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Mediation effect of students' perception of accounting on the relationship between game-based learning and learning approaches

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ABSTRACT

This study explores the mediation effect of students' perceptions toward accounting to enhance their adoption of the deep learning approach. We adopt game-based learning (GBL) using a self-developed LEGO® simulation game as the active learning material. Participants of this study comprised undergraduate students majoring in accounting from a northern university in Italy. This study contributes to the literature by providing several new insights. First, we present statistical evidence of a mediation effect of students' perceptions toward accounting on their learning approach, although the course offers a short-time activity. Second, we did not confirm the significance of students' strong image of conformity in accounting as a mediator in the relationship between GBL and a surface approach to learning. We interpret that students hold more favorable images of conformity to accounting than before taking the GBL course, possibly fostering them to engage with deep approach processes while adopting appropriate facilitation of active learning.

1. Introduction

We investigate the relationship between students' participation in active learning and their deep learning approach with the mediating role of perceptions toward accounting. Our primary motivation is the recent call from academia to change the approaches to learning in accounting among students. That is, the skills needed for future accounting professions should gradually change from surface learning approaches, including memorization and reproduction, to deep learning approaches, such as judgment and decision-making (Association of Chartered Certified Accountants [ACCA], 2016; Griffin, 2016; Institute of Chartered Accountants in England and Wales [ICAEW], 2015; ICAEW Information Technology Faculty, 2018). This deep learning approach strives continuously to improve understanding by applying and comparing ideas, whereas other studies (Biggs, 1987; Marton & Säljö, 1976) describe the opposite concept of the surface learning approach as a reproductive strategy that scarcely attempts to integrate information. Previous studies have attempted to change students' learning approaches using nontraditional and innovative teaching pedagogies, including case studies (Wynn-Williams, Beatson, & Anderson, 2016), team learning activities (Hall, Ramsay, & Raven, 2004), and in-class simulation (Levant, Coulmont, & Sandu, 2016; Phillips & Graeff, 2014). Scholars have reached a consensus about the effectiveness of an active learning approach in developing deep learning in the accounting context.

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However, extant studies have failed to address the mediation effect of perception toward accounting employed by evolving teaching methods and curricula. A substantial body of studies has reported that the perceived nature of accountant duties, or of tasks required in accounting courses among students, and such skewed images prevent them from acquiring new skills (Ferreira & Santoso, 2008; Jackling, 2005; Lucas & Meyer, 2005; Ma, Chen, & Ampountolas, 2016; Wells, 2019). Evidence exists on students' perception of the memory of technical knowledge and calculation as important in the context of learning in accounting. Thus, the key to a successful change in students' contextual approach of learning (such as deep or surface learning) is to reduce the perceived negative view of accounting. Moreover, some prior studies have further examined the role of active learning in students' learning perceptions and attitudes (Butler & Wielligh, 2012; Jackson, 2014; Metrejean, Pittman, & Zarzeski, 2002; Sangster, 2010; Wells, 2019). These studies attempted to alter perceptions of accounting by using various new pedagogies and partially succeeded in accomplishing their objectives. However, no study has yet investigated the relationship between students' participation in active learning and their learning approach by examining the mediating role of their perceptions of accounting.

Compared with the active argument in the accounting literature, other business educational research, including marketing and management disciplines, have listed a few empirical studies of students' perceptions and attitude associated with students' learning approaches (Ballantine, Guo, & Larres, 2018; Faranda, Clarke, & Clarke, 2020). Although the literature in these domains have sensed that student's perceptions toward particular subjects work as a seminal factor to affect and change students' learning approach as the consequence of applying innovative teaching pedagogies, they have failed to address the indirect effect of one's perception as the mediator. Therefore, our research outcomes may also provide valuable insights into solving common issues shared with other domains in business education.

Given this background, we conduct research using a business simulation game—active learning—in an attempt to explore the mediation effect of perceptions of accounting to enhance the deep learning approach. We adopt game-based learning (GBL) using a self-developed LEGO® simulation game as the active learning material.[1] GBL is thought to be an effective teaching and learning material in building students' confidence and creating a more positive attitude toward accounting and sustaining a deeper understanding of accounting principles (Phillips & Graeff, 2014). However, previous accounting literature has not addressed the vital mediating role of perception toward accounting on the relationship between GBL implementation and the adoption of a deep learning approach in the accounting context.

This study contributes to the literature by providing several new insights. First, we present statistical evidence of a mediation effect of students' perceptions toward accounting on their learning approach, despite the short-time activity offered by the course. This finding also ensures that students strongly adopted deep learning approach while participating in the active learning course. Using GBL changed their perceptions of accounting, more specifically in terms of the unstructured and absorbing image of accounting.

Second, we did not confirm that students' strong image of conformity in accounting is a significant mediator in the relationships between GBL and surface approach to learning. We admit that students perceive the surface approach and strategies as necessary for them to progress to high levels of deep understanding in the accounting context. As per our interpretation, students hold more favorable images of conformity; this might foster them to engage more with deep approach processes while adopting appropriate facilitation of active learning.

We have structured the remainder of this paper as follows. Section 2 reviews related literature and discusses the theoretical rationale applied in this study. Section 3 presents the research design. Section 4 demonstrates the results of the analyses. Section 5 presents the discussions and implications. Section 6 offers the conclusion and limitations of the present study, together with an orientation for future research.

2. Literature review and hypothesis development

2.1. Association between active learning and learning approach

Various active learning teaching methods exist in accounting. Prior accounting literature has attempted to change students' learning approaches using these pedagogies, including case studies (Wynn-Williams et al., 2016), team learning activities (Hall et al., 2004), and in-class simulation (Phillips & Graeff, 2014; Levant et al., 2016). These studies are based on the Biggs' (1993a, 1993b, 1987, 2001) Presage–Process–Product (3P) model as the theoretical framework. This model explains the mutual interactions between student factors, teaching context, on-task approaches to learning, and learning outcomes as a dynamic system (Biggs, Kember, & Leung, 2001).

According to the 3P model, students' learning has three components: *presage*, *process*, and *product*. *Presage* includes student-based factors and the teaching context. Meanwhile, *process* describes how a student executes the task, and *product* is the learning outcome. With this model, the active learning approach is thought to be part of the teaching context of the presage stage, which intends to play an important role in determining students' approach to learning as a consequence (Anderson & Lawton, 2009; Hall et al., 2004; Phillips & Graeff, 2014; Sivan, Leung, Woon, & Kember, 2000).

[1] LEGO® is a trademark of the LEGO Group of companies, which do not sponsor, authorize, or endorse this manuscript.

2.2. Effect of GBL on learning approach

GBL employs games to promote learning, skill acquisition, and training (Boyle, Connolly, & Hainey, 2011; Randel, Morris, Wetzel, & Whitehill, 1992). In the literature, GBL encourages deeper learning rather than passive learning methods (Prince, 2004; Riley & Ward, 2017). It is a form of active learning relying on the senses to build or construct learning by experiencing problems and reflecting on the experience to clarify understanding (Kolb, 1984; Stainton, Johnson, & Borodzicz, 2010).[2]

The GBL also intends to include unstructured and uncertain aspects into the learning process, the characteristic of which is pivotal in nurturing learners' deep learning approaches. In principle, accounting education should provide students with opportunities to develop the ability to identify and solve unstructured problems in unfamiliar settings (Accounting Education Change Commission [AECC], 1990). Constructivist theories also state the importance of deep learning using unstructured problem contexts as deep learning is encouraged by unfamiliar settings, where learning starts by defining a problem that is always unstructured (Bevinakoppa, Ray, & Sabrina, 2016; Hodges, 2011).

