Influence of Gamification Elements on Explicit Motive Dispositions

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ABSTRACT Explicit motive dispositions are the psychological needs that drive the behavior and play a predictive role in the selection of the achievement goal. In the presence of situational incentive cues, the variables of explicit motive dispositions may arouse/suppress. Similar to these incentive cues, gamification elements (such as leaderboards, points, badges, etc.) offer motivational affordances that either increase or decrease performance and engagement depending on the agent’s perception. However, this similarity, and the effects of motivational affordances on the agent’s explicit motive disposition and the selection of subsequent achievement goals, have not been thoroughly investigated. In this paper, the gamification elements (leaderboard and points) of the DRACO gamification system are redesigned to provoke explicit motive dispositions of the students. The results of the field study revealed that the experiment group had a significantly lower fear of failure and power motives (both hope and fear), fewer selections of performance-avoidance goals, and performed better based on theory exams and course grades compared to the control group. Consequently, it supports the hypothesis that gamification elements could provoke explicit motive dispositions and could affect the subsequent achievement goal selection, and the design of the gamification elements could be a determinant factor in this behavior change. Furthermore, this study contributes a systematic Spanish translation of the UMS-3 questionnaire.

INDEX TERMS Achievement-goal, education, explicit motives, gamification, human–computer interaction, motivation, motivational affordances, user experience.

I. INTRODUCTION

Gamification elements contain situational cues called motivational affordances [1]. The perception of these affordances may satisfy motivational needs and lead to behavior change; however, motivational affordances are not always perceived as intended [2], and may have a diminishing effect on agent performance, leading to dropout. From the 40 experiments on gamification reviewed in their empirical study, Hamari et al. [3] found that only 14 of them were positive in the aspect of performance and engagement. Chembumroong et al. [4] reported that the results are not always the same even if the same gamification element is used, such as a leaderboard. They implemented three different leaderboard styles with different goal-setting levels to observe the effect of the design on user behavior change.

1. In the first design, all the ranked individuals were visible on the list.
2. In the second design, only the three higher and lower ranking individuals of the corresponding user were visible on the list.
3. In the third design, only the top five individuals on the leaderboard were visible.

For each design, the performance and engagement of the students were significantly different. Their work presented that the design of the gamification elements is another factor that changes perception and affects user behavior. Chembumroong et al. work was limited to student performance measurement, which prevents observing how gamification affects behavior. Motive disposition theory (MDT) [5] and
achievement goal theory [6] could be beneficial in understanding differences in user behavior and lead to better designs for each gamification element that align with desired behavioral changes.

Motive dispositions are the psychological needs, and the level of each cluster differs per individual. The “big three” of these needs are: (1) “Need for Achievement”, (2) “Need for Power” and (3) “Need for Affiliation” [5]. Each of these motive clusters has two bidirectional driving components: Hope and fear.¹

- The hope (approach) factor drives an individual to seek the attainment of the desired goal state.
- The fear (avoid) factor is, in contrast, the desire to avoid the undesired goal state.

MDT consists of two basic concepts: implicit and explicit. Implicit is a slow-changing and evolving phenomenon that shapes a person’s behavior. On the other hand, explicit motive dispositions drive behavior in the presence of situational cues [7], and their arousal is responsive to external stimuli. Both implicit and explicit motives play a predictive role in behavior changes and achievement-goal choices [8].

From the perspective of the achievement goal theory proposed by Elliot and Church [6] in 1997, it suggests that individuals tend to prefer certain types of goals and outcomes over others in competency-relevant behavior. According to the Trichotomous Achievement Goal Model, there are two main types of goals relevant to competence: mastery-approach and performance (performance-approach, performance-avoidance). The mastery-approach goal (1) focuses on the development of self-competence and has been shown to positively affect intrinsic motivation and lead to sustained well-being. The performance-approach goal (2) focuses on demonstrating competence to others. If someone perceives themselves as successful compared to others, this can increase their performance and even improve their well-being. However, comparing oneself to others can also result in a performance-avoidance goal (3), which is acting in a way to prevent self-esteem from being damaged by comparisons with others. Since variables of motive dispositions predict achievement goal orientation, these variables should lead the agent to select mastery-approach and performance-approach goals and minimize the selection of performance-avoidance goals.

