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Research notes

Gender differences in learning preferences among participants of serious business games

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ABSTRACT

We examine gender differences in learning style revealed by attitudinal response to participation in serious business games. Two hundred twenty undergraduate business students played *The Marketing Game!* and completed exit surveys soliciting their attitudes toward the game experience, as well as an inventory revealing learning styles. Results extend empirical support for previously developed female and male learner profiles to learning game participants. Results also indicate games to be a rather different experience across genders, though a positive learning experience for both. Pedagogical implications are discussed.

Gender differences in learning preferences among participants of serious business games

We examine the effect of gender on attitude toward learning from serious business games. Prior research shows serious business games to be valuable as inclusive learning tools, in that they accommodate learners regardless of learning style and are shown to be a positive experience for learners of all types (Frontczak, 1990; Karns, 2003; O'Neil, Wainress, & Baker, 2005). Such inclusiveness is managed because the game experience is flexible, so that students are able to frame the game experience to match their preferred learning styles (Garber, Hyatt, Boya, & Ausherman, 2012). Our interest here is to know whether female and male participants in serious business games exhibit distinct, gender-based learning preferences, and, if so, how women and men frame the game experience to suit themselves.

Drawing on a review by Faria, Hutchinson, Wellington, and Gold (2009), Garber et al. (2012) found that students largely frame the game experience in one or more of four ways to render it compatible with their preferred manner of learning. These four ways are: learning experience, collaborative learning, competition, or analytical exercise. We now extend these findings to examine the role of gender, such that the purpose of this research is provide the answers to two research questions. First, do females and males learn differently when engaged in experiential learning, particularly in the context of serious business simulation games as the primary learning vehicle, and if so, how? (RQ1)? Second, do females and males have different attitudes toward serious business games and the process of playing them (RQ2)?

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Specifically, we review the literature on serious business games, learning styles and the finding of gender-based differences in learning preferences. Then we test for evidence of gender-based learning preferences among participants of serious business games using the Kolb (1984) LSI (RQ 1). Finally we test for gender differences in attitude toward the instructional business game experience (RQ 2). Theoretical implications and pedagogical prescriptives are then laid out.

1. Background

1.1. Serious business games as experiential learning tools

Here is a succinct description of what serious business games do:

> "They allow for dynamic business decision making where players formulate a strategy and then carry out a series of decisions to implement the strategy. Game participants receive feedback that demonstrates the consequences of their decisions, and the participants are able to evaluate their strategies and, if necessary, reformulate their strategies. The experience gained from the repeated iterations of decision periods provides direct feedback to players, from which they are able to learn."

(Faria et al., 2009, p. 480).

The use of serious games in education has been growing (Wilson et al., 2009), becoming commonplace in the classroom (Karns, 2008; Young, Klemz, & Murphy, 2003). Forty-eight percent of faculty from AACSB-accredited North American business schools reported using serious business games (Faria & Wellington, 2004). However, whether students really learn from the game-playing experience is a question that has not been completely answered. The sparse empirical evidence dealing with learning through simulations and games is mixed (Chin, Dukes, & Gamson, 2009; Gosen & Washbush, 2004).

Not many scholars are engaged in assessment research (Gosen and Washbush, 2004), and only a few dozen of the more than 2000 serious simulations in use have ever been assessed (Chin et al., 2009). What research there is concerning the effectiveness of serious games shows conflicting results (Laughlin & Hite, 1993; Vaidyanathan & Rochford, 1998; Wellington & Faria, 1991). Most studies agree that students think serious games are fun and motivating (Fortmüller, 2009; Hromek & Roffey, 2009; Wideman et al., 2007), which can be argued to allow for creative problem solving (Prouty, 2000). And some studies have found that serious games lead to improved learning and class performance (e.g., Blunt, 2007; Borodzicz & van Haperen, 2002; Bredemeier & Greenblat, 1981; Chen & Michael, 2005; Habgood, Ainsworth, & Benford, 2005; Prensky, 2001; as cited in; Wilson et al., 2009).

On the other hand, some studies have found serious games to be superficial activities that might not contribute to student learning (Dickinson, Whitely, & Faria, 1990; Egenfeldt-Nielsen, 2007; O'Neil et al., 2005; Wellington & Faria, 1991), and there are others who remain skeptical of the efficacy of business games (Anderson & Lawton. 2009). Gosen and Washbush (2004) conclude that there are not enough consistent research findings (from methodologically sound studies across multiple games) to conclude that serious games are valid, though they are more positive regarding serious business games.

1.2. Learning styles

In the field of education over the last several decades there has been a major increase in interest in understanding individual student learning styles (Kolb & Kolb, 2009; Lemire, 2000). The goal of such research is to match learning activities with student learning styles to improve learning outcomes (Bacon, 2004, pp. 205–208; Dunn, Dunn and Price, 1996; Frontczak, 1990; Karns, 2006; Kolb, 1984, 1988; Young et al., 2003). Learning activities predicated on accommodating diverse learning styles are typically based on engaging students in their *own* learning, known as experiential learning (Brown, David, & Randles, 2005). The effort to accommodate learners preferring different learning styles is particularly pronounced in applied disciplines including business, where educators seek to link theory and practice in both in- and out-of-class activities using experiential learning tools (Brown et al., 2005).

Research seeking to empirically link learning styles to academic outcomes has produced mixed results. In a review of 81 studies in accounting and business education (along with some medical disciplines and education), Hickox (1991) found that 61.7% support using experiential learning tools to induce learning, 16.1% show mixed support, and 22.1% show no support. Frontczak (1990) and Karns (2003) argue that experiential learning does accommodate learners of all styles, while Vaidyanathan and Rochford, (1998) question this. Since classrooms are typically composed of diverse learners of all styles, including both female and male learners (e.g., see Frontczak & Rivale, 1991; Karns, 2008; Loo, 2002; Young et al., 2003), these equivocal results hamper educators' ability to find a practical means of accommodating diverse learners.

An exception to the inconsistencies mentioned above is research into serious business games as inclusive learning tools. Garber et al. (2012) found results supporting the notion that serious business games accommodate learners regardless of learning styles. Games succeed in doing so because their multifaceted and comprehensive nature (Kolb and Kolb, 2009, p. 298) allows students to frame the game experience to accommodate their learning preferences, permitting them to approach the game from a number of perspectives depending on their preferred learning styles (Bartlett, 1996). For example, students can treat the game as a competition, as a learning experience, as a source of marketing knowledge, and/or as an analytical

exercise, depending upon their own learning preferences, which in turn determines what the game experience is for each student, dictating how learning will transpire from it for each individual.

As with this prior research showing that serious business games can be a valid tool for testing learning outcomes, games are shown too to be a valid tool for revealing and testing learning preferences.

1.3. Gender-based learning preferences

A significant literature underscores the belief that females and males learn differently (Gilligan, 1993; Wehrwein, Lujan, & DiCarlo, 2006), and that the optimal classroom must accommodate such differences. However, though these studies discuss a link between the way that students learn, the way that students choose to learn, gender, and success, there is little empirical research to confirm these linkages (Loo, 2002; Severiens & ten Dam, 1994). A reason for this may be that empirical research seeking to draw characteristic gender-based learner profiles shows mixed and at times contradictory results, hampering the ability of instructors to know how to design accessible classrooms.

A particular source of differences in the gender learning profiles that prior empirical research have drawn, and the one that is of prime concern here, is that a number of disparate learning style inventories have been applied (McCabe, 2014). These can differ widely in terms of the learning theories upon which they are based and the learning dimensions into which they are decomposed. As a result, the learning profiles that are drawn from them can be hard to reconcile across learning style instruments.

However, our review of the literature does reveal a pocket of reliability, namely those studies based on Kolb's Experiential Learning Theory (ELT) (Kolb, 1984) and measured with his Learning Styles Inventory (LSI) (Kolb, 1984, 1976). These studies draw uniform learning profiles for females and males across a number of gender-based learning studies that utilize LSI, showing that it is sensitive to gender (Brew, 2001). Given this uniformity of prior results (Severiens and ten Dam, 1994) with respect to measuring gender-based learner profiles, and more generally, that its internal validity and consistency have been demonstrated (Kayes, Kayes, & Kolb, 2005), along with the fact that Kolb's LSI is commonly used and widely accepted (McCabe, 2014; Ramayah, Sivananbdan, Nasrijal, Lechumanam, & Leong, 2009), we select it to extend gender-based learning styles research to the participants of serious business games. Though the gender-based learner profiles drawn with Kolb's LSI (1984, 1976) are uniform, the studies from which they are taken are nonetheless relatively few in number, and fewer still test business students. It is therefore a contribution of this research to add to and extend the empirical literature seeking to reveal gender-based learner profiles to the participants of serious business games, utilizing the Kolb LSI (1984, 1976).

