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Exploring accounting hybrid skills in a serious games' environment

Explorando as hybrid skills de contabilidade no ambiente de *serious games*

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Ribeirão Preto
2022

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Tese apresentada ao Programa de Pós-Graduação em Controladoria e Contabilidade da Faculdade de Economia, Administração e Contabilidade de Ribeirão Preto da Universidade de São Paulo, como parte dos requisitos para a obtenção do título de Doutor em Ciências

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Dedico este trabalho ao meu filho Daniel e à minha esposa Aline, os motivos do meu acordar, persistir e batalhar diariamente

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Descobri que o analfabetismo era uma castração dos homens e das mulheres, uma proibição que a sociedade organizada impunha às classes populares.

Paulo Freire

Explorando as hybrid skills de contabilidade no ambiente de serious games

RESUMO
Soft skills precisam ser adicionadas ao ensino das hard skills na contabilidade para atendimento às demandas do mercado. Assim, os educadores contábeis buscam alternativas de ensino para desenvolver essas hybrid skills em seus alunos, como o uso de serious game. Contudo, apesar de pesquisas mostrarem os benefícios desses jogos na educação, elas também demonstram riscos. Os serious games podem resultar em uma dificuldade de aplicabilidade do conhecimento explorado no jogo ou podem resultar em nenhum desenvolvimento nos alunos e ter a necessidade de uma alta curva de aprendizagem para o educador. De modo a se minimizar esses riscos, foi desenvolvido um framework dimensional que guia o educador na aplicação do serious game. As dimensões do framework são formadas por elementos do game-based learning, experiential learning theory e theory of planned behavior. A análise desses elementos permitiu a estruturação do ambiente do serious game para auxiliar a entrada e permanência do jogador na metodologia de ensino nas dimensões práticas, sociais e/ou reflexiva. A dimensão prática objetiva a exploração de hard skills. As soft skills são trabalhadas nas dimensões sociais (comunicação e colaboração) e reflexiva (pensamento crítico e resolução de problema). Esse framework foi validado com argumentos da teoria moderna da validação. A validação de constructo permitiu validar a interação dos elementos conceituais, criando o ambiente do serious game. A validação de conteúdo demonstrou as hybrid skills que podem ser exploradas com a utilização de jogos como metodologia de ensino. Por sua vez, os argumentos da validação relacionada integraram as possíveis hybrid skills da contabilidade a serem exploradas com o jogo com os elementos conceituais que formam o ambiente do serious game. Desse modo, o framework guia o educador contábil para aplicar a metodologia de ensino serious game e explorar a hybrid skill almejada, suavizando a curva de aprendizagem e pontecializando a exploração das hybrid skills. Contudo, esse framework não permite verificar como os alunos estão explorando a hybrid skills, de modo a efetivar seu desenvolvimento. Os jogos possuem elementos que exigem a utilização de conhecimentos técnicos da contabilidade, o que facilita a avaliação das hard skills. Porém, não foram encontradas, na literatura, guias para avaliar os soft skills no ambiente do serious game. Então, foi desenvolvido outro framework para suprir essa necessidade. Dessa vez foram utilizadas revisões da literatura sobre (i) o processo de avaliação na contabilidade para verificar os principais requerimentos para uma avaliação eficaz, (ii) a avaliação dos serious games na contabilidade, de modo a analisar as ferramentas possíveis de utilização nesse processo e (iii) as características das soft skills, para identificação de como avaliá-las. O framework apresenta que as soft skills devem ser segregadas em microsoftskills, preenchendo a lacuna da literatura sobre a avaliação de soft skills. Contudo, as microsoftskills devem ser pertinentes à dimensão do serious game escolhido, com base no framework dimensional e os requerimentos maximizam a veracidade das informações coletadas. Esse framework foi validado e tornado confiável com a aplicação da metodologia desing-based research, com a aplicação em três momentos do serious game DANIEL. Ressalta-se que a validação é para o ambiente apresentado. Pesquisas futuras podem aumentar a abrangência dos frameworks apresentados com adição de novas hybrid skills ou avaliação das skills contábeis em novos ambientes educacionais.

Palavras-chave: Hybrid skills, Serious game, Educação contábil, Avaliação de soft skills

Exploring accounting hybrid skills in a serious games' environment

ABSTRACT

Soft skills need to be added to the teaching of hard skills in accounting to meet market demands. Thus, accounting educators seek alternatives to develop these hybrid skills in their students, such as serious games. However, although research show the benefits of these games in education, they also demonstrate risks. The misuse of serious games can harm the scarce learning time, resulting in the non-transfer of knowledge to the student, transfer problem. To minimize these risks, a dimensional framework was developed to guide the educator in the application of the serious game. The framework dimensions are formed by elements of game-based learning, experiential learning theory and theory of planned behavior. The analysis of these elements allowed to structure the serious game environment to help the player enter and remain in the teaching methodology in the practical, social and/or reflective dimensions. The practical dimension aims at exploring hard skills. Soft skills are worked on in the social (communication and collaboration) and reflective (critical thinking and problem solving) dimensions. This framework was validated with arguments from the modern theory of validation. Construct validation allowed validating the interaction of conceptual elements, creating a serious game environment. Content validation demonstrated the hybrid skills that can be explored using games as a teaching methodology. In turn, the related validation arguments integrated the possible hybrid skills of accounting to be explored with the game with the conceptual elements that form the serious game environment. In this way, the framework guides the accounting educator to apply the serious game teaching methodology and explore the desired hybrid skill, minimizing the risks of this pedagogical practice and preparing the student according to market demands. However, this framework does not allow verifying how students are exploring these hybrid skills. Verifying the application of hybrid skills makes it possible to carry out a diagnosis and evaluate the development of these skills. Thus, it is necessary to apply a tool to capture these hybrid skills in the game environment. The games have elements that require technical accounting knowledge, which facilitates the assessment of hard skills. However, no guides were detected to assess soft skills in the serious game environment. So, another framework was developed to fill this new gap. This time, literature reviews were used on (i) the evaluation process in accounting to verify the main requirements for an effective evaluation, (ii) the evaluation of serious games in accounting, to analyze the possible tools for use in this process and (iii) the characteristics of soft skills, to identify how to evaluate them. This literature made it possible to develop a framework that guides the educator to use the tools detected in the soft skills assessment process in the serious game environment, using microsoftskills. Such skills must be relevant to the chosen serious game dimension (practical, social and/or reflective), and the requirements minimize the analysis of false results. This framework was validated and made reliable with the application of the design-based research methodology in three moments of the serious game DANIEL.
It is noteworthy that the validation is for the presented environment. Future reseaches may increase the validation range of the frameworks presented in this thesis.

Keywords: Hybrid skills, Serious game, Accounting education, Soft skills assessment

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1 INTRODUCTION

Accounting education has changed in recent times. The technical skills, called hard skills in the literature, are increasingly performed in an agile and effective way by information systems, ranging from electronic spreadsheets to integrated management systems. (Ghasemi et al., 2011; Linsley et al., 2019). Thus, the job market has no longer seen hard skills as a differential. On the other hand, soft skills are not expected to be replaced by information technology in the short term. These are multidimensional skills such as communication, collaboration, and social skills (Anthony & Garner, 2016).

A survey carried out with companies listed in the Fortune 500 shows that such companies seek professionals with soft skills developed (Jones et al., 2016). In addition, a study focused on the accounting area carried out in New Zealand pointed out that courses in the business area need to add the development of soft skills to their curriculum. (de Villiers, 2011). Soft skills help professionals negotiate and work in groups existing in a business routine (de Villiers, 2011; Ritter et al., 2018). However, besides having the desired soft skills, the worker must also remain with the minimum knowledge of hard skills to understand their activities. The combination of soft skills and hard skills is known as hybrid skills. (Lavy, 2013). Thus, teachers must use teaching methodologies that develop their students' hard and soft skills to meet these demands, avoiding the phenomenon of skill mismatch (Bastos et al., 2020).

Among the methodologies on the rise to develop hybrid skills is the use of serious games in accounting education. These educational games are tools used to teach accounting to students, e.g., Kahoot (Andrews & Higson, 2008; Gómez & Monroy, 2018), MonopolyTM (Mousa, 2019), DEBORAH (Oliveira, 2018), Accounting Challenge (Seow & Wong, 2016), Platform Wars Simulation (Calabor et al., 2019), Liike (Pelser-Carstens et al., 2019). However, these game applications also create educational risks.

The students' learned skills in a game environment may not be applied in a real-world, referred to as a transfer problem (Šisler & Brom, 2008). The game application is also seen as a leisure time activity, which did not imply skill development (Šisler & Brom, 2008). The instructors' learning curve, the cost, and a structural gap in courses limit serious game application (Carenys & Moya,

2016). A poor serious game may result in a repetivive and boring tool, avoinding active exploration (Brom et al., 2009). Then, educators need a framework to guide them to use the serious game, avoiding the hybrid skills exploration during a game application, matching the accounting skills teaching in an education environment with the skills demanded by the job market.

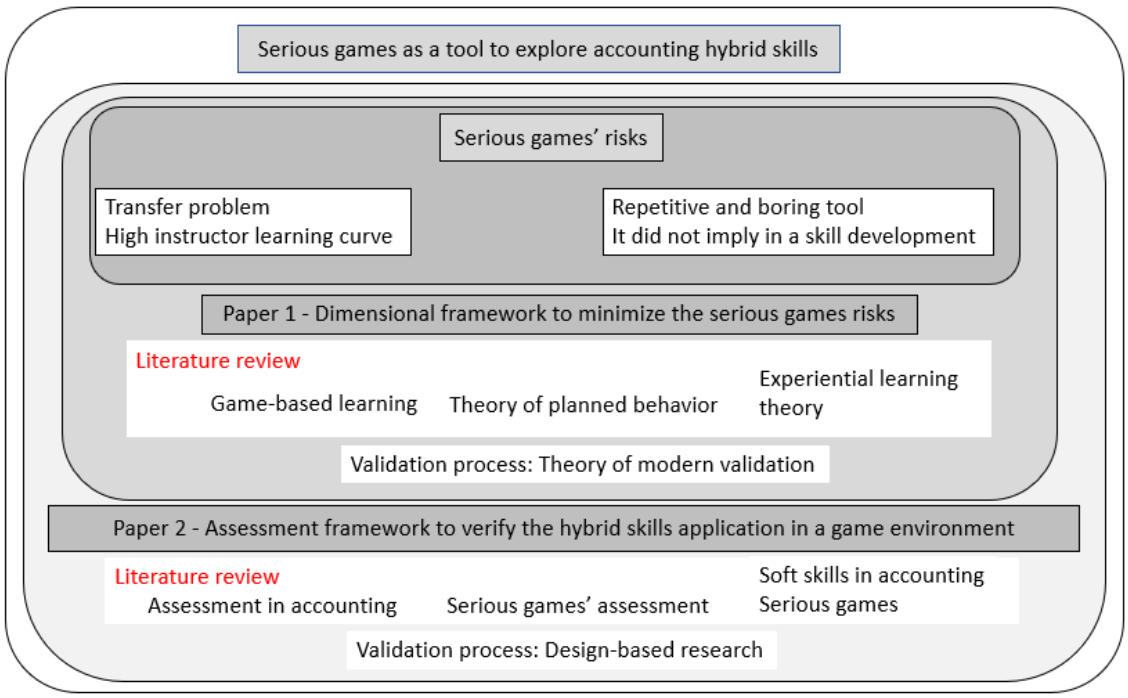
The framework can explain how a serious game explores the hybrid skills, facilitating the adaptation or development of educational games and, thus, the replication of research. (Rooney, 2012). The Stakeholder Experience Assessment framework demonstrated the stakeholders of a serious game (Xu et al., 2013). The Serious Game Design Assessment Framework was created to evaluate the design of a digital serious game (Mitgutsch & Alvarado, 2012), while the Four-Dimensional Framework helped design a serious game for teaching hard skills (Ahmad et al., 2015). However, these frameworks do not explore accounting hybrid skills. Such frameworks are also not concerned with their validity and reliability.

Validity is important for the evaluation of the supports used for the conclusions presented in a research (Kane, 2013; Messick, 1993). The lack of theoretical construction and constructs makes it difficult for the teacher/researcher to replicate research. For such replication to be possible, conceptual, theoretical and empirical evidence is needed. In addition, the framework must also be trusted. Reliability allows replication of results in other practices (Golafshani, 2003). Thus, a valid and reliable framework allows obtaining results similar to those presented in the original research in different researches that use the same concepts.

Thus, the literature review demonstrated that a serious game application may pose risk to the accounting education process which results in a necessity of a validity framework in order to minimize these risks and increase the serious game benefits in a hybrid skills development. So, a first article was prepared to guide the serious game instructor to create an accounting hybrid skill environment. This environment maximizes the serious game potential to explore the hybrid skills chosen by the serious game instructor. The framework was created by a literature review and it was validated with arguments of the modern validation theory. That article was submitted to the “Accounting education” journal on February 22th, 2022, after minor review comments (Attached 1).

The framework developed in article 1 guides the serious game instructor to an accounting hybrid skills environment. However, it does not provide feedback about how the students are exploring their hybrid skills. This feedback is important for the instructor to validate the skill development. The literature review demonstrated some tools that may help this validation. However, that literature focuses on hard skills, thus not solving a gap in the soft skills assessment in a serious game environment. Then, another framework is proposed in article 2 to fill this gap. Then, the game DANIEL (HTTPS:// https://www.falandocontabiles.com/suporte-aos-docentes) was created based on the first framework, and its application to verify the steps to assess soft skills was reported in the article 2. The design-based research was applied to validate the framework and to turn it reliable. That article was submitted to “Education and Information Technologies” on March 7th, 2022. The Figure 1 below demonstrated how this thesis as a whole minimizes the serious games’ risks creating an environment to explore the accounting hybrid skills (article 1) and assessing the soft skills results during a serious game application (article 2).

Figure 1 - Structure of the thesis



Then, this thesis proposes two guides that togheter minimize the risk for transfer problem, non development skills, high learning curve and a boring and

repetitive tool. The frameworks were structured based on a literature review. The first article was validated with the modern validation theory and the second article was validated with the desing-based reseach. The serious game applicaton occurred on an online environment because of the COVID-19 pandemic. The methodology details are described in each article.

