Towards the Social Gamification of e-Learning: a Practical Experiment

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Abstract: Gamification is the use of game mechanics and game design in non-game contexts to engage users and motivate action. Although gamification has a great potential in higher education, existing research focuses on competitive approaches and presents contrasting evidence. We present a social gamification approach and tool designed to address the situated motivational affordances of students (relatedness, competence and autonomy). An experiment (N=374) is conducted to test it in an undergraduate course, comparing students’ performance with a traditional blended-learning approach. Students’ attitude towards the new tool is also analyzed. Results suggest that social gamification can be used to improve the overall academic performance in practical assignments and to promote social interaction. However, our findings also raise and important caveat. The creation of gamified experiences for higher education requires a deep knowledge of the motivational affordances of students and a careful design of the rewards that are introjected by students and that eventually stimulate participation.

摘要：游戏化是在非游戏环境中使用游戏机制和游戏设计来吸引用户并激发行动的动机。尽管游戏化在高等教育中具有巨大的潜力，但现有研究集中在竞争性方法上，并提供了相反的证据。我们提出了一种社交游戏化方法和工具，旨在解决学生所处的动机激励能力（相关性，能力和自主性）。进行了一项实验（N = 374），以在本科课程中对其进行测试，将学生的表现与传统的混合学习方法进行比较。还分析了学生对新工具的态度。结果表明，社交游戏化可用于提高实际作业中的整体学习成绩并促进社交互动。但是，我们的发现也引起了重要的警告。为高等教育创造游戏化体验，需要对学生的激励能力有深刻的了解，并精心设计学生引入的并最终激发参与的奖励。

Keywords: gamification; game-based learning; learning performance; e-learning

1. Introduction

Games are learning tools [1]. Games offer a clear set of goals and rules that constraint possible actions, and a feedback mechanism that provides a seamless sense of progression. Players learn not only what the rules of the game are but also how to master them while honing the skills necessary to achieve the game goals. Koster [2] suggests that games have had an important role in our evolution and McGonigal [3] goes even further suggesting that games have the potential to impact in our daily lives if they are used to tackle real world problems. Gamification is the use of game design elements in non-game contexts [4, 5]. The underlying idea is to try to harness the potential of games for learning and motivation. Bringing game mechanics like points, badges and rewards to other systems is not a new idea. For instance, customer loyalty programs (like frequent flyers) are a classic example. Internet-based information systems enable to keep automated track of users’ interactions and to implement gamification in business models. With social networking and the web 3.0, information systems can leverage gamified approaches that also include social features. Gamification has a great potential in education where unmotivated students are a recurrent problem [6]. However, gamification is a significant task, because game mechanics by themselves result insufficient [7]. Good games have the potential to keep players continuously motivated and engaged by constantly matching challenges at hand with player’s skills in a goal-directed, rule-bound action system that provides clear objectives and immediate feedback, resulting in a feeling of flow or optimal experience [8]. Educational games, sometimes referred as serious games, have already shown their value for instruction impacting on learning, knowledge acquisition, content understanding and even on motivation and other affective outcomes [9-11]. We believe that good gamified activities have the same potential.

游戏是学习工具[1]。游戏提供了明确的目标和规则集，这些目标和规则限制了可能采取的行动，还提供了一种反馈机制，可提供无缝的进度感。玩家不仅可以学习游戏规则，还可以学习如何掌握规则，同时磨练实现游戏目标所需的技能。 Koster [2]认为游戏在我们的进化中起着重要作用，McGonigal [3]进一步指出，如果游戏被用来解决现实世界的问题，它们有可能影响我们的日常生活。游戏化是在非游戏环境中使用游戏设计元素[4，5]。基本思想是尝试利用游戏的潜能进行学习和激发动力。将诸如积分，徽章和奖励之类的游戏机制引入其他系统并不是什么新主意。例如，客户忠诚度计划（如飞行常客）就是一个典型的例子。基于Internet的信息系统可以自动跟踪用户的互动，并在业务模型中实施游戏化。借助社交网络和Web 3.0，信息系统可以利用也包含社交功能的游戏化方法。游戏化在教育中具有很大的潜力，因为缺乏动力的学生是一个经常出现的问题[6]。然而，游戏化是一项艰巨的任务，因为游戏机制本身导致的结果不足[7]。良好的游戏有可能通过在目标导向，有规则约束的动作系统中不断匹配手边的挑战与玩家的技能，从而使他们不断地激励和参与，该系统提供明确的目标和即时的反馈，从而带来流畅的体验或最佳体验[ 8]。教育游戏，有时也称为严肃游戏，已经显示出其教学价值，这些价值影响学习，知识获取，内容理解甚至动机和其他情感结果[9-11]。我们认为，良好的游戏化活动具有相同的潜力。

Education is the most common context for the implementations of gamification [12] but experimental research points to limitations like the overstress on competition [13] questioning its effectiveness [14]. Research on player types [15, 16] suggest that competition is important for a few users but also that other users feel motivated by different needs. Particularly, user needs and abilities for exploration and socialization are usually not accommodated. A social approach to the gamification of learning could also employ peer-assessment to provide feedback, promote reflection and mitigate teachers’ workload [17]. Social experiences would engage students and foster collaborative knowledge production by means of challenges, rewards and social game’s mechanics [18]. Students perceive that online social networks improve their learning interactions [19]. Social game mechanics could also motivate students to create and maintain social bonds influencing learning when properly aligned with learning objectives.

