VAMPIRE GRADES: CAN SIMULATIONS SUPPORT LEARNING WITHOUT REFLECTION?

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Description: No correlation was found between reflection and learning outcomes in a computer simulation, using measured reflection and identified stimuli.

ABSTRACT

Experiential learning through computer simulation is claimed to involve reflection. This study examines the relationship between reflection and assessment using self report, simulation performance over time and summative assessment for 107 students. No relationship between reflection and summative assessment was found. Expected stimuli for reflection were negatively related with assessment.

INTRODUCTION

For over two decades computer simulations have offered the promise of enhanced experiential learning of Marketing in Higher Education. As technology develops it offers not only enhanced experiential learning but also efficiencies in teaching and insights into the processes of learning.

The proposed benefits of computer simulations for teaching Marketing are many; for example robust experiential learning opportunities, understanding non linear problems and the ramifications of choices and the benefits of working through complex inputs and uncertainty as a team (Brooks, Burson, and Rudd 2006). While reports on realising those benefits are equivocal (Beuk 2016) many report on success through a range of approaches (For exmple Cook and Swift 2006; Ganesh and Sun 2009; Vos and Brennan 2010). Simulations are not claimed as a panacea (Feinstein, Mann, and Corsun 2002) and much work highlights the need for understanding and supporting the learning achieved through simulations (Wellington, Faria, and Nulsen 1996; Lamont 2001; Cadotte and MacGuire 2013; Cadotte 2016).

Reflection is one aspect of learning which is widely discussed and accepted across disciplines as a central part of learning at Higher Education and professional level. Reflection is repeatedly given great attention and given this centrality it is not surprising that some studies have examined the role of

reflection in simulation (Cadotte and MacGuire 2013; Hughes and Scholtz 2015) however these have neither measured reflection independently nor explored the aspects of simulation which stimulate reflection.

Simulation offers the opportunity to monitor progress and performance on the simulation itself and identify patterns of reflection and learning. In this study we take this opportunity to examine aspects of reflection. We followed the process of learning for a cohort of students within an eight week exercise centred on a Marketing simulation game. Three data sources were used; self report questionnaires, simulation performance over time and assessment performance and these are combined to examine the role and practice of reflection and game performance.

THE PRACTICE OF USING SIMULATIONS

Ultimately, technology may be more of an enabler than a stimulator of learning (Brennan 2014) and in line with this much research has examined the wider learning environment and brought aspects of learning theory to the practice of using simulations. Johnson et al (1996) looked at factors which enhanced learning, the agenda setting work of Brooks et al (2006) pointed toward research into aspects such as the selection of simulations, involvement and debriefing of students.

Lamont (2001) focussed on team learning theory, Treen et al (2016) built on this by measuring the impact of group size and decision making time. Learning may occur in groups but is primarily an individual process. Individually focussed aspects such as learning histories (Parush, Hamm, and Shtub 2002) and the coaching role of instructors (Cadotte and MacGuire 2013) have been proposed as effective. Predisposition such as performance expectancy and effort expectancy (Caruana, La Rocca, and Snehota 2016) may be precursors to learning. (Parush, Hamm, and Shtub 2002).

Several authors have engaged with the linked aspects of reflection and critical thinking. Hughes and Schultz (2015) linked reflection with impact, Bell and Loon (2015) linked critical thinking disposition with student reported achievement of learning outcomes. The importance of reflection in learning in higher education is widely recognised beyond Marketing across disciplines (Ryan and Ryan 2013). It is particularly apposite for experiential learning such as that proposed for simulation, through its place in the very influential experiential learning cycle of Kolb (1984). Work on reflection is extensive and

reflection is defined and adopted in different ways (see Rogers 2001 for a discussion of the concept) and in this study, reflection is guided by Kolb's and Rogers' work.

Critical thinking is similarly an embedded part of Higher Education practice and discourse, though links to specific interventions are more difficult to make (Tiruneh, Verburgh, and Elen 2014). Based on this, processes of learning such as refection and critical thinking should form part of a well designed environment based around simulations.

To date work on reflection linked to simulation has been largely exploratory. Hughes and Schultz' (2015) study involved participatory action research and while reflection has been explored as a construct extensively elsewhere, links to experiential learning through simulation are limited. The more complex construct of critical thinking has seen similarly limited work, for example Cadotte and MacGuire (2013), though Bell and Loon's (2015) study used measures of critical thinking disposition and self reported learning outcome. Assessing critical thinking is complex and time consuming, however, with the well established tools such as the CCTDI (Facione 2000) and the ATI taking 40 minutes or more to deploy at some financial cost. Cadotte and MacGuire developed an exploratory rubric they aligned with Bloom's taxonomy and Bell and Loon used the much less well known UF-EMI tool.