2 SUBMITED ARTICLES

Article I

Serious games may shape the future of accounting education by exploring hybrid skills

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ABSTRACT

New technologies shape the market by requiring hybrid skills for accounting professionals. Serious games may help to prepare students by cultivating these skills. However, an improper game application may disrupt students' skill development. A guide is necessary to avoid a disruptive scenario by making serious games a proper teaching methodology to ensure desired learning outcomes. Thus, this research aims to structure a valid holistic framework by integrating game-based learning, the theory of planned behaviour, and experiential learning theory to potentialize the benefits of games and minimize their risks. The objective was achieved by designing a framework proposal and validating it with arguments from modern validation theory. This research shows the benefits of serious games and contributes to the accounting education field by adding a new validated framework that guides educators to explore the development of students' hybrid skills.

Keywords: Experiential learning theory; Game-based learning; Serious games; Accounting education

1 INTRODUCTION

Artificial intelligence has been replacing rote accounting tasks such as invoice creation, process, payment, and bookkeeping. Companies with automated software are able to analyse and register data without accountants' manual interaction with a company's system (Balakrishnan et al., 2019). Although some companies continue to operate without these automatization processes, these changes reflect an inevitable trend in the accounting field (Luo et al., 2018). Technical skills, also called hard skills, have been replaced by technological advances. However, technology cannot standardize professionals' social behaviour, or soft skills, such as teamwork and problem solving. *Forbes* highlights the importance of soft skills, arguing that their use increases work effectiveness (Walker, 2021). This discussion does not overlook the importance of hard skills; instead, it amplifies the accounting skills required by society to develop soft skills. This combination of hard skills and soft skills is called hybrid skills (Lavy, 2013).

Serious games may help educators develop hybrid accounting skills. A serious game is a tool, different from gamification, which, in turn, is a process where game mechanics are added in a class, such as the addition of scores, badges, and levels (Hamari et al., 2014; McClean, 2016). Serious games are educational tools that aim to develop skills along with providing commercial entertainment (Eckardt et al., 2018) and hence reduce boredom factors in the learning process, thereby increasing motivation, concentration, and student interest (Silva et al., 2019). Thus, in this research, a serious game is an educational tool whose primary objective is to help students learn and practise a skill rather than provide a means for fun or entertainment. This tool can be created for an educational proposal, such as the DEBORAH game, or it can be a commercial game adapted for a didactic focus, as in the Monopoly™ game in Mousa's (2019) study.

A suitable environment for serious game applications is necessary to develop hybrid skills. Such an environment consists of resources and actions with a learning focus that allow students to share their thoughts, knowledge, and experiences (Anastasiadis et al., 2018). Therefore, if serious games do not receive proper attention during their application, they can hamper the

development of hard and soft skills. To avoid this risk, studies of serious games usually use pedagogy from game-based learning (GBL) to structure serious games (Garcia et al., 2020; Sousa & Rocha, 2019). GBL creates an environment that enhances the acquisition of knowledge and skills (Qian & Clark, 2016) and positively influences students' learning attitudes because of its social factors (Silva et al., 2020b). However, even when using this pedagogy, there is a risk of a "transfer problem" involving divergences between gameplay and learning objectives (Brom, Sisler, et al., 2009) because of student or instructor behaviour.

To avoid the "transfer problem", Sugahara and Lau (2019) used Matsuo's (2015) experiential learning theory (ELT) behaviour factors to facilitate experiential learning, such as the serious game environment (Rooney, 2012). In addition to ELT, the theory of planned behaviour (TPB) suggests that nonmotivation resources, attitudes, and social pressure shape an individual's intention to perform an expected behaviour (Ajzen, 1991, 2002). Thus, the integration of GBL, ELT, and TPB may allow for the development of hybrid accounting skills and may minimize the risk of the transfer problem. This approach may result in students being well prepared for the job market and may effectively demonstrate the relevance of accounting education.

However, the literature lacks a valid conceptual framework with a holistic view representing the integration of GBL pedagogy, ELT behavioural factors, and TPB. A conceptual framework may help researchers see these main aspects and provide a general approach to guide the application of the study with an integrated literature review (Imenda, 2014).

Therefore, this research aims to formulate a valid conceptual framework to guide serious game implementation in accounting to maximize the potential for exploring hybrid accounting skills. To achieve the proposed objective, we aim to answer the following research question: How can GBL, ELT, and TPB elements be integrated to explore hybrid accounting skills through a serious game application?

1.1 Contributions

This research aims to contribute to accounting education theory and practice. The integration of GBL, ELT, and TPB can provide a new way to appreciate and use these theoretical approaches to benefit students' development. The

application of the framework may encourage accounting instructors to adopt teaching methodologies related to serious games, bringing accounting education closer to societal demands and minimizing the risk of harm to students' hard or soft skills development.

2 LITERATURE REVIEW

2.1 Accounting education

The education process must follow global changes (Aris et al., 2013) to fulfil labour market demand. The International Accounting Education Standards Board (IAESB) presents soft skills and hard skills as components of required learning outcomes for professional skills (IAESB, 2017). The addition of soft skills in the accounting curriculum results in accounting graduates being more well-rounded and productive professionals (Rebele & St. Pierre, 2019). By preparing accounting students with soft and hard skills, accounting education can benefit students and prepare them to be better accountancy professionals for the market than accountancy education that supports the formation of only hard skills.

Unfortunately, the traditional accounting teaching method focuses on hard skills preparation. It is based on educational strategies such as lectures, textbooks, and case study techniques that offer limited practice of hybrid skills (Osmani et al., 2018). Educational institutions that use only these traditional teaching programmes do not create an environment for students to practice the hybrid skills required in the marketplace, thus creating a skill mismatch that leads to competence deficits in organizations and difficulties in career development for employees (Bastos et al., 2020). Serious games may offer a solution for this skill mismatch between educational institutions and societal demand.

2.2 Serious games in accounting

The serious game teaching method aims to use experience and emotion to convey learning (Marsh, 2011). Despite some research linking serious games

only to digital games (Rooney, 2012), this research assumes that serious games may be digital or not digital, as demonstrated by Wilkinson (2016).

Serious games in accounting are scarce. A literature review of serious games in management education demonstrated that only three studies (Carenys et al., 2017; Krom, 2012; Moncada & Moncada, 2014)of the 304 studies conducted between 2012 and 2018 related to accounting teaching (Silva et al., 2020a). However, these studies demonstrated the potential of serious games in accounting education.

Games such as DEBORAH (Oliveira, 2018), Kahoot (Gómez & Monroy, 2018), MonopolyTM (Mousa, 2019), Accounting Challenge (Seow & Wong, 2016), Liike (Pelser-Carstens et al., 2019), Management Game (Sugahara & Lau, 2019), AccountinGame (Silva et al., 2020b), FarmVille (Krom, 2012), and Working Capital Simulation: Managing growth V.2 (Carenys et al., 2017) have been shown to contribute to hybrid skills development.

These studies, summarized in Table 1, demonstrate that educators can use this methodology to create an environment for students to develop their hybrid skills. We looked for serious games that are applied in the accounting field and determined which hybrid skills they affect.

2.2.1 HYBRID SKILLS IN SERIOUS ACCOUNTING GAMES

Serious game research applied in the accounting field shows that game applications develop at least six hybrid skills. Previous studies were identified through the Web of Science Database (www.webofknowledge.com) from October 2019 to August 2020 and based on a review of games in education by Silva et al. (2020a). Table 1 shows the hybrid skills that were empirically identified and the definitions used to summarize each hybrid skill in this framework.

Table 1 - Hybrid skills developed by serious games in the accounting field

Hybrid Skills	Definition	Game
Problem Solving	To solve an existing problem and discover the existence of a problem to be solved (Coetzee et al., 2012).	MonopolyTM[1] Liike[2]
Collaboration	Information exchange and collective knowledge development (Romero et al., 2012).	MonopolyTM[1] AccountinGame[3] FarmVille[4] PowerPoint games[5]
Hard Skills	Technical skills to work with business data and administrative routines (de Villiers, 2011).	DEBORAH[6] Kahoot[7] Accounting Challenge[8]

		AccountinGame[9] Working Capital Simulation: Managing growth V.2[10] Marty Raygun's Fistful of dollars[10] FarmVille[4] PowerPoint games[5]
Communication	The individual's communication ability, resulting in interaction, discussion, and sharing ideas, affects perception (Raba, 2017).	MonopolyTM[1] Liike[2]
Critical Thinking	Ability to judge received information, evaluate alternative evidence, and use solid arguments to defend a position (Ku, 2009).	Management Game[11] MonopolyTM[1] Liike[2]

[1] (Mousa, 2019) [2] (Pelser-Carstens et al., 2019) [3](Silva et al., 2020b) [4](Krom, 2012) [5](Moncada & Moncada, 2014) [6](Oliveira, 2018) [7](Gómez & Monroy, 2018) [8](Seow & Wong, 2016) [9](Silva et al., 2020b, 2021) [10](Carenys et al., 2017) [11](Sugahara & Lau, 2018)
Source: The authors

It is not easy to find games to apply in the classroom, and it is even more difficult to find games that cover a variety of hybrid accounting skills. Table 1 shows that players apply specific hybrid skills in the serious games MonopolyTM, DEBORAH, Kahoot, Management Game, Liike, AccountinGame, FarmVille, and Working Capital Simulation and in PowerPoint games. Each game, with its own environment, can explore limited types of hybrid skills. In addition to the games' characteristics, serious games need to be available, educators need to know how to use the games, and educational institutions need corresponding resources (Carenys & Moya, 2016). Furthermore, educators must know a game's strengths and weaknesses in addition to the game's availability before applying a game to support the development of hybrid skills.

Even with the elements above, game application may be frustrating or may result in an unproductive application (Brom, Šisler, et al., 2009). To avoid this scenario, GBL adds characteristics such as a pedagogical function (Sousa & Rocha, 2019), making the game a natural feature of the learning process (Giannakas et al., 2018), adding fun (Al-Azawi et al., 2016), and considering the serious game as a tool that is part of a GBL "umbrella" (Pivec, 2009).

2.3 Game-based learning

The main objective of GBL is to motivate students (Al-Azawi et al., 2016). Students learn in GBL by resolving serious game challenges (Sousa & Rocha, 2019). Educators can use GBL pedagogy in serious game applications to

encourage students join the game, and the learning process occurs during the entertainment process (Pivec, 2009). GBL creates favourable accounting learning images in students (Sugahara & Cilloni, 2021) by rendering an attractive school environment and developing motivation (Silva et al., 2021).

The five most-cited GBL pedagogical characteristics that help serious games become entertainment methods in the learning process are (i) motivation, (ii) competitiveness, (iii) adaptation possibility, (iv) engagement, and (v) immediate feedback (Plass et al., 2015; Qian & Clark, 2016; Viviers et al., 2016). Studies with these pedagogies focus on various aspects of serious games, such as rewards to cultivate motivation, challenge adaptation based on knowledge level, enhanced cognitive engagement with learning mechanics (Plass et al., 2015), and competition and feedback in game design (Qian & Clark, 2016; Viviers et al., 2016).

However, the application of a serious game does not involve just the game. Interactions with external tools and other players during the game application impact the learning process (Giannakas et al., 2018; Matsuo, 2015). GBL is not concerned with students' and instructors' behavioural factors (Taylor et al., 2012; Westera, 2013). The instructor's behaviour reflects the game's use, but unfortunately, it is rarely explicit in serious game research (Taylor et al., 2012). For example, suppose the instructor's behaviour motivates the student to play the game and not apply his or her knowledge in the game. In that case, the learning process does not occur in GBL (Pivec, 2009). ELT, with the addition of behaviour, can help to address this shortcoming of GBL.

2.4 Experiential learning theory and its behavioural factors

ELT argues that learning occurs with practice; the cycle begins with practice (experience itself), reflection on the experience, and abstract conceptualization and ends with experimentation based on the previous process (Kolb & Kolb, 2005). When GBL is used to structure a game, ELT focuses on the practice experience, which can be the application of a game (Kiili, 2005). Matsuo (2015) added five behavioural factors that facilitate learning development in ELT and enhance the ELT experience: (i) challenging tasks, (ii) critical reflection, (iii) pleasure at work, (iv) goal-oriented learning, and (v) network development (Matsuo, 2015). Challenging tasks push students to acquire new skills. Critical

reflection creates new thoughts and actions. Pleasure at work involves the student in the experience (Matsuo, 2015; Sugahara & Lau, 2019). Goal orientation and network development are antecedent factors that impact other behaviours (Matsuo, 2015). Goal orientation represents the individual's intention in an achievement situation, making the student interested in learning. A network is a group of people who help each other think and contribute to providing new insight and influencing enjoyment and changing views (Matsuo, 2015; Sugahara & Lau, 2019).

Sugahara and Lau (2019) applied game management and analysed its results according to Matsuo's (2015) studies. They concluded that "not all types of GBLs give higher efficacy of learning for those who participate in an experiential learning environment" (Sugahara & Lau, 2019). Matsuo's (2015) five factors can minimize this efficacy.

Matsuo (2015) makes serious game applications complex and difficult to apply by using all behavioural factors. However, not all behavioural factors are necessary to create a suitable environment for a specific hybrid skill. For example, if the learning goal is soft skills collaboration, a critical reflection or challenging task may be unnecessary. However, network development is essential in a serious game environment, and a serious game environment to develop a specific hybrid skill requires specific behavioural factors. The same is true for GBL pedagogy. Engagement may influence soft skills collaboration more than immediate feedback. Although all behavioural factors and GBL characteristics are essential in the learning process, the instructor can enhance hybrid skills practice by choosing some behavioural factors and GBL pedagogies. A serious game structure can be simpler and more effortless than Sugahara and Lau's (2019) model with fewer game application elements.

ELT does not include students' intention to join the game environment. Intention is essential in the learning process because it creates a particular behaviour of using a learning resource (Silva et al., 2020b).

2.5 Theory of planned behaviour

The TPB helps to understand human behaviour by analysing the individual intention to perform a behaviour (Ajzen, 1991). Behavioural achievement depends on the perception of behavioural control (Ajzen, 1991), that is, the

motivational and nonmotivational resources for expected behaviour. Nonmotivational resources are time, money, skills, and cooperation, which are required to provide the opportunity for a specific behaviour (Ajzen, 1991). Motivation makes an individual decide to use these nonmotivational resources to perform or not perform a behaviour. Therefore, students need nonmotivational resources to have the opportunity to play a serious game and motivation to make them want to play the game.