教育是实施游戏化的最常见背景[12]，但实验研究指出了局限性，例如对竞争的压力过大[13]，质疑其有效性[14]。对玩家类型的研究[15，16]表明，竞争对一些用户而言很重要，但其他用户也会因不同的需求而受到激励。特别是，通常无法满足用户的需求以及进行探索和社交的能力。一种社会化的学习游戏化方法也可以采用同伴评估来提供反馈，促进反思并减轻教师的工作量[17]。社交体验将通过挑战，奖励和社交游戏机制来吸引学生，并促进协作知识的产生[18]。学生认为在线社交网络改善了他们的学习互动[19]。社交游戏机制也可以激励学生在适当地与学习目标保持一致时建立并维持影响学习的社交纽带。

Motivational theories suggest that addressing situated motivational affordances of students is critical to foster intrinsically motivated behaviors. Among these theories, Self-Determination Theory [20] proposes that there is a kind of continuum between extrinsic motivation, when learner may be motivated by extrinsic rewards like getting a good grade, and intrinsic motivation, when the learner is motivated just by the sake of learning. Extrinsically motivated behaviors are not inherently interesting, but they can be used to engage students in the initial stages. After initial onboarding, three motivational aspects bring about intrinsically motivated behaviors: autonomy, relatedness and competency. Autonomy is the capacity to set one’s own objectives and to work independently towards them. Relatedness is the sense of belongingness to a group with a specific goal. Competence is the feeling of efficiency with respect to a goal. An online gamified experience will keep its users engaged as long as it addresses these situated motivational affordances [21].

动机理论表明，解决学生的动机激励能力对于培养内在动机行为至关重要。在这些理论中，自我决定理论[20]提出，在外在动机（当学习者可能受到获得良好成绩等外在奖励的激励）和内在动机（当学习者仅出于清醒的动机）之间存在一种连续性。学习。出于外在动机的行为本来就不是有趣的事情，但可以用来在初始阶段吸引学生。最初入职后，三个动机方面会产生内在动机行为：自治，亲和力和能力。自主权是设定自己的目标并朝着目标独立努力的能力。关联性是指对具有特定目标的组的归属感。能力是相对于目标的效率感。在线游戏化的体验将使用户保持参与，只要它能够解决这些位于位置上的激励能力[21]。

Building on motivational theories, we suggest that social gamification can satisfy the situated motivational affordances of students impacting on learning performance and students’ attitude in higher education. This paper sets out to design and test a social gamification approach in an undergraduate course. The rest of the paper is structured as follows. Section 2 reviews current literature. Section 3 presents our approach and design for the social gamification of learning. Then we present the experimental design to evaluate its effectiveness. Results follow. The final sections present discussion and summarize conclusions.

在动机理论的基础上，我们建议社交游戏化可以满足影响学生学习表现和高等教育态度的学生所处的动机激励能力。 本文着手设计和测试本科课程中的社交游戏化方法。 本文的其余部分的结构如下。 第2节回顾了当前的文献。 第三部分介绍了我们针对学习的社会游戏化的方法和设计。 然后，我们提出实验设计以评估其有效性。 结果如下。 最后几节介绍并总结了结论。

1. Literature review文献评论

Gamification has been applied across different domains. In a literature review, Seaborn and Fils [22] pointed that top fields for gamification research are education, health and wellness, online communities, crowdsourcing and sustainability. Education accounted for over one quarter (26%) of the scientific publications about the practical application of gamification found by Seaborn and Fils in 2013. Constructs more frequently measured included effectiveness, attitudes, engagement, assessment and cognitive [23]. Reported results range across the complete spectrum from positive to negative. This suggests that there is need for research that integrates theory and practice. New approaches that integrate innovative techniques and technologies can also shed further light about the benefits of gamification in specific contexts.

