Tiers of Engagement: Achieved Learning From Business Simulations Reflected in Economics Students' Experiences

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Abstract: This article investigates the impact of a business simulator in an online economics course, focusing on the relationship between student engagement and reflections on learning. Utilizing a mixed-methods approach, our study analyzes responses from 328 students who used the "Hubro Business Simulator" in a flexible online bachelor's program in economics and administration. Students provided reflections on the simulator as a learning activity, application of theoretical concepts and practical relevance. Qualitative analysis of 1640 responses further explored the depth of students' reflections, categorized into different tiers of engagement based on their responses. This analysis builds on Self-Regulated Learning (SRL) and motivational theory. The study sought to determine whether students reporting higher levels of engagement exhibited deeper metacognitive reflections compared to their less engaged peers. Findings support a link between the level of engagement and the depth of reflection. Students with higher engagement levels were more likely to reflect on specific ways in which the simulator had supported their learning and understanding of theoretical concepts. This paper discusses the limitations and implications of these findings for enhancing game-based learning interventions, emphasizing the need to foster higher engagement levels to improve educational outcomes in online learning environments. The study contributes to the literature on game-based learning by providing a large empirical study on how business simulators can foster higher-order thinking and deeper learning reflections among economics students. It also highlights the role of engagement in using business simulators as learning tools, offering insights that could improve the learning design and implementation in similar online and flexible learning program contexts.

Keywords: Game-based Learning, Engagement and Motivation, Self-regulated Learning, Online Education, Business Economics Education, Business Simulators.

1. Introduction

In recent years, especially after the pandemic, online education has received more focus in Norway (Breiby et al 2022). Our case is an online bachelor program in business economics and administration. Our students participate through online platforms. The students have a need for flexibility. As a result, activities such as groupwork, discussions and internships are not feasible.

This necessitates alternative activities for student-engaged learning. We therefore use the "Hubro Business Simulator" where students manage a startup company. Throughout the simulation, students were also given custom made narrative assignments. These were made by the course instructor to fit the narrative of the simulation. The assignments were closely linked to the course curriculum, and the normal course work. The reasoning for this was to see if the students could connect the practical tasks in the simulator to the theoretical assignments. To further integrate the simulator into the course, students were given an assignment to reflect on their learning process.

In this article, we analyse the data, looking at students' level of engagement with the simulator and their displayed level of reflection on their own learning.

Our research question is: Are the students that report a high level of engagement operating on a higher taxonomical level when they reflect on how the simulator has impacted their learning, compared to students that report low levels of engagement?

2. Theoretical Background

2.1 Game-based Learning

Games for learning is a potential way to promote increased learning through higher levels of engagement (Schwartz and Plass, 2019). There have been some studies on the Hubro Business Simulator at Norwegian universities. Baksaas and Nygård (2021) find that it can provide deep learning in accounting courses. Hovland et al (2023) find no cognitive effects on quantitative measurements of grades and knowledge tests, but that

students express increased term- and method learning, and positive experiences and motivation. Skjelbred and Daus (2022) presents an RCT that found no evidence that high satisfaction corresponded to game effectiveness.

The use of games in economics education has seen an increase in recent years. Platz (2022) is the first systematic review of learning with digital games in economics programs and synthesizes the results from 20 intervention studies. It examines the effect games have had in comparison to other mediums, and which elements have had an impact on learning. Platz remarks that there is a large variation in effect sizes but concludes that evidence supports that games can be an effective form of learning for economics. She draws attention to results for content knowledge and higher-order thinking skills. An interesting finding is that the effects of GBL on motivation are unclear, but motivation as a factor for learning is supported. Platz points at this dilemma, as motivation is central in GBL-literature. She points out potential in relation to increased challenges to drive engagement and flow, or fostering intrinsic motivation through autonomy.

2.2 Engagement

In higher education, engagement often means engagement with the university, course or program. Our focus is on students' engagement with the simulator as a learning activity, that takes place in the overall context of their scholarly activities.