The perception of behavioural control is an independent concept of intention, along with attitude and social factors, that helps to predict individual intention (Ajzen, 1991). Attitude refers to behavioural beliefs, individual thinking, beliefs influenced by previous experiences, and a favourable or unfavourable evaluation of the behaviour in question (Ajzen, 2002; Alzahrani et al., 2017). It influences continued use intention and word of mouth (Silva et al., 2020b). Social factors influence the individual's predisposition to develop a skill, which is affected by personal or social pressure (Ajzen, 1991).

Thus, nonmotivational resources are essential to enable students to join the game, students' attitude determines whether they believe a given behaviour is favourable for them, and personal or social pressure influences students' desire to join the game. These independent concepts of intention have been found to positively relate to game usage (Alzahrani et al., 2017) and directly or indirectly relate to perceived learning (Silva et al., 2021). Essentially, students are telling themselves, "(I) I can perform the serious game, (II) it will be good for me to play and practice the hybrid skills requested, and (III) I need to develop these hybrid skills during gameplay", thus creating students' intention to play the game.

The TPB demonstrates that attitude, motivation, and flow (used as a surrogate for engagement) influence specific game tasks (Silva et al., 2021). Motivation and engagement are discussed in GBL as part of game pedagogy. The TPB adds that motivation and attitudes stimulate students to improve the quality of their learning process. Engagement affects feelings of pleasure and motivation (Silva et al., 2021). ELT behavioural factors suggest that pleasure at work improves experiential learning. Therefore, we can affirm that GBL, TPB, and ELT have elements that complement each other. However, these complements are not accessible when learning pedagogy and theories are isolated. Therefore,

the following framework proposal aims to create an integrated overview of these theories and concepts.

3 CONCEPTUAL FRAMEWORK PROPOSAL TO POTENTIALIZE HYBRID ACCOUNTING SKILLS WITH SERIOUS GAMES

The proposed framework was assembled by integrating serious games, GBL, ELT, and TPB characteristics that may influence the hybrid accounting skills environment. The hybrid skills in this framework were selected based on the hybrid skills demonstrated in the serious accounting games discussed above. Through discussion of the theories and concepts in the literature review section, we were able to structure a guide to create opportunities for students to practice their hybrid accounting skills in a serious game application. This practice may facilitate the development of hybrid accounting skills.

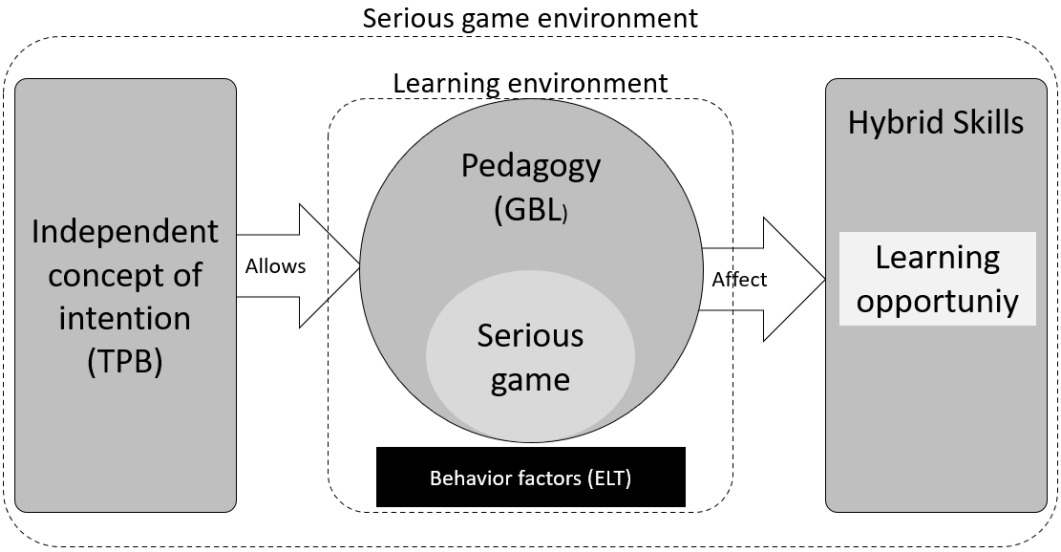
The analysis of serious games, GBL, ELT, and TPB was concluded when integration among them was possible. The methodology section discusses the arguments to validate the framework after its presentation.

The literature review showed that GBL pedagogies focus on serious game structures without considering the instructor's and students' behaviour in learning development (Taylor et al., 2012; Westera, 2013). The behavioural factors of ELT address this shortcoming (Sugahara & Lau, 2019) and create students' intention to play the game. However, they do not create students' intention to join the game for perceived hybrid skills learning. The TPB's independent concept of intention helps to create this intention (Silva et al., 2021). In this way, GBL, ELT, and TPB may resolve each other's gaps. A framework was developed to model and understand this integration.

The instructor's behaviour can facilitate the development of experiential learning through serious games (Rooney, 2012), enhancing practical knowledge (Alshurafat et al., 2020). Experiential analysis is an example of behaviour that helps this learning process (Bosschaart et al., 2016). Experiential methodology examples found in the literature are case studies, small discussion groups, teamwork, pedagogical novels, short stories, guest speakers, problem-based learning, teaching novels, and mock trials (Alshurafat et al., 2020). In all these teaching approaches, ELT is the basis for enhancing hard skills. ELT studies usually do not discuss serious game methodologies or soft skills.

In this conceptual framework, we assume that the behavioural factors of ELT facilitate GBL to create an environment for the practice of hard and soft skills using serious games rather than directly developing these skills. However, this environment creates the opportunity for students to develop and practise hybrid accounting skills. The first barrier to the application of serious games is making students want to join the game environment. Then, the positive behaviour of play must be created before gameplay. Favourable behaviour enhances learning opportunities. The TPB's independent concept of intention creates students' behaviour of playing the game. Figure shows how the integration of serious games, GBL, ELT, TPB, and hybrid skills interacts and creates an accounting hybrid skills environment through the application of serious games.

Figure 1 - Integration of game-based learning (GBL), experiential learning theory (ELT), theory of planned behaviour (TPB), and serious games



Source: The authors

We can conclude that first, the TPB creates students' intention to join a learning environment composed of a serious game. Second, GBL enhances the applicability of the serious game by interacting with ELT behavioural factors, thus facilitating experiential learning. Third, this interaction creates an environment that allows students to apply their skills, thus developing opportunities for learning hybrid accounting skills. This synergy is possible in the hybrid accounting skills environment created through the application of serious games.

However, the serious game environment may differ depending on how this synergy is structured. A game can have many different structures and GBL applications (Sugahara & Lau, 2019). Similarly, ELT behavioural factors can

allow the practice of various skills depending on GBL pedagogy and ELT behavioural factors in the game environment. We analysed hybrid skills in previous research to determine which hybrid accounting skills a serious game may develop.

3.1 Dimensions of hybrid skills learning opportunities

Games' environmental diversity and complexity make each serious game prone to developing different hybrid skills. MonopolyTM and Liike are played in teams, creating an opportunity for students to practice their soft skills in groups. The Kahoot game can promote soft skills when students play the game in a team and hard skills when students choose to answer questions about a specific topic. Other digital games, such as PowerPoint games, can also be adapted, and a simple mobile game can create an environment that stimulates several hard and soft skills. These adaptations and ways to apply serious games in the classroom separate the framework into three dimensions: practical, social, and reflective. Each dimension is structured with ELT behavioural factors and GBL pedagogical characteristics. Applying these characteristics during the experience of serious games creates an environment that can stimulate specific hard and soft skills. The educator can control the environment to aim for the development of hybrid skills.

In each part of the framework, we discuss how it should be applied during accounting classes to create an environment that encourages hybrid accounting skills development.

3.1.1 Practical dimension

Experiential learning motivates learners more than traditional teaching methods do (Burns & Gentry, 1998). Motivation is considered a characteristic of serious games that captivates students' interest, thereby increasing their learning ability (Anastasiadis et al., 2018). Neurological research shows that games release dopamine in players, which is part of the brain's reward system. This release motivates the player, helping them to concentrate (Shunk, 2012). However, the motivation to learn is provided by the game environment, not just by the game itself (Pivec, 2009).

Motivation influences students' efforts to understand questions and propose solutions to presented challenges (Pintrich, 2000). The competitive factor in serious games motivates students to learn (Abdul Jabbar & Felicia, 2015). Serious games provide competition between players or the game itself (Reigeluth & Myers, 2013), but competition between players results in the most pleasurable activities (Goršič et al., 2020; Soares et al., 2020).

The practical dimension demonstrates how GBL pedagogies integrate with ELT behavioural factors, strengthen motivation, and create a space for students to practice their hard skills through goal-oriented learning. Without paying attention to these characteristics, educators may assume that the risks of serious games will not create opportunities for students to apply the basic skills involved in regular expository classes. The inclusion of these skills can advance the pedagogical environment of serious games, thus facilitating students' engagement in learning (Abdul Jabbar & Felicia, 2015).

An example of applying the practical dimension is the creation of questions about studying hard skills in quiz games or challenges that require hard skills. The action required by the player needs to be easy to understand and have clear rules. Tasks should focus on the application of hard skills with intuitive rules to promote pleasure, challenge, and the goal-oriented characteristics discussed in relation to ELT social factors. Each correct answer needs to add points to the player’s score. After the game, a leaderboard is shown with the player’s position. The tasks, score, and leaderboard create the motivation and competition discussed in GBL pedagogy.

Note that the practical structure does not allow the practice of soft skills. The following dimension discusses this gap.

3.1.2 Social dimension

The teacher's pedagogical behaviour is essential to enhance the development of new hybrid skills (Barrows, 1996; Koivisto et al., 2015; Tan & Laswad, 2018). Adapting the game's objective and adjusting the player's performance and the situation are essential for engaging learners in the teaching methodology (Scanagatta et al., 2020). Unlike motivation that seeks to captivate students (Anastasiadis et al., 2018), engagement results in learners' persistence in the learning process (Eseryel et al., 2013).

Game adaptation results in more comprehensive potential to develop hybrid skills through a game (Almeida 2017). Theoretically, flow theory explains this adaptation, which demonstrates the importance of challenging shapes. For gameplay to remain pleasurable, the difficulties must adapt to learners' skills, thus engaging players (Zain et al., 2012). In addition to adapting to challenges, it is essential to adjust gameplay to enhance the development of new hybrid skills. An example of adaptation is changing a single-player game into a team game. Working toward a common goal enhances the development of collaborative soft skills (Lee et al., 2016).

Suppose the interaction among students is motivated by the teacher, and the interaction among players results in the achievement of a goal. In this case, these interactions are essential for players to advance at each game stage (Viviers et al., 2016). Social interaction enhances learners' engagement in the teaching process (Eseryel et al., 2013). In this way, the teacher's role in using the serious game is essential for developing hybrid skills since the teacher makes the necessary adaptations. The teacher is more important than the game itself (Pivec, 2009).

The interacting individuals constitute the social network and provide mutual growth (Matsuo, 2015). The social network develops collaboration and communication among apprentices to solve a specific task. Thus, it provides the construction of collective knowledge, uniting apprentices with increasingly less knowledge (Shabani, 2016). Such networks reveal to learners the importance of sharing information. Therefore, the instructor's adaptation of serious games enhances the development of social networks among learners. These networks in turn help to develop soft skills, collaboration, and communication.

Serious games promote intergroup and intragroup interactions (Romero et al., 2012). Intergroup interaction is motivated by real competition in the game. Intragroup relationships result from the positive interdependence between individuals, where a team member's success can result in the entire team's success. Intergroup information sharing tends to be less efficient as the player's goal is to outperform the other player, and the exchange of information can favour the opponent. Therefore, a game that favours intragroup interaction tends to promote more effective soft skills collaboration. A multiplayer environment can be created in a digital game using the internet to collaborate (Romero et al., 2012),

while a single-player game blocks the development of collaboration. Group activities positively affect communication skills and collaboration skills (Raba 2017; Coleman and Money 2020).

Interaction between students enhances soft skills related to communication (Wicaksono et al., 2019). This interaction contributes to the task assigned by the teacher, which may require technical knowledge to complete, thus contributing to the development of hard skills.

In this way, the social dimension of this framework creates an environment for students to practice their hybrid skills through collaboration and communication. This practice is possible due to the student engagement created by a game adaptation or the choice of a network game goal instead of an individual game goal.

An example of the application of this dimension is the choice of a group game or adaptation of an individual game to play in a group. Students organized in groups provide answers in a quiz game, and each individual in the group has a different role. In four-member groups, one player should be responsible for looking for the answer on the internet, the second player should look for the answer in books, the third player should look for the answer in the classroom notes, and the last player should present the solution. After each action, the players share knowledge with the player who will answer the question. This process adapts the serious game for group interaction, engaging the players using GBL pedagogy. This group interaction also creates a network for the players and goal-oriented tasks in groups, which are characteristics of ELT social factors.

However, this dimension limits the soft skills related to interaction that are created by groups. There are soft skills that require the player to interact with himself or herself. The reflective dimension addresses these skills.

3.1.3 Reflective dimension

While the practical dimension focuses on creating space to practice hard skills, the social dimension creates the opportunity for social interaction, and the reflective dimension focuses on students' minds. The reflective dimension demonstrates to students a better way to think in a game situation.

The safe environment provided by serious games enables players to make mistakes and shape their skills until they can overcome the game's challenges (Wilkinson, 2016). Failure allows learners to criticize their actions and learn from the actions they perform. However, to discover their mistakes, players must receive immediate feedback during the game. Immediate feedback demonstrates how the learner's response affects the task, allowing individuals to learn from their mistakes (Sugahara & Lau, 2019). In this way, players begin to understand their errors in the game challenge and how to succeed in the challenge the next time a similar task is presented.

