Assessing the Potential Learning from Simulation Games

Completed Research

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Abstract

This paper deals with the relevance of simulation games in relation to higher-level business education as well as the challenges that are linked with learning assessment in business simulation game based learning activities. We collected data from 27 business simulation game training sessions on supply chain management and analyzed them qualitatively. Our data analysis shows that the perceived learning varies between the participants. Furthermore, the results of the analysis indicate that the learning through simulations is more like “know-how” than “know-what”. These findings are relevant when discussing the appropriateness of simulation games in MIS education.

Keywords

Simulation games, Learning, Supply chain, and Learning types.

Introduction

The discussion on the relevance of higher-level business education and assessing learning outcomes have been active for many years (Bohanon, 2008; Cannon et al., 2004; Selen, 2001; Vos, 2015; Jewer and Evermann, 2015). Although modern businesses have moved away from function-based organizational structures, university business curriculum is still mired in a functional mentality (Bohanon, 2008). Such curriculum does not meet the requirement for more integrated and dynamic real-world business organizations (Cannon et al., 2004). It lacks the integration of the “traditional” functional areas (e.g. accounting/finance, marketing, operations, and management) in relation to evolving overall business models and strategies (Selen, 2001). In other words, business schools and faculties have a linear, disciplinary focus on business education, which neglects the introduction of process perspective needed in the business curriculum (Walker & Black, 2000), which has introduced a knowledge-doing gap (Jaeger et al., 2015). Business schools are skilled at know-what—teaching disciplinary and functional knowledge, but fall down on know-how—teaching students how to think beyond information silos and to be more self-aware as leaders (Jaeger et al., 2015). Consequently, many scholars acknowledged the need for a clear move in business schools away from viewing programs as solely concerned with the transmission of content, knowledge and skills, towards developing deeper intellectual skills and the capacity to think independently (Prince & Steward, 2000; Heim et al., 2005; Bohanon, 2008). It has been argued that the range of teaching techniques must be extended to include process-oriented approaches (Leitch & Harrison, 1999), more experientially oriented pedagogy (Wren et al., 2007; McHann & Frost, 2010; Jewer and Evermann, 2015), and problem-based learning (Zabit, 2010; Chew, 2010). We believe this is particularly relevant for MIS education, as the MIS professionals must have a clear understanding of the mechanics of information technology operations and relating them to company's overall business process and strategy. For example, in their study on supply chain education, Jaeger et al. (2015) describe that MIS professionals should understand global business processes, how they interact in global supply chains, and how the IS supports and automates operations of each partner. Consequently, the know-how knowledge is very critical for MIS professionals.

Business simulation games (SGs) have traditionally and constantly been suggested to alleviate many of the shortcomings mentioned above. For example, SGs have been suggested to offer experiential learning opportunities for students to learn through hands-on experience and decision-making in a simulated environment. However, the effectiveness of SGs in educational settings is still a matter of debate. The goal of this paper is to assess the potential learning from simulation games and to explore the challenges associated with learning assessment in these types of educational activities.
complete and correct understanding methodology and to follow the objectivist tradition of knowledge where the goal is to strive for a test that stands separate from the instruction is produced, and it

certain learning occurrence. This means that it is not possible to cover the whole spectrum of potential learning incidence. Thus, the research instruments a
designer in a particular game, and often this unintended learning is more valuable because it is relevant to the learner and very much depends on the learners’ previous knowledge, experiences and beliefs; c) unique to the business simulation in use. All these points make it difficult to assess the learning. Further, these same points make the SG learning assessment difficult for quantitative methods (as we will show in next section).

The message of the paper is that we need a shift in thinking of the nature of the potential SG learning and that we need to accept that the learning that the learners take with them from the game experience is not necessarily the same as the game facilitator might think of offering, but is much more diverse.