Kuh (2009) defines engagement as a *"term usually used to represent constructs such as quality of effort and involvement in productive learning activities".* Lu (2020) states engagement is important for online students' course connection and learning. He points out that the course instructor plays a role in facilitating engagement through substantive feedback. Martin and Bolliger (2018) state that student engagement can lessen the feeling of isolation in online courses and improve academic performance, and that engagement is critical for success and reducing the drop-out. Meyer (2014) describes an indicator of engagement from the National Survey of Student Engagement: The level of academic challenge that requires effort to overcome. Sub-categories to this indicator include higher order learning, reflection, integrative learning, learning strategies, and quantitative reasoning. This means engagement is important in online education to ensure student success, learning and completion of the education.

We focus on engagement in the context of a simulation game. According to Plass et al. (2015), engagement occurs inside the context and rules of a game setting. Engagement is also affected by the participation of the user (Salen & Zimmerman, 2004, as cited in Plass et al (2019)). Engagement comes from the individual that is engaging with a game, created by interest and motivation when interacting with the game (Schwartz and Plass, 2019). However, the most important element of engagement is defined by activity. Engaged users are actively taking part in a process of making meaning of the game and tasks therein. (G4LI, n.d., as cited in Schwartz and Plass, 2019). Schwartz and Plass conclude that engaged individuals are exerting some kind of effort and based on this define engagement as *"the active and focused investment of effort in a game environment"* (Schwartz and Plass (2019, pp 55). In the context of our study, we consider engagement to be the active effort, and quality of this effort, students have put into making meaning out of, and make use of the business simulator in their learning processes.

2.3 Motivation and Self-Regulation of Learning

Our approach for analysing the collected data builds on theories of motivation and self-regulated learning (SRL).

Deci and Ryan (2000) examine the motivational causes for actions. They distinguish between intrinsic motivation (doing what is inherently interesting or enjoyable) and extrinsic motivation (doing something because of an outcome or external factors). Furthermore, they say that intrinsic motivation can be seen as residing inside a person. Although, intrinsic motivation can also be seen as residing between a person and a task. This means that someone can be intrinsically motivated for certain tasks, but not for others. Finally, Deci and Ryan (2000) state that intrinsic motivation, in self-determination theory (SDT), cannot be created directly, but be facilitated or catalysed by providing situations where people can express it. We focus on intrinsic motivation relating to engagement with the simulator.

To closer examine how students' engagement with the business simulator impacts learning, we turn to SRL as a conceptual framework. Efklides (2011) concisely refers to SRL as "the setting of one's goals in relation to learning and ensuring that the goals set are attained". Panadero (2017) states SRL is central to "understand the cognitive, motivational, and emotional aspects of learning". His review examines the major models of SRL that have gotten traction in research. He finds that, in general, the models group the different subprocesses students perform

into phases: Preparatory, performance and appraisal. Our study focuses on appraisal aspects, which in the various models involves processes of how students regulate and adapt, (self-)reflect and apply metacognitive strategies in their regulation of learning. Miele and Scholer (2018) conceptualize two metamotivational process-loops in which learners monitor or control their task motivation.

Our survey was not an explicit instrument to measure SRL, but the qualitative data offers a view of how students reflect on the business simulator as a learning activity. Drawing on the SRL literature, we have looked for statements that deal with themes related to the appraisal phase of SRL to assess the level of reflection.

3. Methodological Design

Our study combines quantitative and qualitative data in a concurrent triangulation design. This approach uses complementary data on the same topic to get a deeper understanding of the studied problem (Almeida 2018). Because the aim of our study is to explore the relationship between engagement and level of reflection, we consider this design to be appropriate for our data collection.

Our data was gathered through an online survey. The survey was framed as a reflection assignment for students to complete after finishing the simulator. The first part recorded demographic variables (age and gender). Respondents could answer "other" on gender, but there were no such responses. The second part consisted of four quantitative questions where the students rated the simulator's usefulness in achieving four learning outcomes on a scale from 1 (low) to 5 (high).

The final part consisted of five open-ended questions asking respondents to reflect on the simulator as a learning activity (reported in Table 1). By allowing the student to formulate their answers freely, we aimed to collect data that represented their actual experiences with the simulator. In total there were 1640 comments. These comments make out the main part of our data analysis.