The literature on GBL most often includes empirical investigations seeking to ensure the role of GBL in learning approaches. For example, Sivan et al. (2000) measured business students' approach to learning (surface or deep) and examined the effects of several active learning approaches, including games and simulations. Their findings revealed students' immediate change in their approach to learning is prompted by implementing these active learning materials. Phillips and Graeff (2014) also empirically investigated this theoretical framework by adopting in-class simulation exercises incorporated into the accounting course. They concluded simulation exercise to be a strong and effective active learning tool that helps students move from the surface to a deeper level of understanding of accounting (Phillips & Graeff, 2014). In addition, GBL enhances students' deep learning through the use of individualized and authentically assessed learning tasks. To simplify, GBL helps students apply concepts to their individual or real firm, thus facilitating the development of personal meaning and gaining in-depth understanding of those concepts (Turner & Baskerville, 2013). The abovementioned authors concluded that deep learning enables university students to develop their personal capabilities.

Alternatively, GBL does not necessarily seem to be an effective active learning tool to provide deep learning opportunities.[3] Some extant studies in the accounting education literature have found difficulty in supporting accounting students to change their approach from surface to deep learning by implementing certain active learning-type interventions (Carenys & Moya, 2016; Fox, Stevenson, Connelly, Duff, & Dunlop, 2010; Turner & Baskerville, 2013). Thus, mixed results are found in literature regarding the effectiveness of GBL on learning approaches.

2.3. Association between perception of accounting and learning approach

The mixed results in literature regarding the effectiveness of GBL on learning approaches might partly be due to the strong effect of perception of accounting on learning approaches. Eventually, prior studies addressed the importance of this relationship (Duff & Mladenovic, 2015; Ferreira & Santoso, 2008; Jackling, 2005; Lucas, 2000; Lucas, 2001; Lucas & Meyer, 2005; Ma et al., 2016; Mladenovic, 2000). For example, Jackling (2005) investigated the relationship between the context of learning and learning approaches among second-year accounting students in Australia. This author discovered the tendency of students with negative perceptions of accounting to learn using the surface approach with lower-level strategies, such as rote learning, paraphrasing, and describing. Other studies using quantitative data have also empirically endorsed this analysis between perceptions of accounting and the learning approach (Ferreira & Santoso, 2008; Lucas & Meyer, 2005; Ma et al., 2016).

Furthermore, other studies have reported that surface approaches and strategies are inevitably required to progress to high levels of deep understanding in the accounting context (Hall et al., 2004; Mala & Chand, 2015). For instance, Mala and Chand (2015) conducted a *meta*-analysis and found numerous studies (Bedard & Graham, 1994; Libby & Luft, 1993) that empirically ensure the interaction of fundamental knowledge with the ability to influence judgment. Regardless of the direction of relationships between perceptions of accounting and learning approaches, scholars, however, have not examined the mediating role of students' perceptions toward accounting on the relationship between GBL and learning approaches.

2.4. Mediation role of perception on association between GBL and learning approaches

Although prior studies have not examined the mediation role of students' perceptions of accounting, some previous literature have challenged the implementation of various types of active learning to change one's perceptions of accounting to

[2] GBL can also be defined as experiential learning, which is the process of creating knowledge through experience as opposed to merely receiving or transmitting information (Kolb, 1984; Kolb & Kolb, 2005). In this experiential learning, GBL is thought to involve deep learning that develops a new perspective by integrating new materials with the existing knowledge. This type of learning contradicts traditional instruction, which emphasizes surface learning, including task completions, memorization, and clear-cut answers (Turner & Baskerville, 2013). Given these two theories, Butler, Church, and Spencer (2019) explained that experiential learning is a broader concept than active learning. However, both theories contend that GBL empowers deep learning.

[3] GBL is not likely to be free from constraints. The major weakness that has often been reported in the literature is its reality and validity (Ampountolas, Shaw, & James, 2019; Edelheim & Ueda, 2007; Wolfe, 1976). For instance, when the simulated environment of the game does not duplicate a real business situation, the game could lack validity. Moreover, GBL can mislead participants, causing them to misunderstand incorrect habits as reality, thereby increasing the complexity of GBL (Hely & Jarvis, 1999). The complexity itself becomes a constraint as it makes conceptualizing the relationship between cause and effect more challenging for learners (Fripp, 1993).

improve learning outcomes. For example, Butler and Wielligh (2012), Jackson (2014), and Metrejean et al. (2002) used guest lecturers to explore the effect of altering students' views toward accounting. Here, lectures by invited guests were a form of active learning (Jackson, 2014). The results revealed that guest speakers positively change students' awareness of accounting, motivate them to learn accounting, and strengthen the appeal of a career in accounting.

Further, Sangster (2010) used Luca Pacioli's *Summa arithmetica* in 1494 to conduct active learning and achieved positive results to generate deep learning outcomes. This research implied a pivotal role of perceptions for deep learning. Eventually, this research found that the development of higher-order thinking skills at an earlier stage of tertiary school is facilitated by strong attention to technical knowledge of double-entry bookkeeping. In his interpretation, the author implied that strong and favorable perceptions of conformity toward accounting can draw a deep approach to learning. However, this study did not measure the degree of adopted learning approach to examine the mediation effect of perceptions affected by the implementation of active learning. In addition, no accounting literature has examined this construct of the mediational role of perceptions with the effect of GBL.

Furthermore, recent studies on accounting perceptions complicate the discourse (e.g., Caglio, Cameran, & Klobas, 2019; Carnegie & Napier, 2010). The perception of accounting is neither fixed nor simply categorized into a dichotomous (positive/negative) stereotype as indicated by the abovementioned studies. Caglio et al. (2019) recently attempted to identify images of accountants held by several different groups of individuals, including undergraduate accounting students in Italy; the authors uncovered new images, including nuances, which are neither favorable nor unfavorable. This prior study concluded that perceptions of accountants are not static, but may change over time. With this new and multidimensional image of accounting, the mediation role of perceptions toward accounting being associated with the relationship between GBL implementation and the learning approach is still unclear. Based on these arguments, we developed the following hypothesis:

The mediation effect of students' perceptions of accounting as the result of participating in GBL is significantly associated with a high degree of engagement with the deep learning approach.

3. Research design

3.1. Active learning course using the LEGO ® simulation game

We designed an intensive course for introductory accounting based on an active learning approach using the LEGO® simulation game. The active learning course (ALC) provides opportunities for participants to enhance the intrinsic interest of accounting; comprehend the importance of accounting in a real business setting; and learn how to apply technical knowledge, generic skills, and professional judgment in practical accounting and business. To achieve these learning aims, we considered LEGO® as a part of the learning materials used by participants to play a simulation game. This type of game-based learning pedagogy is called GBL (Boyle et al., 2011).

Everaert and Swenson (2014) inspired using LEGO® as an active learning material for the game. These authors adopted LEGO® to include unstructured problems and uncertainties when understanding the skills students require for management accounting. Structured problems require well-defined methodologies for finding a solution; they also require particular data to reach a decision. Alternatively, unstructured problems rely on expertise and/or intuition. The present study also follows this framework.

While playing the game, the teams use LEGO® to design an automobile, mass-produce it as their company products, and sell them to the market. The more LEGO® pieces the team uses to make a product, the more cost they need to cover. They must also make decisions on the number and price of products manufactured under cost–volume–profit analysis. The ranking of each team's product, evaluated during the motor show, influences the number of units ordered from the market. Each team prepares and delivers a promotional presentation in front of other teams. Students need to consider which and how many LEGO® pieces they use to assemble a well-designed and popular automobile model, together with a consideration of production cost, to be evaluated better than other companies. Financial statements present all figures arrived as the result of the game. Thus, participants learn both the fundamental principles of accounting and basic skills of how to use them for decision-making.