The Problematic Nature of Learning Assessment

Prior studies pointed assessing learning as difficult and problematic. For example, Gosen and Washbush (2004) claim that objective measures of learning from simulation games are still limited to the basic knowledge, comprehension, and application stages of cognitive learning. Anderson & Lawton (2009) note that attempts to measure analysis, synthesis, and evaluation stages of the gamers have continued to be limited to participant perceptions of their improved abilities. Gosen and Washburn (2004) argue that learning measures should be tied to explicit learning goals and claim that it is not possible to construct an assessment activity without knowing what it is we expect to measure.

From epistemological point of view we have a different view in our research than the authors above. First, we do not believe that the possible learning that takes place in games-based learning activities is generalizable. This is because of the huge variety of different (business) games (computerized/ non-computerized, group/individual learning activities, clock-driven/batch-decision games, competitive/non-competitive, functional/general management, and so on), their differences in content, method of implementation, user-interfaces, and functional structure. We believe that every game forms its unique case of learning potential, which might not be relevant compared to other games. What could be said on a generalizable level is, for example, that the learning from simulation games could include understanding of group dynamics and behavior in team-based simulation games.

Second, following Gosenpud (1990), we believe that the learner often learns things not intended by the designer in a particular game, and often this unintended learning is more valuable because it is relevant to the learner. This is a challenge for learning research. Quantitative research methods require that the researcher states his/her research topic (in this case the kind of learning he/she is studying) before the actual learning incidence. Thus, the research instruments are tuned to catch information only about a certain learning occurrence. This means that it is not possible to cover the whole spectrum of potential learning that takes place in the games-based learning activities, not even the unintended learning, which might be the most important and relevant for the learner.

The majority of the discussion evolving around SG learning results seems to be based on the quantitative methodology and to follow the objectivist tradition of knowledge where the goal is to strive for the complete and correct understanding – a test that stands separate from the instruction is produced, and it
is designed to probe the knowledge acquired in an objective way (Tao et al., 2012; Jewer and Evermann, 2015). Gosenpud (1990) notes that most researchers stress the importance of keeping dependent measures concrete and specific and measuring dependent variables as precisely consistent with designer goals as possible. We would like to question the idea of quantifying the learning that takes place in gaming.

Studying learning is utterly difficult, if we select and anchor the learning phenomena under investigation and are not open to any other type of learning outside this selection. Gosenpud (1990) has further stated that game evaluation, defined by the designer (researcher), may miss the real worth of the experiential experience because what is valuable for the learner is defined by the learner and may have nothing to do with the designer’s intention. This clearly favors qualitative research, in which the possible area of research results is left open and not closed as in survey type quantitative methodology. In this paper we perform qualitative analysis to a data collected from 27 business simulation game sessions.

**What Kind of Learning to Look for?**

Duffy and Cunningham (1996) note that learning is an active process of constructing rather than acquiring knowledge, and that instruction should be a process of supporting the construction rather than communicating knowledge. Therefore, the use of learning tools that support this process of active construction of knowledge is recommendable. Simulation gaming focuses on developing the skills of the learner to construct (and reconstruct) plans in response to situational demands and opportunities (Duffy & Jonassen, 1992a). Thus, SGs provide contexts and assistance that will aid the individual in making sense of the environment as it is encountered.

The constructivist learning paradigm emphasizes the group environment, and what Brown et al. (1989) describe as group learning is much like the description of a SG: collective problem solving, displaying multiple roles, and providing collaborative work skills. In each game, the players interact with one another while applying different rules and utilizing different resources (Klabbers, 2003). In SG, the learner is building an internal representation of knowledge and a personal interpretation of experience (Bednar et al., 1992). Learning in a SG is an active process in which meaning is developed on the basis of social experience.

Learning in SG environments is situated in a context, which is rich and reflective of real-world, making it possible for this constructive process to occur and transfer to environments beyond the learning situation. The goal is to portray tasks, not to define the structure of learning required to achieve that task. In game-based learning we leave the identification of relevant information and correct solutions open in the instructional situation. This implies that SG environments offer tools to construct knowledge with—not from, like conventional programmed instruction.