游戏化已应用于不同领域。 Seaborn和Fils [22]在一篇文献综述中指出，游戏化研究的主要领域是教育，健康和保健，在线社区，众包和可持续性。 2013年，Seaborn和Fils在有关游戏化实际应用的科学出版物中，教育占四分之一以上（26％）。更经常测量的结构包括有效性，态度，参与度，评估和认知[23]。 报告的结果涵盖从正到负的整个范围。 这表明需要进行将理论与实践相结合的研究。 整合创新技术的新方法还可以进一步阐明游戏化在特定情况下的好处。

The effects of gamification in social networks have also been widely studied. Not surprisingly, the social website Foursquare, that implements gamification mechanics, has been extensively used as a test field to analyze the influence of game elements and dynamics on the social network [22]. Thom et. al. [24]. studied the effects of removing gamification features from an enterprise social network. They found that contributions declined suggesting that gamification in social settings promotes action but also the repetition and continuation of the action. Social networking in education is also a fruitful field of study. Positive effects were reported in a wide variety of cognitive and affective aspects when either popular social networking sites or specific educational networks are meaningfully integrated in learning actions [25, 26]. Previous studies suggest that the underlying social network plays a vital role in learning performance and in learning interactions [27, 28] in traditional as well as in technology mediated learning environments. Social networking technology just made explicit the underlying network facilitating communication and interaction, but also making possible to automate the running and operation of the network. Recent research shows that social networking technology noticeably changes communication patterns and values during learning [29]. Technology facilitates the development and computation of new measures, like network presence, that was used to explore the influence of the network in creativity and flow in groups of students [30].

游戏化在社交网络中的作用也得到了广泛的研究。毫不奇怪，实施游戏化机制的社交网站Foursquare已被广泛用作测试领域，以分析游戏元素和动态因素对社交网络的影响[22]。汤姆等al。 [24]。研究了从企业社交网络中删除游戏化功能的影响。他们发现捐款减少了，这表明社交环境中的游戏化促进了行动，但也促进了行动的重复和延续。教育中的社交网络也是一个富有成果的研究领域。当流行的社交网站或特定的教育网络被有意义地整合到学习活动中时，就会在各种各样的认知和情感方面报告积极的效果[25，26]。先前的研究表明，底层的社交网络在传统以及技术介导的学习环境中，在学习成绩和学习互动中起着至关重要的作用[27，28]。社交网络技术只是明确了底层网络，以促进通信和交互，但也使自动化网络的运行和操作成为可能。最近的研究表明，社交网络技术在学习过程中会显着改变沟通方式和价值观[29]。技术促进了新度量的开发和计算，例如网络存在，这些新度量用于探索网络对学生群体的创造力和流动的影响[3​​0]。

When it comes to studies that deal with gamification and social networking in education, Simões et. al. [18] presented a theoretical framework with an implementation but it was not empirically assessed. Lampe [31] compared both approaches suggesting that they complement each other offering great opportunities if combined. We also found comparative studies like [32, 33] that analyze both approaches, and compared them with others like traditional elearning or learning games. Although these studies provide a solid foundation and interesting insights about what approach can work better in specific contexts, they do not consider the integration of gamification and social networking. Recently, de-Marcos et. al [34] studied the relation between the position in the social network and learning performance in a gamified elearning course with social mechanics. They concluded that position influences learning pointing that social mechanics play a vital role in the gamification of learning. The social gamification of learning that we present in this study builds on these previous works but it also differentiates because we deal with integration of social networking and gamification in a twofold feedback loop. Firstly, gamification dynamics are used to foster and promote social actions. Then such actions feed learning-driven mechanics.

关于教育中的游戏化和社交网络的研究，Simões等人。 al。 [18]提出了一个具有实现的理论框架，但没有经验评估。兰普[31]比较了这两种方法，这表明它们相互补充，如果结合使用，将提供巨大的机会。我们还发现了比较研究，例如[32，33]，可以分析这两种方法，并将它们与传统的电子学习或学习游戏等方法进行比较。尽管这些研究为在特定情况下哪种方法可以更好地工作提供了坚实的基础和有趣的见解，但他们并未考虑游戏化和社交网络的集成。最近，de-Marcos等。等人[34]研究了在具有社交机制的游戏化学习课程中，社交网络中的位置与学习成绩之间的关系。他们得出结论，职位影响学习，表明社会机制在学习的游戏化中起着至关重要的作用。我们在本研究中介绍的学习的社会游戏化基于这些先前的作品，但它也与众不同，因为我们在双重反馈回路中处理了社交网络和游戏化的整合。首先，游戏化动力被用来促进和促进社会行为。然后，这样的动作会激发学习驱动的机制。