1.4. Kolb's Experiential Learning Theory

The theory upon which Kolb's LSI is based is Kolb's Experiential Learning Theory (ELT) (Kolb, 1984). ELT is an adult form of learning predicated on the notion that learning comes from experience (McCabe, 2014). According to it, knowledge comes from the transformation of experience, which has two parts, referred to by Kolb (1976) as grasping and transforming. There are two opposing modes of grasping experience, Concrete Experience (CE) and Abstract Conceptualization (AC), and two opposing modes of transforming experience, Reflective Observation (RO) and Active Experimentation (AE).

Kolb's (1984) ELT conceives of learning, then, as a cyclical process, shown in Fig. 1, in which learning arises from the sequential execution of four separate stages, in no particular order, which are the above four learning modes, CE, RO, AC, and AE.

These four modes have been portrayed by some (e.g., Garland & Martin, 2005; Orthun, 2007) as distinct activities that follow each other in a sequence that executes the learning process: feeling (Concrete Experience, CE), watching (Reflective Observation, RO), thinking (Abstract Conceptualization, AC), and feeling (Active Experimentation, AE). This sequence comprises a cycle or spiral that is continuously recurring as the next experience is encountered, and is directed by individual needs and goals (Joy & Kolb, 2009). In other words, we select what it is we choose to learn.

The four learning modes (CE, RO, AC, AE) are shown as the end points of the primary axes that span this two-dimensional learning space. The horizontal axis is a continuum whose endpoints are Active Experimentation (AE) and Reflective Observation (RO), those two opposing learning modes that comprise the transformation of knowledge experience. The vertical, axis is a continuum whose endpoints are Abstract Conceptualization (AC) and Concrete Experience (CE), those two opposing learning modes that comprise the grasping of knowledge experience.

Learning styles arise from the notion that individuals prefer to learn in different ways. These individual preferences may then be defined in terms of ELT as a preference for one or more of the four learning modes over others, so that, for example, the individual learner may be portrayed as a point within the learning space of Fig. 1, revealing their preferred modes of learning (Garber et al., 2012). For example, those learners who favor Concrete Experience (CE) and Reflective Observation (RO) would be represented as points somewhere in the upper right-hand quadrant, those who favor Abstract Conceptualization (AC) and Active Experimentation (AE) would be positioned as points somewhere in the lower left-hand quadrant, and so on. Those who favor a single learning mode would be positioned along the axis with which that learning mode is associated.

Just as individual learners may prefer one learning mode over another, they may also favor one form of grasping knowledge over the other, whether that be Abstract Conceptualization (AC, interpreting) or Concrete Experience (CE, sensing), and/or they may also favor one form of transforming knowledge over the other, whether that be Active

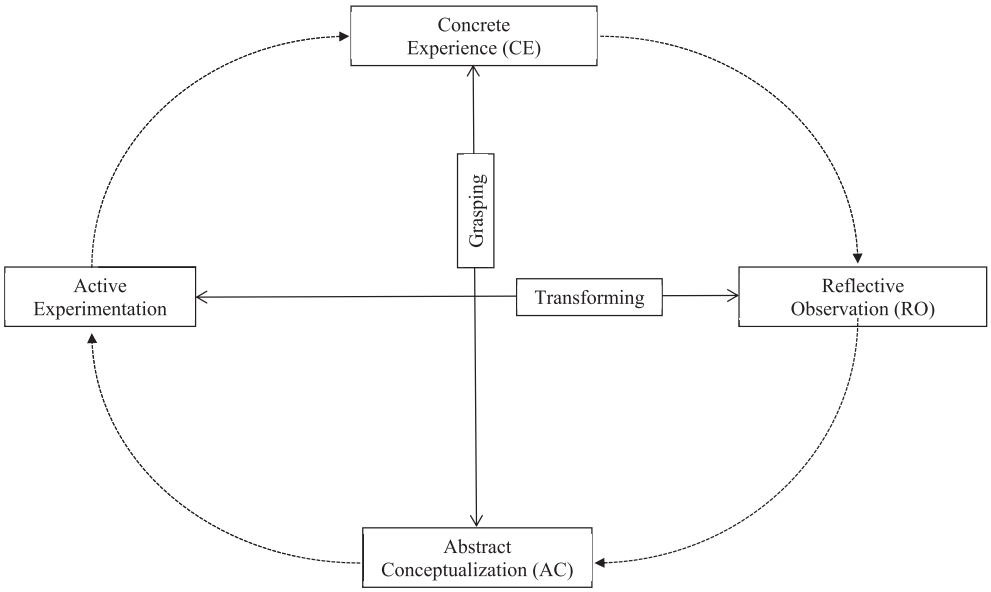

Fig. 1. Kolb's (1984) experiential learning cycle.

Experimentation (AE, doing) or Reflective Observation (RO, considering). These preferences too may be represented and interpreted by the positions of individual learners within this learning space.

2. Conceptual development

We are first interested in finding out whether serious business game participants evidence distinct gender-based learning styles and, if so, what they are and how they compare to generally accepted gender-based learning styles.

2.1. Research question 1: gender-based learning style preferences from Kolb's LSI

Looking first at Kolb's grasping dimension, prior research indicates that male learners prefer Abstract Conceptualization (AC) (Kolb, 1984, 1976). This has been shown for distance learners (Garland & Martin, 2005), for undergraduate arts and science students at an Australian university (Wilcoxson & Prosser, 1996) and for freshman undergraduates at a private university in the northeastern US (McCabe, 2014). Female learners prefer Concrete Experimentation (CE) (Kolb, 1984). This has been shown for undergraduate arts and science students at an Australian university (Wilcoxson & Prosser, 1996) and for first year undergraduates in a general psychology course at Stockholm University (Heffler, 2010).

Further research shows that male learners prefer Abstract Conceptualization (AC) over Concrete Experimentation (CE), whereas female learners prefer Concrete Experimentation (CE) over Abstract Conceptualization. This has been shown for non-students from 7 countries who ranged in age and educational level (Joy & Kolb, 2009), for undergraduate arts and science students at an Australian university (Wilcoxson & Prosser, 1996), for students enrolled at Penn State Berks (Kulturel-Konak, D'Allegro, & Dickinson, 2011), for 5th semester mathematics students at Anadolu University, Turkey (Orthun, 2007), for first year undergraduates in a general psychology course at Stockholm University (Heffler, 2010) and for freshman undergraduates at a private university in the Northeastern US (McCabe, 2014).

Extending this research to undergraduate participants in serious business games, we predict that female and male participants will exhibit the following distinctive patterns of learning style preferences on Kolb's (1976) grasping dimension as follows:

H1a. Concrete Experience (CE) is favored by female participants in serious business games, more so than by male participants.

H1b. Abstract Conceptualization (AC) is favored by male participants in serious business games, more so than by female participants.

H1c. Male participants in serious business games prefer Abstract Conceptualization (AC) over Concrete Experience (CE).

H1d. Female participants in serious business games prefer Concrete Experience (CE) over Abstract Conceptualization (AC).

Prior research has also shown that there are no concomitant differences for the other two of Kolb's (1976) learning modes, Active Experimentation (AE) and Reflective Observation (RO) or their combination (AE-RO), as has been shown among first

year undergraduates in a general psychology course at Stockholm University (Heffler, 2010), among non-students from 7 countries who ranged in age and educational level (Joy & Kolb, 2009), among 5th semester mathematics students at Anadolu University in Turkey (Orthun, 2007), among freshman undergraduates at a private university in the Northeastern US (McCabe, 2014) and among people learning to use computers (Vernon-Gerstenfeld, 1989). Echoing all of the above, Brew (2001) finds that female and male responses are "distinctly different" for AC and CE, though she does not specify direction, and not "distinctly different" for AE and RO or their combination.

Thus, we predict that female and male participants in serious business games will exhibit no distinct learning preferences on Kolb's (1984) transforming dimension.