During the game, the participants discuss the characteristics of the environment, negotiate, learn from each other, and make decisions. Thus, they develop identity as decision-makers of the firm they are running. The game environment provides contexts and assistance that will aid the players in making sense of the events and business logic embedded in the game environment. In business game sessions, the players build interpretations of the experience. The SG learning context includes social interaction and decisions, which cover a multidisciplinary field and where the environment is in change.

As discussed previously, a wide spectrum of potential learning takes place in the games-based learning activities. In order to tap the possible learning, we adopt Greenblat’s (1980) classification of learning. Greenblat (1980) presented 9 types of learning, which aptly illustrates the diversity of the potential learning from a SG experience. However, Greenblat’s (1980) categorization lacks collaboration and teamwork, which has been suggested as an important type of learning from SG (Pasin & Geroux, 2011; Lin & Tu, 2012). Consequently, we add collaboration and team work as an additional category of learning. The final categories and their descriptions are presented in Table 1.

<table>
<thead>
<tr>
<th>Learning Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual information</td>
<td>Factual information refers to the true information. For example, Internet has made learning materials easy to access is a factual information.</td>
</tr>
<tr>
<td>Explicit referents for concepts</td>
<td>Explicit referents for concepts describe human behavior and abstract concepts such as organization, power, stratification, and negotiation</td>
</tr>
<tr>
<td>Procedural</td>
<td>Participants in simulation games learn procedural sequences. The participants</td>
</tr>
</tbody>
</table>
Assessing Learning from Simulation Games

Table 1: Taxonomy of learning types from SG experiences

<table>
<thead>
<tr>
<th>sequences</th>
<th>learn the rules, comprehend the essential features of the environment, understand the implications of the alternatives open to them, and develop increasingly elaborate strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>General principles of the subject matter simulated</td>
<td>Participants in simulation games learn general principles of the subject matter simulated (e.g., the need for social control, good communications, and long-range planning)</td>
</tr>
<tr>
<td>Understanding the structure of real world in a simplified manner</td>
<td>Simulation games provide simplified worlds from which participants can stand back and understand the structure of the everyday, &quot;real&quot; world. Games seem to display in a simple way the structure of real-life situations.</td>
</tr>
<tr>
<td>Gain in explicitness</td>
<td>Explicitness refers to the capacity to identify consciously elements of a problem in an analytic or technical sense</td>
</tr>
<tr>
<td>Systematic analytic approach</td>
<td>Participants in simulation games learn a systematic analytical approach for problem solving</td>
</tr>
<tr>
<td>Better decision-making skills</td>
<td>Participants in simulation games learn better decision-making skills, applicable in practical situation</td>
</tr>
<tr>
<td>Winning strategies</td>
<td>Participants in simulation games learn winning strategies in those situations simulated</td>
</tr>
<tr>
<td>Collaboration and team work</td>
<td>Participants learn collaboration and team work toward solving a problem</td>
</tr>
</tbody>
</table>

If we believe that learning is a constructive process in which the learner is building an internal representation of knowledge, then this representation is constantly open to change and has varied forms and stages (Bednar et al., 1992). If the outcome of the learning is personal, then this further adds complexity and challenge for the researcher. Impact of personality on the learning outcome further emphasizes research instruments, which are open to unexpected learning findings.

To conclude, we note that there is a paradoxical and contradictory relation in the educational (business) gaming field between the games and how they are assessed as learning environments. The games themselves offer an experiential and most of all constructivist learning experience (Lainema, 2009), but the learning research of these environments mainly follow the objectivist view of learning (Eom et al., 2006; Tao et al., 2012).

From this point forward, whenever we discuss about learning, we refer to perceived learning of the game participants. We content with the notion that what the participants explicitly state as learned may be different from what they take with them from the learning sessions and show in real world working environments.