The ALC herein is team-based, with each team comprising up to six persons. Each team is an executive group of the company, which competes in the game to maximize profit.[4] Further, recent research in GBL is shifting to test the effect of digital GBL (DGBL).[5] Given this aspect, we incorporated ALC as an internet-based cloud scoring system, where participants of the LEGO® game can transmit scores from their decisions via their own cellular phones. This enables immediate and automatic calculation of activity outcomes without hand-scored-type errors. This innovative technology successfully allows the ALC to reduce nuisances than traditional paper-and-pen type GBL. Further, ALC can facilitate more face-to-face interactions among participants than the full-fledged DGBL using a video game platform.

[4] Note that Faria and Dr., Hutchinson, D., Wellington, W. J., & Gold, S. (2009) show that the reasons for using GBL have rarely changed over the past 40 years; further, developing teamwork and providing interactive occasions are constantly listed as high, coupled with developing learners' thinking and problem-solving skills.

[5] Faria and Dr., Hutchinson, D., Wellington, W. J., & Gold, S. (2009) noted the benefit of the change in technology. For example, educators and users can now avoid hand scoring, which is time-consuming, prone to error, and limits the games in terms of the complexity of decisions and amount of feedback.

3.2. Data collection

The participants of this study comprised undergraduate accounting students who enrolled in a semester-based course known as "management accounting" at a northern university in Italy. This course is a selective course open for any undergraduate who attends three-year international business programs. Students who attend this course have sufficient fluency in English language skills, and thus, the medium of instruction for this course is English. Among these students, the researchers of this study randomly selected participants who were invited to attend ALC (*ALC students*), which provided 15-hour intensive weekend learning activities as educational intervention. A questionnaire-based survey was administered for data collection after the ALC. We also collected data from other students who attended to "management accounting," but did not participate in the ALC. The data were used as the control group (*nonALC students*).

Table 1 shows the demographics of our sample. We collected our research data from two intensive courses over two semesters from autumn 2019 to spring in 2020. Participants who attended each semester were not the same students. The first data collection in 2019 allowed us to collect 72 effective responses (43 control and 29 experiment sample) out of 85 original participants, thus we decided to conduct the second data collection, where additional 74 effective responses (44 control and 30 experiment sample) out of 92 original subjects were collected in 2020. We did not observe any significant difference in the demographics between subjects from two semesters.[6]

With regard to the experimental group (ALC students), we initially collected data from 76 students,[7] but 17 were discarded due to incomplete surveys, giving us 59 samples for analysis (77.63% effective response rate). For the control group, of the total 101 original responses, we collected 87 effective responses from the nonALC students' group (86.13% effective response rate). The relatively high incomplete rate for ALC students was due to the setting for online questionnaire survey system, in which we failed to set the requirement for participants answering to questions. Thus, 17 students unintentionally skipped several question items to answer. We discarded these incomplete samples from our analysis data set. The chi-square test and *t*-test analysis did not report significant differences in either gender or age between the ALC and nonALC student groups (see Table 1).

3.3. Questionnaire development and analyses

We designed a survey instrument to address this research hypothesis. The data collection consists of the following two components: perceptions of accounting and approach to learning in accounting.

3.3.1. Perceptions of accounting

In this part, the participants were asked to complete 36 five-point scales of opposing adjectives based on their perceptions of accounting (Table 2). We measured these scales on a semantic differential scale with "1″ indicating agreement with the left-hand word and "5" indicating agreement with the right-hand word. This instrument was originally developed by Saemann and Crooker (1999) to assess respondents' perceptions of the accounting profession (Perception of Accounting Profession Index: PAPI); however, we adopted it to measure perceptions of accounting.

In this investigation, the responses for students' perceptions were initially compiled using principal component analysis (PCA) to decrease the number of perceived factors. Table 3 lists the previous studies adopting the PAPI, their participants, compiled factors loaded by PCA, and the country of each study.

3.3.2. Approach to learning in accounting

The learning approaches are measured using the 20-item questionnaire invented by Biggs et al. (2001), known as the Revised Two-factor Study Process Questionnaire (R-SPQ-2F). We used these tools to assess deep (DA) or surface learning approaches (SA). Each student establishes a score for their inclination toward both deep and surface learning. The R-SPQ-2F instrument also finds wide application in the accounting education literature (Bobe & Cooper, 2018; Wynn-Williams et al., 2016).

3.4. Mediation effect analysis

To test for mediation effect, we defined students' perception of accounting as the mediator in relation to the association between students' participation in ALC (independent variable: X) and degree of learning approach (dependent variable: Y). We tested the statistical significance of the mediation effect using a bootstrapping sampling procedure (Hayes, 2018). This procedure provided a distribution of parameter estimators for the indirect effects of hypothesized mediator. We hypothesized that the indirect effect of students' perceptions of accounting (*ab*) will mediate the association between learning approach (Y) and participating in ALC (X) (direct effect = *c*').

[6] We conducted robustness analyses to investigate differences in several demographics among participants between 2019 Autumn semester and 2020 Spring semester. The chi-square tests and *t*-test analyses did not report significant differences in age and gender (Appendix 1). Further, we also compared differences in dependent variables (DA and SA) and independent variable (ALC), and we did not find any significant differences in these all variables (Appendix 1). Finally, we explored original 36 items of PAPI items (Appendix 2) and three mediators (SPO, PRE, and INT) extracted by the principal component analysis (PCA) (Appendix 1) to compare the scores between two semester groups. These results revealed that only two items of P19 and P27 had significant but weak differences (Appendix 2). We regarded that these findings do not affect our primary research construct.

[7] 12 responses from international students and Erasmus students were excluded from the original 88 responses.

Table 1
Demographics.

	ALC students (n = 59)	NonALC students (n = 87)	
Age (Mean [Std. Dev.])	20.59 (2.889)	21.16 (1.848)	*t*-test
Min	18	18	t-value = 1.335 (p = 0.185)
Max	31	23	
Gender			Pearson chi-square test
Male	28 (47.5%)	32 (36.8%)	χ^2 = 1.655 (p = 0.198)
Female	31 (52.5%)	55 (63.2%)	
Total	59 (100.0%)	87 (100.0%)	

Table 2
Perception of accounting profession index (PAPI).

P1 Cut & dry vs. creative solution [a]	P19 Theoretical vs. practical [a]
P2 Repetition vs. variety	P20 Tedious vs. absorbing
P3 Established rules vs. new ideas [a]	P21 Monotonous vs. fascinating [a]
P4 Boring vs. interesting	P22 Concrete vs. abstract [a]
P5 Easy vs. challenging [a]	P23 Efficiency vs. effectiveness [a]
P6 Dull vs. exciting	P24 Logic vs. imagination [a]
P7 Structured vs. flexible [a]	P25 Superficial vs. thorough [a]
P8 Solitary vs. interaction with others	P26 Routine vs. unpredictable [a]
P9 Conformity vs. originality	P27 Details vs. overview
P10 Stable vs. dynamic [a]	P28 Accurate vs. imprecise
P11 Standard operating procedures vs. new solutions	P29 Uniform standards vs. alternative views [a]
P12 Introvert vs. extrovert [a]	P30 Fixed vs. changing [a]
P13 Conceptual vs. analytical	P31 Methodical vs. novelty
P14 Compliance vs. innovation [a]	P32 Record keeping vs. decision-making
P15 Facts vs. intuition [a]	P33 Profit driven vs. benefit society [a]
P16 Certainty vs. ambiguity [a]	P34 Ordinary vs. prestigious [a]
P17 Planned vs. spontaneous	P35 Adaptable vs. inflexible
P18 Number crunching vs. people-oriented [a]	P36 Mathematical vs. verbal

Note. [a] The scores are measured oppositely from the original questionnaire.

Table 3
Prior studies using PAPI.