In a safe environment, a student can make mistakes, for example, without risks (Choleva et al., 2013). In accounting, a false accounting report or booking may generate an incorrect decision, resulting in an organizational loss or closing. The learning acquired from the error is presented as reality, minimizing the possibility of mistakes with real impacts (Anastasiadis et al., 2018; Reigeluth & Myers, 2013). A safe environment in serious gaming allows the player to take risks when making decisions without a real impact, as in surgery or accounting. Serious games also show the player the results through points or advancement. The next time the task is presented, to advance in the game or to earn the proposed task's points, the player must act differently to succeed in the task. Errors in the game, which are shown by immediate feedback, allow a change in the player's thinking in simulated situations. This change occurs when the learner notices the benefits of the change (Lee et al., 2016) and believes in the development of his or her ability through practice (Lee et al., 2012). Requiring students to solve tasks based on critical reflection facilitates and improves practical learning (Cinque, 2016). Errors must be critically analysed so that a change in thinking can occur and the student can understand the reasons for his or her mistakes and prevent them in the future. Cognitive learning suggests that reflection is essential for developing critical thinking (Lockman et al., 2019). Thus, the critical reflection characteristic of ELT is directly associated with the hybrid skill of critical thinking.

Problem solving is another soft skill that critical reflection helps to develop. Problem solving does not involve merely solving an existing problem, as the name suggests; it also involves discovering a problem to be solved (Coetzee et al., 2012). It begins with analysing the facts and circumstances of the object under

study to understand and search for the problem (Osmani et al., 2018). Then, motivation is necessary to create an environment for students to persist in discovering a solution to a problem. Learners with a higher level of motivation are more likely to find a solution than those with a lower level of motivation (French & Thomas, 1958).

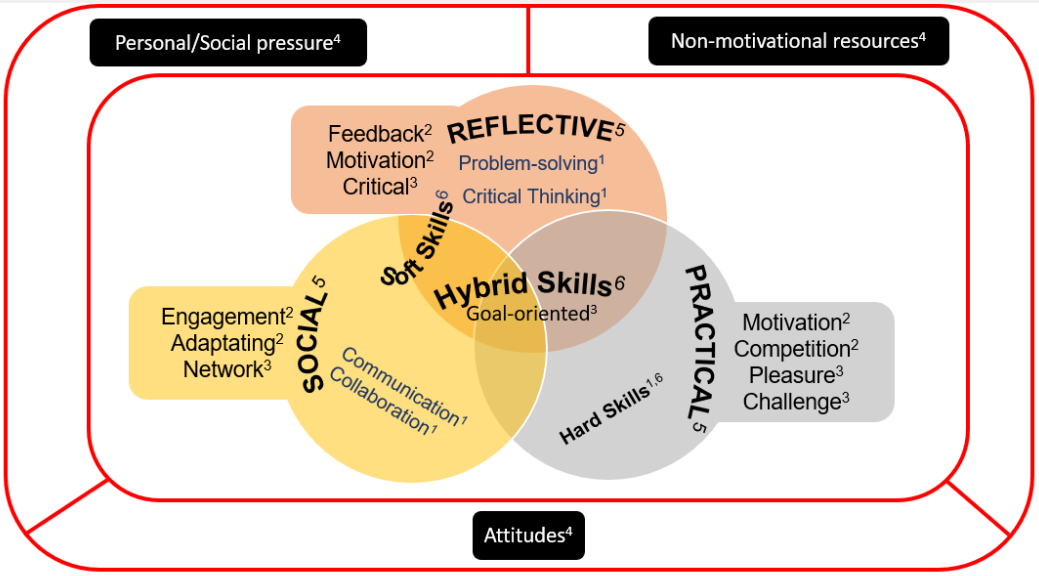
An example of applying this dimension is not creating a yes or no question or choosing an answer from a list. In a quiz game, the player needs to develop or validate a sentence with his or her own words. After the solution, the game administrator needs to provide feedback, showing the mistakes and creating an opportunity to try again later in a similar task. The tasks need to be easily understandable for players with a score reward to create motivation. This feedback and motivation are part of GBL pedagogies, and the goal-oriented game to address tasks critically is part of ELT social factors.

In addition to the practical and social dimensions, the reflective dimension covers the hybrid skills discussed in this research. To help the serious game instructor manage student learning in the serious game environment, the TPB works as a belt surrounding the discussed dimensions.

3.2 Framework consolidation

Figure 2 summarizes how TPB, GBL, ELT, and serious games create an opportunity for developing the hybrid skills presented in Table 1. Note that each dimension in the learning environment is independent. The social dimension does not necessarily develop hard skills or critical thinking, but it can do so. The educator should add practical or reflective dimension characteristics.

Figure 2 - Illustrative summary of the conceptual framework



4 METHODOLOGY

The integrated framework proposal needs to be validated before its application to increase the successful application rate. As this framework guides the application of serious games in a social system and each social configuration has unique unmeasured parameters, generalizing this kind of study is difficult (Parsons et al., 2020). Therefore, the validation of qualitative research must abandon standard evaluation criteria and use classic concepts, alternative concepts, and empirical findings for research validation (Kihn & Ihantola, 2015). This research aims to validate the arguments using modern validation theory (Kane, 2013). Modern validation theory arguments unify constructs, theories, and related preview research results (Messick, 1993; Wolming & Wikström, 2010). These topics are discussed below.

4.1 Construct validation

The constructs used in this research are based on elements of GBL, ETL, and TPB. Constructs correspond to construct validation (Messick, 1993). Therefore, the integration of the TPB's independent concepts of intention, GBL pedagogy, and the ELT behaviour factor form the conceptual framework for a hybrid skills environment in accounting using serious games that is validated with supporting evidence and plausible arguments in this segment.

4.2 Content validation

The content corresponds to the validation of other studies' conclusions (Messick, 1993). Studies that demonstrate the development of hybrid skills in a serious game environment are considered in this section. The integration of GBL pedagogies and ELT behavioural factors results in an environment that enables different hybrid skills. The purpose of content validation is to determine which hybrid skills a serious accounting game can affect. We limited this research to hybrid skills already identified in studies of serious accounting games.

4.3 Relative validation

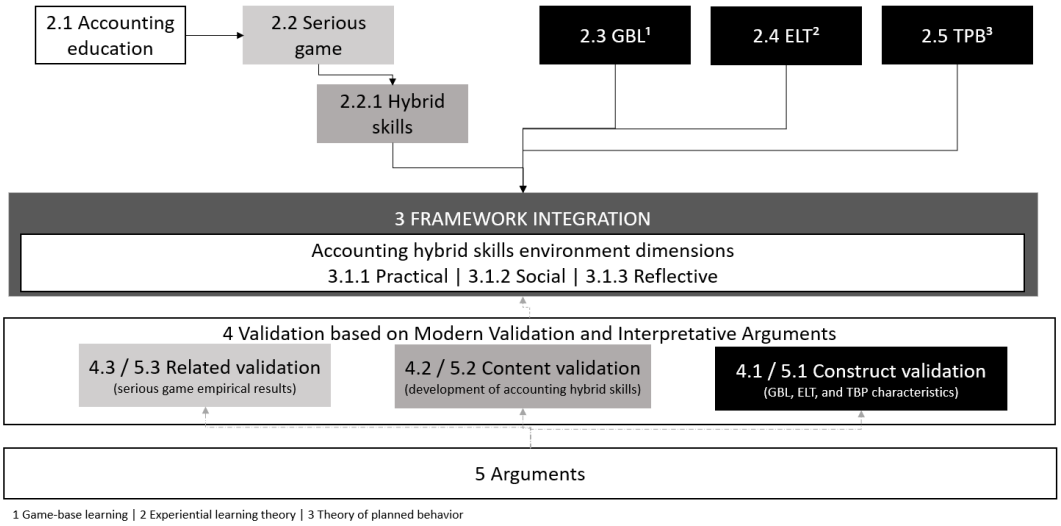
The empirical results represent relative validation (Messick, 1993). We used the empirical results of serious accounting games to validate the influence of each GBL, ELT, and TPB element in the development of hybrid accounting skills during the application of serious games.

We construct the proposed framework based on the interpretation of this evidence.

5 RESULTS

Each part of the validation discussed in the methodology demonstrates the arguments used to construct the framework. These arguments are inherently plausible or supported by appropriate evidence to confirm the validity of this research (Kane, 2013). To clarify the validation process, Figure schematizes the whole article from the literature review to the methodology. The theory, construct, and arguments used in section 2 create the basis for the framework described in section 3. Section 4 specifies how this basis will be validated to increase the successful application rate of the framework. Section 5 demonstrates these arguments.

Figure 3 - Methodological scheme used to validate the proposed framework



5.1 Construct arguments

The social influence of the TPB impacts the intention to play a game, making it possible for instructors to use the serious game environment to enable students to practice hybrid accounting skills. Flow experience, perceived enjoyment, attitude, subjective norms, and perceived behavioural control influence game use based on the TPB (Alzahrani et al., 2017).

Flow encourages nonplayers to try a serious game for the first time; it is a state between boredom and anxiety (Chen, 2007). Perceived enjoyment affects players emotionally, providing a high degree of excitement. Both flow and perceived enjoyment positively influence students' attitudes (Alzahrani et al., 2017). Attitude demonstrates how favourable or unfavourable the players consider joining the game. To synthesize the framework, attitudes also represent flow and perceived enjoyment.

Subjective norms have a direct impact on actual game usage (Alzahrani et al., 2017) and relate to social influence to perform a specific behaviour (Ajzen, 1991).

Perceived behavioural control is the individual perception of how easy or difficult the requested performance is (Alzahrani et al., 2017). In serious games, this attribute is related to nonmotivational resources that allow the student to know or not know how to play the game. After entering the game environment, other emotions, such as motivation and engagement, are discussed in the GBL pedagogies.

Attitude, perceived behavioural control (nonmotivational resources), and subjective norms (social pressure) positively impact individual intentions (Aries et al., 2020). In this framework, these three TPB aspects are used as resources to increase students' intention to join the game environment. This intention needs to be continuous during gameplay, which creates a positive perception of learning.

Perceived learning impacts the continued use of intention and word of mouth, influencing serious game usage. A good game experience positively influences students' intention to play a serious game, and their recommendations influence other students' game perceptions (Silva et al., 2020b). Thus, after a student joins the game environment, the TPB's independent concept of intention must be monitored and nurtured to create a positive continued use of intention and word of mouth for continuous play of the serious game.

In a serious game environment, interaction studies have demonstrated that ELT interacts with GBL. These findings support the idea that games can represent practical experience and change students' positions (Dholakiya et al., 2019), but this outcome is not guaranteed (Rooney, 2012). A serious game must represent the real world for ELT to be applied (Westera, 2013). ELT has the weakness of not considering students' and instructors' behaviour (Koivisto et al., 2015; van der Molen & Peijs, 2009), which can prevent GBL and the delivery of scheduled course content, thereby impeding the learning process (Enfield et al., 2012).

Plausible arguments discuss this supporting evidence by first using the construct view and demonstrating the strength of GBL and how this pedagogy contributes to the application of serious games. Second, the weakness of GBL poses a risk to the learning process. Third, this weakness exists in ELT and can be minimized by using ELT behavioural factors. Fourth, the interconnection between GBL and ELT supports the framework.

The clipping process suggests that GBL pedagogies focus on serious game applications using the game as a tool in the learning process (Jantke, 2010) based on rules and artificial conflicts (Plass et al., 2015) to make students play the game (Al-Azawi et al., 2016). Motivation, competitiveness, adaptation possibility, engagement, and immediate feedback are GBL pedagogies that can

help instructors achieve GBL objectives (Plass et al., 2015; Qian & Clark, 2016; Viviers et al., 2016).

However, GBL does not consider instructors' and students' behaviours. This weakness has been noted in the ELT cycle by Matsuo (2015). To minimize this weakness, GBL must add ELT behavioural factors: challenging tasks, critical reflection, pleasure at work, goal-oriented learning, and network development. As the application of serious games is a part of GBL pedagogy and can represent the practicality of ELT, we argue that these behavioural factors minimize GBL weaknesses related to students' or instructors' behaviour. The interaction with GBL and ELT creates a serious game environment for hybrid skills practice.

5.2 Content arguments

Mousa (2019) applied the MonopolyTM game in accounting classes. The author observed the practices of problem solving, collaboration, communication, and critical thinking using participant observation methodology. These soft skills were validated using students' reports and with students' actions.

The DEBORAH game application by Malaquias (2018) demonstrated that the game improves students' hard skills performance. The group presentations and exam after the game application confirmed the improvement in hard skills.

The Kahoot game application in Gómez and Monroy (2018) also tested hard skills. Kahoot allowed instantaneous validation of hard skills with quiz answers by students during the game. In a questionnaire distributed to 64 students, 58 students stated that the game helped them understand the hard skill content.

Similar to the Kahoot game, the mobile quiz game Accounting Challenge provides an environment for hard skills practice. Seow and Wong (2016) administered a survey to 242 volunteer students who played the game. On a Likert scale from 1 (strongly disagree) to 7 (strongly agree), student responses had a medium score of 5.76 affirmative answers, suggesting that Accounting Challenge helped the students learn accounting.

Sugahara and Lau (2018) used a board game management game in accounting classes and demonstrated its impact on critical thinking or critical reflection. An open survey administered after the game validated students'

perceptions. The students stated that the game inspired them to critically solve the challenges.

Finally, the application of a board game, as in Pelser-Carstens, Bunt, and Greeff (2019), can demonstrate a game environment that offers the possibility for soft skills practice. An observer verified that the players communicated with one another during the game and displayed critical thinking and problem-solving skills.

We argue that serious accounting games can affect problem solving, collaboration, hard skills, communication, and critical thinking. However, all serious games do not develop all hybrid skills in accounting. Each game creates a specific environment that allows students to practice specific hybrid skills. The related validation analysed these environments and the structure of the framework.

5.3 Related arguments

The independent concept of intention in the TPB to encourage students join the serious game environment is the first step to validate the empirical results.

The application of serious games may result in social factors, such as recognition and social influence, that positively influence individual attitudes (Silva et al., 2020b). This research also demonstrates the positive effect of GBL and the social factors of the TPB on attitudes towards learning. Continued use intention is a strong determinant of the future frequent use of a serious game and its recommendation (Silva et al., 2020b). The literature on online games demonstrates that the TPB's social influence characteristics impact the behavioural intention to play games (Alzahrani et al., 2017).