Among the achievement variables of motive disposition, the hope of success leads to the mastery-approach and performance-approach goals, yet the fear of failure plays a predictive role in performance-avoidance goal selection [6]. On the other hand, the power variables of motive disposition are a double-edged sword, as people with a high need for power correlate with aggression, maladaptation [9], and avoidance [10] if they do not satisfy their needs in competitive situations [11] and they feel depressed more than others [12]. Thus, both hope for power and fear of losing power could lead to a performance-avoidance goal. Therefore, fear of failure [13] and both variables of power motive (hope for power and fear of losing power) [10], [14] should be minimized to prevent the tendency to the selection of performance-avoidance goal orientation.

Motivational psychology provides several mechanisms for arousing (or suppressing) the variables of explicit motive dispositions. Schultheiss [15] demonstrated the arousal of the explicit power motive with an achievement cue by presenting a competitive environment. In the study, the agents’ power motives increased, which has been reflected in behavior change. It is also presented that highly competitive environments could increase the fear of failure for concern of being judged by others, which might lead to performance-avoidance behavior to prevent such outcomes [16]. Likewise, the study of Wikman et al. [17] managed to reduce the explicit fear of failure and subsequent achievement goal selection of young athletes through positive feedback. Another mechanism of goal-setting could reduce the fear of failure by introducing subgoals aligned with the main objective [18], which increases the success percentage [19], [20]. These environmental cues of the competition, feedback, and goal-setting mechanism have already been the subject of the gamification systems; thus, it is expected that gamification elements could arouse or suppress the explicit motives of the agents. Revealing this relationship and benefiting from motivational psychology mechanisms could mitigate the risk of failure of gamification systems by measuring the effects of these mechanisms on agents’ perception.

However, the connection between these motivational cues of gamification elements and their effect on explicit motive dispositions have not been investigated in depth. Furthermore, the design of each element could also play a determining role as the perception of the motivational affordances of the gamification elements changes by design. Therefore, the research questions of this article are to investigate whether gamification elements influence explicit motive dispositions (R1) and if the design of each gamification element contributes to this change, subsequent achievement goal selection, and performance (R2).

With this objective in mind, in this study, the leaderboard and point gamification elements in the DRACO gamification system² were redesigned in an effort to reduce fear of failure and both power motives, hence minimizing the adoption of performance-avoidance goals. Two different designs were subjected to a field study in the controlled experiment. A significant difference between these two groups would indicate that gamification elements could act as a situational cue and arouse or suppress explicit motive dispositions, and the

¹ The hope variable for achievement motive is hope for success (nAch), for the affiliation is hope of affiliation (nAff) and for the power motive is hope of power (nPow). And the fear variables are fear of failure (fAch) (achievement motive), fear of rejection (fAff) (affiliation motive) and fear of losing control (fPow) (power motive) respectively [39].

² “DRACO” is an educational gamification system to teach Compiler Design at the Universidad Politécnica de Madrid. Accessed August 10, 2022. https://dsiis.fi.upm.es/draco/
design of the gamification elements influences this change. Thus, it is hypothesized that:

- **H1:** The “fear of failure” in the experiment group will be lower compared to that of the control group.
- **H2:** The hope for the power of the experiment group will be lower compared to that of the control group.
- **H3:** The fear of losing the power of the experiment group will be lower compared to that of the control group.
- **H4:** The selection of performance-avoidance goals of the experiment group will be lower compared to the control group.

In addition, this research presents a systematic Spanish translation of the UMS questionnaire, which, to our knowledge, has not been previously published in the relevant academic literature.

### II. MATERIALS AND METHOD

#### A. DRACO GAMIFICATION SYSTEM

DRACO is a gamification system for education that encourages student learning and engagement in the subject of compiler design for the BSc. in Computers Engineering. Students are expected to accomplish a set of assignments given by the system. DRACO assignments primarily consist of three types of activities assessing the four main skills of the Compiler Design course (lexical analysis, symbol table, parsing, and semantic analysis). These types are short answer, multiple-choice, and ordering. (1) In the short answer, students are given a statement and are expected to fill in the blank (e.g., “The first phase of compiler development is the analysis of ....”). (2) In multiple choice, students need to choose the correct answer(s) for a given set of statements (e.g., “Which of the following statements about augmented grammar is correct?”). (3) In the ordering assignment, students are required to arrange a given set of statements in the correct order. (e.g., “Order the following modules in accordance with the compilation order”).