1. Designing the social gamification of learning设计学习的社会化

The model of situated motivational affordances [21] suggests that an experience engages users when it satisfies their situated motivational needs of competence, autonomy, and relatedness. An online gamification instrument that addresses such needs was designed and implemented. In terms of competence, learning activities were presented as short-term challenges with clear goals in increasing levels of difficulty. Students could submit their work and then review the activity of another student. Peer assessment was used. Existing research indicates that student generated rating scores can be valid and reliable, and also that rating compels students to reflect on their own work [35]. Peer assessment was based on teacher-generated rubrics. Students could comment, resubmit and engage in a discussion about each learning activity. In this way, assessment is approached as part of learning, so that mistakes are opportunities rather than failures. Peer assessment then also addressed the motivational need for competence by facilitating discussion about learning activities. Our approach used a social network to provide additional opportunities for social interaction and bonding. The Elgg open source social network engine [36] provided the backbone. Students and teachers participating in the social learning environment were included in a private instance of Elgg that provided functionalities for creating and sharing contents (blog, videos, questions and answers, tweets), liking and friends. All public interactions with the platform were shared in an activity dashboard, which was the home page. Dashboards and other activity streams have the potential to activate students and promote action [37]. Participants also had different options for customization that provided social status. Several of them were initially locked and students had to work and participate to earn points to get them.

情境激励性馈赠的模型[21]表明，当一种体验满足其能力，自主性和相关性的情境激励需求时，就会吸引用户。设计并实现了一种满足这些需求的在线游戏化工具。在能力方面，学习活动被视为短期挑战，其明确目标是提高难度。学生可以提交他们的作业，然后查看另一个学生的活动。使用了同行评估。现有研究表明，学生生成的评分分数是有效和可靠的，并且评分也迫使学生反思自己的工作[35]。同行评估是基于教师生成的评价标准。学生可以评论，重新提交并参与有关每种学习活动的讨论。这样，评估就成为学习的一部分，因此错误是机会，而不是失败。然后，同伴评估还通过促进关于学习活动的讨论来解决能力方面的动机需求。我们的方法是使用社交网络为社交互动和联系提供更多机会。 Elgg开源社交网络引擎[36]提供了骨干。参与社会学习环境的学生和教师被包含在Elgg的私人实例中，该实例提供了创建和共享内容（博客，视频，问题和答案，推文），喜欢和朋友的功能。与平台的所有公共交互都在活动仪表板（即主页）中共享。仪表板和其他活动流具有激活学生和促进行动的潜力[37]。参与者还具有提供社会地位的自定义选项。他们中有几个最初被锁定，学生们必须工作并参与以获得积分才能获得积分。

To address autonomy, the system implemented a wide set of possibilities together with game mechanics aiming to provide a sense of progression. Achievements, points, virtual shop and leaderboard were used. Achievements were digital badges that had a visual representation, a witty title and a description of how to get them. Lecturers and instructional designers planned achievements to encourage students to complete tasks and to interact with the online system. Students got points for completing and reviewing tasks and getting achievements. A virtual shop was also included enabling students to use points as in-game currency to buy different items that provided personalization and social status. Points were also used to create a public leaderboard, giving students the opportunity to compete.

为了解决自治问题，该系统实现了广泛的可能性以及旨在提供渐进感的游戏机制。 使用成就，积分，虚拟商店和排行榜。 成就是数字徽章，具有可视化表示，机智的标题以及如何获得的描述。 讲师和教学设计师计划成就，以鼓励学生完成任务并与在线系统互动。 学生获得了完成和复习任务并获得成就的分数。 还包括一个虚拟商店，使学生能够使用积分作为游戏中的货币来购买提供个性化和社会地位的各种物品。 积分还用于创建公共排行榜，为学生提供竞争的机会。

Although gamification is intended to motivate action, several concerns also need to be considered about external rewarding and regulation. Self-Determination Theory suggests that if the student feels that the learning process is tightly regulated by an external entity, motivation can be undermined [20]. The effectiveness of regulations depends on the degree of acceptance and introjection by students. Autonomy and relatedness facilitate introjection. This suggests that regulations included should not be mandatory or restrictive, and they should try to foster social relationships between students. In our design, students may feel that gamification mechanisms, especially the competitive meta-game and rewards, act as external regulations. We expect that the social aspect of such mechanisms can facilitate introjection. For example, when a student gets an achievement for answering a question submitted by a classmate, the answer also establishes a learning-oriented social relation between students. In the future, the student will be motivated to ask or to answer more questions to keep that relation, to establish new ones, or just to learn more (intrinsic motivation) instead of doing it just to get more points (extrinsic motivation). Additionally, points and the virtual shop were designed to foster student’s autonomy. Students could obtain points in different ways, focusing either on the challenges or on the social aspects of the platform. Students could also decide how to spend their points.