There were 365 responses, with 328 consenting to being used in research. The quantitative data was analysed by measuring the mean, and standard deviation (SD) in the answers.

A large part of our study involves analysis of the qualitative reflections. Based on the theory outlined above, we attempted to identify signs of engagement and motivational type. We used SRL to guide our analysis of the level of reflection. In doing this we aimed to illustrate the tiers of engagement and corresponding reflection on learning in the context of game-based learning and simulator games. Finally, we analysed the quantitative data of each tier to determine if students on higher tiers of engagement and reflection reported higher scores on the learning outcomes.

As our data is self-reported, there are risks related to validity. Based on Gonyea's (2005) criteria for validity of self-reported data, we consider the data to be generally valid for our study. In the context of the simulator, the questions are clearly phrased and unambiguous, and relate to a recent experience and context familiar to the respondents. The open-ended questions gave opportunities to provide feedback related to their individual experience at their preferred level of detail. The survey is anonymous with a long response time, preserving privacy and avoiding pressure. Respondents also had to explicitly give consent for their responses to be used for research. We will further discuss possible limitations of the data later.

4. Empirical Findings and Analysis

Table 1: Categories in reflection assignment

Category	Query
Reflection	Write what you liked/disliked with the simulator. What could we have done to make the simulator more useful for your learning?
Collaboration	The simulator can also be used in groups where several people take part in each company. 1) Would you have preferred to use the simulator in collaboration with other students? 2) Do you think collaboration in groups would improve the learning outcomes?
Learning outcomes	What do you think you learned by taking part in the simulation?
Practical relevance	1) Did you gain an increased understanding of how theory and practice are connected in business economic analysis? 2) How could the simulator be improved in this regard?
Simulation as a learning activity	What do you think about this activity as a way of working?

4.1 Summary of Aggregated Findings

The qualitative comments were analysed by categorizing what we could interpret as the meaning of the comments and performing a frequency analysis. A significant number of respondents appreciated the simulator, noting the engaging and realistic nature, although some expressed concerns regarding time demands, oversimplification of real-world scenarios, and lack of clarity. A preference for traditional assignments was noted by a small minority. The simulator enhanced reported understanding of business concepts such as accounting and market dynamics. While the simulator was used individually, opinions on hypothetical collaboration were mixed. Many recognized potential benefits of collaboration and discussion, but few wanted to work in groups, citing concerns about coordination or a preference for working alone. Comments highlighted requests for guidance and feedback. Some also wanted integration with other courses. Positive remarks were made about the interactive elements of the simulator, the ability to observe the consequences, and comprehensive understanding of business, aligning well with the course curriculum.

4.2 Analysis of Engagement, Motivation, Reflection and Learning

Drawing on the theory presented on engagement, motivation, and reflection, we defined criteria and indicators for our categorization of the variables, shown in the tables below.

Focusing on the appraisal aspects of SRL, we applied the concept of metamotivation. Scholer et al (2018) describe "metamotivation as the processes by which individuals monitor and control their motivational states in order to achieve their goals". Miele and Scholer's (2018) metamotivational model of motivational regulation builds on SDT. It attempts to illustrate the process of students' awareness of their level of motivation (i.e. motivated "enough" or "in the right way"), arguing that motivation regulation is tied to tailoring the level of motivation to the demands of the task. They suggest that extrinsically driven students might be as highly motivated in tasks as their intrinsically motivated peers but find the tasks less engaging thus with less complex, creative and flexible effort. Furthermore, they provide a list of relevant feelings that signal high or low levels of different motivational components (e.g. confidence/frustration for self-efficacy, or enjoyment/boredom for intrinsic value).

We categorized engagement as low (1), medium (2), and high (3). We used the same scale for assessing level of reflection. We categorised motivation as extrinsic (1) or intrinsic (2). As classifying motivation can be challenging, we assessed if there was a considerable intrinsic component present in the response, or if it was strictly extrinsically motivated. We reiterate that the score assigned to each variable was based on the interpretation of the researchers using our defined criteria, and not a measurement of SRL. Both researchers analysed the data and discussed uncertain classifications. Therefore, results might not accurately represent the actual engagement, motivation, and reflection, but what we could assess and categorize from the data in the responses.