Understanding processes of experiential learning through simulations in practice is closely linked to understanding learning itself. Reflection is at the heart of conceptions of experiential learning and has been researched extensively. This study will use some of that work to investigate the role of reflection in learning through a simulation.

ASSESSING THE BENEFITS OF SIMULATIONS

The potential benefits of simulation in teaching Marketing have long been identified. Burns and Gentry (1992) provided an early typology of simulations and highlighted the potential value for experiential learning. Cook & Swift (2006) added to these and the list offered by Brooks et al (2006) above, extending potential areas of learning to include problem solving skill sets and high level decision making. Through these and many others simulation has established a strong role in marketing education.

The response of users both students and instructors is often presented. Ganesh and Sun (2009), examining use of simulation in a "capstone" marketing course shared the positive view of many

adopters; “The overwhelmingly positive feedback from the students is evidence of the success of this approach and its project. The adoption of this approach in other teaching institutions is strongly recommended” Cook & Swift (2006) claimed students found the simulation experience to be an exceptional learning tool Vos & Brennan (2010) examined lecturer and student perspectives finding enthusiasm in both and that simulation was a highly effective learning method. This contrasted with the more equivocal view of Beuk (2015) on the benefits in sales simulation. Beuk took a similar dual perspective to that of Vos & Brennan but found that while students enjoyed the simulation they did not evaluate usefulness as highly as lectures.

The attitudinal response of participants is only one basis for assessing the benefits of simulation in practice. Perceived learning (used by Johnson, Johnson, and Golden 1996; Bell and Loon 2015 among others) involves a self report from the beneficiaries of the simulation and is aimed at the objective; learning. These self reports are limited of course by the attitude and subjectivity of the respondents. This can be exacerbated by deployment when for example the study includes staff with an interest in the simulation itself, for example Cook & Swift (2006). It is not simple to control for these factors.

Assessing specific skills such as numeracy (Brennan and Vos 2013) offers the advantage of providing robust measures but does not fully reflect the potential breadth of learning claimed for simulation. This is a popular choice for financial and accounting skills but has limitations (Burdon and Munro 2017) not least that it focuses on lower level skills rather than more complex learning. Game performance in the simulation (Sauaia 2014) provides a similarly objective measure but is divorced from learning outcomes and the experience of the learner. Attempts to develop bespoke measures (such as those in Abdullah, Hanafiah, and Hashim 2013) offer breadth and can incorporate different aspects of assessment for the simulation but can lack internal consistency.

In a higher Education setting learning is constructed around learning outcomes and these are measured by summative evaluations or grades achieved. This approach is used for example by Blackford and Shi (2015) through standardised test scores and Woodham (2017) using overall course performance. Summative evaluations may be assessed by only one or two assessors but involve processes of scrutiny

and moderation built on extensive experience and compliance is controlled by the Higher Education institution. These processes help to make summative evaluation one of the most direct and valuable evaluations for learning experiences. As Salas et al (2009) assert, in the absence of assessing employment based behaviours assessment of learning outcomes is the most appropriate measure of the performance of learning based on simulation.

DEVELOPMENT OF HYPOTHESES

In this study we draw together the measurement of learning outcomes with the processes of learning, specifically reflection through the simulation based exercise. Our research question is;

What are the relationships between reflection and learning outcomes in simulation based learning?

Based on the importance of reflection to experiential learning identified by Bloom (1984) and developed by many others we posit a basic hypothesis:

H_1: Reflection has a positive impact on learning outcomes

This fundamental inference from learning theory is included to provide the basis for analysis of the practice of reflection in the simulation, specifically to explore factors which encourage or stimulate reflection. Drawing on cognitive psychology Poole et al (2013) proposed emotion as a stimulant, Ash and Clayton (2004) proposed explicit articulation of learning as one process to stimulate reflection. Some (for example Brockbank and McGill 1998) centre the reflective process on a facilitator or other external agent rather than the learner, "the role of the tutor" in reflection through learning technologies as Seale and Cann (2000) described. While predisposition, the environment and the role of the tutor are important, they are similarly important in non-simulation environments, and in the study setting were established as part of the teaching design and discounted as factors. This study focussed on stimuli directly linked to the simulation. Stimuli generally involve new subject matter, allowing learners to become cognitively stimulated Schön (Schön 1983; Strampel and Oliver 2007). This aligns with Rogers' (2001) description of reflection "Triggered by an unusual or perplexing situation or experience" where learners "identify a problem and make a deliberate decision to seek a solution".