The DRACO gamification system utilizes a triad of points, badges, and leaderboards to engage students in their assignments, thereby accelerating their learning curve. Each student receives a point reward for a given assignment based on a formula that includes the correct response and completion time as variables. In compliance with the Werbach game element hierarchy [21],

1) Each point is responsible for providing feedback on the activity’s win status, and task progress. Furthermore, the accumulated points serve as a metric for ranking on the leaderboard and acquiring badges, thereby establishing a connection with the other gamification elements of leaderboards and badges.

2) The leaderboard, on the other hand, provides significantly more feedback on the student’s progress and challenges, introducing public comparison table between the students. Nonetheless, this public visibility is accompanied by the fear of not being able to attain the leading position or a sense of frustration with the current standing. Therefore, it may result in undesirable behavior.

3) Lastly, the DRACO badges provide students to set a goal within achievement-related objectives. The badges can be obtained through accomplishing several pre-defined activities (e.g., Students earn the “Super Semantic” badge if they answer 15 questions about semantic analysis correctly).

With the complete gamification element triad and more than 300 students using the DRACO gamification system each semester, the ecosystem is suitable for a controlled experiment. And hence, the DRACO gamification system is the primary tool utilized in this study for evaluating the indicated research questions in section I.

#### B. CHANGES IN THE DESIGN OF DRACO GAMIFICATION ELEMENTS

The original design of DRACO’s leaderboard and points creates a highly competitive environment, which may increase the fear of failure, the fear of losing control, and the power requirements. Thus, the system is suitable for testing our four hypotheses by implementing the motivational mechanism described in Section I. With this goal in mind, the DRACO gamification system’s leaderboard and point elements were redesigned with motivational psychology-derived mechanisms to reduce the experiment group’s explicit fear of failure and power motives.

To conduct a scientifically controlled experiment, the badges and activities did not change during the experiment.

In the subsequent sections, the original design of the leaderboard and points will be discussed first, followed by the new design.

1) **LEADERBOARD**

The original DRACO gamification system contains a leaderboard design that offers two view options for users. The first one (All – “Todos” in the Spanish version, Figure 1) is the competitive leaderboard in which users could observe the entire leaderboard table. In the second option (Brief – “Resumen”, Figure 2), users could only see the 6 persons close to them (the 3 immediately high ranked and the 3 immediately low ranked), together to the top five on the leaderboard. Since users are free to switch between these views anytime during the interaction, they can compare themselves with any user at any time. The places of the users are determined by the points they acquired from both assessing the four main skills of the Compiler Design course and out-of-course activities pooled together. The high visibility of this design is similar to the ranking mechanism in the Schultheiss experiment and creates a highly competitive environment, thus expected to arouse explicit power and fear of failure motives during the interaction.

In the redesign of the leaderboard of DRACO, the objective is to reduce power motives and fear of failure by lowering the highly competitive environment and providing additional
FIGURE 1. All ("todos") view of the original "Clasificación" (leaderboard) design of DRACO. Students could view the entire list. The highlighted line (#12) corresponds to the respective user. a) "Nombre" (nickname) of the user has been obscured for privacy reasons. (b) "Nivel" (level) is the user’s level based on the accumulated points. (c) "Puntos" (points) represents the user’s accumulated points from activities. (d) "Modo de visualización" (Visualisation Mode) allows switching between the two views: "Todos" (All) and "Resumen" (Brief).

FIGURE 2. Brief ("resumen") view of the original “Clasificación” (leaderboard) design of DRACO. Students could view the top 5 and the closest 6 students (3 above and 3 below) on the list.

FIGURE 3. New design of the "Clasificación" (leaderboard) of DRACO. Students can now only view the top 5 and the closest 6 students (3 above and 3 below) on the list. The highlighted line (#49) corresponds to the respective user. The new dropdown list "Habilidades" (Skills) provides four ranking options based on the main competencies of the course: "Todos" (All points collected from activities), "Análizador Léxico" (lexical analysis), "Tabla de Símbolos" (symbol table), "Análisis Sintático" (parsing) and "Análisis Semántico" (semantic analysis).