Table 2: Criteria for categorization of engagement level

Engagement indicators:	Quantity of effort (comments about desire to complete or finish the simulator, how many things they have tried/done), quality of effort (comments about whether the simulator "fits" their motivation for engaging in the task, how thorough they have been in the task), exploration of the simulator, mastery of the simulator.
High:	High quantity and quality of effort put into exploring and mastering the simulator.
Medium:	High quantity or quality of effort put into exploring or mastering the simulator, but not both.
Low:	Low levels of both quantity and quality of effort put into exploring and mastering the simulator.

Table 3: Criteria for categorization of primary motivation type

Motivational indicators:	Joy, interest, external pressure, rewards or outcomes.
Intrinsic:	Presence of comments indicating joy from, or interest in, the simulator.
Extrinsic:	Presence of comments about instrumental use of the simulator, focus on external factors (rewards, outcomes), time/effort expenditure.

Table 4: Criteria for categorization of reflection on learning

Level of reflection on learning indicators:	How the students describe their experience with the simulator, their perceived learning from it, and insight regarding their learning process. We differentiate between how detailed and deep their thoughts about the simulator and their own learning are as described below.

High:	Reflects on what they have learned, but also how they learned, and what could facilitate more learning. Relating their learning to larger contexts.
Medium:	Reflects on what they have learned.
Low:	Reflects on what tasks they have done and if they have learned/not learned (e.g. answering "yes" or "no" without further specifications).

We categorised based on assessed levels of engagement and motivation. Categories were high, medium, and low engagement, where each category of engagement had sub-categories for motivation. This resulted in six tiers. No respondents were categorized as having high extrinsic engagement. This row is therefore left out. We counted the number of responses in each category, calculated mean levels of reflection and reported learning outcomes, and SD for each category. We also report mean SD of age, and gender distribution.

Figure 1 shows that 61% have been categorized as showing medium engagement, with the largest tier being medium intrinsic engagement, followed by high intrinsic engagement and medium extrinsic engagement.

The mean level of reflection appears to increase with higher levels of engagement and intrinsic motivation. The SD on reflection varies from 0.5 to 0.76, which is moderate to high. This indicates a moderate to high variance within each tier. The mean of reported learning also increases with higher engagement and intrinsic motivation. The SD for this is also moderate to high, indicating similar variance. Intrinsic motivation seems to influence engagement. We see that most responses we have coded as showing intrinsic motivation are categorized in medium to high tiers of engagement. Furthermore, we see that age does not vary in any significant way between tiers. The SD is not high considering the range of ages, and similar between tiers.

Regarding gender differences, we see some differences for each tier. Especially the percentage of men and women in each tier. These percentages are based on how many men or women are present in a tier in relation to the total population. 28% of men are categorized as having high intrinsic engagement vs. 20% of women. We see that a larger percent of men is categorized in the higher tiers, while a larger share of women is categorized in the lower tiers.

Engagement tiers	Distribution of students	Mean level of reflection	Standard deviation reflection	Mean of reported achievement of learning outcomes	Standard Deviation LO	Mean of age	Standard Deviation age	Percentage Men	Percentage of men	Percentage women	Percentage of women
High Intrinsic Engagement	23%	2,49	0,58	4,07	0,60	29,22	6,77	52%	28%	48%	20%
Medium Intrinsic Engagement	45%	1,75	0,69	4,01	0,66	29,31	7,35	47%	48%	53%	43%
Medium Extrinsic Engagement	16%	1,68	0,58	3,90	0,62	30,96	6,39	40%	15%	60%	17%
Low Intrinsic Engagement	2%	1,71	0,76	3,21	0,64	27,29	7,30	29%	1%	71%	3%
Low Extrinsic Engagement	13%	1,28	0,50	2,60	0,84	30,28	9,63	26%	8%	74%	17%

Figure 1: Results of data analysis

Categorizing by intrinsic motivation and level of engagement separately, we can see from Table 2 that in the overall population of respondents, a larger percentage of men tends to be intrinsically motivated and engaged by the simulator.