H2. Neither female nor male participants of serious business games have a differential preference for Active Experimentation (AE) over Reflective Observation (RO), nor a distinctive preference for their combination.

2.2. Research question 2: gender-based differences in attitude toward serious business games and learner profiles

Gilligan further (1982, 1993, p. 14) states that: "From her studies of females, Horner identified as a third category [of achievement motivation], the unlikely motivation to avoid success ('fear success'). Females appeared to have a problem with competitive achievement." So finally, we predict from this finding and the above arguments that when comparing female and male learners:

H3a. Female learners respond more positively to serious business games as learning experience and collaborative learning.

H3b. Male learners respond more positively to serious business games as analytical exercise and competition.

3. Method

In this research we add to and extend the sparse literature on serious business games by testing *The Marketing Game!* (TMG) (Mason & Perreault, 2002), one among several serious business games that have rarely if ever been tested. (Though *The Marketing Game!* has recently been discontinued by Irwin Prentice Hall, it is a valid vehicle for this research because it works in essentially the same way as most other serious business games.) TMG is also selected because it is used by the authors for undergraduate marketing classes within AACSB-accredited programs.

TMG functions similarly to and is representative of most serious business games, in particular Markstrat, after which it appears to have been patterned. The simple, elegant design of TMG makes it particularly suitable for undergraduate students. It simulates a software industry consisting of four firms, with a different student team serving as each firm's marketing department. The market consists of six consumer segments served by two channels of distribution. Student teams must allocate a budget to various activities including advertising, sales, product design and development, and marketing research. Firms also make decisions regarding the sales force (size, commission rate, proportion of non-selling time, and allocation to channels), the intensity of distribution, type of advertising, price, and production level. Teams are given the objective of maximizing contribution margin.

During the semesters from which data for this research were drawn, meetings with individual firms were held half-way through the term to review progress and allow for questions. Student assessment was in two parts. The first was with regard to the quality of their involvement in the mid-term firm meeting and the firm presentation. This assessment was done by the course instructor and each member was evaluated at each point. The second part was based on each firm's evaluation of the other members. More often than not, firm members would give each other very similar "grades," but they were often willing to partially downgrade the slacker(s). This was mediated (generally not positively) by the instructor's observation.

Undergraduate business students in eight sections of Principles of Marketing ($n = 220$) at a public university in the Southeastern US participated in TMG as an in- and out-of-class exercise. All eight sections were taught by the same instructor who administered the game in the same manner across all the sections. Firms generally consisted of 4–5 members who were self-selected. A number of interactive exercises in the first and second class meetings allowed students to meet and get to know each other before groups were formed.

In order to test our first hypothesis and answer our first research question, we had students complete Kolb's LSI (Kolb, 1976) as an exit task, which consists of nine sets of four descriptors. Students rank order the four descriptors within a set according to how well each descriptor describes themselves as learners. These rankings are then combined to calculate a score for each of the four learning modes. The set of four scores comprises a learning profile that may be interpreted as that student's distinct learning style.

3.1. The survey

Though students find simulations to be fun and motivating, critics argue that these qualities do not in themselves constitute learning (Chin et al., 2009). However, it may be further argued that these qualities are in the least an inducement to learning, and are necessary preconditions for higher-order learning (Bloom, Englehart, First, Hill, & Krathwohl, 1956) and self-learning, as well as goals of experiential learning, and may therefore serve as reasonable proxies for learning in the eyes of

some (e.g., McHaney, White, & Heilman, 2002; Thompson & Dass, 2000; Zalatan & Mayer, 1999; Herz & Merz, 1998; Comer & Nichols, 1996; Leonard & Leonard, 1995; White & Von Riesen, 1992; Boyatzis & Kolb, 1991; Washbush & Gosenpud, 1991; Hergert & Hergert, 1990). In that vein, a number of studies have used perceptions of or attitudes toward learning to assess simulation effectiveness.

In order to answer our second research question, we measure TMG participants' attitudes toward learning. We solicit attitude toward learning using a series of statements about the game experience that attempt to measure the four learning goals that serious business games are intended to achieve according to prior research (e.g., see Faria et al., 2009; Fortmüller, 2009). The 46 attitudinal statements included in the survey were taken from Garber et al. (2012), and are designed to solicit student attitudes toward the game on all four learning objectives. Those four primary learning objectives are: the learning experience and learning outcomes from applying marketing principles in context [referred to henceforth as Learning Experience]; the strategy aspects of business games [Analysis and Problem Solving]; the decision-making experience gained through business games [Competition]; and the teamwork experience provided through business games [Collaborative Learning]. (See the Appendix for a list of the items included under each learning dimension.)

Specifically, participants completed a pencil-and-paper exit survey. The 46 statements were rated using a seven-point valence scale, where students report their level of agreement or disagreement with each of the statements according to how well each statement describes their game experience in some particular way. A second part of the survey solicited personal information including gender, class year, major and GPA.

4. Results

4.1. Respondent profile

Of the 220 traditional undergraduate business students who participated in TMG and completed the exit surveys, 73 (33.2%) were female and 147 (66.8%) were male; 101 (46.5%) were seniors and 116 (46.5%) were juniors; 103 (46.6%) had undeclared majors or were from outside the business school, 50 (22.5%) were management majors, 32 (4.5%) were production and CIS majors, 27 (12.2%) were marketing majors, 19 (8.6%) were finance majors, 14 (6.3%) were accounting majors, and 9 (4.1%) were economics majors; and 32 (14.5%) reported a GPA between 3.50 and 4.00 on a 4-point scale, 92 (41.4%) reported a GPA between 3.00 and 3.49, 78 (35.3%) reported a GPA between 2.50 and 2.99, 17 (7.7%) reported a GPA between 2.00 and 2.49, and none reported a GPA lower than 2.0.

In the following two sections, we catalog results offering expected support for each of the hypotheses listed in Table 1.

4.2. Results for research question 1: differences in gender-based learning preferences using Kolb's LSI

Three discriminant analyses were run using SAS PROC CANDISC (SAS 2015), predicting the gender of serious business game participants based on their learning scores on Kolb's (1976) LSI. Results are shown in Tables 2, 3 and 4, and graphically in Figs. 2, 3 and 4.

4.2.1. Evidence for differences in how females versus males prefer to grasp experience to create knowledge

These results provide evidence for differences in how females *vs.* males prefer to grasp experience to create knowledge. Inspection of the discriminant plot in Fig. 2 shows the relative positions of the gender classes and the learning modes as points along the discriminant function. The coordinates from which the plot in Fig. 2 is generated are provided in Table 2. Boxes around a learning mode indicate that univariate response means between females and males are significantly different, offering support for the expectation that females and males have different preferences for those learning modes. Those differences shown in Fig. 2 and Table 2 are significant, offering support (H1a) for our expectation that female serious business game participants prefer Concrete Evidence (CE) more so than male participants. Male participants rate Abstract Conceptualization (AC) significantly more highly than female participants, offering support for the expectation that male participants prefer Abstract conceptualization (AC) more so than female participants (H1b). Further, males rate the combination score AC-

Table 1
Summary list of hypotheses. Findings offer support for all hypotheses.

Hypotheses Concerning Research Question 1: Gender-Based Learning Styles Expressed in Terms of Kolb's (1984) Experiential Learning Theory (ELT)	
H1a	Concrete Experience (CE) is favored by female participants in serious business games, more so than by male participants.
H1b	Abstract Conceptualization (AC) is favored by male participants in serious business games, more so than by female participants.
H1c	Male participants in serious business games prefer Abstract Conceptualization (AC) over Concrete Experience (CE).
H1d	Female participants in serious business games prefer Concrete Experience (CE) over Abstract Conceptualization (AC).
H2	Neither female nor male participants of serious business games have a differential preference for Active Experimentation (AE) over Reflective Observation (RO), nor a distinctive preference for their combination.
Hypotheses Concerning Research Question 2: Gender-Based Learner Profiles	
H3a	Female learners respond more positively to serious business games as learning experience and collaborative learning.
H3b	Male learners respond more positively to serious business games as analytical exercise and competition.

Table 2
Results of discriminant analyses revealing. Gender based learner preferences. According to Kolbian learning modes.