Research	Participant	Compiled factor	Country
Wells (2019)	Random sample from people in public	Structured/definite, precise, interest, compliance-driven, solitary	New Zealand
McDowall et al. (2012)	Secondary school students	Definite, boring, precise, compliance-driven	Australia
Sugahara, Boland, and Cilloni (2008)	Undergraduates	Procedural, precision, static, structured	Australia
Byrne and Willis (2005)	Secondary school students	Definite, boring, precise, compliance-driven	Ireland
Saemann and Crooker (1999)	Undergraduates	Structured, precision, solitary, interest	United States

In this research, we performed the bootstrapping procedure with the Macro "PROCESS version 3.5" developed by Andrew F. Hayes in SPSS. Later, we tested the combined mediating effect of the hypothesized mediators under investigation. We further estimated the bias-corrected 95% confidence intervals on 5,000 bootstrap samples for testing of the indirect effect. If the confidence interval did not include zero, the indirect effect was a significant mediator (Hayes, 2018).

Concerning this analysis, Baron and Kenny (1986) argued that a significant relationship between X and Y is a crucial start for mediation analysis. They regarded a significant coefficient as a necessary condition for testing mediation. Alternatively, Shrout and Bolger (2002) highlighted that finding a significant association between the independent and dependent variables (a total effect of *c* or a direct effect of *c*') using a bootstrapping analysis is not always necessary, as long as their relationship has a solid theoretical background. Similarly, Rucker, Preacher, Tormala, and Petty (2011) also stated that a significant total effect should not be viewed as a necessary step before examining the hypothesized indirect effects. In other words, significant indirect effects can occur in the absence of a significant total or direct effect.

4. Results

4.1. Preliminary analysis for students' perception of accounting

We performed PCA to reduce the 36 perception scales for the data collected from the posttest. Table 4 (1) shows the analysis outcomes. Applying Cattell's scree test (Cattell, 1966; Field, 2018),[8] we were able to derive three factor scores from 36 original variables. In this analysis, 14 adjectives were loaded as the first component from the original 36 adjectives (Table 4 [1]). Of the 14 attributes, we assigned nine aggregated variables interchangeably with the "structured" label by Saemann and Crooker (1999) or "structured/compliance-driven" label by Byrne and Willis (2005) and Dowall et al. (2012).

For the other two attributes of P12 (extrovert/introvert) and P18 (number oriented/people-oriented), Saemann and Crooker (1999) and Wells (2019) labeled them as "solitary." In this study, we did not comply these two variables as an individual factor, but are incorporated them as a part of the largest compiled factor. "Solitary" is eventually the factor related to the people-involved aspect; hence, P12 and P18 may react with other variables compiled in the same factor, such as creative thinking (P1) or alternatively judging (P23), which are similarly regarded as people-involved aspects. With this preliminary interpretation, we considered the "structured/people-orientation" (SPO) label as the largest component factor. Moreover, we extracted five variables as the second factor. In a prior study, these factors were attributed to the factor label "precision" (PRE) by Saemann and Crooker (1999). All factors compiled in PRE are related to discretions at the point of decisions regarding whether individuals would simply comply with conventional rules or could possibly create new solutions. By following the prior study, we labeled this second largest factor as PRE. Finally, the third factor's label is set as the "interest" (INT), similar to Saemann and Crooker (1999), Wells (2019), and McDowall et al. (2012) who included the same three variables and labeled the factor as the INT.

In the *t*-test between ALC and nonALC students, 20 out of 22 attributes were significant. Further, we conducted t-tests to compare the scores of each compiled factor of SPO, PRE, and INT. The results revealed that the scores of the three factors for ALC were significantly higher than those of nonALC students ($t[146] = -4.443$, $p < 0.01$ for SPO; $t[146] = -5.623$, $p < 0.01$ for PRE; $t[146] = -3.121$, $p < 0.01$ for INT). The results indicated the tendency for ALC students to perceive accounting to be more unstructured with people-orientation, more discretional, and a more interesting subject compared with nonALC students. Furthermore, concerning the reliability check for these three components, Cronbach's alphas were also calculated and reported in Table 4, which confirmed sufficient reliability of three factors.

Apart from significant differences in perceptions between ALC and nonALC students, we determined that the three original attributes for the ALC group concerning PRE were still closer to the left-hand words even after their ALC experience. That is, the image is more compliance-oriented than discretional (i.e., P17: planned/spontaneous; P36: mathematical/verbal). As for the INT, the scores of two attributes for P6 (dull/exciting) and P4 (boring/interesting) were greater than 3.50, indicating the subjects' perception of accounting to be interesting and absorbing even among nonALC students. This finding is partly consistent with the image of the modern professional in Caglio et al. (2019), whose results revealed accounting to be honest and not boring. In their study, the factor "honest" is compiled by "complies with law," "behaves ethically," and "trustworthy," whereas the factor of "boringness" is compiled by "boring," "sad," and "shy" (Caglio et al., 2019). This commonality with our study arises as the current research subjects of Italian accounting undergraduate students are similar to Caglio et al. (2019).

4.2. Primary analysis of mediation effect

4.2.1. Parallel mediation

As per our PCA reports, three compiled factors (SPO, PRE, and INT) influenced subjects' perceptions of accounting. Considering these, it would be interesting to witness if any of these dimensions drive the mediation more than the others do, or if all three contribute to it by adopting the parallel mediation analysis. Table 5 reports correlations between key variables explored by Spearman's rho correlations. The results indicated significant correlations between all three dimensions of perceptions of accounting, which allowed us to adopt the parallel mediation. The mediators in a parallel mediation can be correlated, but they do not causally influence each other (Kane and Ashbaugh, 2017). We failed to confirm significant correlation between ALC and two learning approach (deep and surface). However, the significant correlation is not a necessary condition for testing mediation as long as a solid theoretical background (Biggs' 3P model of this study) exists about their relationship (Shrout & Bolger, 2002).

We conducted two parallel mediation analyses, in accordance with two learning approaches as the dependent variables. Figs. 1 and 2 show results from these parallel mediation analyses.

4.2.2. Mediation analysis on deep learning approach

The results of mediation analysis on deep learning approach indicated the indirect relationship between students' participations in LEGO® simulation game and their deep learning approach through its relationship with two perceived dimen-

[8] For the factor extraction process, Cattell (1966) suggested using the sharp decent point of a scree plot as the cut-off for retaining factors. Our analysis also adopted Cattell (1966) scree test.

Table 4
Results of principal component analysis and *t*-test mean (S.D.).