To begin with, the visibility of the others has been reduced by eliminating the option to view the whole ranking list (Figure 3). Because visibility has been restricted to six people close to them and the top five students, it is expected that a highly competitive environment will be reduced and, thus, fear of failure and power motives will not arouse as anticipated from the previous design. Then, the success criteria have been increased with additional goals by providing a categorical ranking option (Figure 3d). These options include:

1) POINTS
The original DRACO gamification system contains a point design (Figure 4) that allows to view the points collected from each activity. The students could sort the list by date, activity name, and points. The list only presented the collected points, without considering the whole quantity of activity that corresponded to those points. Therefore, it was challenging...
FIGURE 4. Original "Puntos" (Points) design of DRACO. Students could view the points collected by "Actividad realizada" (Accomplished Activities) and the "Fecha" (Date) of the achievement. Students could select the "Número de elementos" (Number of elements) to be visible on the screen.

FIGURE 5. "List ("Lista") view of the new design of "Puntos" (Points). Students can view the points collected (with bonus score for relevant activity) by "Actividad realizada" (Accomplished Activities), the "Fecha" (Date) of the achievement, (a) the "Máximo de Actividad" (Maximum points could be collected by activity) and (b) the Percentage, which represents the success rate for the relevant activity. (c) The "Habilidades" (Skills) dropdown list provides four categorical options based on the main competencies of the course: "Todos" (All points collected from activities), "Análizador Léxico" (lexical analysis), "Tabla de Símbolos" (symbol table), "Análisis Sintático" (parsing) and "Análisis Semántico" (semantic analysis).

FIGURE 6. Chart view of the new design of "Puntos" (Points). Students can now view the collected points (with bonus score for relevant activity) in percentage (Y-axis). The solid line represents the points collected by the student. The columns represent the standard deviation of each specific activity, and the dashed line represents the average scores of the activity. On the X-axis, the "Actividades personales realizadas hasta la fecha" (activities completed to the date) are listed by date.

C. DEMOGRAPHICS AND THE PROCEDURE OF THE FIELD STUDY

The students were undergrads (mostly 20 years old from Spain) who had enrolled the Compiler Design course and studied Computer Engineering at the Universidad Politécnica de Madrid, Spain. The course aims to develop compiler development skills and is conducted in Spanish. Students are encouraged to participate in the DRACO gamification system during the one-term course (4 months).

A total of 392 students (194 experiment and 198 control) have been subjected to the DRACO system, and the experiment group interacted with the new design. The control and experiment groups were assigned randomly based on the last digit (even or odd) of the students’ enrollment number, which
is a common method for dealing with selection bias and systematic bias (thus minimizes demographic differences) in order to conduct a scientifically controlled experiment [22].

Students were invited to complete an online survey through Google Forms to assess “explicit motive dispositions” and “achievement goal orientation. The survey was conducted at the end of the four-month course, after all course activities and student assessment were completed, and before the publication of the course grades, to prevent possible bias. It was specifically stated that the research would not affect grades but would be used for academic purposes. Students were informed that the survey results would be subjected to the research project and participation is optional.

At the end of the semester, the DRACO points and the course grades have been collected as performance data. For the analysis, survey results and the performance of control and experiment groups have been compared using the Student’s t-test.

D. MEASUREMENT OF PERFORMANCE
The performance of the students has been measured through the total points collected from each student in the DRACO system, and the theory and final grades of the course. DRACO points affect 10%, and the theory grades (measured through an exam) are 60% of their final grade (group project affects the rest of 30%).

E. MEASURING EXPLICIT MOTIVE DISPOSITIONS
The Unified Motive Scales (UMS) questionnaire has been used to measure explicit motive dispositions. The UMS has been developed by Schönbrodt and Gerstenberg [23] from existing questionnaires (such as GOALS [24] and the Personal Values Questionnaire [25]) with the inclusion of fear factors of motivation. The advantage of the UMS is its prediction capabilities with a minimum number of items, and it has been preferred in the literature for its flexibility. The UMS questions are inherently composed of two main categories: “Statements” and “Goals”. Students have indicated on a 6-point Likert scale from 1 ("strongly disagree" for “Statements”, and “of little importance to me” for “Goals”) to 6 ("strongly agree" for “Statements”, and “extremely important to me” for “Goals”).

1) TRANSLATION OF UMS
To our knowledge, there was no Spanish version of the UMS questionnaire; therefore, the scale needed to be translated, considering cross-cultural differences. As a translation methodology, the “committee approach” has been preferred. Compared to back-translation, committee translation is a less common but comprehensive and collaborative approach [26]. The authors have applied the suggested procedure (Figure 7) explained by Pan and Puente [27].