As discussed in regard to content validation, different games result in various hybrid skill applications. This variation was noted in the empirical results when applying games in accounting classes. However, each game has GBL pedagogies and ELT social factors that allow the instructor to create a specific practical environment for hybrid skills development. By using these empirical results and analysing which constructs exist in each environment, we created a framework with three environmental possibilities for accounting classes to apply serious games. Each environmental possibility involves a specific dimension:

practical, social, and reflective. One or more dimensions may exist in a single game. Below, we discuss each environmental dimension.

5.3.1 PRACTICAL DIMENSION VALIDATION

A practical dimension game has the objective of creating an environment to practice hard accounting skills**.** The player achieves the goal of the game, solving the game's challenges related to accounting content. AccountinGame, Kahoot, DEBORAH, Accounting Challenge, and PowerPoint games easily demonstrate the application of hard skills; student needs to use his or her accounting skills to answer the quiz questions. However, to make students apply hard skills when playing a game, motivation is necessary. The AccountinGame application demonstrated that GBL motivation affects accounting education (Silva et al., 2021). Competition and pleasure in gameplay help instructors motivate students. The studies of Pintrinch (2000) on motivation theory, Jabbar and Felicia (2015) and Reigeluth and Myers (2013) on competition characteristics, and Goršič, Hlucny, and Novak (2020) and Soares et al. (2020) on competition and satisfaction demonstrate the links among motivation, competition and pleasure. The Accounting Challenge game revealed that ranking the competition motivated students and made the games pleasurable (Seow & Wong, 2016).

These findings demonstrate that a game's motivation, competition, and pleasure make students use their hard skills to achieve the goals of the game. These GBL and ELT behavioural factors create a hard skills environment.

5.3.2 SOCIAL DIMENSION VALIDATION

In the social dimension, student interaction is necessary to practice the soft skills of communication and collaboration. The game needs to request this interaction for students to achieve the goals of the game. However, games are usually designed for single players, and exchange is not possible. The game DEBORAH is a single-player game that does not facilitate interaction between students. This game does not promote the development of the soft skill of collaboration (Oliveira, 2018). The same result is seen in the application of the Accounting Challenge game, which focuses on competition.

In addition, a game's goal may be to adapt and change the game's rules to promote player interactions. The MonopolyTM gameplay applied by Mousa

(2019) showed this adaptation: a new game goal changed a single-player game to a group player game. The group enhances engagement (Eseryel et al., 2013), promotes intergroup and intragroup interaction (Romero et al., 2012), unites students with less knowledge (Shabani, 2016), and enhances students' network and their mutual growth (Matsuo, 2015). In the Liike game application, communication and collaboration were observed because the game was designed to facilitate these interactions in groups (Pelser-Carstens et al., 2019). FarmVille created a collaborative environment that entailed students' interaction via Facebook, allowing players to discuss and share ideas and enhancing the game engagement discussed in GBL (Krom, 2012). PowerPoint team games create engagement through collaboration and discussion (Moncada & Moncada, 2014).

The present arguments reinforce the finding that engagement and networks enhance player interaction. A game goal needs to request this interaction for players to practice their collaboration and communication skills.

5.3.3 REFLECTIVE DIMENSION VALIDATION

Finally, the reflective dimension focuses on the student's mind, cultivating soft skills, problem solving abilities, and space for critical thinking. To change their way of thinking, students need to know that this change is necessary. The game's feedback provides this signal to the student, showing why an action is considered a mistake. This feedback is critical and must indicate the reason for the mistake and the benefits of thinking differently to motivate the player to modify their actions to achieve the game's goal. The use of a board game called the Management Game facilitated the development of critical thinking in students. Players learned from their negative experiences and failures (Sugahara & Lau, 2019). The question card answers in the Liike game (Pelser-Carstens et al., 2019) and the book entries in Monopoly™ require students to identify any errors in recording transactions (Mousa, 2019) to provide students with a problem-solving experience. In a safe environment (Wilkinson 2016), games result in cognitive learning arguments (Lockman, Thomas and Hill 2019) that provide motivation to guide players' efforts (French & Thomas, 1958) and reinforce the impact of feedback and thinking skills.

Feedback indicates whether a problem is solved. The critique consists of identifying the problem and analysing whether the problem is solved; it may provide the player with the opportunity to defend a previous answer. Motivation is necessary for players to persist in the game. A goal-based game needs to request players' actions according to the feedback received to create an environment to practice the soft skills of problem solving and critical thinking.

Importantly, this research focuses on the accounting field. Given the interdisciplinarity of serious games, it may be possible to replicate the study in other fields (Wilkinson, 2016). However, due to the limitations of research in this area, we limit our discussion to accounting education.

6 FINAL CONSIDERATIONS

To address this paper's research question, a valid conceptual framework integrates GBL, ELT, and TPB elements. This integration creates an environment that allows hybrid skills to be developed and minimizes the risks of serious games in accounting education. The arguments followed modern validation theory, validating the framework with construct, content, and related arguments.

Construct validation demonstrated how the integration of ELT, GBL, and TPB elements supports a conceptual framework by allowing students to develop accounting hybrid skills. These elements create a gradual and flexible guide for the application of serious games, making them more accessible for educators.

Content validation shows that serious games develop soft and hard skills. To guide educators to encourage this development during the serious game application, three dimensions were included in the framework: practical, social, and reflective. These dimensions can be applied individually or blended based on the teaching goals.

Each framework dimension focuses on creating specific environments for hybrid skills and linking them with specific ELT behavioural factors and GBL pedagogy. This link was possible with the related validation, empirically verifying which GBL, ELT and TPB elements influence the development of each accounting hybrid skill. A goal-oriented definition is necessary for all dimensions. Goals drive students’ behaviour in the game to focus on the targeted hybrid accounting skills.

The TPB works outside the game environment. It creates students' intention to join the game. During the game application, players remain inside the game. The GBL, ELT, and TPB elements compose a conceptual framework that helps educators predict the hybrid skills developed during accounting classes based on the characteristics of serious games.

Applying a serious game without a framework can impair students' learning, resulting in neither the practice of hard skills already developed in regular expository classes nor the additional development of soft skills.

This framework maximizes the advantages of serious games in accounting classes, creates opportunities to develop hybrid accounting skills, and minimizes the possibility of impairing the accounting learning process.

The hybrid skills in this research are limited to the serious game literature in accounting, although other hybrid skills may work with this framework with or without adjustment. The adjustment may be made by adding new ELT, GBL or TPB elements according to the extensive literature on these themes. Research that adds new hybrid skills can validate this hypothesis in the future.

The application is limited to the accounting field because it is the authors' area of research. However, this study may be applied to other fields. The framework application also might strengthen this research, creating an opportunity to compare a serious game application result using a different learning methodology.

Finally, this research focused on creating opportunities for students to develop their hybrid skills. The resulting framework provides guidance for educators to extract the potential of serious games and achieve their teaching goals.

6.1 Summary of contributions

This research contributes to theory and practice in the current accounting educational literature. The theoretical contribution is based on discussion and revision of the GBL pedagogy, ELT behavioural factors, TPB intention, and hybrid skills in accounting with a focus on integrating these elements and creating a new conceptual approach and a new way to link them in the application of serious games.

The practical contribution consists of guidance for the use of serious games in the accounting field to create a learning environment that maximizes opportunities for students to develop hybrid skills and to prepare for changes and challenges in the accounting marketplace.

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Article II

Framework wheel for soft skills assessment in accounting serious games

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ABSTRACT

Accounting instructors have explored soft skills by using teaching methodology to attend to the job market demands, such as serious game applications. However, the assessment applied during the serious game application has gaps, such as fraud opportunity, lack of criteria, bias risk, and presence of uncomfortable situations. These gaps may result in serious games application impairing the students' development, instead of helping them. To avoid this scenario the serious game's assessment must be reliable and valid. Thus, this research proposes an assessment framework for soft skills assessment in a serious games' environment. The serious game instructor must check the game environment elements in the framework dimension to allow students to explore the target soft skill. After this validation, the educator must prepare the assemsent environment preparation, game application, and post-game actions. These steps were structured in a framework wheel and it was validated with the design-based research. An anonumous rubric is necessary to capture the students' perceptions. We developed the concepet of microsoftskills to be used as the target soft skill surrogate and simplify the soft skills assess. The proposed framework minimize the serious game application risk by guiding the serious game assess application.

Keywords: soft skills assessment; accounting education; serious games

1 INTRODUCTION

World companies are looking for accounting professionals with more than hard skills, which are technical approaches used in the accounting profession (Rebele & St. Pierre, 2019). In addition, soft skills, such as communication, responsibility, initiative, positive attitudes, have been added to the hard skills demands (Jones et al., 2016), making changes necessary in the accounting education process.

The serious games are methodology tools that may develop soft and hard skills in the educational environment (Mari Sol Calabor et al., 2019a). This type of game presents didactic content to be learned by the students (Brom, Šisler, et al., 2009), more than entertainment purposes. These games may have a digital format, such as AccountinGame (Silva et al., 2021) and DEBORAH (Oliveira, 2018), or a non-digital form, such as MonopolyTM (Mousa, 2019) and Liike (Pelser-Carstens et al., 2019).

Traditional learning focuses on one-way communication with knowledge memorization. Serious games create a safe platform and make the learning by doing or playing, turning them into a strong soft skill development tool (Bidarra et al., 2013). Games application also has been seen as a solution to overcome the teaching limitation during the pandemic caused by Covid-19 disease, promoting a virtual environment for student practice (Fabricatore et al., 2020).

However, a game application may create a transfer problem, resulting in divergences between gameplay and learning objectives (Brom, Sisler, et al., 2009). Game application not necessarily means the hard and soft skills student development (Abbott, 2019). A game may be boring, repetitive, and consume precious class time, harming the learning process (Brom, Sisler, et al., 2009). However, the benefits of a game include developing soft skills such as problem-solving, learning through mistakes, developing self-esteem, and tolerance (De Albuquerque & Ainsworth, 2013), besides the hard skills. Then, to ensure that the serious game will be helpful for the soft skills development, the serious game instructors need a guide to prepare a careful assessment to validate serious game results. Without this guidance, the serious game effectiveness in soft skills

will always be a doubt for instructors, students, employees, and other academy staff.

There are frameworks in the serious game literature, e.g., dimension for hard and soft skills (Carvalho and Neto, 2022), design assessment (Mitgutsch & Alvarado, 2012), hard skills performance assessment (Zielke et al., 2015), and pedagogy (Rooney, 2012). However, the frameworks found did not evidence the soft skills assessment. We highlight that this assessment is essential to track soft skills development. These skills are crucial to employability in the competitive world (Vasanthakumari, 2019).

This study aims to create a valid and reliable framework to assess soft skills in a serious game environment. We proposed a framework based on the literature and applied design-based research (DBR) to add validation and reliability to the framework structure to accomplish the research objective.

2 ASSESSMENTS IN ACCOUNTING

The assessment process influences the whole student learning development. It consists of not just evaluating a student, but identifying, collecting, and interpreting the pieces of information of an outcome (Farrell & Rushby, 2016). The addition of the Assessment of Professional Competence in South Africa in 2014 has required hard and soft skills for accountants entering their professions. This exam has driven the accounting learning, and elements applied in the classroom without relation to the assessment were least valuable for students (Parsons et al., 2020). The decrease in financial accounting content in South Africa increased the understanding of basic accounting principles (Miller, 2020). The assessment proposal is to improve the learning intervention (Farrell & Rushby, 2016), then it is essential to make the student understand its proposal and be motivated for it.

Explicit assessment rules motivate students to learn what the activity rule demands (Helfaya, 2019; Parsons et al., 2020). A pre-test, used as an example for the actual exam, and a simple and explained evaluation minimize the exam process's wrong understanding. These facts maximize the authentic assessment results (Miller, 2020). Another motivation factor during the assessment is using criteria as a guide for assessment, demonstrating transparency during the activity analysis (Hutaibat, 2019). A group activity must be assessed individually instead

of in-group; otherwise, the student creates negative feelings because of the different individual contributions for the final activity results. The peer assessment also results in negative feelings as students do not feel comfortable penalizing another student with low grades (Opdecam & Everaert, 2019).

However, the uncomfortable assessment environment may result in better student development. Group activities may result in better learning development than individual activities. The peer assessment may result in assessment understandable by students and helps students self-learning (Malan & Stegmann, 2018). Then, although group assessment may demotivate students, this environment may also help develop their skills. However, in both an uncomfortable and comfortable assessment environment, the student may have misconduct resulting in frauds that harm the assessment process.

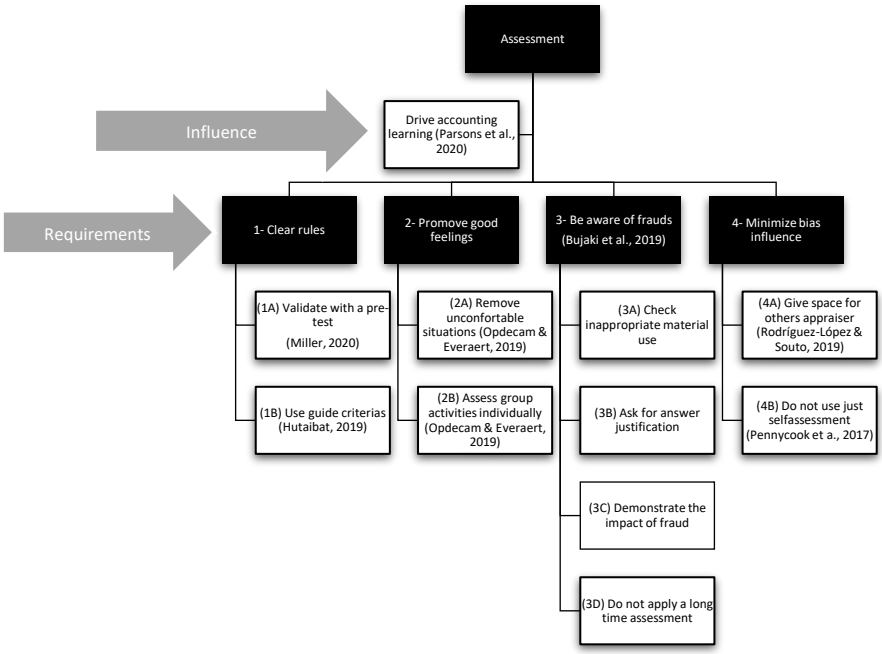
Frauds on assessing happen when students use dishonesty with an unfair advantage, which results in inappropriate assessment. These frauds are motivated by the accounting student's necessity of good grades, long time of assessment process, the close gap between evaluation set and the teaching model does not adapt with students learning style. Besides these students' motivations, the instructors may facilitate the fraud indirectly. For example, the instructor may use the same test over time, not check the existence of inappropriate material during the assessment time, not ask for the question-answer without a justification, and give students the perception that fraud action does not impact their educational process (Bujaki et al., 2019).