尽管游戏化旨在激励人们采取行动，但也需要考虑一些有关外部奖励和监管的问题。自我决定理论认为，如果学生认为学习过程受到外部实体的严格控制，则动机可能会受到损害[20]。法规的有效性取决于学生接受和融入的程度。自主性和相关性有助于注入。这表明所包含的法规不应是强制性或限制性的，它们应努力促进学生之间的社会关系。在我们的设计中，学生可能会感到游戏化机制，尤其是竞争性元游戏和奖励，充当了外部法规。我们期望这种机制的社会方面可以促进注入。例如，当学生获得回答同学提出的问题的成就时，答案还建立了学生之间面向学习的社会关系。将来，学生会被激励去问或回答更多的问题以保持这种关系，建立新的关系，或者只是学习更多的东西（内在动力），而不是仅仅为了获得更多的积分（外在动力）。此外，积分和虚拟商店旨在提高学生的自主性。学生可以通过不同方式获得积分，重点关注平台的挑战或社交方面。学生还可以决定如何使用他们的积分。

1. Experimental design 实验设计

4.1. Study site 学习地点

The course ‘Qualification for ICT users’ is 15-week undergraduate course covering the basics of information and communication technology providing basic knowledge and skills of computing and office applications. The course includes the following learning modules: [1] Introduction to the computer, the operating system and networks, [2] word processing, [3] spreadsheets, [4] presentations and [5] databases. Syllabus is based on the European Computer Driving License (ECDL) and the International Computer Driving License (ICDL) certification programmes [38], which are intended to become vendor independent de-facto standard certifications of digital literacy. The course has a blended learning approach including readings and additional activities delivered online using an e-learning platform. Students have 2 hours of lectures every week. Each learning module has two or three activities designed to practice the core skills of the learning experience. Activities are introduced on the lectures but students have to complete them on their own. Textual descriptions in documents as well as sample solutions are delivered through the e-learning platform. The course has five evaluation items. Modules 2 to 5 mostly include practical skills so students are required to complete four practical assignments. A final written examination covering all modules is also required. Students are also credited for participation in class as well as for their contributions in the e-learning platform. Participation represents a 5% of the final score.

“信息通信技术用户资格”课程是为期15周的本科课程，涵盖信息和通信技术的基础知识，提供计算机和办公应用程序的基本知识和技能。该课程包括以下学习模块：[1]计算机，操作系统和网络简介，[2]文字处理，[3]电子表格，[4]演示文稿和[5]数据库。教学大纲基于欧洲计算机驾驶执照（ECDL）和国际计算机驾驶执照（ICDL）认证计划[38]，这些计划旨在成为独立于供应商的事实上的数字扫盲标准认证。该课程采用混合学习方式，包括阅读和使用电子学习平台在线提供的其他活动。学生每周有2个小时的讲座。每个学习模块都有两个或三个活动，旨在练习学习经验的核心技能。讲座中介绍了活动，但学生必须自己完成。通过电子学习平台可以提供文档中的文字描述以及示例解决方案。该课程有五个评估项目。模块2至5主要包括实践技能，因此要求学生完成四项实践作业。还需要涵盖所有模块的最终笔试。学生也因参加课堂活动以及他们在电子学习平台中的贡献而获得赞誉。参与度占最终分数的5％。

4.2. Research questions研究问题

Our underlying assumption is that social gamified features designed to satisfy the situational motivational affordances of students may impact positively on learning performance and students’ attitude. Therefore our experiment aims to explore the following research questions:

我们的基本假设是，旨在满足学生的情境动机能力的社交游戏功能可能会对学习成绩和学生的态度产生积极影响。 因此，我们的实验旨在探索以下研究问题：

1. Does social gamification impact learning performance? 社交游戏化会影响学习成绩吗？
2. Do students have a positive attitude towards social gamification tools?学生对社交游戏工具持积极态度吗？

4.3. Instruments仪器

The main instrument was a social gamification tool as described in the previous section. Eleven activities were gamified (2-3 activities per module) representing the core of the learning experience. Gamified activities and social features provided the basis to create 28 complementary achievements. Instructional designers and lecturers designed achievements using activities completed by students (e.g. ‘Database expert’ for completing all database activities), actions performed by students (e.g. ‘Reviewer’ for reviewing 7 activities) and social interactions (e.g ‘Compulsive liker’ for liking 50 items).

如上一节所述，主要工具是社交游戏化工具。 游戏化了11项活动（每个模块2-3项活动），代表了学习体验的核心。 游戏化的活动和社会特征为创造28项互补成就奠定了基础。 教学设计师和讲师使用学生完成的活动（例如，完成所有数据库活动的“数据库专家”），学生执行的动作（例如，对7项活动进行回顾的“审阅者”）和社交互动（例如喜欢50的“强迫喜欢者”）来设计成就 项目）。

We compared this approach with a traditional e-learning approach. The control instrument was the current course delivered online through the BlackBoard learning management system. Students had documents with the contents of each learning module, documents of the activities with sample solutions, self-assessment tests, complementary materials and references, and the set of tools offered by traditional learning management systems including forums, messaging and a schedule.