Following this description the stimuli in the simulation should involve overcoming unusual situations, perplexity and new subject matter. This should occur where learners see some form of challenge or setback. If the scenario is understood without difficulty and good decisions are made from the start, stimuli should be less. If poor decisions are followed by a shift to consistent good performance in the simulation, opportunities for reflection should be indicated. Examining performance in the simulation (measured financially) allows identification of potential stimuli. These stimuli should lead to increased reflection and therefore to improved learning outcomes. Our last two hypotheses therefore examine how learners have responded to the scenario. The first reflects an identified stimulus to reflection; overcoming setback and subsequently achieving consistently good performance. We posit that;

H_2: Overcoming negative performance has a positive influence on learning outcomes

The second looks at the *lack* of opportunity for reflection. To achieve high financial performance in the simulation students need to perform well from the start. This would involve making good decisions from the start and using a priori understanding. This reduces the opportunity for reflection. We recognise other factors may outweigh this effect but ceteris paribus we posit that:

H_3: Financial performance in the simulation has a negative influence on learning outcome

METHOD

Participants were students at a business school in the UK enrolled in a final year International Marketing optional module. Total number of enrolled students was 150 (55 percent female 45 percent male). All except one were between 18 and 24 years old. 60 percent were UK residents, 40 percent non-UK. 107 students (71%) completed both surveys and the summative assessment and form the sample analysed.

The research centred on the first assessment of the module. This involved use of the simulation "Country Manager" by Interpretive Simulations, with assessment of a final presentation on the approach to and learning from the simulation. Country Manager is a web-based simulation in which students manage a hypothetical toothpaste manufacturer in America, which intend to expand into Latin America. Students have to make decisions with regard to market data and environmental changes in each year. There are ten years (or periods) available in the simulation and students were directed to reflect on their performance in the assessment.

Of the summative assessment 35 percent was based on reflection, the remaining 65 percent directed at the learning outcomes (final grade in the UK is out of 100). The learning outcomes involved analysing the factors influential in internationalization of businesses, evaluating the attractiveness of international markets and applying international marketing theories and internationalization strategies. These were rendered into marking criteria as 1: Market evaluations and rationale behind decisions and 2: use of international marketing concepts. The marking criteria also involved a small component of presentation. The marks for this component correlated very closely with the other two components and when tested had no appreciable effect on the outcomes. Students were assessed in groups of 4. Students were not assessed based on their financial performance in the simulation.

To measure reflection we used the 7-point Reflection scale of Peltier (2005), which usefully separates Reflection from Intensive Reflection (largely changes to the self), Habitual Learning and Understanding. In doing this it delineates the nature of reflection tested. In the initial survey, at the introduction of the simulation, we asked students to assess their reflective learning approach across their course of study to date in the questionnaire given to them. In the final survey they were asked about their reflective learning approach in the simulation activity. This was intended to provide an opportunity for us to compare the change in self-report reflection before and after using the simulations.

The final grade (excluding the reflection component) was used as an assessment of learning outcomes, which is the dependent variable. In addition, the cumulative net contribution (profit/loss) that students generated was extracted to examine how it is related to their final grade.

RESULTS

The first result is the non-significant change in the self-report reflection scale (1=very low reflective learning approach, 7= very high reflective learning approach) before and after the simulation: ($M_{reflection\_before}$=5.05, SD=0.56; $M_{reflection\_after}$=5.06, SD=0.56). This means that students did not report that their reflective learning had significantly changed after the simulation, though the reflective learning approach in the simulation remained high. The students' reported reflection in the simulation exercise was the same as that reported before.

Hypotheses H_1 and H_3 were examined using Multiple Regression, with cumulative net contribution and reflective learning as independent variables. The beta coefficients are presented in Table (1). As the table suggests, the self-reported reflective learning has no impact on the final grade, but the cumulative net contribution that students generated in the simulation has a significant positive impact. **Therefore both H_1 and H_3 are rejected**. Indeed the reverse of H_3 was supported by the data.

Table (1) – The impact of financial performance and reflection on learning outcome:

	Learning outcome standardised coefficient	Significance level
Reflection	0.13	0.17
Cumulative net contributions	0.32	0.001
R^2	0.12	

To address H_2: that overcoming negative performance has a positive influence on learning outcomes we analysed the financial performance in the simulation of students over time. We identified two profiles which reflected overcoming negative performance, Either of these might indicate overcoming negative performance/ The first reflected a substantial setback (dip in results) followed by positive performance and could demonstrate learning from reflection regarding a substantial event. The second reflected any other pattern of non positive performance with consistent growth at the end of the simulation and could demonstrate learning from experimentation and reflection.