Gender	Class Means	AC-CE[a]	
		T- Value	P
Female	−17	2.00	0.0227
Male	36	−3.91	<0.0001
Kolb (1984) **Learning Modes**	**Canonical Coefficients**	**P > F**	**Signif.**
Concrete Experience (CE)	59	(0.0049)	***
Reflective Observation (RO)	33	(0.2639)	
Abstract Conceptualization (AC)	63	(0.0121)	**
Active Experimentation (AE)	16	(0.6032)	

Notes.
Class means and canonical coefficients are multiplied by one hundred for ease of presentation.
****p < 0.001.
***p < 0.01.
**p < 0.05.
*p < 0.10.
A graphical representation of the data in the above table is also to be found in Fig. 1, for ease of interpretation.
[a] Reports results for t-tests for two population means with variances unknown and unequal, from Kanji (1993, p. 29), as tests of H_{1c} and H_{1d}.

CE than females offering support for the expectation that men prefer AC over CE (H1c), and females rating CE more significantly more highly then AC, offering support for the expectation that females favor CE over AC (H1d).

The discriminant plot shown in Fig. 2 also shows that female and male serious business game participants do not differ in their preferences for Active Experimentation (AE) and Reflective Observation (RO), nor do they differ in their preference for their combination (AE-RO), indicating that female and male serious business game participants share their preferences for how they transform experience in order to create knowledge. In summary, these results indicate that female and male participants differ in terms of how they prefer to grasp experience in order to create knowledge, but not in terms of how they prefer to transform knowledge, and these results confirm the gender-based learning preferences of prior empirical studies utilizing Kolb's (1984, 1976) LSI.

To further explore the learning preferences of female and male learners, beyond those that were hypothesized, we looked inside CE and AE to see what within them differentiates female and male learners as graspers of experience. The discriminant plots shown in Fig. 3 and Table 3 predict the gender of serious business game participants based on the traits that comprise CE, one of the "grasping" learning modes that discriminate between female and male game participants. Specifically, in Fig. 3 we find that, of those traits that fully define Concrete Evidence (CE), those which significantly differentiate female and male learners are "Present-Oriented," "Accepting," "Feeling," and "Receptive." Of these, "Present Oriented" is favored by males more so than females, indicating that males as concrete experiencers view themselves more as being mindfully aware of what is going on in the here and now. In contrast, those other differentiating traits, "Accepting," "Feeling," and "Receptive," are favored by females, indicating that females as concrete experiencers view themselves more as sympathetic receivers of experience.

In Fig. 4, we see which of those traits defining Abstract Conceptualization (AC) differentiate female and male learners. We find that males score significantly more highly on "Logical" and "Analytical," offering support for our expectation (H1b, H2b) that male learners, relative to female learners, see themselves more as logical and analytical in their approach to grasping experience.

Though prior research has empirically demonstrated differences between females and males on ELT'S grasping dimension, no one has, as yet, to our knowledge, deconstructed the grasping dimension to identify the source of these differences at the level of individual items comprising the grasping dimension in Kolb's LSI (1976). Such an identification may open the door to even more insights into the preferred learning styles of females and males, and other means to accommodate learners by gender in the classroom.

4.2.2. Evidence for how female and male learners share preferences for transforming experience to create knowledge

The discriminant plot shown in Fig. 2 also shows that female and male marketing game participants do not differ statistically significantly in their preferences for Active Experimentation (AE) and Reflective Observation (RO), nor do they differ in their preference for their combination (AE-RO), in support of H2, indicating, that female and male marketing game participants do not differ in their preferences for how they transform experience in order to create knowledge.

However, this hypothesis differs from the others in this paper because it is an hypothesis of "no difference," meaning that we are expecting and therefore predicting no difference in mean response between females and males on the transforming dimension. For such hypotheses, it is considered insufficient to declare two populations to be equivalent merely on the basis of no statistical difference, because such a finding may be due to small sample size and insufficient statistical power (Barker, Rolka, Rolka, & Brown, 2001). Therefore, we applied the standard test for equivalence between two populations, Schuirman's (1987) two one-sided t tests (TOST) using the TOST statement in SAS PROC TTEST (2015). A part of this method is to a priori

Table 3
Results of discriminant analyses revealing. Gender based learner preferences according to those items comprising the concrete experience (ce) learning mode.

Gender	Class Means		
Female	−41		
Male	21		
Descriptors Comprising Concrete Experience (CE)	**Canonical Coefficients**	**P > F**	**Signif.**
Present-Oriented	40	(0.0776)	*
Intuitive	07	(0.4215)	
Experience	-0.19	(0.3258)	
Accepting	-0.36	(0.0098)	***
Feeling	-0.40	(0.0078)	***
Receptive	-0.42	(0.0184)	**

Notes.
Class means and canonical coefficients are multiplied by one hundred for ease of presentation.
A graphical representation of the data in the above table is also to be found in Fig. 3, for ease of interpretation.
****p < 0.001.
***p < 0.01.
**p < 0.05.
*p < 0.10.

Table 4
Results of discriminant analyses revealing gender based learner preferences according to those items comprising the abstract conceptualization (ac) learning mode.

Gender	Class Means		
Female	−51		
Male	26		
Descriptors Comprising Abstract Conceptualization (AC)	**Canonical Coefficients**	**P > F**	**Signif.**
Analytical	63	(0.0003)	***
Thinking	−08	(0.1633)	
Evaluation	−25	(0.7515)	
Logical	69	(<0.0001)	****
Conceptual	−01	(0.3552)	
Rational	01	(0.1290)	

Class means and canonical coefficients are multiplied by one hundred for ease of presentation.
A graphical representation of the data in the above table is also to be found in Fig. 3, for ease of interpretation.
****p < 0.001.
***p < 0.01.
**p < 0.05.
*p < 0.10.

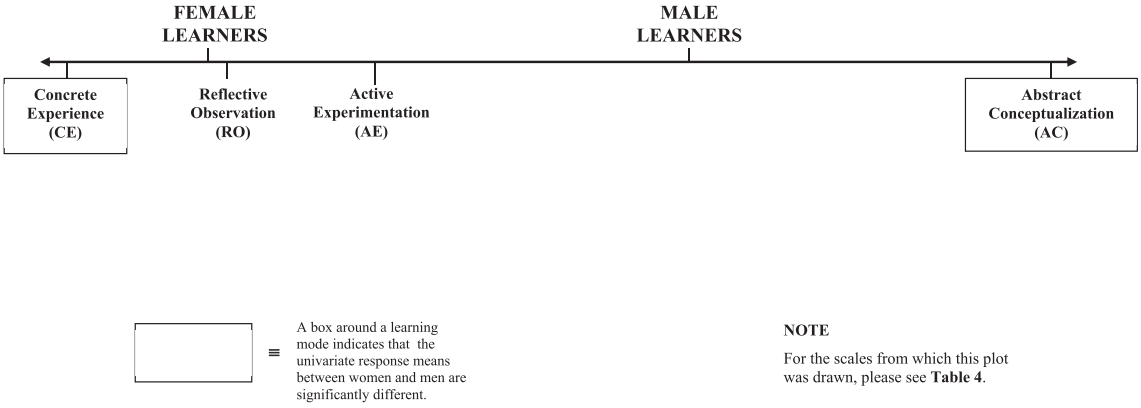

Fig. 2. Discriminant plot showing relative positions of gender classes and learning modes as points. along the discriminant function.

