
Mojang. (2009). *Minecraft*. Mojang.
Morschheuser, B., Riar, M., Hamari, J., & Maedche, A. (2017). How games induce cooperation? A study on the relationship between game features and we-intentions in an augmented reality game. *Computers in Human Behavior, 77*, 169–183. https://doi.org/10.1016/j.chb.2017.08.026.
Nichols, A. L., & Maner, J. K. (2008). The good-subject effect: Investigating participant demand characteristics. *The Journal of General Psychology, 135*(2), 151–165. https://doi.org/10.3200/GENP.135.2.151-166.
Opdenakker, R. (2006). Advantages and disadvantages of four interview techniques in qualitative research. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research, 7*(4). Retrieved from: http://www.qualitative-research.net/index.php/fqs/article/view/175.
Ortiz de Gortari, A. B., Aronsson, K., & Griffiths, M. D. (2011). Game transfer phenomena in video game playing: A qualitative interview study. *International Journal of Cyber Behavior, Psychology and Learning, 1*(3), 15–33.
O'Leary, S. (2016). Graduates' experiences of, and attitudes towards, the inclusion of employability-related support in undergraduate degree programmes. *Journal of Education and Work*, 1–22. https://doi.org/10.1080/13639080.2015.1122181.
Ployhart, R. E., & Bliese, P. D. (2006). Individual adaptability (I-ADAPT) Theory: Conceptualizing the antecedents, consequences, and measurement of individual differences in adaptability. In *Understanding adaptability: A prerequisite for effective performance within complex environments* (Vol. 6, pp. 3–39). Emerald Group Publishing Limited. Retrieved from: http://www.emeraldinsight.com/doi/full/10.1016/S1479-3601%2805%2906001-7.
Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000). Adaptability in the workplace: Development of a taxonomy of adaptive performance. *Journal of Applied Psychology, 85*(4), 612–624. https://doi.org/10.1037/0021-9010.85.4.612.
Ruggiero, D. (2015). The effect of a persuasive social impact game on affective learning and attitude. *Computers in Human Behavior, 45*, 213–221. https://doi.org/10.1016/j.chb.2014.11.062.
Scharkow, M., Festl, R., Vogelgesang, J., & Quandt, T. (2015). Beyond the "core-gamer": Genre preferences and gratifications in computer games. *Computers in Human Behavior, 44*, 293–298. https://doi.org/10.1016/j.chb.2014.11.020.
Seidel, S. B., & Tanner, K. D. (2013). "What if students revolt?"—Considering student Resistance: Origins, options, and opportunities for investigation. *CBE-Life Sciences Education, 12*(4), 586–595. https://doi.org/10.1187/cbe-13-09-0190.
Shin, D.-H., & Ahn, D. (2013). Associations between game use and cognitive empathy: A cross-generational study. Cyberpsychology. *Behavior and Social Networking, 16*(8), 599–603. https://doi.org/10.1089/cyber.2012.0639.
Shute, V. J., Ventura, M., & Ke, F. (2015). The power of play: The effects of Portal 2 and Lumosity on cognitive and noncognitive skills. *Computers & Education, 80*, 58–67. https://doi.org/10.1016/j.compedu.2014.08.013.
Smith, E. M., Ford, J. K., & Kozlowski, S. W. J. (1997). Building adaptive expertise: Implications for training design strategies. In M. A. Quiñones, & A. Ehrenstein (Eds.), *Training for a rapidly changing workplace: Applications of psychological research* (pp. 89–118). Washington, DC, US: American Psychological Association.
Sofaer, S. (1999). Qualitative methods: What are they and why use them? *Health Services Research, 34*(5 Pt 2), 1101–1118.
Stojanović-Prelević, I. (2011). On communicative intention and saying/implicating distinction. *Facta Universitatis, 9*(2), 107–114.
Swingler, M. V., Armour, S., Bohan, J., Cleland-Woods, H., Curry, G. B., & Roy, A. W. N. (2016). Where am I now and where do I want to be? Developing awareness of graduate attributes in pre-honours students. *New Directions in the Teaching of Physical Sciences, 0*(11). Retrieved from: https://journals.le.ac.uk/ojs1/index.php/new-directions/article/view/580.
Teng, C.-I., & Chen, W.-W. (2014). Team participation and online gamer loyalty. *Electronic Commerce Research and Applications, 13*(1), 24–31. https://doi.org/10.1016/j.elerap.2013.08.001.
Teng, C.-I., Chen, M.-Y., Chen, Y.-J., & Li, Y.-J. (2012). Loyalty due to Others: The relationships among challenge, interdependence, and online gamer loyalty. *Journal of Computer-Mediated Communication, 17*(4), 489–500. https://doi.org/10.1111/j.1083-6101.2012.01586.x.
The Fullbright Company. (2013). *Gone Home*. The Fullbright Company.
Topping, K. J. (1996). The effectiveness of peer tutoring in further and higher education: A typology and review of the literature. *Higher Education, 32*(3), 321–345. https://doi.org/10.1007/BF00138870.
Valve Corporation. (2007). *Team Fortress 2*. Valve Corporation.
Valve Corporation. (2011). *Portal 2*. Valve Corporation.
Van Lier, L. (2004). The ecology of language learning: Practice to theory, theory to practice. In *Presented at the UC language consortium conference on theoretical and pedagogical perspectives*. Santa Cruz: University of California. Retrieved from: http://uccllt.ucdavis.edu/events/ULCCTPP/leo.php.
White, S. S., Mueller-Hanson, R. A., Dorsey, D. W., Pulakos, E. D., Wisecarver, M. M., Deagle, E. A., et al. (2005). *Developing adaptive proficiency in special forces officers*.
Zauszniewski, J. A., Lai, C.-Y., & Tithiphontumrong, S. (2006). Development and testing of the resourcefulness scale for older adults. *Journal of Nursing Measurement, 14*(1), 57–68. https://doi.org/10.1891/jnum.14.1.57.