We assessed the first as a substantial drop in performance followed by at least two results showing significant positive results and termed it “setback and recovery”. The second involved any non-positive pattern of early performance followed by sustained positive results in the final three periods “positive finish”. The results were grouped into four based on as follows:

Group 1: Those who had setback and recovery and had a positive finish.
Group 2: Those who had no set back and recovery and no positive finish.
Group 3: Those who had no set back and recovery but had a positive finish.
Group 4: Those who had set back and recovery but no positive finish.

The ANOVA result between groups shows that the learning outcome, measured by the final grade, is significantly different between the first three groups: (M_{group1}=59.55, M_{group2}=67.03, M_{group3}=69, M_{group4}=58.96, F=7.70, $p<0.001$). **This leads to the rejection of H_2.** As with H_3 the reverse of the hypothesis was found. While positive finish had limited influence, the groups which showed setback

and recovery had significantly and substantially lower learning outcomes (summative assessment grade). Put simply, one bad year cost a grade (8 or 9%) even when performance fully recovered. That is a very substantial difference equivalent to one standard deviation in the distribution of marks.

DISCUSSION

The first and perhaps most surprising finding was that reflection had no correlation with learning outcomes measured by summative assessment. This is at odds with much theoretical work on learning which holds reflection as central to learning processes. This is despite reflection forming a (separate) part of summative assessment and the design of the environment for the exercise which conformed to recommended practice (Hughes and Scholtz 2015; Canhoto and Murphy 2016). One reason may be the difficulty of measuring such a complex construct. Set against this the scale has strong internal consistency and has been deployed successfully elsewhere (Lim 2011; Ghanizadeh 2017; Peltier, Hay, and Drago 2006). A second measurement issue is that self report may be unreliable. Students are repeatedly introduced to concepts of reflective learning and this may introduce a normative behavioural bias, and students may simply be over confident about their learning behaviour. The response pattern does not align with those explanations; responses were consistent across two surveys without correlating with summative assessment. We believe the explanation is simpler; that achievement of the learning outcomes may require some reflection but more is not necessarily better. This aligns with much work on simulations and learning. Many studies support student perceptions and skills enhancement, Maher and Hughner (2005) found a simulation as valuable as a live project and Cook and Swift (2006) found it surpassed the textbook in student perceptions for example. Claims for learning beyond skills, comprehension and behaviour are few. Wellington (1996) found cognitive learning much less affected than behavioural, Seale and Cann (2000) found the evidence for reflective learning in their study “not overwhelming” and Blackford and Shi found simulations no more effective than no experiential learning while case based learning was associated with higher learning outcomes for the same students.

The findings relating simulation performance with learning outcomes (assessment performance) are also consistent with non-reflective learning. Recovering from setback has a negative correlation with assessment performance, suggesting that rather than reflection, it fosters other processes such as reduced

motivation or self efficacy. With the construct of reflection removed from our model of learning, the correlation of simulation performance with assessment performance is easily explained; understanding the simulation and being able to make good decisions could have several causes, such as ability or experience which might also lead to good assessment performance without reflection. This aligns with the work of Woodham (2017). It is at odds with the importance of reflection in the experiential learning of simulations, however. It also does not support work such as that of Brady and Devitt (2016) who proposed that valuable learning could come from worse game performance through reflection.

CONCLUSION

The results can be summarised that in a marketing simulation based learning environment designed to promote reflection and with reflection a part of the summative assessment, no evidence was found that reflection helped attainment of the learning outcomes. Students who reflected more didn't get better grades (final summative assessments). Other factors such as simulation performance were associated with improved learning outcomes. This is consistent with some other studies.

We do not challenge that reflection has a role in experiential learning, nor do we reject the work on creating an environment to support reflective learning. We do not question the work on skills improvements through simulation or that student attitudes are positive, indeed we found the same. However this work suggests that computer simulations do not provide a basis for reflection or that beyond a certain level, more reflection does not lead to better learning.

We do not claim that just as the vampires of legend could survive very well with no reflections students can learn effectively through simulation with no reflection. The inferences possible from this study are a little more complex. Computer simulations may be popular tools with proven efficacy for lower level learning but the benefits for reflective learning have not yet been demonstrated. More broadly, it's possible enough reflection is enough.

These findings are necessarily tentative; this is a single cohort study and this is a substantive limitation. They are also very surprising and open avenues for developing understanding of experiential learning. We would welcome replication in other environments. Beyond this, existing literature on processes of learning through simulations is limited and relatively few large quantitative studies have been

completed. Computer simulations allow measurement of students' behaviour across time. We would encourage further theoretically grounded studies which exploit this aspect of simulations.

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