(1) Principal component analysis			(2) Independent sample t-tests between non ALC and ALC students		
Compiled factors		**Factor loadings**	**Non-ALC (n = 87)**	**ALC post-test (n = 59)**	**t-value(p-value)**
Factor 1[a]structured(SPO)	P30 Fixed vs. changing [d]	0.751	3.17(1.193)	3.55(1.118)	−1.972(0.051)**
	P14 Compliance vs. innovation [d]	0.706	3.26(1.083)	3.93(1.014)	−3.749(0.000)***
	P10 Stable vs. dynamic [d]	0.702	3.36(1.132)	3.91(1.021)	−3.040(0.003)***
	P29 Uniform standards vs.alternative views [d]	0.691	3.36(1.132)	3.91(1.021)	−3.040(0.003)***
	P12 Introvert vs. extrovert [d]	0.676	3.39(0.992)	3.93(1.127)	−3.060(0.003)***
	P26 Routine vs. unpredictable [d]	0.646	2.97(1.022)	3.45(1.039)	−2.768(0.006)***
	P3 Established rules vs. newideas [d]	0.642	2.80(1.237)	3.84(1.047)	−5.482(0.000)***
	P1 Cut & dry vs. creativesolution [d]	0.636	3.26(1.061)	4.03(1.016)	−4.372(0.000)***
	P18 Number crunching vs.people-oriented [d]	0.609	3.08(1.069)	3.47(1.072)	−2.182(0.031)**
	P7 Structured vs. flexible [d]	0.607	2.73(1.135)	3.50(1.179)	−3.972(0.000)***
	P5 Easy vs. challenging [d]	0.593	3.87(1.076)	3.89(0.977)	−0.141(0.888)
	P21 Monotonous vs. fascinating [d]	0.591	3.78(0.920)	4.10(0.824)	−2.150(0.033)**
	P15 Facts vs. intuition [d]	0.572	2.93(1.118)	3.23(1.179)	−1.588(0.114)
	P34 Ordinary vs. prestigious [d]	0.557	3.34(1.087)	3.79(1.149)	−3.410(0.001)***
	Mean score of compiled SPO	–	3.32(0.692)	3.74(0.701)	−4.443(0.000) ***
Factor 2[b]discretion(PRE)	P17 Planned vs. spontaneous	0.674	1.93(0.873)	2.34(1.092)	−2.396(0.018)**
	P9 Conformity vs. originality	0.597	2.87(1.246)	3.69(1.071)	−4.131(0.000)***
	P36 Mathematical vs. verbal	0.561	2.02(0.976)	2.71(1.099)	−3.885(0.000)***
	P31 Methodical vs. novelty	0.528	2.29(0.999)	2.97(1.159)	−3.774(0.000)***
	P11 Standard operatingprocedures vs. new solutions	0.508	3.01(1.234)	3.93(0.998)	−4.966(0.000)***
	Mean score of compiled PRE	–	2.42(0.742)	3.13(0.740)	−5.623(0.000) ***
Factor 3[c]interest (INT)	P6 Dull vs. exciting	−0.794	3.82(0.909)	4.14(0.798)	−2.188(0.030)**
	P4 Boring vs. interesting	−0.768	4.09(1.007)	4.39(0.788)	−1.909(0.058)*
	P20 Tedious vs. absorbing	−0.694	3.26(0.855)	3.71(0.832)	−3.137(0.002)***
	Mean score of compiled INT	–	3.72(0.769)	4.08(0.601)	−3.121(0.002) ***

Note: We use the principal component analysis extraction method; the rotation method constitutes the Oblimin with Kaiser normalization, and rotation converged in 14 iterations. Factor loadings of greater than 0.5 were reported. The Kaiser–Myer–Olkin (KMO) measure of sample adequacy value is 0.834 and Bartlett's test of sphericity value is significant (approx. χ^2 = 1787.416, p < 0.000). ***, **, and * indicate two-tailed statistical significance at the 1%, 5%, and 10% levels, respectively. [a] Eigenvalue = 8.329, % of variance = 26.030, Cronbach's α = 0.881; [b] Eigenvalue = 2.897, % of variance = 9.052, Cronbach's α = 0.688; [c] Eigenvalue = 2.410, % of variance = 7.532, Cronbach's α = 0.740. [d] The scores were measured in opposite directions from the original questionnaire.

sions of "structured/people-orientation" and "interest" (refer to Fig. 1). First, students who participated in ALC reported more unstructured ($a_{1\text{-}1}$ = 0.5215, p = < 0.001) and more absorbed ($a_{1\text{-}3}$ = 0.3553, p = < 0.001) images of accounting, than those who did not, and such perceived views were subsequently related to the increased adoption of deep learning approach ($b_{1\text{-}1}$ = 2.8595, p = < 0.001 for SPO; $b_{1\text{-}3}$ = 2.1840, p = 0.003 for INT). A 95% bias-corrected confidence interval based on 5,000 bootstrap samples indicated that the indirect effect through more unstructured ($a_{1\text{-}1}$ $b_{1\text{-}1}$ = 1.491) and more interesting ($a_{1\text{-}3}$ $b_{1\text{-}3}$ = 0.775) views were entirely above zero, respectively (0.421 to 2.803 for $a_{1\text{-}1}$ $b_{1\text{-}1}$; 0.450 to 3.466 for $a_{1\text{-}3}$ $b_{1\text{-}3}$) (refer to Fig. 1). Therefore, these results indicated the statistical affirmation of the analyses on mediation effects, particularly in terms of these two perceptions.

For "precision," our bootstrapping analysis revealed more discretional view of accounting by students who participated in ALC ($a_{1\text{-}2}$ = 0.7035, p = < 0.001) than those who did not. However, such high discretional perceptions are not significantly associated with a strong adoption of deep learning ($b_{1\text{-}2}$ = − 0.6028, p = 0.437) (refer to Fig. 1). Thus, we were unable to confirm the indirect effect of $a_{1\text{-}2}$ $b_{1\text{-}2}$.

Further, the nonsignificant direct effect (c_1' = 0.2053, p = 0.862) suggested the complimentary full mediation by students' high unstructured and absorbing perceptions toward accounting[9], as the total effect (c_1 = 2.0475, p < 0.1) was significant (refer to Fig. 1). Therefore, our mediation analysis confirmed the relation between students' participation in ALC and their adoption of the deep learning approach in learning accounting indirectly through their strong perceptions of unstructured and absorbing views toward accounting.

4.2.3. Mediation analysis on surface learning approach

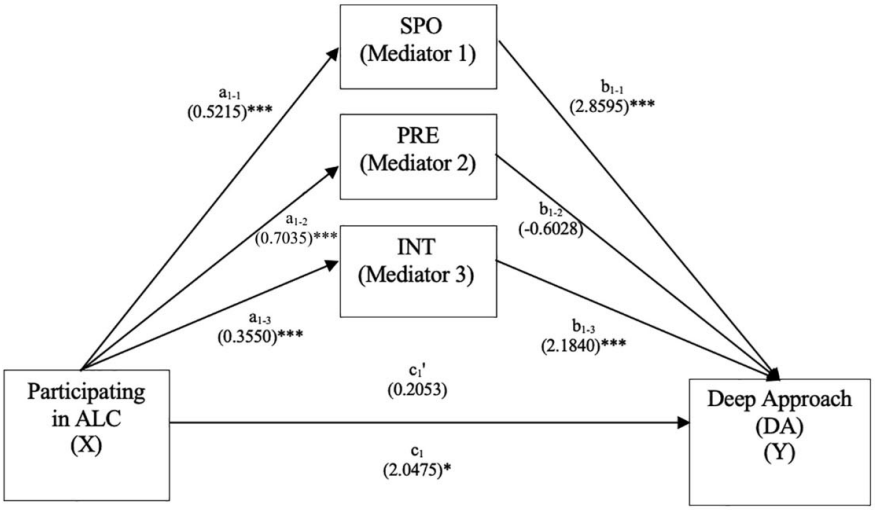
The results of parallel mediation analysis on the surface learning approach revealed that students' perceived dimension of "structured/people-orientation" is only an effective mediator that is significantly associated with their surface learning approach (refer to Fig. 2). Students who participated in ALC reported more unstructured ($a_{2\text{-}1}$ = 0.5195, p = < 0.001) views

[9] We confirmed this is a complimentary mediation effect especially for deep learning model (Fig. 1 [A]), based on the categorizations by Zhao, Lynch, and Chen (2010).

Table 5
Correlations between key variables; Spearman's Rho correlations.

Variable	1. ALC	2. SPO	3. PRE	4. INT	5. DA
1. ALC	–				
2. SPO	0.344***	–			
3. PRE	0.442***	0.506***	–		
4. INT	0.192**	0.237***	0.293***	–	
5. DA	0.125	0.294***	0.163**	0.251***	–
6. SA	−0.021	−0.363***	−0.110	−0.128	−0.112

ALC: Students' Participation in ALC
SPO: Compiled factor of students "Structured/People-orientation" image toward accounting.
PRE: Compiled factor of students "Precision" image toward accounting.
INT: Compiled factor of students "Interest" image toward accounting.
DA: The score of deep learning approach measured by the R-SPQ-2F.
SA: The score of surface learning approach measured by the R-SPQ-2F.
*** and ** indicate statistical significance at the 5%, and 10% levels, respectively.