Preliminary forward translation has been held for each item independently by two translators (Spanish literature and one bilingual local Spaniard). Subsequently, the two translations have been rated by the first committee of Spanish experts.

The selected items have been applied to the field study with 197 samples. The reliability analysis of the items -the need for achievement (3 items; \(\alpha = 0.70\)), the affiliation (3 items; \(\alpha = 0.58\)), the power (3 items; \(\alpha = 0.65\)), and the fear factors (3 items; \(\alpha = 0.74\))- was not adequate, especially for the need for affiliation and power.

For the second iteration, the high Cronbach alpha items are kept, the low ones are retranslated, and additional items were added (APPENDIX A) by a third translator (a bilingual local Spaniard). Subsequently, the second committee with two experts selected and approved the items with minor changes, and the final version was obtained. According to the second field study (TSFS) with 29 samples\(^1\), the reliability analysis of the final version -the need for achievement (3 items; \(\alpha = 0.82\)), the affiliation (4 items; \(\alpha = 0.70\)), the power (3 items; \(\alpha = 0.87\)), and the fear factors (6 items; \(\alpha = 0.81\))- was satisfactory, thus this final version (APPENDIX B) has been used in the present work. Reliability has been tested by measuring internal consistency, and construct validity has been investigated by exploratory factor analysis.

F. MEASURING ACHIEVEMENT GOAL ORIENTATION
The validated Spanish version [28] of Elliot’s Revised Achievement Goals Questionnaire (AGQ-R) [29] was used to assess the achievement goal orientation of the students (APPENDIX C). The AGQ-R questionnaires consist of 9 items that could be adapted for a given context. The items
assessed the mastery-approach (3 items; e.g., “My aim is to completely master the content presented in Draco”; α³ = 0.77), the performance-approach (3 items; e.g., “My goal is to perform better than the other students in Draco”; α = 0.79), and the performance-avoidance (3 items; e.g., “My aim is to avoid doing worse than other students”; α = 0.86) orientations in the Draco gamification system.

### III. RESULTS

#### A. ANALYSIS OF WHOLE ACTIVE STUDENTS

In total, there were 392 active (accomplished activities > 0) DRACO users subjected to performance analysis (DRACO points, Theory Grade, and Final Grade). Among these 392 active students, 198 of them belonged to the control group and 194 of them belonged to the experiment group (Table 1). For comparison means of performance, the Student’s t-test has been conducted. The experiment group (x̄ = 4661.88) collected more DRACO points than the control group (x̄ = 4650.85), although it was not significant. The first remarkable result occurred in the differences between the Theory Grades and the Final Grades of the subject. The experiment group significantly (p < 0.05) obtained higher results in both Theory Grades (experiment: x̄ = 5.43, control: x̄ = 4.97) and Final Grades (experiment: x̄ = 5.44, control: x̄ = 4.93). Moreover, the Final Grade of the control group scored below the passing grade (5), in contrast with the experiment group, which scored over the passing grade.

#### B. RESPONDENTS

The total number of respondents was 188 out of 392 active users of the Draco gamification system. The sample size was within the 95% confidence level range with a margin error of 5% according to the Slovin formula [30]. This range falls within the acceptable size (between 4% and 8% of margin error with a 95% confidence level) for research activities [31].

1) RELIABILITY OF THE TRANSLATION OF UMS-3 AND CONSTRUCT VALIDATION

Primarily, the Spanish version of the UMS-3 questionnaire has been validated to perform further analysis. According to the reliability analysis, the internal consistency (Cronbach alpha) of the hope of success (α = 0.80), the need for affiliation (α = 0.71), the hope for power (α = 0.82), and the fear factors (α = 0.80) are all within the acceptable range, which is α > 0.70 [32]. The factorial analysis has been conducted after the confirmation of the internal consistency (Table 2).

In the explanatory factor analysis, the “Principal Component Analysis” (PCA) [33] method has been applied for the factor acquisition method, and the varimax rotation method is used likewise in the study of Tugsal [34]. There are two prerequisites for conducting the factorial analysis: the Kaiser-Meyer-Olkin Criterion (KMO) [35] and Bartlett’s Test of Sphericity [36]. KMO determines if the scale is factorable, and BT measures whether the variables are uncorrelated or not. Both the KMO⁴ (KMO = 0.73) test and the BT⁵ (χ² = 1030.35, p < 0.01) results indicate that the scale is factorable, and the variables are correlated.