我们将该方法与传统的电子学习方法进行了比较。 控制工具是通过Blackboardard学习管理系统在线提供的当前课程。 学生拥有包含每个学习模块内容的文档，带有样本解决方案的活动文档，自我评估测试，补充材料和参考资料，以及传统学习管理系统提供的工具集，包括论坛，消息传递和时间表。

An attitudinal survey was also used on the experimental group to gather quantitative and qualitative data about students’ perception and attitudes about the instrument. The attitudinal survey had 10 items based on a 5-point Likert scale.

实验组还进行了态度调查，以收集有关学生对乐器的看法和态度的定量和定性数据。 态度调查基于5点李克特量表，有10个项目。

4.4. Method方法

A pre-test post-test quasi-experimental design was used to compare students’ performance. Interactive tests were used to assess students’ pre-test performance for each practical module. Post-test data comprised scores of assignments for each practical module as well as the final examination score, and also a participation score for each student. The participation score was automatically computed based on attendance to lectures and contributions in the elearning platform. Engagement with the experimental instrument was scored using the same standards as in the e-learning course. All scores were normalized to a 0-100 scale. Pre-test and post-test data were compared using Kruskal Wallis tests.

测试前的测试后准实验设计用于比较学生的表现。 交互式测试用于评估学生在每个实际模块中的测试前表现。 测试后的数据包括每个实际模块的作业分数，期末考试分数以及每个学生的参与分数。 参加分数是根据参加演讲的人数和在电子学习平台中的贡献自动计算的。 使用与在线学习课程相同的标准对与实验仪器的互动进行评分。 所有分数均归一化为0-100分。 使用Kruskal Wallis测试比较了测试前和测试后的数据。

Two groups of students were selected to participate in the experiment. The social gamification tool was delivered to an experimental group of 210 first- and second-year undergraduate students. The control group included 164 first- and second-year undergraduate students. The selection of groups was arbitrary. Experiments were run during spring 2013. Lectures took place on different physical spaces for the experimental and control groups (different campuses in different cities) and groups also had separated e-learning spaces.

选择两组学生参加实验。 该社交游戏工具已提供给210名一年级和二年级本科生的实验小组。 对照组包括164名一年级和二年级本科生。 组的选择是任意的。 实验于2013年春季进行。针对实验组和对照组（不同城市的不同校园）在不同的物理空间上进行了演讲，各组也有单独的电子学习空间。

1. Results 结果

5.1. Achievement of students 学生成就

Pre-test results (table 1) suggest that there was no significant difference between the experimental and control groups in the four evaluation items assessed. Post-test results (table 2 & figure 1) suggest that the experimental group outperformed the control group on the four practical assignments but, surprisingly, the control group outperformed the experimental group in the final examination score and this difference is statistically significant (H=5.65, p=.017) although small. Finally, there was no significant difference in both groups when comparing the participation score.

测试前的结果（表1）表明，在所评估的四个评估项目中，实验组和对照组之间没有显着差异。 测试后的结果（表2和图1）表明，在四个实际任务上，实验组的表现均优于对照组，但令人惊讶的是，对照组在最终考试成绩上的表现优于实验组，且该差异具有统计学意义（H = 5.65，p = .017），尽管很小。 最后，在比较参与评分时，两组均无显着差异。

\*\*\* Figure 1 here \*\*\*

\*\*\* Table 1 here \*\*\*

\*\*\* Table 2 here \*\*\*

5.2. Attitudinal survey态度调查

An attitudinal survey was used to appraise the satisfaction of students and their attitude towards the social gamification tool. The instrument used was five-point Likert scale questionnaire with all questions scored in a positive scale. Answers were anonymous. 116 students of the experimental group provided feedback using this instrument. Questions and results are summarized in table 3. The average was 3.75, which suggest that the attitude of students was positive. The highest rated items were items 4, 5 and 6 suggesting that the tool was easy to use and it presented a sufficient number of activities that students found useful. Lowest rated items were items 8 and 9, which were related with involvement of students and their willingness to learn more about the topic. Although the score was not so bad, such results question the alleged benefits of gamification. All in all, at the end of the term students were not intrinsically motivated to learn more.

使用态度调查评估学生的满意度以及他们对社交游戏工具的态度。 使用的工具是五点李克特量表，所有问题的评分均为正。 答案是匿名的。 实验组的116名学生使用该仪器提供了反馈。 问题和结果总结在表3中。平均值为3.75，表明学生的态度是积极的。 评分最高的项目是项目4、5和6，这表明该工具易于使用，并且提供了大量学生认为有用的活动。 评分最低的项目是项目8和9，这与学生的参与程度以及他们愿意学习更多有关该主题的意愿有关。 尽管得分还不错，但是这样的结果质疑了游戏化的好处。 总而言之，在学期末，学生没有内在的动机去学习更多。

\*\*\* Table 3 here \*\*\*

Answers variability was low since overall standard deviation was .96 which roughly represents 1/4 of the mean, so answers could be considered homogeneous. An item analysis test returns a Cronbach's alpha score of .866, which was higher than a commonly used benchmark value of .7. This suggests that at least some of the items measured the same construct of students’ attitude.