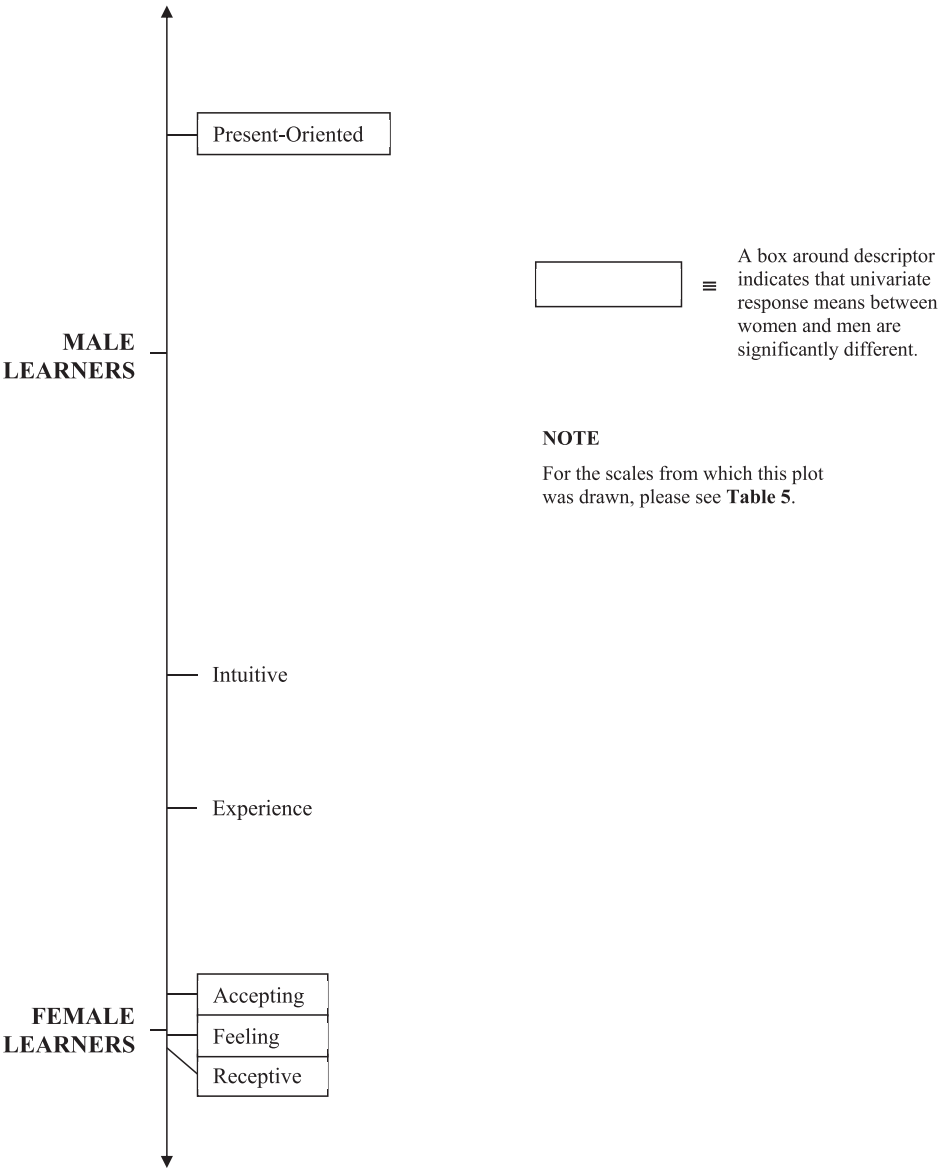

Fig. 3. Discriminant plot showing relative positions of gender classes and the descriptors comprising the concrete evidence (ce) learning mode as points along the discriminant function.

choose a criterion for determining equivalence according to the practical circumstances for which it is applied, and what minimum level of difference is meaningful in that regard (Castellos & Tobias, 2006). Our criterion for equivalence is that the difference in female and male mean responses for the combination score AE-RO be no greater than two levels out of a full range of 36 levels from Kolb's (1976) Learning Styles Inventory (LSI), 5% of the total range. Findings from the TOST are significant ($p = 0.0328$), offering support for our expectation (H2) that female and male learners share preferences for transforming experience to create knowledge. In contrast, by that same two level, 5% criterion, the TOST for the grasping dimension is not significant ($p = 0.8925$).

4.3. Results for research question 2: gender differences in attitude toward playing serious business games

4.3.1. Univariate results for gender

Table 5 compares the respective mean responses of female and male learners to each of the 46 attitudinal statements soliciting their views about the serious business game experience. The statements are rank-ordered in descending order by t-

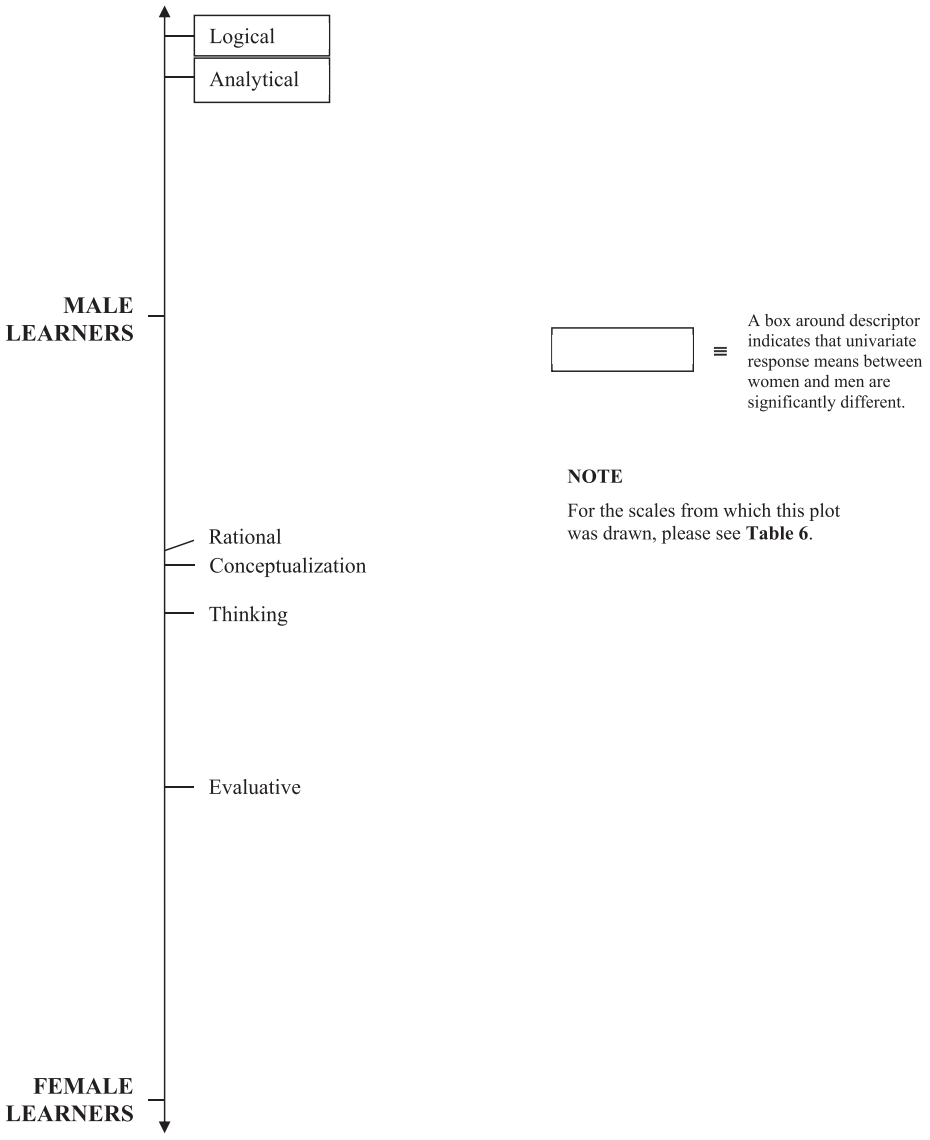

Fig. 4. Discriminant plot showing relative positions of gender classes and the descriptors comprising the abstract conceptualization (ac) learning mode as points along the discriminant function.

values indicating the significance of the differences between mean female and male responses given. The boxed ones at the top of the list are statements where the means of the female learners are significantly greater than those of the male learners. The boxed ones at the bottom of the list are statements where the means of the male learners are significantly greater than those of the female learners. Looking at this table for evidence of the learning profiles exhibited by females and males participating in serious games, we confine ourselves to those statements for which the response means between females and males are significantly different at the $p = 0.05$ level: at the top and the bottom of the list in Table 5 denoted by boxes.

4.3.1.1. Evidence for female participant learning preferences. Inspection of those statements in Table 5 for which mean female responses indicate a higher level of agreement than male responses, shows that female learners find the game to be challenging, examine problems in greater detail, and find the game to be a valuable learning experience. It also shows that female learners are less confident, made uncomfortable by the uncertainty of the game, and are less competitive than males. Additionally, females scored significantly higher on social learning and team learning, offering support for the expectation that females felt more strongly that they benefited from the social learning opportunities that playing the game in teams provided.

Table 5
The mean responses of female and male serious business game participants to those attitudinal statements for which their differences are significant at a level of p = 0.10 or lower.