Study Design

Research Setting

RealGame (www.realgame.fi) is a clock-driven simulation game, which represents business processes (for example, the order-delivery process). The simulation participants, who play the game in small groups, are able to follow their company's operations and material flows in real time, providing a dynamic and transparent view of cause-effects in business organizations. The success of the decision-making is measured with several performance indicators, like cash flow, profitability, production costs, inventory levels and market shares.

We have drawn our data from 27 in-house training sessions of an industry-leading company offering technical solutions and equipment to many different industries worldwide – automotive, energy, mining, nuclear power, oil and gas production, ports, to name the most important ones. These training sessions were held between February 2008 and June 2011. A total of 474 participants took part in these trainings.

The simulation model of RealGame was tailored for the training sessions in question so that the industry in the simulation model had many similarities with the company's reality. The tailoring is mainly related to the supply chain and production processes in the simulation model, as it had similar dependencies in the lead times, raw material requirements and production hierarchies as the case company had in reality.
The training itself ran for two days, but it also included a light assignment (in the simulation game introductory material) to be done before the training. The number of the participants in the training sessions varied from 12 to 22. We aimed at teams of 3 persons running their own company in the sessions, but in the smallest sessions with less than 14 participants had also teams of two participants (to create enough companies for a functioning market situation).

**Data Collection**

Schluter et al. (2007) suggested collecting data using open-ended questionnaires if the target is cover a large number of respondents. Following this suggestion, we collected data using open-ended survey questions from the 474 training participants. We developed an online questionnaire where, we first asked the respondents to report their demographic information and then asked to report their opinion on the training sessions using a 7-point Likert Type scale. Finally, we asked them to report three most important things that they learnt during the training sessions using an open-ended question. The questionnaire is presented in Appendix A. The questionnaire was sent to all the 474 participants from one to three days after the simulation gaming session. If the respondents did not reply, a new request was sent within one week. Out of 474 participants, 263 participants answered the questionnaire resulting 55.5% response rate.

The average work experience of the participants was 14.5 years, and 84.4% of them were male. Their educational background was as follows: Engineering 40%; Business 20%; Natural sciences 1%; Humanistic studies 2%; High school or equivalent 4%; and Unknown 32%.

Table 2 presents the participants’ opinions regarding the training sessions. The high averages on the question items indicate that the training had a clear structure, was very motivating and interesting, and was able to illustrate the overall supply chain process. In addition, the participants regarded the experience useful from the perspective of their real world work tasks and organization.

<table>
<thead>
<tr>
<th>Question: What is your opinion on the following statements (1=disagree, 7=agree):</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>The supply chain module (SCM) module had a clear structure</td>
<td>5.5</td>
</tr>
<tr>
<td>The SCM module created motivation in learning</td>
<td>6.0</td>
</tr>
<tr>
<td>RealGame helped to achieve a holistic view of SCM operations</td>
<td>5.7</td>
</tr>
<tr>
<td>It was interesting to learn through playing</td>
<td>6.4</td>
</tr>
<tr>
<td>Our group's collaboration was an essential part of learning</td>
<td>5.8</td>
</tr>
<tr>
<td>I believe that the SCM module was useful regarding my real work</td>
<td>5.4</td>
</tr>
<tr>
<td>The module helped me to see the effects of my own work to other parts of [our company] organization</td>
<td>5.4</td>
</tr>
</tbody>
</table>

Table 2. Participants’ opinion about the training sessions (N =263)

In the questionnaire the participants were asked to answer the open-ended question: What were the three most important things you learned during the session? In this paper we will mainly analyze the participants’ answers to this question. Out of the 263 respondents, there were 15 respondents who did not give any answer to this question.

**Data Analysis**

The answers were content analyzed (Holsti, 1969) and classified according to the taxonomy of learning types in Table 1. This kind of content analysis is called directed content analysis and usually used when the target of the research is to validate or extend a theoretical framework (Hsieh & Shannon, 2005).