答案的变异性很低，因为整体标准偏差为0.96，大约代表平均值的1/4，因此可以认为答案是同质的。 项目分析测试的Cronbachα得分为0.866，高于常用的基准值0.7。 这表明至少有一些项目衡量了学生态度的相同构成。

The attitudinal survey was also used to ask students that did not use the instrument for the reasons that prevented them from participating. 52 students provided feedback. Results are summarized in table 4. Students could argue more than one reason or no reason at all. Time available was the reason argued most frequently by students. Lack of interest was the second most argued reason. The reason argued less frequently was the difficulty to use or understand the online system. Under ‘other reasons’ students could provide additional feedback. Examples of answers provided by students were “I submitted the initial activities, but then I realized that nobody was reviewing my submissions, I got bored so I stopped using it” and “I registered but I never used it. Because it is not in the BlackBoard system, I forgot it existed”. They pointed to potential problems to be considered.

态度调查还被用来询问未使用仪器的学生，原因是他们无法参加。 52名学生提供了反馈。 结果总结在表4中。学生可以争论一个以上的原因或根本没有理由。 可利用的时间是学生争辩最频繁的原因。 缺乏兴趣是第二大争论的原因。 争论较少的原因是难以使用或理解在线系统。 在“其他原因”下，学生可以提供其他反馈。 学生提供的答案示例包括：“我提交了最初的活动，但后来我意识到没人在审查我的提交的内容，我感到无聊，所以我停止使用它”和“我注册了但从未使用过。 因为它不在Blackboard系统中，所以我忘记了它的存在。 他们指出了需要考虑的潜在问题。

\*\*\* Table 4 here \*\*\*

1. Discussion讨论

We can now go back to the original research questions. For the first question (Does social gamification impact learning performance?), results suggest that there was a positive impact for those students who actively participated by submitting and reviewing tasks. Social gamification impacted learning performance on practical assignments but it did not impact learning performance on the final examination. Indeed participants in the control group got better scores in the examination suggesting that a traditional e-learning approach can still be effective to convey conceptual knowledge. Gamified tasks were designed to hone practical skills, rather than to facilitate conceptual learning or memorization. It would be necessary to design different gamified tasks if we want to investigate whether social gamification can also improve conceptual learning.

现在，我们可以回到最初的研究问题。 对于第一个问题（社交游戏化会影响学习成绩吗？），结果表明，对于那些积极地通过提交和复习任务积极参与的学生有积极的影响。 社交游戏化影响了实际作业中的学习成绩，但并未影响期末考试的学习成绩。 确实，对照组的参与者在考试中得分更高，这表明传统的电子学习方法仍然可以有效地传达概念知识。 游戏化的任务旨在磨练实践技能，而不是促进概念学习或记忆。 如果我们要调查社交游戏化是否也可以改善概念学习，则有必要设计不同的游戏化任务。

The second research question is related to the attitude of students towards social gamification tools. Results suggest that students had a positive attitude towards the new tool. The lowest scored questions in the survey were those related to student’s involvement and their willingness to learn more about the course topic. This suggests that students were not intrinsically motivated to learn, questioning the alleged benefits of gamification. Also according to the feedback provided by students, they needed more time to complete tasks. Changes may also be necessary in the procedure to assess tasks in order to have all tasks peerreviewed. Other than that, students felt that the online social gamification approach and its content were properly designed and useful for learning.

第二个研究问题与学生对社交游戏工具的态度有关。 结果表明，学生们对新工具持积极态度。 在调查中得分最低的问题是与学生的参与程度以及他们愿意学习有关课程主题的意愿有关的问题。 这表明学生没有内在的动机去学习，质疑所谓游戏化的好处。 另外，根据学生提供的反馈，他们需要更多时间来完成任务。 在评估任务的过程中也可能需要进行更改，以便对所有任务进行同行评审。 除此之外，学生们认为在线社交游戏化方法及其内容经过适当设计，对学习很有用。

No difference in the participation scores was observed between the experimental and control groups. This also raises concerns about the alleged benefits of gamification that have to do with promoting action. Besides, it also points to an important limitation of the social gamification of learning that is related with the challenges that designers face to create engaging experiences that motivate sustained participation. The motivational effect of social gamification decreased gradually for most of the players. One possible reason could be the rewarding scheme, which consistently rewarded active students who submitted tasks, but did not reward in the same way students that preferred to use only the social functions of the platform. This unbalance may drove those students lacking of any initial interest in task completion to consider rewards as a heavy external regulation, thus reducing their sense of autonomy and undermining their willingness to continue using the platform. Another possible reason that could account for the decreasing levels of motivation observed is that the duration and timing of the course were not considered as an essential factor during the design phase, resulting in motivational mechanisms that had a limited effectiveness in the middle and late stages of the course. Therefore social gamification requires that designers think carefully about how their rewarding scheme will be accepted and introjected by students over time. Furthermore, if the group of students that participates is heterogeneous, the design can be even more challenging since different students may be motivated by different types of rewards, and therefore the sequence and timing of the actions that they are likely to follow until they eventually become active participants would be probably different.