	% men	% women
Intrinsic motivation	78%	66%
High engagement	28%	20%
Medium engagement	63%	60%
Low engagement	9%	20%

Figure 2: Division of motivation and engagement by gender

4.3 Visualizing the Tiers of Engagement

In this section we visualize the data showed in the earlier chapter in figures.

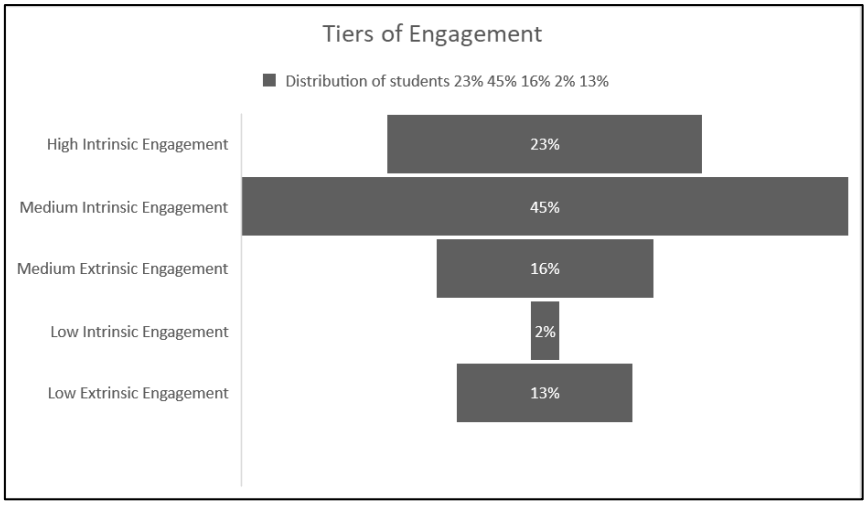

Figure 3: Tiers of Engagement

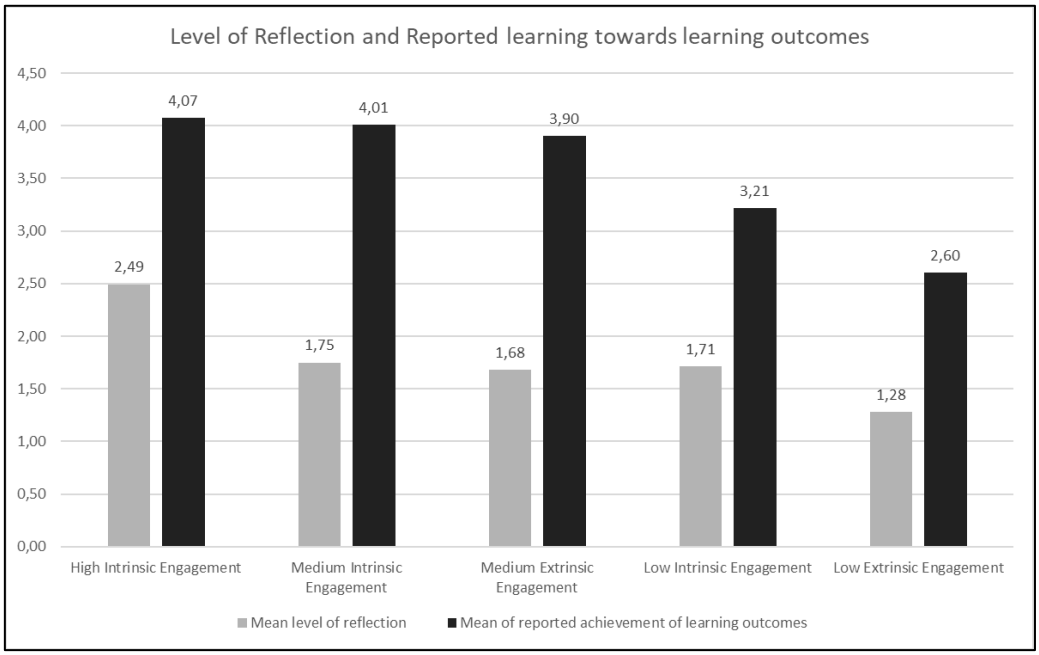

Figure 4: Level of reflection and reported learning

5. Limitations and Discussion

5.1 Limitations

This study is based on self-reported data. Although we believe we satisfy the criteria for validity proposed by Gonyea (2005), there are challenges with self-reported data and he therefore recommends that self-reported data should be combined with more objective data to increase validity. Our study would be stronger if we had measured motivation and engagement with instruments designed for this purpose. While our analytical framework has been designed to identify the presence of engagement and motivation, it is based on our interpretation of the data and application of the criteria, which weakens the validity. We consider the responses to be valid and representative of students' experiences, as discussed in the methods section, but we acknowledge that our analytical approach opens for errors of interpretation. In addition, there are potential confounding variables that can impact our findings and transferability to other contexts.