In addition to fraud, the assessment bias may also harm the learning process. The presence of the student-tutor on the exam process on entrepreneurial dissertation influences the assessment, and the results may not represent the reality (Rodríguez-López & Souto, 2019). A self-assessment process has the student bias and the Dunning-Kryger effect, assessing themselves with good grades because they cannot realize that they do not know the assessed subject (Pennycook et al., 2017).

Then, this literature review demonstrated that every assessment choice results in positive and negative results (Miller, 2020). The instructor must decide the learning focus and choose the assessment that highlights this focus to students. The discussion above shows in general, the assessment decision-making by the instructors impacts the whole hybrid skill learning process because

it guides the student focus. The instructor needs to make the assessment rules clear to students, validate the assessment instrument with a pre-test, and promote good feelings for the assessment process. Besides it, the instructor must be aware of fraud's motivation characteristics and minimize the bias influence. These arguments helped us to establish requirements for an efficient assessment environment. Figure 1 demonstrates the assessment structure based on this review.

Figure 1 - Assessment influence on accounting hybrid skills and attention points



3 SERIOUS GAMES' ASSESSMENT IN ACCOUNTING

We looked for the serious game in accounting applications, analyzing how to assess serious game results. However, as the serious game in accounting focuses more on hard skills than soft skills, we analyzed both skills to learn the weaknesses and strengths in the complete skills assessment. Therefore, the results of this literature review are the knowledge of which tool can be used during a game application for the assessment framework.

A Monopoly game application study used participant observation and qualitative analysis in NVivo 10 software to validate skills development on students (Mousa, 2019). These skills were self-reported by undergraduate students. A spreadsheet add-on to the game environment for accounting book entries helped the instructor to do a hard skills assessment. Then, activities in the game may allow the instructor to do a hard skills assessment. Besides the game's tasks, the instructor asked students to write the gaming learning outcomes in an

open self-report. The instructor noticed the soft skills potential with this report. The game demonstrated the potential to develop soft skills like problem-solving, communication, and critical thinking. However, this self-report may be biased by the student and may suffer the Dunning-Kruger effect, making the students' soft skills development uncertain. Does the student really know what critical thinking is? Or what is critical thinking for the instructor? We did not find this definition on the paper. These doubts are considering the weak points of this article. The strong point is to use the game' activities for hard skills assessment.

DEBORAH's game made the undergraduate accounting students live the accounting history. An open questionary captured the game's vision that affirmed that the game helped the hard skill development (Oliveira, 2018). As already discussed, the self-assessment suffers the Dunning-Kruger effect. In another research with the same game, activities after the game with group presentations and exams validated the hard skills development (Malaquias et al., 2018). The after-game activities allowed validating the skills developed with the serious game application. However, the soft skills assessment is still a gap.

Accounting research with the games Accounting Challenge (Seow & Wong, 2016) and Kahoot (Gómez & Monroy, 2018) still focus on hard skills. These games used objective questions to assess the skills; the instructor just needs to check the right and wrong answers. Authors applied the games online without physical students' presence in a classroom. This application generates a fraudulent environment because students may share their answers or use material not allowed on the assessment process. Besides this, the instructors just receive the results and do not check the students' behavior, which impairs the soft skill assessment.

Students made a self-assessment before and after the Platform War Simulation game application and related that it increased their accounting and collaboration skills (María Sol Calabor et al., 2018). After this study, the authors used Delphi methodology to assess the serious game. Platform War Simulation game allowed the instructor to check the skills developed during the serious game (Mari Sol Calabor et al., 2019b). In each serious game round, monitors applied questionaries to instructors. Monitors analyzed the questionary and anonymously sent them to other instructors. Then, the answers were changed until monitors reached a consensus. Analyzing the questionaries without instructors' names

minimized the other instructor's bias. The questionaries had open and closed questions, allowing the instructors to clarify and explain their opinion or judgment. An instructor affirmed that the students' assessment must require explanations for each game decision. Another instructor describes that the assessment is necessary before and after the game application. The research focused on hard accounting skills. This research does not focus on the student's point of view. It highlights a way to minimize bias, removing the assessed name, demonstrate the benefits for open and closed assessed with choice explanation in questionary, and give tips for a more detailed valid assessment, applying an assessment before and after the game.

The serious game' Liike allowed the instructors to assess the soft skills with developers' serious game feedback and the hard skills with the game challenge (Pelser-Carstens et al., 2019). Observing the gameplay during three workshops and playtesting, the authors notice that game rules established skills accruement as the fraud elements in the game promote ethical behavior, and the game challenges promote problem-solving, collaboration, and communication. Then, the observation of repetitive gameplay added on feedbacks were used as soft skills and hard skills assessment. The use of both methods is a strong point in this study. However, the developers' point of view may be skewed as they already know the purpose. This purpose may not be reached with students' gameplay or other instructor's applications.

During observation, interviews, and surveys, the non-accounting serious game golf developed accounting professionals' networks (Lee et al., 2020). These methods complemented each other, increasing the research validation. The strong point is using complementary data collectors for soft skills, minimizing instructors' bias. However, the research did not analyze hard skills, and serious games applied in a classroom may unviable the use of all these data collector steps because of the limitation of time and the number of students.

Table summarizes how the skills have been assessed in accounting serious game application.

Table 1 - Serious game in the accounting

Author(year)	Game	Hard skills	Soft skills
Mousa (2019)	Monopoly	Game activity	Self-report
Oliveira (2018)	DEBORAH	Self-reported	Not reported
Malaquias et al. (2018)	DEBORAH	After game activities, such as presentations and exams	Not reported
Seow & Wong (2016)	Accounting Challenge	Game activity	Not reported
Gómez & Monroy (2018)	Kahoot	Game activity	Not reported
Calabor et al. (2019)	Platform War Simulation	Anonymous questionary in each game round with opened and closed questions	Not reported
Calabor et al. (2018)	Platform War Simulation	Self-reported, before and after the game	Self-report, before and after the game
Pelser-Carstens et al. (2019)	Liike	Game activity	Gameplay's observation
Lee et al. (2020)	Golf	Not detected	Observation, interviews, and surveys

We can notice that game observation, self-report, interviews, game activity, and surveys are the tools used during a game assessment. It is possible to check that the soft skills rarely are assessed during a game application, proving that the existing literature lacks soft skills information in a serious game environment in accounting. Then, we looked for soft skill literature to structure an assessment framework proposal.

Therefore, with the best practice in accounting assessment and the strong and weak points in accounting serious game assessment application, we can propose a framework to guide the soft skills assessments in the accounting education process.

4 SOFT SKILLS IN ACCOUNTING SERIOUS GAMES

The soft skills depend on the analysis context. A "same individual may be both good and poor at problem-solving skills, depending on the nature of the problem" (Bransford & Stein, 1993). Then, a student that presents problem-solving in a specific serious game context may not present these soft skills in other realities. Therefore, the game context needs to be part of the assessment process, and different types of contexts should be applied for a wide assessment. So, the soft skill definition must always be clear, and the game environment must be considered.

It is not easy to define soft skills, and they have a different definition for each author. For example, problem-solving skill is defined as a cycle of "problem definition, problem analysis, solution design, interventions, and evaluations" (van Aken & Berends, 2018) or as a person's ability to understand and resolve a problem where a method to solve it is not available (Shute et al., 2016). Another example, collaboration soft skills are assumed as the same as teamwork (Vogler et al., 2018), a part of it (Anthony & Garner, 2016), or a segment of relationship management (Cobo, 2013). Then, the instructors must define which soft skills they will work with and choose the skills characteristics to explore during a serious game application.

However, to observe the soft skills characteristics, the instructors must validate if choosing a serious game creates an environment for these characteristics' application. The serious game has dimensions that allow students to practice their soft skills. Each serious game has elements that classify the game in a social, reflective, and/or practical dimension. The social dimension allows the serious game instructor to explore soft skills like communication and collaboration, while the reflective dimension creates the opportunity to work with problem-solving and critical thinking. The

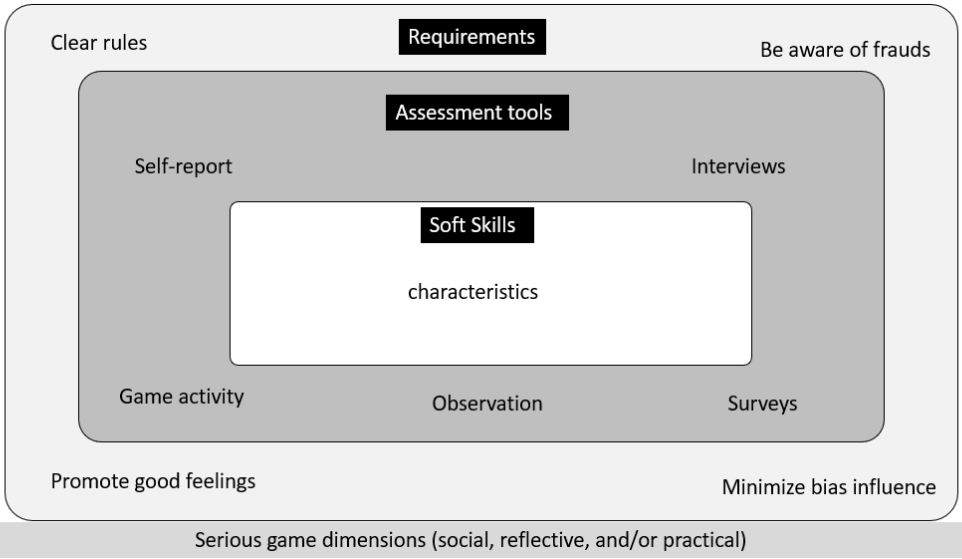
accounting hard skills are part of the practical serious game dimension (Carvalho & Neto, 2022). Then, the serious game instructors must verify in which serious game dimension the game is to explore the possible soft skills and their characteristics.

Therefore, with the assessment requirement, serious game assessment tools mapped, serious game dimension defined, and the details of the soft skills, we can propose a framework to assess the soft skills in a serious game environment in accounting.

5 FRAMEWORK PROPOSAL

Using these pieces of literature review information, we structured the framework proposal for the accounting serious game assessments in Figure 2.

Figure 2 - Current framework based on literature



The first step for a serious game assessment is to plan and define which soft skills to assess to drive the accounting learning properly. These will guide the instructors to choose a serious game for application, checking if the game could create a learning environment for students to apply the target soft skills.

Serious games assessment environment is split into three stages, (I) environment preparation, (II) game application, and (III) post-game actions, and each stage has its steps. The stage I creates a setup for assessment with the serious game application. Stages II and III compose a continuous process for application and reapplication of the game. The reapplication is necessary to compare the first assessment results with the others. The first assessment works as a diagnostic assessment, while the next applications work to verify an improvement on the target

soft skills. The information retrieved during the literature review and summarized in Figure 1 are highlighted between brackets during each framework stage.

5.1 Stage I: Environment preparation

The preparation stage occurs once by a set of target skills. Then, it is necessary to (a) **define** which skills will be assessed. This definition will influence the whole learning environment (Figure 1 – influence). There are several soft skills that a serious game may develop and assess. Thus, the serious game instructor must identify in which dimension the serious game is, according to Carvalho and Neto (2022) study. This identification is the basis for the whole assessment. It is impossible to assess a specific soft skill if the serious game does not allow the instructor to explore it during the game application.

As soft skills are different among people, their assessments are subjective. For example, a person with creativity for the criteria of a single person may not be creative based on another person's criteria. Then, the instructors' criteria must be clear and formulate the assessment guides. A game behavior expected may help the instructors to create this definition, associating this behavior to the soft skills in analysis, creating a microsoftskills that can be identified in the game activity.

Each soft skill is composed of several characteristics, microsoftskill. The microsoftskill represents students' behavior expected, allowing instructors to affirm that this student has developed an element of the soft skills.Table 2 shows three examples of how the soft skill may be split into microsoftskills. Notice that the microsoftskills are personal, reflecting what the serious game instructor realizes as an element of the main soft skill.

Table 2 - Exemple of microsoftskills

Soft Skills	Microsoftskill
Problem-solving	Problem definition Problem understanding Problem-solution
Communication	Transparency Objectivity Understandable
Collaboration	Teamwork Responsibility Availability

Using the Table 2 definitions mitigates the problem-solving, communication, or collaboration definition issue, helping the instructors create clear assessment guides and making the assessment process more objective (Figure 1 – 1B). The instructor must validate if a chosen game has the chosen soft skills dimension. Then, these microsoftskills must be present in a (b) **draft** a tool to assess the students' soft skills individually (Figure 1 – 2B) in the game environment. The tools can be a self-report, surveys, game activity, or interview road map.

The microsoftskills assessment tool must follow the Figure 3 instructions to increase the assessment's chances to verify students' reality, avoiding the gaps presented in the current serious games in accounting. The next step is to (c) **present** the rules for the players, and this stage ends (d) **pre-test** the game to validate the previous steps (Figure 1 – 1A).

5.2 Stage II: Game application

After environment preparation, the assessment enters a possible wheel phase. Each game application works as an assessment and needs to be compared with the previous game results to check the development or not of each microsoftskills. Without the reapplication of the game, the instructor just can inform if the student has or note the microsoftskill in analysis.

The wheel phase starts with the serious game application creating the (e) **on-time assessment**. In this stage, every microsoftskills need to be observed by the instructors. In addition, the instructor needs to validate if the students are following the game rules and inform the punishment if they try to cheat during the game (Figure 1 – 3A, 3C). These pieces of information are crucial for the post-game stage (Figure 1 – 4B).