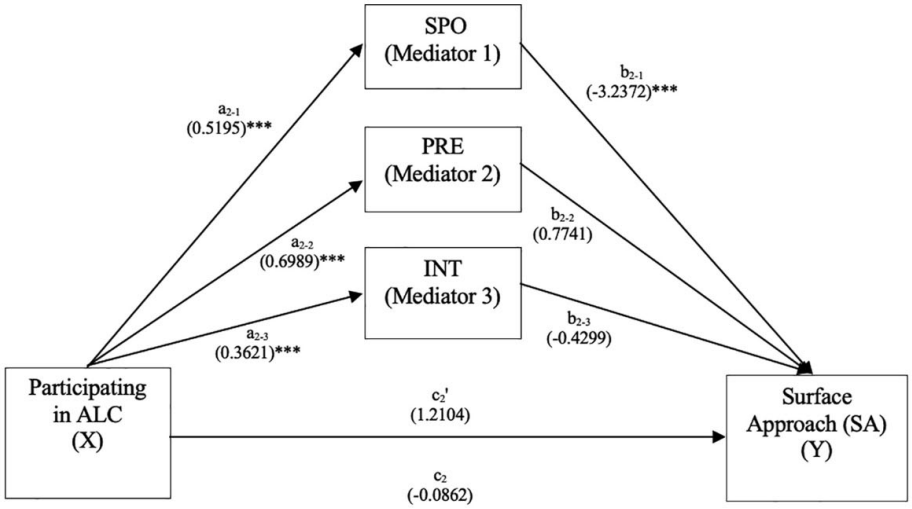


	Path	Effect	B (Parameter Estimates)	SE	BC 95% CI	
					Lower Limit	Upper Limit
DA	c_1	Total effect of X on Y	2.048	1.117	−0.160	4.255
	c_1'	Direct effect of X on Y	0.205	1.176	−2.119	2.530
	$a_{1\text{-}1}b_{1\text{-}1}$	ALC → SPO → DA	1.491	0.613	0.421	2.803
	$a_{1\text{-}2}b_{1\text{-}2}$	ALC → PRE → DA	−0.424	0.604	−1.057	0.814
	$a_{1\text{-}3}c_{1\text{-}3}$	ALC → INT → DA	0.775	0.377	0.158	1.610

ALC: Students' Participation in ALC
DA: The score of deep learning approach measured by the R-SPQ-2F.
SPO: Compiled factor of students "Structured/People-orientation" image toward accounting.
PRE: Compiled factor of students "Precision" image toward accounting.
INT: Compiled factor of students "Interest" image toward accounting.
X = Independent variable; Y = Dependent variable
B: Coefficient B
SE: Standard Error
BC: Bias-Corrected
CI: Accelerated Confidence Interval
*** and * indicate statistical significance at the 1% and 10% levels, respectively.

Fig. 1. Mediation effect analysis for learning approach: Model A: Deep learning.

of accounting than those who did not, and such a perception was subsequently related to limited adoption of surface learning approach ($b_{2\text{-}1}$ = − 3.2372, p = < 0.001). In addition, the indirect effect through more unstructured perception ($a_{2\text{-}1}$ $b_{2\text{-}1}$ = 1.491) was entirely below zero (−2.957 to − 0.780) (refer to Fig. 2). Therefore, this result affirmed that students' more unstructured perceptions of accounting are indirectly but negatively related to their adoption of surface learning.



	Path	Effect	B (Parameter Estimates)	SE	BC 95% CI	
					Lower Limit	Upper Limit
SA	c_2	Total effect of X on Y	−0.086	1.034	−2.130	1.958
	c_2'	Direct effect of X on Y	1.210	1.101	−0.967	3.388
	$a_{2\text{-}1}b_{2\text{-}1}$	ALC → SPO → SA	−1.682	0.557	−2.957	−0.780
	$a_{2\text{-}2}b_{2\text{-}2}$	ALC → PRE → SA	0.541	0.592	−0.422	1.900
	$a_{2\text{-}3}c_{2\text{-}3}$	ALC → INT → SA	−0.156	0.268	−0.702	0.310

ALC: Students' Participation in ALC
SA: The score of surface learning approach measured by the R-SPQ-2F.
SPO: Compiled factor of students "Structured/People-orientation" image toward accounting.
PRE: Compiled factor of students "Precision" image toward accounting.
INT: Compiled factor of students "Interest" image toward accounting.
X = Independent variable; Y = Dependent variable
B: Coefficient B
SE: Standard Error
BC: Bias-Corrected
CI: Accelerated Confidence Interval
*** indicate statistical significance at the 1% levels.

Fig. 2. Mediation effect analysis for learning approach: Model B: Surface learning.

For the other two perceptions of "precision" and "interest," our analysis demonstrated more discretional and absorbing view of accounting by students who participated in ALC ($a_{2\text{-}2}$ = 0.6989, p = < 0.001 for PRE; $a_{2\text{-}3}$ = 0.3621, p = < 0.001 for INT) than those who did not (refer to Fig. 2). However, such status of perceptions was not significantly associated with their adoption of surface learning ($b_{2\text{-}2}$ = 0.7741, p = 0.2859 for PRE; $b_{2\text{-}3}$ = − 0.4299, p = 0.5464 for INT). Thus, the indirect effects of $a_{2\text{-}2}$, $b_{2\text{-}2}$, and $a_{2\text{-}3}$ $b_{2\text{-}3}$ were not significantly confirmed (Fig. 2). Moreover, both direct effect (c_2' = 1.2104, p = 0.2736) and total effect (c_2 = − 0.0862, p = 0.9337) were not significant as well (Fig. 2). Therefore, our analysis confirmed an indirect-only mediation of the perception on students' surface learning approach.[10,11]

[10] The score of "c" for the model of surface learning was not significant (Fig. 2), thus we interpreted it was an indirect-only mediation, based on Zhao et al. (2010).

[11] We also conducted a supplementary test for mediation analysis by using standardized score of learning approach. We standardized each of these two scales (DA and SA) and computed the difference between the deep and surface learning approach scales for each subject (ZDA). With this ZDA score, the subjects with a difference score above 0 were considered to have a deep learning approach, whereas those with a difference score below 0 were considered to have a surface learning approach. With this ZDA score, we conducted a mediation analysis (Appendix 3). The results of this analysis were similar to those of the mediation analysis with deep learning approach (Fig. 1), indicating that students' participations in LEGO® simulation game is indirectly related to their learning approach through its relationship with two perceived dimensions of "structured/people-orientation" and "interest". However, the indirect effect of "precision" view was not significantly confirmed.

5. Discussion and implications

5.1. Mediation role of perception of accounting

Our findings reveal that there is a significant correlation between the mediation effect of students' perceptions toward accounting after the ALC and the deep learning approach (Fig. 1). The finding empirically confirms our hypothesis that ALC is an effective tool to enhance students' deep learning through the mediation effect of their perception profiles. Primarily, the present research successfully shows statistical evidence of a positive association between perceptions and learning approaches, although the course offers a short-time activity. In addition, most prior studies use active learning materials simply as proxies for effective interventions (Phillips & Graeff, 2014; Sangster, 2010; Turner & Baskerville, 2013), whereas we ensure students' strong adoption of deep learning when their participation in ALC changes their perceptions of accounting. This effect was effective in particular for students' unstructured and absorbing images of accounting.

Similar to the result of the deep approach, our results for the surface learning approach also confirm a significant role of perceptions toward accounting as the mediation effect, particularly in terms of an unstructured view (Fig. 2). Compared with the results of a deep approach, signs of coefficient beta for this perception were inverse, which means the opposite function of the effect of perception of accounting on the learning approach. Further, students' absorbing image of accounting did not contribute significantly to the degree to which they adopt a surface learning approach. We will explain the implications of these outcomes on the mediation effect of perception as per each of the three compiled factors of perceptions in the following subsections.