The study was made in the context of a fully online program, with a student population that has chosen the program due to the high level of flexibility, often combining it with full-time employment. As we see in their reflections on possibilities for collaboration, this impacts what they see as preferable or practically feasible. Similarly, the simulator was a mandatory assignment. As such, as a learning activity that differs from 'traditional'

assignments, the students' views could be impacted by not conforming to their expectations for an online program. This could also be seen in relation to the variance in age. Some respondents in the higher age groups are possibly not interested in digital games. These variables could impact students' motivation for the simulator.

Prior knowledge could also have an impact. Some students had prior experience with the simulator from a different course, which could have influenced their experience with the simulator (e.g. having mastered the simulator as a game, putting less effort into it as a learning activity for this course). Some students also reported experience from working in business, which could impact their views on the simulator's realism or relevance to working life.

5.2 Discussion

We aimed to examine if higher levels of reflection on learning could be found with students who were highly engaged by the simulator, compared to students showing low levels of engagement. As our survey was not intended to measure the level of engagement and motivational types, we had to develop an approach for analysing and coding our data. Our analysis indicates that there seems to be a connection between levels of reflection on learning and engagement, with high engagement corresponding with more complex reflections on learning. Intrinsic motivation seems to influence the level of reflection and engagement. This matches established theory. The tier of low intrinsic engagement breaks with this trend. This tier represents only 2% of the responses and could be an example of imprecision in our data analysis method. If we presume it to be valid, it could mean that intrinsic motivation is more intricately tied to reflection, than engagement itself. Nevertheless, intrinsic motivation appears to be key in attaining high engagement, as intrinsically motivated students populate most of the higher tiers of engagement.

The respondents have a varied demographic makeup. Within the tiers the average age and variance is similar. There is a relatively higher share of men in the intrinsic high and medium tiers of engagement. In the lower engagement tiers, there is a larger relative share of women. Our data has not revealed any specific insight on the gender gap, but this might link up with other studies, such as Riemer and Schrader's (2015) finding that women reported higher general negative affect towards GBL.

Students report they understand more of the context of working in a business, and the link between curriculum and "real" businesses. Some reflect on how this understanding affected their following work in the course. The simulator feeling realistic matches the results reported in Baksaas and Nygård (2021) and Hovland et al (2023).

The simulator itself is simplified in relation to reality. The most reflected students report that they see the connection between theory and practice, but also the shortcomings of the simulator. This points to how engaged students who want a more a complex and challenging simulator can see the shortcomings because they are on a higher reflection level. We expected that highly reflected respondents could report lower levels of achieved learning, as they might be more critical to the simulator's ability to provide insight due to the abstractions. While critical reflections on realism are present in the responses, the highly engaged and reflected students still reported the highest mean achieved learning outcomes. This could mean that awareness of the abstracted reality of the simulator is not a hindrance for learning, provided that students are sufficiently motivated to go beyond the simulator in their learning.

68% exhibit criteria signifying intrinsic motivation, and medium or high engagement. Returning to Miele and Scholer's (2018) concept of metamotivation (are the students motivated "enough" and/or "in the right way") brings some insight. Some comments that shed light on motivation revolve around interactivity and being able to make decisions and experiencing consequences. There's reflection on learning from effort put into exploring the simulator and making use of the information provided by in-game reports. The activity was individual, but when reflecting on the potential of collaboration, students express that group discussions would be useful for learning. Even so they prefer individual use. This is not surprising, as the program is online and flexible. The students are motivated to use the simulator, but not to use it in a less flexible context that would require more coordination.