	Mean Ratings[a]			t-test (two-tailed)	
Attitudinal Statements	Female	Male	Difference	t	p
I thought the game was really not easy.	0.76	0.08	0.69	3.26	0.0006
I think we worked very hard on the game.	1.70	1.11	0.60	2.79	0.0026
I don't think that those who won the game learned a great deal more than those who lost.	1.61	1.16	0.46	2.09	0.0183
I don't think I could have done a lot better in the game if I had done it on my own.	1.08	0.57	0.52	2.06	0.0197
In our strategy, we took careful account of competitor activity.	1.97	1.67	0.31	1.85	0.0322
I felt really comfortable in my group.	2.45	2.20	0.25	1.59	0.0559
The game gave me a great sense of how channels of distribution actually work.	0.71	0.35	0.35	1.58	0.0571
I feel that I am now much better able to cope with ambiguity and uncertainty in business, having played the game.	0.49	0.15	0.34	1.52	0.0643
I thing that differentiating your product is important to doing well in the game.	1.38	1.06	0.31	1.50	0.0668
I did not feel completely ignored by other group members.	2.56	2.34	0.21	1.40	0.0808
My group was not much too large to be really effective.	2.37	2.16	0.21	1.40	0.0808
I feel as if I really understood how the game worked.	0.69	1.06	-0.37	-1.44	-0.0749
My group had very strong leadership.	1.18	1.47	-0.28	-1.50	-0.0668
I had a lot of fun playing the game.	0.31	0.74	-0.43	-1.62	-0.0526
I do not think that the game was too challenging and difficult to be useful.	1.29	1.62	-0.33	-1.66	-0.0485
The uncertainty of the game did not make me feel uncomfortable.	-0.21	0.36	-0.57	-2.23	-0.0129
I am an extremely competitive person.	1.18	1.69	-0.51	-2.46	0.0070
I always had great confidence in my ability to do well in the game.	0.49	1.25	-0.77	-3.58	-0.0002

4.3.1.2. Evidence for male participant learning preferences. Inspection of those statements at the bottom of Table 5, for which male learners indicate a significantly greater agreement than female learners, offers support for H3b, the expectation that male learners are more confident and tend to view the game as competition more so than as a learning exercise.

Further inspection of those statements at the bottom of Table 5, for which male learners indicate a significantly greater agreement, offers support for the expectation that male leaners are very confident in their abilities and prefer doing the simulation on their own. As the expectations that males are highly competitive, that they place great emphasis on winning, (which leads them to be somewhat more clearly focused on the key performance outcome of net contribution), and that they find the game to be more fun and place a little more emphasis on the importance of fun in an educational experience are confirmed, we find support for H3b.

In summary, the results for gender indicate a bit of a means-ends distinction. That is, male business game participants, highly confident and more willing to go it alone, are focused on the ultimate outcomes: winning and having a good time. They appear less concerned with having a structure for how to win. Female business game participants are more detail-oriented, thoughtful, focused on how things work, and less concerned about finishing first. However, females do appear to be better focused on the learning outcomes to be gained from the simulation.

4.3.2. Multivariate results by gender

Three discriminant analyses were run using SAS PROC CANDISC (SAS 2015), predicting the gender of serious business game participants based on their responses to the 46 attitudinal statements soliciting their views about the serious business game experience. Results are shown graphically in the plots of Figs. 5, 6 and 7. The gender means and canonical coefficients for the attitudinal factors from which the plots were generated are shown in Tables 6, 7 and 8.

4.3.2.1. Evidence for gender differences in attitude toward the serious business game experience. Inspection of the discriminant plot in Fig. 5 shows the relative positions of the two genders and attitudinal statements along the discriminant function. Further

inspection of those statements at the top of Table 5 for which female learners indicate a significantly greater agreement indicate that those significant differences offer support for our expectation that female game participants tend more so than males to view the serious business game principally as Collaborative Learning (H3a). Those statements at the bottom of Table 5 for whom male response is significantly greater offer support for our expectation that males tend to view the serious business game more so than females as a Competition (H3b).

To further explore the learning preferences of female and male learners, we looked inside the dimensions of Collaborative Learning and Competition to see which individual attitudinal statements most differentiated female and male game participants as Collaborative Learners and as Competitors. Figs. 6 and 7 and Tables 7 and 8 predict the gender of serious business game participants based on those respective attitudinal statements that comprise Collaborative Learning and Competition.

4.3.2.2. Evidence for differences between female and male serious business game participants as collaborative learners. In Fig. 6, we find that two of the 11 attitudinal statements that belong to Collaborative Learning significantly distinguish between female and male game participants, offering support for our expectation that female more so than male game participants tend not to believe that they could have "… done a lot better in the game if they had done it on their own," indicating their greater preference for collaborative learning (H3a). Significant differences indicated in Fig. 6 also offer support for our expectation that females think more so than males that they "… worked very hard on the game," suggesting a greater preference for elaborative processing, introspection and self-criticism.

4.3.2.3. Evidence for differences between female and male serious business game participants as competitors. In Fig. 7, among those seven attitudinal statements that comprise Competition, we find two that significantly differentiate female and male game participants. Additionally, these differences also offer support for our expectation that male participants, more so than female participants, see themselves as "… very competitive persons, suggesting that they like to frame the game as a competition (H3b).

4.4. Summary

Our results confirm gender-based learner profiles found in prior research utilizing Kolb's (1984, 1976) LSI, and extend these findings to serious business games. In answer to Research Question 1, females and males do exhibit different learning preferences. Female participants show themselves to be Concrete Experiencers (CE), viewing themselves as learners who are accepting, feeling, and receptive graspers of experience. Male participants are Abstract Conceptualizers (AC), viewing themselves as learners who are logical, analytical and present-oriented graspers of experience. Female and male serious game participants also differ in terms of the means by which they prefer to grasp experience to create knowledge, represented by the combination score AC-CE. We found no gender differences on the transforming experience dimension of Kolb's (1984) ELT – female and male learners are similar in their preferences for Active Experimentation (AE) and Reflective Observations (RO), and their combination (AE-RO). Further, female participants are more accepting, feeling and receptive than their male counterparts, who are in turn more present-oriented. Additionally, male participants favor a more logical and analytical approach.

In answer to Research Question 2, female and male participants differ in their attitude toward the serious business game experience itself, in a manner that rather conforms to a priori generally accepted gender-based learner profiles, extending these prior findings to the serious business game context. Female game participants are collaborative learners, feel

Table 6
Results of discriminant analyses revealing gender based learner preferences according to learning game attitudinal factors.

Gender	Class Means		
Female	−37		
Male	19		
Learning Game Attitudinal Factors	**Canonical Coefficients**	**P > F**	**Signif.**
Games as Active Learning	−37	(0.9090)	
Games as Collaborative Learning	−98	(0.0901)	*
Games as Competition	121	(0.0135)	**
Games as Analytical Exercise	04	(0.7714)	

Notes.
Class means and canonical coefficients are multiplied by one hundred for ease of presentation.
A graphical representation of the data in the above table is also to be found in Fig. 4, for ease of interpretation.
****$p < 0.001$.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.10$.

Table 7
Results of discriminant analyses revealing gender. Based learner preferences according to those attitudinal statements comprising factor 2: serious games as collaborative learning.

Gender	Class Means		
Female	−37		
Male	19		
Attitudinal Statements for Collaborative Learning	**Canonical Coefficients**	**P > F**	**Signif.**
I did not feel completely ignored by other group members.	0.6	(0.1626)	
My group was really great at getting down to business.	5	(0.5513)	
I felt really comfortable in my group.	−51	(0.1043)	
Everyone in my group got along really well.	12	(0.2056)	
I think that everyone had a chance to have their say and contribute to my firm's decisions.	8	(0.3401)	
It wasn't very hard for my group to get down to business whenever we met.	25	(0.8270)	
I don't think I could have done a lot better in the game if I had done it on my own.	−21	(0.0542)	*
I think we worked very hard on the game.	−40	(0.0135)	**
My group did not vehemently disagree a great deal on what our strategy should be, and we had great difficulty in coming to consensus.	40	(0.6678)	
My group was not much too large to be really effective	−24	(0.1586)	
My group wasn't too small to be really effective.	45	(0.5468)	

Notes.
Class means and canonical coefficients are multiplied by one hundred for ease of presentation.
A graphical representation of the data in the above table is also to be found in Fig. 5, for ease of interpretation.
****$p < 0.001$.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.10$.

comfortable in groups, work very hard and do not feel they can do better working on their own. Male participants are competitors who find the game easy.