5.2. Structured image of accounting (SPO)

Regarding structured image of accounting, Wells (2019) contended the existence of a general agreement that accounting is perceived as more structured among individuals regardless of their previous experience of accounting. However, our study confirms the effectiveness of ALC in persuading ALC participants, compared with the nonALC group, and concludes that accounting is a more unstructured type subject, whereby perception surely enhances the deep learning approach. This might be due to the ALC, which provides students with opportunities to face more unstructured problems, and the experiences thereof might reflect students' change of view of accounting.

In the ALC, we prepared many tasks focusing on judgment and decision-making to ensure that students confronted unstructured problems and did not resort to memorization and rote learning. The experience of a constructivist pedagogy incorporating unstructured aspects is crucial to changing students' learning approaches (Bevinakoppa et al., 2016; Hodges, 2011); however, we proved this was also achieved by the mediating role of unstructured image of accounting in a short-time course using the GBL.

Moreover, our PCA result indicates that this unstructured image incorporates high involvement of people-related aspects. This aspect, in turn, accelerates the image of accounting to be more extroverted and people-oriented, thus fostering people-related skills among students, such as communication and interpersonal skills. Such generic skills are highly relevant to deep learning approaches in accounting (ACCA, 2016; ICAEW Information Technology Faculty, 2018). Thus, we suggest stronger emphasis on using active learning methods, including GBL, to enhance students' image of accounting to be more unstructured and people-oriented. The use of active learning methods with GBL serves to be an effective way to urge young candidates in accounting to redevelop their skills for future work.

5.3. Conformity image of accounting (PRE)

Our results revealed that participating in ALC would contribute to change the image of accounting to be less conformed and more discretional. However, we find insignificant association between this perception and both deep and surface learning approach. Some prior research contended the association between perception of conformity among students about learning accounting and rote learning strategies, including memorizing accounting standards, learning specific knowledge, and accurate mathematical calculation. This trait is more likely to employ learners' surface approaches than deep approaches (Flood & Wilson, 2008; Jackling, 2005; Lucas, 2000; Ma et al., 2016). However, our analysis outcomes failed to report significant evidence of this construct.

In our ALC using LEGO® game, participants can avoid technical tasks by using a computer and spreadsheet that allows them to concentrate more on discretional decision-making and original judgment, which intends to encourage their deep learning approach. However, perception-related responses via the ALC were neither associated with the adoption of the deep approach nor with a surface approach. This finding implies other extant variables significantly relating to the mediation effect of the perception. Sangster (2010), who contended possible association between a strong perception of conformity and a particular learning approach depending on whether its image is favorable, could support this interpretation. This perspective is also consistent with a recent study by Caglio et al. (2019), who expressed strong pride in honesty (including conformity aspect) as a favorable image of recent accounting professions among Italian accounting students, which is in contrast to other prior studies that defined conformity image as an unfavorable one (Byrne & Willis, 2005; McDowall, Jackling, & Natoli, 2012; Saemann & Crooker, 1999). Eventually, our sampled students were inclined to be similar to those of Caglio

et al. (2019); thus, this perceived aspect of favor may distort the hypothesized mediation effect of conformity image on learning approach.

Moreover, such a favorable status of perception relies on how successfully educators facilitate pedagogies. Sangster (2010) eventually used his teaching material with strong conformity aspects (*Luca Pacioli's Summa arithmetrica*) to conduct active learning and achieved positive results to generate deep learning outcomes. As far as students hold strong, but favorable, perceptions of conformity, this image can foster their engagement with the process of deep understanding. The key to achieving an effective deep approach with a strong conforming image is to understand how one can facilitate active learning materials to trigger appropriate learning with a favorable image of accounting.

5.4. Image of interest (INT)

Regarding the INT, our research indicates that participants were completely motivated during the course of the study. Our results also confirmed the positive effect of interest in accounting among participants, thereby empowering the learners' deep approach. However, the perceived positive attribute does not significantly contribute to influencing the degree of surface approach.

A theory in literature, wherein a strong interest in a subject characterizes a deep approach to learning, supports this finding (Biggs, 1987). In addition, a previous study states that positive perceptions, including interest in accounting, can cause an increase in motivation and cognitive processing (Ferreira & Santoso, 2008), which is the essence of the deep approach. Using GBL as a learning material is another important aspect to obtain significant results as prior studies demonstrated that it can produce affective learning outcomes that help improve learners' motivation, engagement, and interests (Carenys & Moya, 2016; Vlachopoulos & Makri, 2017). In particular, our study highlights that the ALC using LEGO® game improves students' interest level even with its higher evaluation prior to experiencing the ALC (i.e., higher INT scores of nonALC students in Table 4) owing to the stereotype associated with the accounting profession among nonALC students (Caglio et al., 2019). This finding supports the evidence that accounting curriculum coordinators seek room in the curricula and programs to incorporate teaching materials that can elevate learners' interest to deploy their deep approach of learning.

6. Conclusion

The explicit contribution of the present study is our successful clarification of the mediator as the types of students' perception profiles regarding accounting that are affected by a relatively short-term ALC, which ultimately shifts learning approaches toward deep learning. We demonstrated that even a short-term experience of GBL in accounting courses could enhance students' favorable perceptions of accounting that mediate the development of their deep learning approach. Furthermore, our study clearly identified which specific dimensions of perceptions would work as effective mediators on the learning approach. Moreover, this analysis technique has not been widely adopted for research in other domains of business disciplines. Thus, our research also contributes to provide valuable insights into solving a common issue shared with the accounting research. One primary limitation is that we address only one case of ALC at a certain point, and the results may not be generalizable. In addition, a longitudinal study is relevant in investigating the effect of ALC on changes in students' intrinsic interest. Then, future research can compare the findings of this longitudinal study with those of the present study that deal with a short-time active learning activity, as well as address the aforementioned limitations.

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Appendix 1. . Descriptive data for two semester classes

	2019 autumn semester (n = 72)	**2020 spring semester (n = 74)**	
Demographics			
1) Age (Mean [Std. Dev.])	20.83(2.188)	21.03(2.477)	*t*-test
Min	18	18	t = 0.500 (p = 0.618)
Max	26	31	
2) Gender			Pearson chi-square test
Male	33 (55.0%)	27 (45.0%)	χ^2 = 1.317 (p = 0.251)

. Descriptive data for two semester classes (*continued*)

	2019 autumn semester (n = 72)	**2020 spring semester (n = 74)**	
Female	39 (45.3%)	47 (54.7%)	
Total	72 (100.0%)	87 (100.0%)	
Independent Variable: ALC			Pearson chi-square test
ALC students	29 (49.2%)	30 (50.8%)	χ^2 = 0.001 (p = 0.974)
NonALC students	43 (49.4%)	44 (50.6%)	
Dependent Variable:			
1) DA (Mean [Std. Dev.])	33.18 (7.048)	33.53 (6.336)	t = 0.313 (p = 0.755)
2) SA (Mean [Std. Dev.])	21.18 (6.204)	21.30 (5.997)	t = 0.113 (p = 0.910)
Mediator:			
1) SPO(Mean [Std. Dev.])	3.41 (0.739)	3.50 (0.745)	t = 0.393 (p = 0.695)
2) PRE*(Mean [Std. Dev.])*	2.66 (0.824)	2.76 (0.811)	t = 0.788 (p = 0.432)
3) INT(Mean [Std. Dev.])	3.89 (0.683)	3.84 (0.771)	t = 0.409 (p = 0.683)

ALC: Students' Participation in ALC
DA: The score of deep learning approach measured by the R-SPQ-2F.
SA: The score of surface learning approach measured by the R-SPQ-2F.
SPO: Compiled factor of students "structured/people-orientation" image toward accounting.
PRE: Compiled factor of students "precision" image toward accounting.
INT: Compiled factor of students "interest" image toward accounting.