As mentioned in Tugsal’s study [34], the loadings of 0.71 indicate excellent, 0.63 indicate very good, 0.55 good, and less than 0.45 should be interpreted poorly. Thus, factor loadings below 0.55 have been omitted for minimum good significance. According to the eigenvalue rule [34], only the factors that have above the eigenvalue 1.0 are extracted. PCA analysis demonstrates that six different factors covered a total of 62% of the variance, which is higher than the acceptable rate of 50% [37], and higher than the study of Schönbrodt and Gerstenberg [23]. Factor 1 represents “fear factors”, Factor 2 represents “hope for power”, Factor 3 represents “hope of success”, and Factor 4 represents “hope of affiliation”. The fear factors are clustered together like in the study of

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### TABLE 1. Performance comparison of active students in DRACO.

|                | Control (N=198) | Experiment (N=194) |
|----------------|----------------|-------------------|
| DRACO Points   | 4650.85 ±3068  | 4661.88 ±3097     |
| Theory Grade   | 4.97 ±2.65     | 5.43 ±2.58        |
| Final Grade    | 4.93 ±2.99     | 5.44 ±3.03        |

**p<0.05

### TABLE 2. Presents each factor and the relevant factor loadings after the varimax rotation.

| Item | Domain | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|------|--------|----------|----------|----------|----------|
| nAff-1 | Hope of Affiliation | 0.69 |
| nAff-2 |                      | 0.70 |
| nAff-3 |                      | 0.82 |
| nAff-4 |                      | 0.65 |
| nAch-1 | Hope of Success      | 0.81 |
| nAch-2 |                      | 0.84 |
| nAch-3 |                      | 0.83 |
| nPow-1 | Hope for Power       | 0.81 |
| nPow-2 |                      | 0.90 |
| nPow-3 |                      | 0.80 |
| fAch-1 | Fear Factors         | 0.71 |
| fAch-2 |                      | 0.63 |
| fAch-3 |                      | 0.71 |
| fPow-1 |                      | 0.76 |
| fPow-2 |                      | 0.77 |

Cumulative Variance (%)  
20.31  39.22  51.45  62.34

Eigenvalue  
3.24  3.02  1.95  1.74

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⁴For factorization to be worthwhile, KMO should normally be at least 0.6 [40].  
⁵Bartlett’s test for sphericity tests the hypothesis that the correlation matrix amongst the variables is an identity matrix, indicating that they share no common variance. Since the P-value is < 0.05, that hypothesis is rejected [40].

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<sup>1</sup> α represents the value of Cronbach alpha of the current study for the indicated subscale.
[23]. As a result, the Spanish version has desirable construct validity and reliability, which is a well-structured model of the original scale.

2) ANALYSIS OF THE RESPONDENTS
For the analysis of the respondents, their performance (DRACO Points, Theory Grade, and Final Grade), explicit motive dispositions, and achievement goal selections of both the experiment and the control groups have been measured, and a t-test has been conducted for the comparison of the means (Table 3). There were 91 respondents from the control group and 97 from the experiment group.

First, the performance analysis has been conducted to determine if there is a bias that might affect self-reported survey results. There was no significant performance difference between the control and experiment groups, which indicates that both groups are sampled similarly in the aspect of performance.

Second, the explicit motive dispositions have been analyzed. There were no significant differences in the hope of affiliation and the fear of rejection between the control and the experiment groups as there were no external administration of the new DRACO design affecting the variables of affiliation motive. For the explicit achievement needs, the control group significantly ($p = 0.02$) felt more hope for success ($\bar{x} = 5.35$) than the experiment group ($\bar{x} = 5.15$) and the fear of failure of the control group ($\bar{x} = 3.62$) was significantly ($p = 0.01$) higher compared to the experiment group ($\bar{x} = 3.24$). The experiment group ($\bar{x} = 3.47$) predicted significantly ($p = 0.0253$) less hope for power compared to the control group ($\bar{x} = 3.72$) as hypothesized. Fear of losing power of the experiment group (experiment: $\bar{x} = 3.31$, control: $\bar{x} = 3.56$) was also less, but was partly significant ($p = 0.07$). These results were expected since changes in the design of the leaderboard and points were made with this intention.