4.5. Pattern model

Our research tests learning traits favored by each gender. Beyond confirming these preferences on a per-trait basis, the entire pattern of preferences shown here reveals and empirically confirms entire gender profiles, perhaps the first time that a complete pattern of gender learning preferences is provided in a single study. Support for such a claim comes from the pattern model. As reported in Hunt (1983, p. 99), Kaplan (2009, p. 332-35) defines and discusses the pattern model:

> Very roughly, [in the pattern model] we know the reason for something when we can fit it into a known pattern … something is explained when it is so related to a set of other elements that together they constitute a unified system. We understand something by identifying it as a specific part in an organized whole … in the pattern model we explain by instituting or discovering relations … These relations may be of various different sorts: causal, purposive, mathematical, and perhaps basic types, as well as various combinations and derivatives of these. The particular relations that hold constitute a pattern, and an element is explained by being shown to occupy the place it does occupy in the pattern …
>
> The perception that everything is just where it should be to complete the pattern is what gives us the intellectual satisfaction, the sense of closure, all the more satisfying because it was preceded by the tensions of ambiguity.

By inspecting our results across hypotheses, a pattern is revealed that completes learner profiles for both females and males, the unified patterns that we claim are in line with patterns seen in prior literature but offered only in a piecemeal manner. These results would unify and provide a single source for those patterns, lending some additional measure of convergent validity (Campbell & Fiske, 1959).

4.6. Pedagogical implications

This research confirms that serious business games are inclusive of learners of all styles, including those defined by gender preferences, with females and males both finding the game to be a positive learning experience. This research further confirms and extends to serious business games that females and males prefer to learn differently, and details the nature of those distinct preferences, lending insight into how best to accommodate female and male learners as participants of serious games. For example, male learners consider themselves to be analytical and prefer to treat the game as a competition, but are not so detail oriented. Therefore, the teacher, in providing feedback to male students, can tell them they need to learn the inner workings of the game (and thereby the core principles that the game is designed to teach) in order to win.

Table 8
Results of discriminant analyses revealing gender based learner preferences according to those attitudinal statements comprising factor 3: serious games as competition.

Gender	Class Means		
Female	−39		
Male	20		
Attitudinal Statements for Learning Games as Competition	**Canonical Coefficients**	**P > F**	**Signif.**
I always had great confidence in my ability to do well in the game.	68	(0.0005)	****
It was very important to me to finish first in our industry.	−29	(0.6416)	
I am an extremely competitive person.	28	(0.0201)	**
I do not think that the game was too challenging and difficult to be useful.	3	(0.1712)	
My group had very strong leadership.	1	(0.1649)	
I feel as if I really understood how the game worked.	−8	(0.2873)	
I don't think the game was really easy. [c]	−6	(0.5017)	

Notes.
Class means and canonical coefficients are multiplied by one hundred for ease of presentation.
A graphical representation of the data in the above table is also to be found in Fig. 6, for ease of interpretation.
****$p < 0.001$.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.10$.

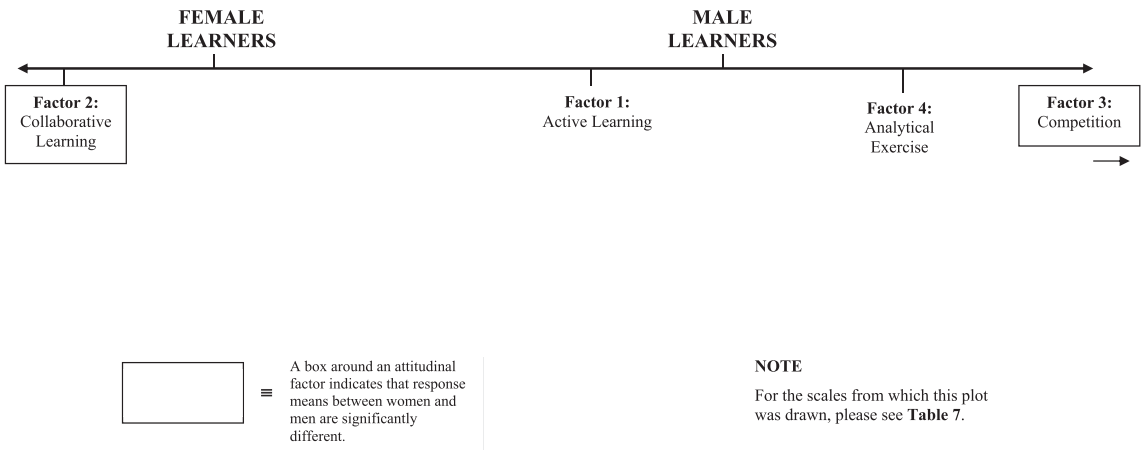

Fig. 5. Discriminant plot showing relative positions of gender classes and attitudinal learning game factors as points along the discriminant function.

Female learners approach serious games as a collaborative learning experience, but feel uncertain of what they know and their ability to learn. Teachers will want therefore to reassure their female students, confirming what they know and understand, and state that they should feel confident in their ability to turn that knowledge into actionable strategy.

There is another pedagogical implication of these findings. Serious games are accessible because students can frame the serious game experience to match their preferred learning styles. However, there is an inherent limitation to this very fact: learners may learn more when they are stretched to learn in some other manner that is not according to their learning preferences. One way to encourage students to expand on their learning repertoire, to in effect balance their learning style across all of Kolb's (1984) learning modes, is to place serious game participants into varied groups according to their learning preferences.

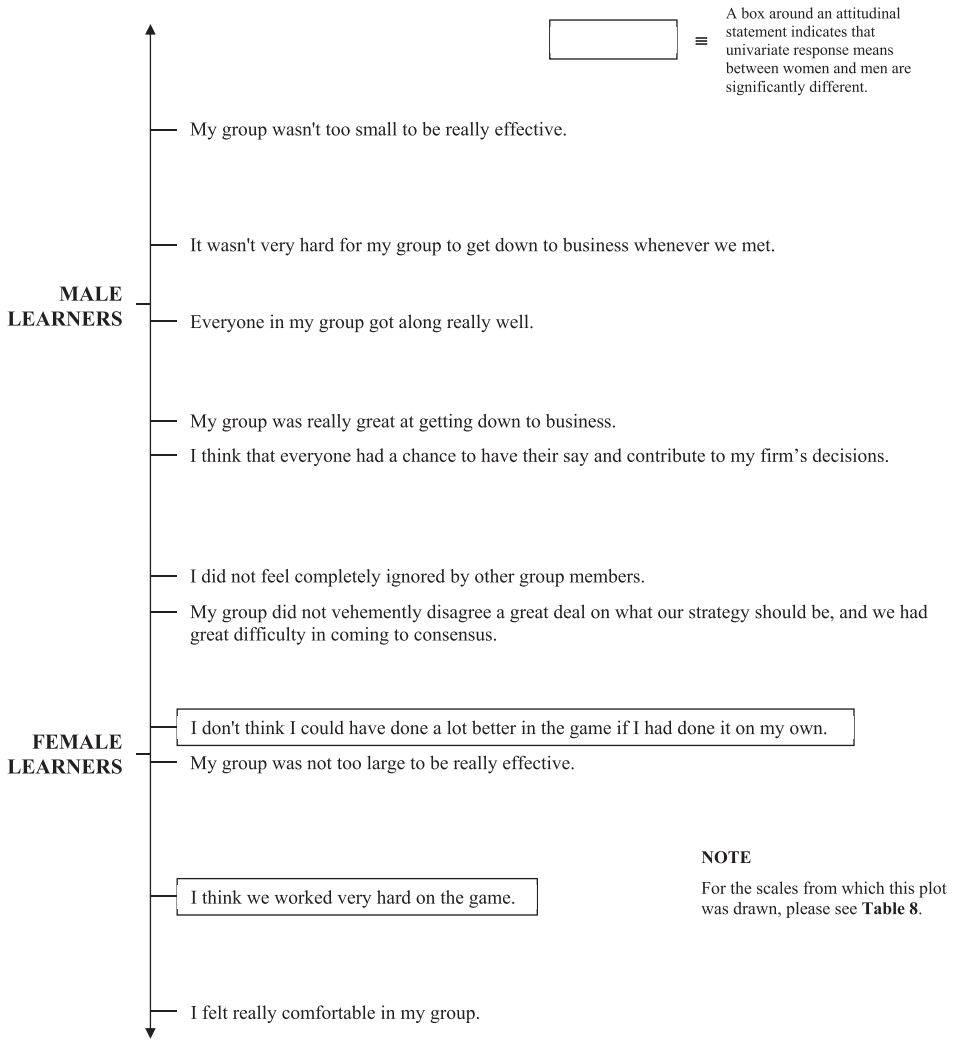

Fig. 6. Discriminant plot showing relative positions of gender classes and attitudinal statements comprising the collaborative learning factor as points along the discriminant function.