Appendix 2. . T-test results of PAPI items between 2019 semester and 2020 semester sample

	Perception items	2019 autumn semester(n = 72)	2020 spring semester(n = 74)	*t*-test analysis
		Means (Std.Dev)	Means (Std.Dev)	t-value (p-value)
P1 [a]	Cut & dry vs creative solution	3.61 (1.107)	3.54 (1.112)	−0.38 (0.702)
P2	Repetition vs variety	3.44 (1.185)	3.35 (1.187)	−0.47 (0.636)
P3 [a]	Established rules vs new ideas	3.27 (1.177)	3.17 (1.358)	−0.48 (0.629)
P4	Boring vs interesting	4.13 (0.903)	4.30 (0.961)	1.11 (0.266)
P5 [a]	Easy vs challenging	3.94 (1.060)	3.82 (1.011)	−0.70 (0.485)
P6	Dull vs exciting	3.90 (0.891)	3.99 (0.868)	0.57 (0.566)
P7 [a]	Structured vs flexible	3.06 (1.190)	3.02 (1.238)	−0.21 (0.833)
P8	Solitary vs interaction with others	3.97 (1.138)	3.99 (1.014)	0.08 (0.936)
P9	Conformity vs originality	3.07 (1.260)	3.34 (1.219)	1.30 (0.193)
P10 [a]	Stable vs dynamic	3.52 (1.150)	3.64 (1.090)	0.65 (0.516)
P11	Standard operating procedures vs new solutions	3.35 (1.177)	3.42 (1.282)	0.35 (0.726)
P12 [a]	Introvert vs extrovert	3.52 (1.137)	3.68 (1.019)	0.90 (0.368)
P13	Conceptual vs analytical	3.40 (1.057)	3.41 (1.084)	0.01 (0.988)
P14 [a]	Compliance vs innovation	3.51 (1.125)	3.55 (1.087)	0.21 (0.827)
P15 [a]	Facts vs intuition	3.00 (1.113)	3.10 (1.188)	0.56 (0.572)
P16 [a]	Certainty vs ambiguity	2.43 (0.961)	2.58 (1.059)	0.89 (0.371)
P17	Planned vs spontaneous	1.97 (0.855)	2.22 (1.089)	1.50 (0.135)
P18 [a]	Number crunching vs people-oriented	3.25 (1.071)	3.22 (1.104)	−0.11 (0.911)
P19 [a]	Theoretical vs practical	3.61 (0.986)	3.90 (1.009)	1.78 (0.077) *
P20	Tedious vs absorbing	3.50 (0.888)	3.39 (0.857)	−0.74 (0.455)
P21 [a]	Monotonous vs fascinating	3.87 (0.821)	3.94 (0.963)	0.47 (0.633)
P22 [a]	Concrete vs abstract	2.06 (0.844)	2.14 (0.960)	0.52 (0.598)
P23 [a]	Efficiency vs effectiveness	2.68 (0.931)	2.66 (1.050)	−0.11 (0.911)
P24 [a]	Logic vs imagination	2.15 (0.898)	1.94 (0.756)	−1.50 (0.134)
P25 [a]	Superficial vs thorough	4.09 (0.734)	4.10 (0.836)	0.08 (0.934)
P26 [a]	Routine vs unpredictable	3.09 (1.036)	3.24 (1.070)	0.83 (0.404)
P27	Detail-oriented vs overview-oriented	2.01 (1.144)	2.34 (1.208)	1.66 (0.099) *
P28	Accurate vs imprecise	1.42 (0.960)	1.38 (0.823)	−0.25 (0.796)

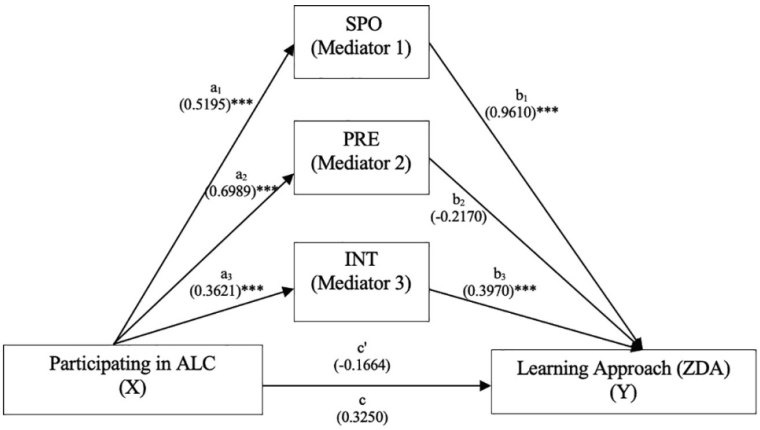
(*continued on next page*)

. T-test results of PAPI items between 2019 semester and 2020 semester sample (*continued*)

	Perception items	2019 autumn semester(n = 72)	2020 spring semester(n = 74)	*t*-test analysis
P29 [a]	Uniform standards vs alternative views	3.22 (1.212)	3.51 (1.161)	1.48 (0.140)
P30 [a]	Fixed vs changing	3.22 (1.177)	3.43 (1.171)	1.08 (0.281)
P31	Methodical vs novel	2.67 (1.075)	2.46 (1.149)	−1.12 (0.263)
P32	Record keeping vs decision-making	3.69 (1.043)	3.73 (1.038)	0.20 (0.838)
P33 [a]	Profit driven vs benefit society	2.94 (1.071)	2.88 (1.123)	−0.29 (0.772)
P34 [a]	Ordinary vs prestigious	3.55 (1.118)	3.47 (1.143)	−0.38 (0.704)
P35	Adaptable vs inflexible	2.39 (1.029)	2.50 (1.162)	0.61 (0.542)
P36	Mathematical vs verbal	2.22 (1.010)	2.38 (1.143)	0.87 (0.384)

* indicate two-tailed statistical significance at the 10% level.
a The scores were measured in opposite directions from the original questionnaire.

Appendix. 3. Mediation effect analysis for standardized score of learning approach



Path	Effect	B (Parameter Estimates)	SE	BC 95% CI	
				Lower Limit	Upper Limit
c	Total effect of X on Y	0.325	0.253	-0.176	0.826
c'	Direct effect of X on Y	−0.166	0.254	-0.667	0.335
a_1b_1	ALC → SPO → ZDA	0.499	0.151	0.237	0.822
a_2b_2	ALC → PRE → ZDA	−0.152	0.119	-0.407	0.066
a_3c_3	ALC → INT → ZDA	0.144	0.075	0.015	0.310

ALC: Students' Participation in ALC
ZDA: The difference between standardized deep (DA) and surface (SA) learning approach scales for each subject
SPO: Compiled factor of students "Structured/People-orientation" image toward accounting.
PRE: Compiled factor of students "Precision" image toward accounting.
INT: Compiled factor of students "Interest" image toward accounting.
X = Independent variable; Y= Dependent variable
B: Coefficient B
SE: Standard Error
BC: Bias-Corrected
CI: Accelerated Confidence Interval
*** indicates statistical significance at the 1% levels.

Path	Effect	B (Parameter Estimates)	SE	BC 95% CI Lower Limit	Upper Limit
c	Total effect of X on Y	0.325	0.253	−0.176	0.826
c'	Direct effect of X on Y	−0.166	0.254	−0.667	0.335
a_1b_1	ALC → SPO → ZDA	0.499	0.151	0.237	0.822
a_2b_2	ALC → PRE → ZDA	−0.152	0.119	−0.407	0.066
a_3c_3	ALC → INT → ZDA	0.144	0.075	0.015	0.310

ALC: Students' Participation in ALC
ZDA: The standardized score of the difference between the deep and surface learning approach scales.
SPO: Compiled factor of students "Structured/People-orientation" image toward accounting.
PRE: Compiled factor of students "Precision" image toward accounting.
INT: Compiled factor of students "Interest" image toward accounting.
X = Independent variable; Y = Dependent variable
B: Coefficient B
SE: Standard Error
BC: Bias-Corrected
CI: Accelerated Confidence Interval
***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

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