Two researchers were involved in the data coding and categorizing. First, the researchers coded and categorized the sample data separately. The process consists of repeated, careful readings and sorting of the answers into the categories described in Table 1 based on themes of the texts. If an answer could be coded in several categories, all these classes were noted. In some cases an answer could be classified to as many as 5 of the 9 different classes. After completing coding, the researchers then met to compare the coding and classifications. There were 601 agreements and 87 disagreements in coding between the two researchers. The Miles and Huberman’s (2004) inter-coder agreement, calculated as the sum of all the agreements divided by the sum of all agreements and disagreements was 0.87. The disagreements were resolved by discussion. In practice, the disagreements were resolved by consensus. Using an iterative...
process, the researchers read, sorted, reread, and recombined the responses until consensus was achieved. Most of the disagreements were related to the conceptual overlap of the categories.

At the end of the process, we counted the category frequencies that encountered in the data. Despite the fact that Morse (2007) criticized and questioned counting in qualitative research, she encouraged to use it meaningfully if required. Many qualitative researchers also agree that enumeration is an intrinsic part of qualitative research (Miles and Huberman, 2004 and Sandelowski, 2001). Miles and Huberman (2004) described that quantification of qualitative data is useful to confirm ideas and may contribute to more trustworthy analysis. Thus, it is justified to count the frequencies of the emerged categories.

**Results and Discussions**

From the point of view of learning types the participants experienced their perceived learning very differently. Table 3 below summarizes the learning types and the number of answers from the data into each of the classes.

<table>
<thead>
<tr>
<th>Classes of potential learning from business simulation game participation – Learning types</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual information</td>
<td>41</td>
<td>6.0</td>
</tr>
<tr>
<td>Explicit referents for concepts</td>
<td>20</td>
<td>2.9</td>
</tr>
<tr>
<td>Procedural knowledge and gain in explicitness</td>
<td>201</td>
<td>29.2</td>
</tr>
<tr>
<td>General principles of the subject matter simulated</td>
<td>204</td>
<td>29.7</td>
</tr>
<tr>
<td>Understanding the structure of real world in a simplified manner</td>
<td>42</td>
<td>6.1</td>
</tr>
<tr>
<td>Systematic analytical approach and Better decision-making skills</td>
<td>100</td>
<td>14.5</td>
</tr>
<tr>
<td>Wining strategies</td>
<td>21</td>
<td>3.1</td>
</tr>
<tr>
<td>Collaboration and team work</td>
<td>59</td>
<td>8.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>688</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3. The participant answers categorized by the type of the perceived learning (N= 263).**

There were 41 answers referring to learning of factual information (6.0%). Answers referring to factual learning were rare, as the answers almost always referred to something that was more abstract or dynamic in nature. This is not surprising considering that the simulation game was built and the sessions were planned to provide understanding of the nature of a supply chain management process, which, fundamentally, is about the relationships and cause effects of the process. Few sample quotes, which are classified as learning of factual knowledge is shown below:

*Automated [information] systems help a lot [in managing the supply chain process].*

*Properly functioning IT systems really work.*

Answers categorized as explicit referents for concepts class were also rare (N= 20; 2.9%). The low number indicates that the business game in question mostly illustrates relationships of a mechanical process of materials, not relationships between human stakeholders in the simulation. The following sample quotes focus on learning concerning explicit referents for concepts:

*I learnt* SCM principles

*I learnt* Cash flow / Inventory management

The difference between learning types, procedural knowledge and gaining in explicitness was so subtle, that in the analysis we combined these two classes. These two learning types produced 201 answers (29.2% of the answers). The simulation game was meant to provide know-how about business processes. Thus, it is not surprising to have many responses in this class. The big share of answers to this class also indicates that the construction of the business game in question has been successful from the point of
view of the aims of developing it. Some sample quotes categorized as procedural learning and gaining in explicitness are given below:

[I learnt] How each part of the organization had to be performing to satisfy the customer

[I learnt] How lack of inventory can directly effect customer expectations. How the lack of inventory can affect your costs with unproductive hourly employees.