4.7. Limitations and future directions

Given the potential effects of group composition as a mediating variable on the learning experience, it would be beneficial to test the effects of group composition in the context of these findings. Though there has been considerable research on the effects of various aspects of group composition in serious games, there has been relatively little empirical research investigating the interaction between attitude toward serious games, preferred learning style, and group effects in the manner that we have studied them here. It would be interesting to test, for example, whether diverse groups in terms of the learning styles of its members provide a better learning experience than do homogeneous groups, or whether learning is augmented by groups comprised of a single gender, or groups that are mixed.

In this study we examine a relatively homogeneous set of students enrolled in one university all taught by one instructor, all selected into groups in a similar manner, all participating in the same serious business game. This uniformity naturally provides experimental controls for a number of potentially confounding effects. On the other hand, future research should extend its findings to other schools, to classes of other sorts, to non-traditional students, to other instructors, to other geographic regions, to other countries, and so on. In particular, there is a need to replicate this study using other serious business games, and test their effects using other learning models.

An additional research opportunity concerns the measurement of the effects of preferred learning style and attitude to the serious game on performance, or conversely, the use of serious game performance to assess learning. This study employs attitudes toward the serious game as dependent variables, which some would consider to be limited in the sense that student self-reports of learning constitute mere perceptions of learning, not learning itself (Gosen and Washbush, 1999; Gentry,

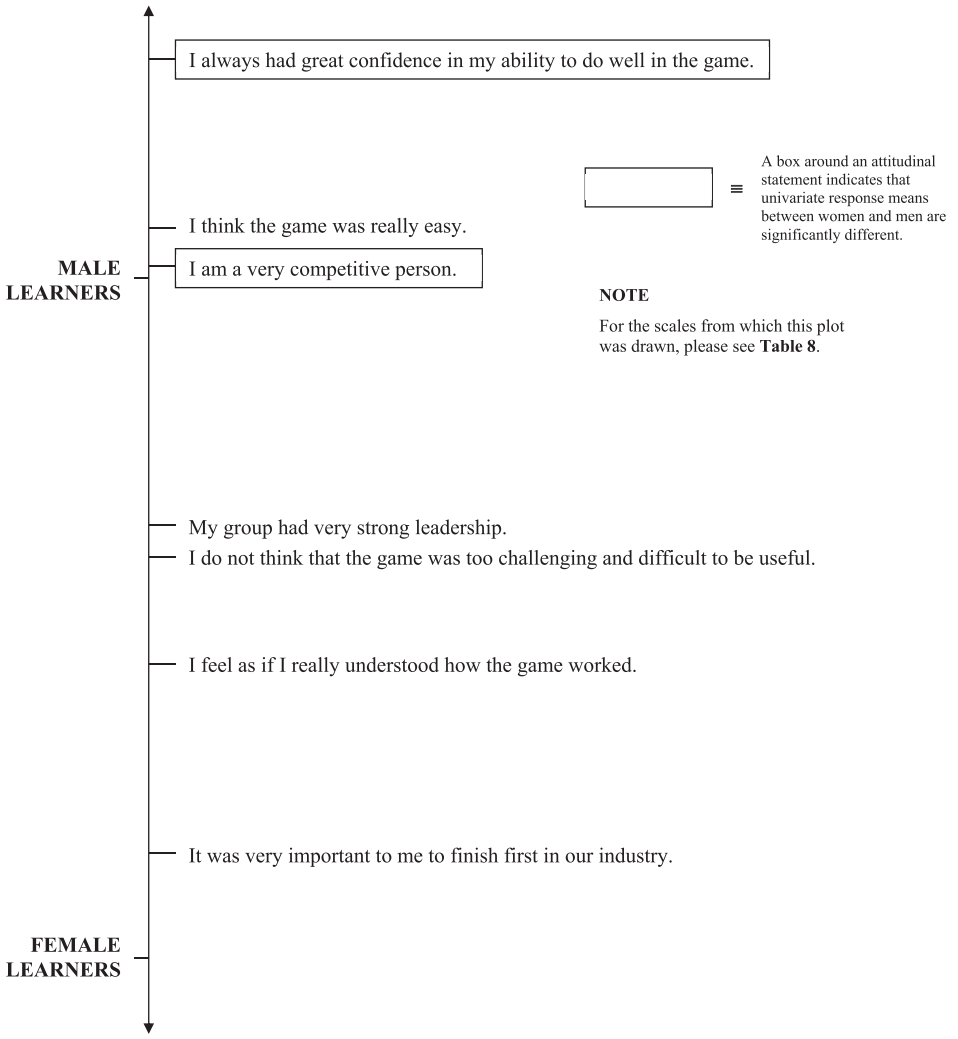

Fig. 7. Discriminant plot showing relative positions of gender classes and attitudinal statements comprising the competition factor as points along the discriminant function.

Commuri, Burns, & Dickenson, 1998). We agree that self-reported learning as a dependent variable is limiting, and that a following study examining the effects of attitudes toward serious games and learning styles as independent variables interacting to affect performance in the serious game, and in the course, among other possible performance measures could be valuable.

Appendix

Attitudinal statements*
The Serious Business Game as Learning Experience
My understanding of the game got a lot better as the game went along.
I thought that the game was not too challenging and difficult to be useful.
It is important that the game be fun to play in order for it to be a valuable educational experience.
feel that the game provided a really valuable educational experience.
I always had great confidence in my ability to do well in the game.
feel as if I really understood how the game worked.
I had a lot of fun playing the game.
I think that those who struggled at some point in the game learned a lot more than those who never struggled.
I thought that playing the game was a lot of fun.
I feel that I am now much better able to cope with ambiguity and uncertainty in business, having played the game.
I did not think the game was really easy.

(*continued*)

Attitudinal statements*
The uncertainty of the game did not make me feel uncomfortable.
I feel that game is a very true representation of how business actually works.
The Serious Business Game as Analytical Exercise
I feel it was crucial to buy the marketing research reports to do well in the game.
I believe that I got a good sense of how all the marketing mix decisions must work together for an overall marketing strategy to be effective.
I think that differentiating your product is important to doing well in the game.
My experience in the game leads me to believe that the various principles taught in basic marketing are entirely correct in practice.
I think that total net contribution is the very best measure of financial performance in the game.
I feel that the game does a great job of integrating all the concepts presented in the class.
I feel that the game experience gave me a much better sense of how product design affects marketing outcomes in the real world.
Market share is the very best indicator of financial performance in the game.
The Serious Business Game as Analytical Exercise (cont.)
I feel that the game gave me a much better sense of how promotion actually works in the real world.
The game gave me a great sense of how channels of distribution actually work.
Sales volume is the best indicator of game performance.
I think that performance within target segments, and not overall performance, is the very best indicator of game performance.
I don' t think that you have to be a very analytical person to play the game well.
The Serious Business Game as Competition
In our strategy, we took careful account of competitor activity.
My experience in the game leads me to believe that target segmentation is an absolutely essential competitive strategy.
I am an extremely competitive person.
I think that those who lost the game learned no less than those who won.
It was very important to me to finish first in our industry.
I feel that the game experience gave me a much better sense of how competition affects marketing outcomes in the real world.
The Serious Business Game as Collaborative Learning
Everyone in my group got along really well.
I felt included by other group members.
I felt really comfortable in my group.
I do think that everyone had a chance to have their say and contribute to my firm's decisions.
My group was not too large to be really effective.
My group was not too small to be really effective.
My group had no trouble coming to agreement about our decisions.
It wasn't very hard for my group to get down to business whenever we met.
My group was really great at getting down to business.
My group had very strong leadership.
I think we worked very hard on the game.
I feel that I learned a lot about how to function effectively within a group by playing the game.
I don't think I could have done a lot better in The game if I had done it on my own.

*from Garber et al. (2012).

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