Furthering reflection on metamotivation, a question is if some of the students who reach medium, but not high, engagement does so because they found the simulator to be lacking in challenge or realism. Could challenge and realism be a ceiling for engagement by limiting the feeling of meaningfulness? Although some comment on the simulator being too complex for an introductory course, others state that they found it helpful for grasping the course basics. Platz (2022) points out that GBL research on such design elements are hard to generalize and compare, with more studies needed. Our analysis has not resulted in strong findings on this point, but we can

see from some comments that highly engaged students seem to want more complexity and challenge. This suggests that challenge and complexity/realism could be a driver for engagement, but there could be individual differences (possibly related to type and amount of motivation) between students on what they deem complex or challenging enough to be engaged. Explaining why some are highly engaged by the simulator's current challenge and complexity (but want more), and some do not reach the higher tiers of engagement because of a lacking level of challenge and complexity. At the same time, the simulator must also not be too complex. This is an area where a deeper analysis of the qualitative responses might shed more light.

Comments relating to technical or practical issues with the simulator are recurring. Seen from a motivational perspective, it could point to such issues as external factors that inhibit the students from expressing their intrinsic motivation, i.e. reducing both the quality and amount of their motivation to engage with the learning activity and obscuring the connection between the simulator and the curriculum. Issues reported deal with how the simulator is introduced, the allotted time, feedback and guides for use. Among these we also find reflections that go beyond instrumental concerns about making it easier or taking less effort to complete. From these comments we can see potential for helping students reach higher tiers of engagement. By reducing frustration, we could potentially prime students to better experience the simulator as a meaningful learning activity by making the usefulness for learning more apparent. Additionally, opportunities for challenge could be included for the students who feel that the simulator is too simple to further their learning.

Some students reflected on how the additional narrative tasks they had to complete were useful for their learning. These assignments were added by the instructor to expand the simulator to also include theoretical tasks and terminology in a practical context. Many responses reflect on how this added realism or helped with visualizing or fostering understanding of concepts. Comments on the same relationship from lowly engaged students report that they didn't see connections between the theoretical curriculum and the practical tasks. These reflections are also coded as low. This could show that engagement is important to see the connections, and therefore reach a higher level of reflection.

6. Conclusion and Future Work

Our study shows that the students in the highest tier of engagement express higher levels of reflection on their learning than the respondents in the lower tiers. The middle tier, both intrinsically and extrinsically motivated, express lower mean levels of reflection (1.75 and 1.68 on a scale of 1-3 compared to 2.49 for the highest tier). This shows that engagement is important for students' perceived learning in our context: An online business simulator game as a learning activity. The qualitative data provides insight into several factors relating to the respondents' reflections. There is a large degree of variance within each tier. The high and medium level reflections contain a broad display of metacognitive thinking about the simulator as a learning activity. The comments highlight the importance of appropriate challenge and opportunities for the players to find the simulator meaningful. Intrinsic motivation seems to be a key component in reaching the highest tier of engagement.

The lowest tiers of engagement display a low level of reflection (1.71 and 1.28). The intrinsic motivated tier corresponds to only 2% of the respondents and could be reflective of methodological weakness in our analysis. When providing reflections beyond one-word responses, their concerns revolve primarily around issues connected to effort and technical/practical issues.

Our analysis indicates that the intrinsically motivated students have been more engaged and found the simulator meaningful. It is important to create opportunities for students to express their intrinsic motivation. With a heterogenous student population with a high need for flexibility, this could necessitate more focus on options to customize the simulator to fit their optimal level of complexity. Arenas for students to discuss the tasks could also be useful, provided it matches their needs for flexibility.

Based on our work so far, we see the use for a more precise measurement tool in future data collection. This will provide the opportunity to closer examine various motivational components connected to the students' self-regulation of learning, as well as possibly shedding more light on the relationship between intrinsic and extrinsic motivation on reflection. We also see the potential in reducing frustration and improving the integration of the simulator in the course to better enable students to see how it can be a meaningful part of their learning process and motivate them to reach a higher tier of engagement. The qualitative comments also point towards questions that could benefit from further inquiries. This includes the effect of the narrative assignments that expand on the simulator, realism, and complexity/challenge.

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