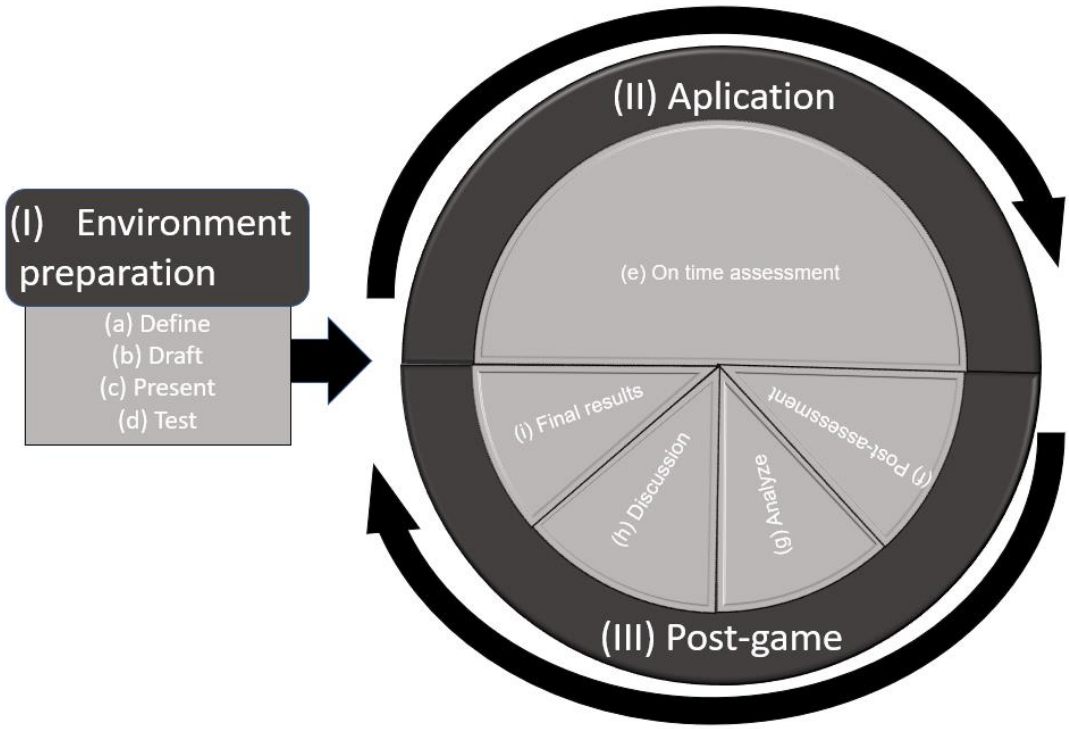
5.3 Stage III: post-game actions

It is necessary to apply the (f) **post-assessment** after game application. This assessment must be anonymous to track the students' microsoftskills (Figure 1 – 2A, 4A, and 4B). After this, the instructor must (g) **analyze** on-time and post-assessment results to verify possible inconsistencies between these tools.

The assessor must (h) **discuss** the inconsistency with the students by asking students to justify some answers (Figure 1 – 3B). Finally, the instructors must (i) provide the analysis and discussion **results** as feedback to the students.

These analyses and feedbacks demonstrate how serious games explored the microsoftskills. Suppose the instructors want to verify the students' microsoftskills development. In that case, they can apply a new round of the game and stay in the framework wheel, comparing each round results, returning to Stage II.

Figure 3 – Framework wheel for hybrid skill assessment in serious game application



We apply this framework to test, validate, and turn the framework wheel reliable following the DBR methodology.

6 METHODOLOGY

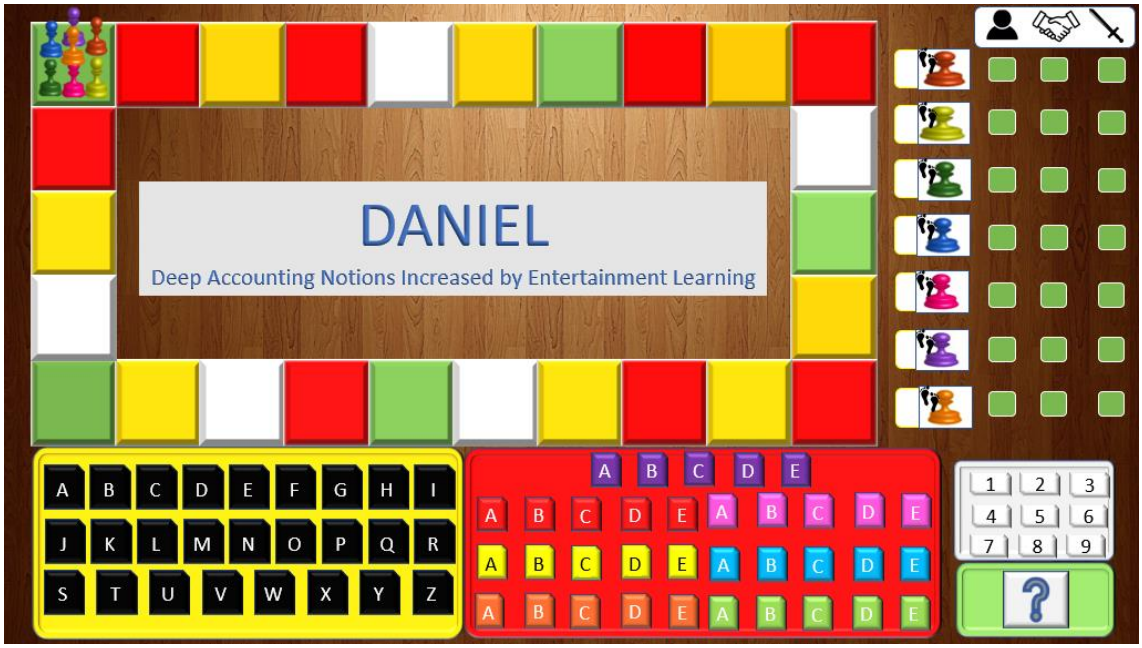
The final framework model consists of the saturation of DBRs. Saturation corresponds to the minimum research evolution compared with the previous application (Eisenhardt & Graebner, 2007).

The application occurred during the COVID-19 pandemic in Brazil, resulting in an online game application. The application was in a public education institution in Brazil with limited technological resources. Most of the students followed the online class with old mobile phones, which allow just the Google Meet connection. Then, the game DANIEL was chosen for this application (https://www.slideshare.net/LucianoBastosdeCarva1/daniel-251233217). The

instructor is also the research of this article and used Google Meet to share his screen with the game for students.

The first and second DANIEL applications were in the same accounting class of a technical administration student. The game application had the goal to validate and create a robust framework base. The third game application was applied in a group of cost management of administration degrees and had the goal to turn the framework reliable.

Figure 4 - DANIEL PowerPoint boardgame



It is important to highlight that this methodology was applied to validate the framework and turn it reliable, not to demonstrate the soft skills development. Because of this, the framework was applied once in each class and replied with the students' feedback and game application notes.

6.1 Serious game and assessment applications

There were three applications of the DANIEL game until the framework consolidation. Each step of the game application is detailed below.

6.1.1 First application

The first application environment was composed of 27 students. We followed the framework proposal as a guide for the assessment application.

5.1.1.1 Stage I: Soft skill and microsoftskill definition

The DANIEL game is an adapt game playable in groups that create network and engagement. These elements fit the game in the social dimension of Carvalho and Neto (2022) framework. This dimension allowed us to work with the collaboration soft skill. We explored the soft skill collaboration and its microsoftskills teamwork, and responsibility for all applications.

6.1.1.2 Stage I: Draft of the assessment tool

Self and peer-assessment were done with a Microsoft Excel Spreadsheet. The students should choose the group mates' behaviors (peer-assessment), including themselves (self-assessment). After the game application, the spreadsheet was delivered for students to answer in five days. Questions 1 and 2 were about the microsoftskill responsibility, and questions 3 and 4 were about the microsoftskill teamwork. Figure 5 shows the behavior options.

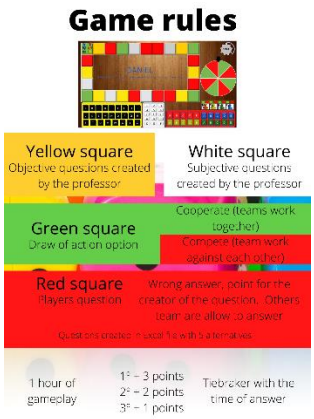
Figure 5 - Collaboration assessment for post-game phase

Collaboration			
Contributed to all game questions	Contributed to most questions in the game	Contributed to the minority of questions in the game	Did not contribute to game questions
Helped answer all game questions	Helped answer most game questions	Helped the minority answer the game's questions	Didn't help answer any questions in the game
Always gave his opinion in decision making during the game	Opined most of the time in the game's decision making	Opined the minority of times in the game's decision making	Didn't have an opinion in the game's decision making
He/She has always wanted to hear a colleague's view of a possible game action	Most of the time he/she wanted to hear the colleague's view of a possible action in the game	A minority of times he/she wanted to hear the colleague's view of a possible action no jogo	He/She never wanted to hear the colleague's view of a possible action in the game

6.1.1.3 Stage I: Environment presentation

The presentation was a divulgation and explanation of the game rules. It was done during the class, and a banner and video were posted on the online environment for future consultations. The banner is presented in Figure 6. We gave an extra point to the winner group for traditional hard skills assessment to motivate the students to play the game. There weren't academic points related to the soft skills results to avoid fraud in the microsoftskills assessment. These steps were equal in each application.

Figure 6 - DANIEL game rules banner



The assessment templated was explained during the online class for the student before the game application.

6.1.1.4 Stage I: Pre-test

The DANIEL serious game test application was recorded and sent to the students via a YouTube link. The instructor requested them to watch the video and send feedback to avoid doubts during the game application.

6.1.2 Stage II: on-time assessment

The first DANIEL application occurred for 1 hour. The students interacted between group members with WhatsApp and other students using Google Meet chat. The instructor analyzed both interactions for collaboration assessment. The interactions in WhatsApp were analyzed after the game application.

6.1.3 Stage III

6.1.3.1 Post-assessments

The students' answers were added in a consolidated spreadsheet, and an average was done for each student, considering all students' answers. In the total of 27 students, 22 answered the collaboration peer-assessment (81.84%), and 14 students answered the self-assessments (51.85%). The observation happened following the group's WhatsApp conversation.

6.1.3.2 Analyzes

The on-time assessment via WhatsApp observation and the post-assessment were compared. The average of students' collaboration skills was 3,68, and the median was 3,75, in a total of 4, meaning a high skill level. However, some students with a high collaboration score in the peer and self-assessments had low actions in WhatsApp observation. Then, the discussion step focused on this divergence.

6.1.3.3 Discussion

The student revealed that the group members were in a WhatsApp call during the game, and they just used the WhatsApp chat for a few moments. So, the WhatsApp analyses did not correspond to the reality of the microsoftskills. This information confirmed the importance of discussion between instructor observation and student assessment after the assessment when analyzing soft skills.

The discussion conducted by the instructor after the game also highlighted other issues. Some students did not know how to use the spreadsheet and did not make the self-assessment. The application was at the same week as other subjects' assessments, and some students focused on these other assessments than the soft skill assessment.

6.1.3.4 Results

During a class, after the serious game application, the instructor showed the microsoftskills results for the students as a general report, and the instructor detailed the assessment fails with them. Then, the instructors asked students if they wanted to check the individual information. Still, the students preferred to see just the general report, avoiding a bad environment with the exposition of the negative answers of the classmates.

Then, the points necessary for the assessment update in a second application are (I) create an easier tool for students to fill the self-assessment and peer-assessment, (II) avoid applying the assessment in a week with great demand, (III) find another way to observe the student behavior in an online environment, and (IV) create a general way to provide the soft skills feedbacks.

6.2.1 SECOND APPLICATION

We noticed that instructors use a rubric to avoid misunderstanding during the assessment process first application by the criterion-referenced evaluation (Kinne et al., 2014). So, the following framework changes were applied:

I- To assess the microsoftskills was applied Google Forms tools as a rubric, instead of Excel Spreadsheet;

II- The assessment was shorted and applied right before the game application, using the current class time for it; and

III- We assumed that it is not possible to control students' interactions in an online environment.

IV- We used an anonymous general report of the Google Forms as the feedback reports

The preparation, application, and post-game stages followed the discussion in the first application. Therefore, below we discuss only the differences in the stages of the second application, compared with the first one.

This time a total of 24 students played the game, split into five groups, four groups with five students, a group with four, a group with two. This application was in the same accounting class as the first application.

6.2.1.1 Stage I changes

The instruction advised the students that a Google Form would be applied after the game application. Therefore, the class time was split into fifteen minutes for game preparation, one hour for game application, and fifteen minutes for game assessment. The Google Forms was created with twelve questions, five yes or no, four with Likert scale, and three open questions. Questions 1, 2, and 3 were about hard skills, 4 and 5 about microsoftskills self-assessment, 6 and 7 about microsoftskills peer-assessment, 8 and 9 were open questions about soft skills, and 10, 11, and 12 about the game environment. However, to maintain the focus of this paper, we discuss just questions 4, 5, 6, 7, 8, and 9 about soft skills. This time, we chose not to create forms for each student to assess the whole group members to make it possible to be answered in class.

5.2.1.2 Stage II changes

The only on-time assessment was the interaction between students in the game environment. The instructor did not observe WhatsApp this time.

6.2.1.3 Stage III changes

After the game application, Google Forms was available to students. A total of 21 students answered the assessment, representing 87,5% instead of 51,85% of the first application.

We run three correlations using Microsoft Excel, function CORREL, to validate the questions about the microsoftskills. The correlations were between self and peer-assessments with the same task; questions 4 and 6 related to microsoftskill Responsibility, questions 5 and 7 related to microsoftskill teamwork, and the average of questions 4 and 5 and 6 7 average. The questions' details are in Table 3, demonstrating that the peer and self-assessment average strongly correlate.

Table 3 - Correlations between collaboration soft skills

Questions	Correlation (r-Pearson)
questions 4 and 6	0,7606
questions 5 and 7	0,953911
questions 4 and 5 average with 6 and 7 average	0,985094

Then, we assume that applying a form with peers and self-assessment during the class time had a better result than comparing students' answers with observation in an online environment because it increased the answer rate and the answers with the same microsoftskills had a strong correlation.

We applied the game a third time with another student group to validate these results and check if the framework was reliable.

6.3.1 THIRD APPLICATION

The game was applied to a total of 21 students in a total of six groups, one with five students, three with four students, and two with two students.