实验组和对照组之间的参与分数没有差异。这也引起了人们对游戏化的所谓好处的关注，这与促进行动有关。此外，它还指出了学习的社会游戏化的一个重要局限性，这与设计师要创造激发持续参与的引人入胜的体验所面临的挑战有关。对大多数参与者而言，社交游戏化的动机影响逐渐减小。一个可能的原因可能是奖励计划，该计划会持续奖励提交任务的在职学生，但不会以只喜欢使用平台社交功能的学生相同的方式来奖励。这种不平衡可能会驱使那些对完成任务缺乏最初兴趣的学生将奖励视为繁重的外部规章，从而降低了他们的自主意识，并削弱了他们继续使用该平台的意愿。可能导致观察到的动机水平下降的另一个可能原因是，在设计阶段，课程的持续时间和时机不被认为是必不可少的因素，导致动机机制在课程的中，后期效果有限。课程。因此，社交游戏化要求设计师仔细考虑他们的奖励方案将如何随着时间的流逝而被学生接受和引入。此外，如果参加的学生群体是异类的，则设计可能会更具挑战性，因为不同的学生可能会受到不同类型的奖励的激励，因此，他们可能会遵循的行动顺序和时机，直到他们最终成为活跃的参与者可能会有所不同。

The main limitation of our study has to do with the generalization. Results are circumscribed to a specific case-study using a limited sample. Results and conclusions cannot be generalized. Further experimentation is required to determine whether results can be extrapolated or are transferable to other areas or subject domains. We have just used a web-based approach but current research suggest that mobility is required to capture and engage new students. For instance, Huan et. al. [39] suggested that perceived engagement is key factor in m-learning adoption. Similarly, our approach implements peer assessment but self-assessment has also demonstrated to be effective and complementary particularly in learning experiences with many learners [40]. Also, the integration of automatic mechanisms to produce personalized [41] and adapted contents [42, 43] can ensure that the experience is appropriately tailored to the needs of each particular student.

我们研究的主要局限性与泛化有关。 使用有限的样本将结果限制在特定的案例研究中。 结果和结论不能一概而论。 需要进行进一步的实验以确定结果是否可以推断或可以转移到其他领域或主题领域。 我们刚刚使用了基于Web的方法，但是当前的研究表明，要吸引和吸引新学生，就必须具备流动性。 例如，Huan等。 等 [39]提出，参与度是采用移动学习的关键因素。 同样，我们的方法实现了同伴评估，但是自我评估也被证明是有效和互补的，特别是在许多学习者的学习经历中[40]。 同样，集成自动机制以产生个性化的[41]和适应的内容[42、43]可以确保根据每个特定学生的需求适当地调整体验。

1. Conclusion结论

We approached the social gamification of learning by designing a technology-enabled learning experience that specifically addresses the motivational affordances (competence, autonomy and relatedness) of learners. The approach and the system were tested in an undergraduate course to assess their impact on learning performance and on students’ attitude. Mixed results were found. While results suggest a positive impact on learning performance in practical assignments, the control group performed better on a written examination. No differences were found in terms of participation, although participation was measured using traditional means that did not considered new forms of interaction. Attitude of students towards the new approach was positive suggesting that the tool was easy to use. The attitudinal survey also pointed to potential problems like students’ involvement and their willingness to learn more about the topic that ultimately question the effect that gamification has on intrinsic motivation. We argue that it is necessary to analyze students’ needs and motivations in order to design and test carefully the rewarding scheme, considering also timing and duration, to address adequately the motivational affordances that create compelling socially gamified learning experiences.

我们通过设计一种技术支持的学习体验来应对学习的社会游戏化，这种学习体验专门针对学习者的动机能力（能力，自主权和亲和力）。该方法和系统已在本科课程中进行了测试，以评估其对学习成绩和学生态度的影响。发现混合结果。虽然结果表明对实际作业中的学习成绩有积极影响，但对照组的笔试成绩更好。在参与方面没有发现差异，尽管参与是使用传统方式衡量的，而传统方式并未考虑新的互动形式。学生们对新方法的态度是积极的，这表明该工具易于使用。态度调查还指出了潜在的问题，例如学生的参与以及他们愿意学习更多有关该主题的知识，这些问题最终质疑了游戏化对内在动机的影响。我们认为，有必要分析学生的需求和动机，以便仔细设计和测试奖励计划，同时考虑时间和持续时间，以充分解决产生令人信服的社交游戏学习体验的动机。