While I understood SCM in general terms before the class this enabled me to better understand how all segments of the business are involved in the process.

See how different purchasing methods (amount, price, delivery and payment terms) affect result – See how selling different products (price low - quantity high; price high - quantity low) affect the company result and see that also selling “cheap” products which have an good CMII is a quiet good decision – see how the result can be affected by selling a product which is new into the market (high CMII).

The biggest class in the answers was general principles of the subject matter simulated with 204 answers (29.7% of the answers). The share of answers to this class is not surprising as the game is built to illustrate certain principles. The SG required participants connect real operational performance with concepts such as lead times, demand/supply variability, supply chain flexibility, raw material requirements and production hierarchies along the supply chain. With a deep exposure of details and hands-on operation of order management cycles, the participants connect practical skills to their theoretical understanding.

Some example quotes are shown below:

[I learnt] Cost effective procurement is very important. You may think that savings with one item doesn’t have a big impact for the result of the group but when there are many small savings the amount to save as a whole is remarkable.

[I learnt] Balancing supply chain, and methods for competitive pricing.

There were 42 (6.1%) answers that can be categorized as understanding the structure of real world in a simplified manner. Some example quotes are as follows:

[I learnt] Supply chain management at [our company].

[I learnt] How SCM fits into [our company] business...

[I learnt] The price effect on market (not really what we want in [our company])

All these answers directly refer to the case company’s real world way of doing things and how a certain topic in the simulation game is related to reality. The SG based training provides an understanding of the detailed data in the end-to-end information flow along the chain. Getting such insight across a supply chain can be achieved in an educational setting by the SG, while being much harder if not impossible in a real business environment. The last quote of the above examples is interesting. The respondent pointed out a contradiction between the simulation game learning and the company policy. We see this also as a positive result, i.e. one should not accept the simulation message without questioning it. These kinds of awakenings are especially valuable if they lead to discussions in the game teams, since through discussion the participants get an opportunity speak aloud and to critically assess their perceptions.

Again, the difference between learning types, systematic analytical approach and better decision-making skills was so subtle, that in the analysis we combined these two classes. There were 100 answers (14.5 % of answers). Some example quotes are given below:

[I learnt] To make analyses constantly to review status in the marketplace, in the company and among suppliers.

[I learnt] Raw material cost/availability and finished product pricing should be monitored constantly in order to capitalize on changes to supply/demand/delivery etc. If you don’t stay on top of those details you lose the opportunity to make more money.

The share of this class answers can be explained by the simulation game’s continuous nature of requiring constant analysis making and decision-making based on the analysis. The decision-making process in the simulation game demands the attention of the participants and their focus on several decision-making
tasks, on several levels (operational and strategic) at the same time (Siewiorek et al., 2012). Also our observations during the sessions clearly are that analytical approaches are constantly in use in the groups (for example, they build their own what-if analysis using spreadsheet applications).

There were only 15 responses (4.9% of the answers) that can be categorized as winning strategies. We think the low number of answers to this class is an indication that the participants did not regard the simulation game mostly as something that is about winning the session and fiercely competing against the other game teams, but more interesting to them was their overall performance and supply chain management success. This should be extremely good message, as if the participants were more concentrated in the winning strategies of the game in question, that would imply that the game is more about entertainment than about serious learning activities. An example quote from the data is shown below:

[I learnt] Decision speed is a key to win

The class added to Greenblat’s (1980) original classification became evident from the data too. Collaboration and teamwork was the fourth biggest learning type with 59 answers (8.6% of the answers). The results support the claims that in SGs the players interact with one another, discuss the logics of the environment, negotiate, change knowledge, and learn from each other. Some sample quotes are as follows:

[I learnt] It is important that team works well

[I learnt how to] Play as a team

As we have mentioned, many of the answers could be classified to several different classes. One of the most diverse examples that was classified as procedural sequences, general principles of the subject matter simulated, gain in explicitness, systematic analytic approach, and better decision making skills classes is shown below.