6.3.1.1 Stage I details

The same steps and schedule discussed in the second application were followed.

6.3.1.2 Stage II details

We used only Google Meet during the application. However, the students used external systems to interact among them.

6.3.1.3 Stage III details

After the serious game application, the students had fifteen minutes to answer the Google Form. During this time, the professor explained each question to avoid misunderstands. This time all students answered the form.

As the second application, we grouped the questions with the same microsoftskills tasks by teams and ran a simple correlation. As a result, we reached 98,18% in Responsibility during the question make phase and 93,77% in teamwork, or 97,44% in total, as shown in Table 4. Then, we assume that the peer and self-assessment matched the same results presented in the second application.

Table 4 - Third application correlation

Questions		Correlation (r-Pearson)
4- On a scale of one (any) to five (all), how much I helped the game questions' development	6- On a scale of one (any) to five (all), how much other group's members helped to create games questions	0.9818
5- On a scale of one (any) to five (all), how much I helped to answer the game's question	7- On a scale of one (any) to five (all), how much the other group's members helped to answer the game's question	0.9377
questions 4 and 5 average	6 and 7 average	0.97437

The same results in applications two and three represent the saturation of the analysis. We did not discuss questions 1, 2, and 3 because they refer to the hard skills, which is not the focus of this paper.

Questions 8 and 9 of the google forms were open questions, and they had the intention to check what they had learned about collaboration. Question 8 was "What have you learned about collaboration during the game?" and in the second and third applications, 28.6% of the students informed the importance of group discussion. Examples of students' sentences are "Team behavior was important to decide the final result, with everyone helping each other it becomes easier" (second application student), and "knowing how to listen to everyone's opinion and being organized", and (third application student).

Question 9 was "Do you think teamwork is important during the game? Why?". All students answered yes in the second application, and 85.7% informed sentenced that teamwork is important to find the correct answer in the game. In the third application, 81% agreed, with 47.1% informing the same reason for the second application. For example, "Yes, thinking together is more likely to get the questions

right" (second application student) and "Yes, because if the group doesn't help, no one wins, not just the person who didn't help" (third application student). Unfortunately, 19% delivered the google form report with this question without answering the question.

This game demonstrated that the students applied the soft skills and learned them. The open questions 8 and 9 showed that students learned with collaboration in both applications, second and third. They learned that working in a team is important to reach the game goal (find the correct answer), and the collaboration impacts the game results. This result was possible to verify because of these open questions. The game's instructor should avoid the no-answer form delivery, making the question required to be answered before sending the answers in google forms configuration.

7 RESULTS DISCUSSION

The serious game environment gives students opportunities to apply their soft skills, and the instructors need to use tools to validate the applicable soft skills. The serious game hard and soft dimension analysis is crucial to validate if the target soft skill can be explored or not with the chosen serious game. The use of microsoftskills instead of the main soft skill made the assessment practice simple and easier. However, these microsoftskills must be captured by more than one assessor to avoid misunderstanding, as demonstrated during the first serious game application.

The peer and self-assessment are important because the game instructor cannot follow all players' interactions, and just the players knew how the other players in the same team used their soft skills. The student may use applications beyond the game instructor's knowledge to practice their microsoftskills. If the game instructor did not apply the peer and self-assessment, the observation results would not be real. Therefore, we can affirm that peer and self-assessment are more important than observing during the soft skills assessment. Maybe it is possible to control the student behavior and apply an effective observation in class with less than ten students or/and in person environment. However, applying the observation successfully in class with more than 20 students in an online environment was impractical. Future research exploring this control may turn the observation tool stronger.

The soft skills assessment must be clear, and the instructor needs to save time after the game application to explain the soft skills assessments or read and explain

the questions while the students are answering them. In addition, the microsoftskills questions must be related to a game task closing them to students' reality.

The instructor must provide the feedback without identifying the students, and the soft skill assessment results can not interfere with college grades. This general feedback avoids embarrassing a specific student, increases the good feelings about the assessment process, and incentivizes students to present the real facts they observed during the serious game application.

The open questions allowed students to relate details about the soft skills characteristics they have learned. For example, the question 8 and 9 answer demonstrated that the students learned the importance of group discussion and that working as a team increases the win probability. Unfortunately, these characteristics were not possible to observe with the analysis of the objective question.

Thus, the applications resulted in the validation and reliability of the framework wheel for soft skills assessment in a serious game application. The compilation framework with the changes during the DBR is summarized in Table 5. We emphasize that the framework objective was to verify how to capture the soft skill in a serious game application, not measure their development. However, this development is possible by reapplying the serious game and the assessment tool, using the framework wheel structure.

Table 5 - Framework wheel for soft skills assessment using a serious game

Serious game Stage	**Serious game Steps**	**Actions**
I. Environment Preparation	(A) Definition	Verify which **dimension** the selected serious game is in the Carvalho and Neto (2022) framework to verify the possible soft skills to explore
		Define which main soft skill to work with
		Segregate the main soft skills in **characteristics** (i.e., microsoftskills) to be assessed in the game
	(B) Draft the assessment report	Create an anonymous assessment tool with the game's environment representing the microsoftskill. The tool must be short, objective, and the questions must be answered before the end of class time. Add open questions to verify extra information. Verify if it is possible to register the players' microsoftskill practice during the game to compare in the future. The tool can be a rubric for **self and peer-report**, **interviews**, **game activity, observation,** or **surveys**. It is

		important to apply more than one to validate the answers.
	(C) Present	Show the game and assessment **rules** and the punishment if the players cheat during the game application.
	(D) pre-test	Apply the game as a pre-test to validate the stage I steps, checking if the microsoftskills can be observed in the game. Otherwise, create tools just for a peer and self-assessment.
II. Game Application	(E) On-time assessment	If possible, follow the students' actions and behaviors related to the microsoftskills. Then, save time at the end of the game application for the post-assessment.
III. Post-game actions	(F) Post-assessment	Apply at least two assessment tools with two different assessors, like a self and peer assessment. Both assessments are important to **minimize bias influence**. Inform students not to identify themselves and classmates in the report to potentialize **good feelings**.
	(G) Analyzes	Compare the assessments and observation notes to minimize mistakes and **frauds**.
	(H) Discussion	Discuss assessment inconsistencies with the students, asking students to justify some answers. Highlight to students that the answers will not interfere with the game score, classmates' grades, and the students' names will not be revealed.
	(I) Results	Provide feedback in the group for all students, demonstrating how the microsoftskills are among them.

8 CONCLUSIONS

The serious games application in the accounting field allows educators to develop students' soft skills. However, the validation and reliability of their efficacy were a gap yet. The framework wheel developed in this research helps researchers and educational professionals better plan the serious game application to capture the target soft skill.

The literature review of the accounting assessment demonstrated best practices that could be inserted in the serious game environment, creating three stages, preparation, application, and post-game. Following the steps in each of these stages minimizes the current assessment fails detailed during the accounting serious game literature. Although it is impractical to measure the soft skills directly, we used microsoftskills as a main soft skill surrogate. As a result, Microsoftskills turned the soft skills assessment easier and more practical.

This framework contributes to the accounting education literature with the accounting assessment review and adds the wheel framework to be applied in a

serious game teaching methodology. It also has a practical contribution guiding educators to develop the soft skills requested by society.

Applying the wheel framework will guide the educator to the microsoftskill development. The first framework will show if the target soft skills are weak or not among the students. If the framework results demonstrated weak microsoftskills students, the educator could reply to the serious game methodology to teach the soft skills to the students. A framework reapplication will validate if the students are developing or not the target microsoftskills. If the framework results in students with strong microsoftskills development, the educator can work with a different set of microsoftskills or main soft skills.

This research limits the discussion in the accounting field because it is the researcher's field. However, other researchers may apply this framework in other knowledge areas to amplify its potential.

We do not intend to exhaust the soft skills assessment with this research. However, future research may extend this framework by creating new ways to assess soft skills.

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3 FINAL CONSIDERATIONS

Serious games can be a teaching tool for exploring hybrid accounting skills. However, their application needs to be careful to avoid a negative effect on the learning process of accounting students. Thus, the frameworks developed and presented in this thesis guide the educator to effectively apply the serious games in accounting and allow him to track the intended teaching hybrid skill. In this way, accounting educators can prepare students for emerging social demands using serious games.

The dimensional framework guides the educator towards a conscious application of the serious game. This framework smooth the serious game learning curve by showing which elements a serious game needs to have and by guiding the instructors during the game application to create a hybrid accounting skill environment. Furthermore, this framework allows educator to verify which accounting hybrid skills the game will explore before its application. Thus, the problem of the application of the game having a pedagogically unexpected result is minimized and allows the educator to choose the best serious game for the intended objective. Then, the dimensional framework filled the gaps on the literature about the transfer problem, maximized the potential of the serious game to explore the hybrid skills, minimized the game application to results in a boring and repetitive, and minimized the cost and the limitation of the serious game application. However, this framework does not fill the gap of to assess the soft skills to avoid the consume of precious class time without a positive impact in the learning process.

The hybrid skills assessment is important to ensure their exploration in the game environment. The games taks helps to track the hard skills application. However, soft skills are complex to be tracked due to their subjectivity. In this scenario, the soft skills assessment wheel framework helps accounting' educators investigate their students' use of soft skills, filling this literature gap. The segregation of the evaluation process in three moments allows the analysis of the students’ behavioral results through microsoftskills. As a result, it is possible to affirm that a certain behavior exists or does not exist in a serious game environment.

The use of frameworks wheel does not allow the educator to affirm soft skills development. It is because the development depends on factors beyond the educator's reach, such as the student's wish. Even though theories show that the elements used in the game provide behavior that will explore students’ soft skills, it is up to the student

to work on their will to develop them. However, we can affirm that the exploration of soft skills allows the educational environment to verify strengths and weaknesses in students regarding the hybrid skills worked. Then, the use of the dimensional framework and the framework wheel together fill the serious games gaps discussed during the introduction of this thesis. Using dimensional framework as a guide minimize smooth the serious game learning curve and create a dinamyc environment that minimize a boring and repetitive activity. Adding the framework wheel the serious games' instructor minimize the risks of transfer problem and non development skills.

Future research can apply the frameworks developed in other areas of knowledge, expanding the results worked here beyond accounting. As this research was developed in a pandemic environment, face-to-face classroom applications were limited. Future research can also carry out this type of application and verify the necessity or not to complement the frameworks presented here. These reapplication will validate the frameworks for scenarios that were not this thesis' target.

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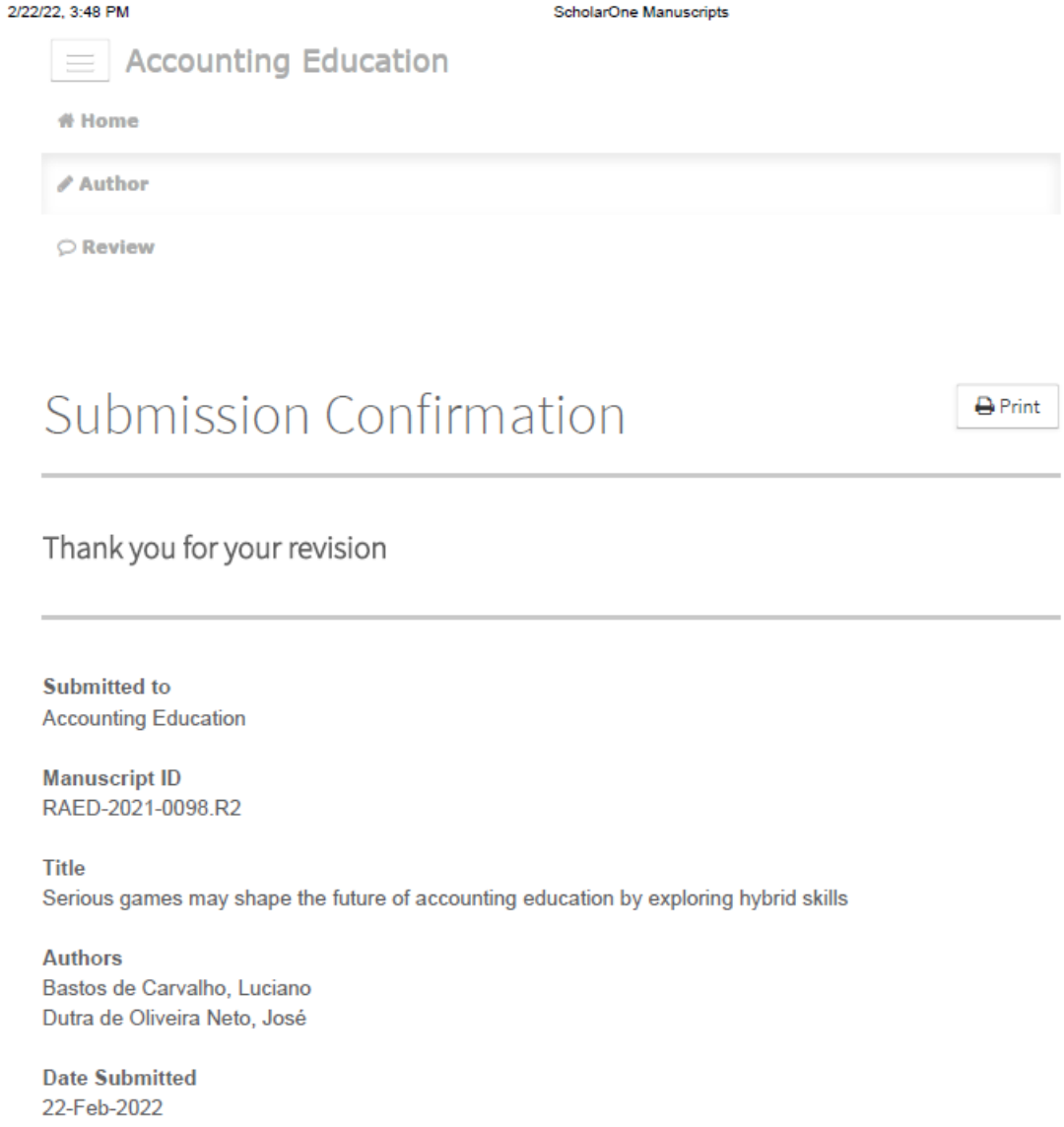
ATTACHMENTS

Attachment 1



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Attachment 2