1. Each aspect of the supply chain must communicate well and work in tandem in order control efficiently, balance capacity and make the best profit - EX: Marketing, Purchasing, Mfg, Production, Shipping, etc. 2. Strategy is key - you must develop, execute, adjust as needed and manage with consistency - to get the desired outcome. 3. Raw material cost/availability and finished product pricing should be monitored constantly in order to capitalize on changes to supply/demand/delivery etc. If you don’t stay on top of those details you lose the opportunity to make more money.

Overall, the findings suggest that the learning that the learners take with them from the game experience is not necessarily the same as the game facilitator might think of offering, but is much more diverse and personal. Also, the results show that most learning is “know-how” in nature.

Implications

In this paper we have discussed the nature of the learning from business games. Our data clearly showed that the learning is not just factual, but possible more of procedural and conceptual kind. The huge diversity also clearly shows that the perceptions of the participants are diverse and unique to the learner. Our assumption is that the reason for this is, at least partly, the differences in the learners’ previous knowledge, experiences on the learning topics.

Simulation gaming is most of all about learning of “knowing how”, not learning of “knowing what” (Polanyi, 1958, Jaeger et al., 2015). If we think that simulation gaming based learning leads to tacit awareness, which relies upon assumptions acquired within a simulation game context, we cannot assume that these assumptions have universal validity (Polanyi, 1958). This is why the rationalist epistemology so poorly suites to simulation game learning assessment. As researcher we should start thinking of simulation based learning as knowledge that is constructed and not being something that is objective and true according to the classical objectivist epistemology. This matter clearly needs more judgment and research in the field.

Another potential matter aggravating game learning assessment is the lack of clarity on how generalizable the results from a specific simulation game are to games in general. As we noted earlier, there is a huge variety of different kinds of games and they differ at least in respect of object content, method of
implementation, user-interfaces, and functional structure. There is clear demand for research, which would discuss the generalizability of learning results from single learning cases/simulations. If, as we suggested earlier, every game forms more or less its unique case of learning potential, simulation gaming research is in front of huge challenges.

The findings of this paper suggest that we need a shift in thinking of the nature of the potential SG learning and that we need to accept that the learning that the learners take with them from the game experience is not necessarily the same as the game facilitator might think of offering, but is much more diverse and personal, making generalization on SG learning very questionable. This has implications also for the use of business games in higher education.

SGs might be a viable tool to train MIS students in order to aid them the “know-how” knowledge, which is necessary for modern organizations. However, SGs can bring the best potential when used as collaboration between departments. The issues that pop up require expertise from many areas and it may be difficult to find a single professional who can solve. We suggest making SG teams comprising participants from different disciplines, so that they could learn from each other. Furthermore, the facilitator(s) must be prepared to take into discussion of ad-hoc topics. This may be a requirement, which does not suite to educators who are accustomed to run lectures according to a standard procedure. The facilitator must also understand that the learning outcome can vary very much – it depends on the participant’s previous education and experiences.

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**Appendix A: The simulation game training questionnaire**

1) My education
2) My current job description
3) How many years of work experience do you have (in total, all employers)?
4) What is your opinion on the following statements (1=disagree, 7=agree):
   - The supply chain module (SCM) module had a clear structure
   - The SCM module created motivation in learning
   - RealGame helped to achieve a holistic view of SCM operations
   - It was interesting to learn through playing
   - Our group’s collaboration was an essential part of learning
   - I believe that the SCM module was useful regarding my real work
   - The module helped me to see the effects of my own work to other parts of [our company] organization
5) What were the three most important things you learned during the session? (Open-ended)