Lastly, the achievement goal orientation has been analyzed. For the mastery goal orientation, there were no significant ($p = 0.30$) differences between the two groups (experiment: $\bar{x} = 3.90$, control: $\bar{x} = 3.84$). The control group ($\bar{x} = 3.63$) preferred the performance-approach goal significantly ($p = 0.04$) higher than the experiment group ($\bar{x} = 3.41$). However, the experiment group ($\bar{x} = 2.93$) had a lesser preference for the performance-avoidance goal selection compared to the control group ($\bar{x} = 3.24$), which was also significant ($p = 0.03$).

3) MULTIPLE REGRESSION ANALYSIS
For each sample, two multiple regression analyses were conducted to examine the causal relationship. The first was from explicit motive dispositions to selected achievement goal orientation in order to observe the influence of explicit motive dispositions on the selection of achievement goal orientation, and the second was from achievement goal orientations to performance in order to observe the mediating role of achievement goal selection.

**Table 3. Comparison of explicit motives and achievement goal orientations of the respondents.**

|                      | Control (N=91) | Experiment (N=97) | F-test (p) | t-test(p) |
|----------------------|---------------|-------------------|------------|-----------|
| DRACO Points         | 663.96 ±2680  | 641.98 ±2753      | 0.77       | 0.29      |
| Theory Grade         | 6.17 ±2.07    | 6.57 ±1.98        | 0.67       | 0.17      |
| Final Grade          | 6.58 ±2.59    | 6.95 ±2.50        | 0.74       | 0.1599    |
| nAff                 | 3.97 ±0.98    | 3.97 ±0.88        | 0.27       | 0.49      |
| fAff                 | 3.47 ±1.23    | 3.39 ±1.39        | 0.24       | 0.34      |
| nAch                 | 5.33 ±0.67    | 5.15 ±0.71        | 0.59       | **0.02**  |
| fAch                 | 3.62 ±1.15    | 3.24 ±1.22        | 0.56       | **0.01**  |
| nPow                 | 3.64 ±1.08    | 3.29 ±1.05        | 0.76       | **0.01**  |
| fPow                 | 3.56 ±1.14    | 3.31 ±1.17        | 0.81       | *0.07     |
| Mastery              | 3.90 ±0.71    | 3.84 ±0.85        | 0.09       | 0.30      |
| Performance          | 3.63 ±0.82    | 3.41 ±0.94        | 0.21       | **0.04**  |
| Avoidance            | 3.24 ±1.06    | 2.93 ±1.15        | 0.45       | **0.03**  |

**p < 0.05; *p < 0.1**

Starting with the control group (Figure 8), hope of success significantly predicted both mastery goal orientation ($\beta = 0.33$, $p < 0.01$) and performance-approach goal adoption ($\beta = 0.29$, $p = 0.02$), while hope of power significantly predicted both performance-approach ($\beta = 0.14$, $p = 0.05$) and performance avoidance ($\beta = 0.20$, $p = 0.05$), demonstrating the theory’s double-edged sword feature of power motives. Furthermore, fear of rejection has predicted the performance-approach goal selection ($\beta = 0.17$, $p = 0.02$), which can be explained by the first design’s higher competitive environment.

The experiment group, on the other hand, had only one significant prediction ($\beta = 0.41$, $p < 0.01$) which was from hope of success to mastery-approach with a higher coefficient compared to control group (Figure 9). Reduced competitiveness and presentation of course-based skills eliminated the other predictions observed in the control group, causing students’ explicit motive dispositions to shift more toward mastery.

Thus, the differences between control and experiment demonstrate the effect of design differences on explicit
motive dispositions and subsequent achievement-goal selection.

b: ACHIEVEMENT GOAL TO PERFORMANCE
For the control group (Figure 10), mastery goal significantly predicted all performance variables, including DRACO points ($\beta = 1054$, $p < 0.01$), theory grades ($\beta = 0.82$, $p < 0.01$), and course grades ($\beta = 1.12$, $p < 0.01$), demonstrating the power of mastery orientation on behavior as theory suggests. The performance approach goal has also predicted all variables of DRACO points ($\beta = 877$, $p = 0.02$), theory grades ($\beta = 0.84$, $p < 0.01$), and course grades ($\beta = 0.63$, $p = 0.09$), but the prediction of course grade was only partially significant, whereas performance-avoidance had no diminishing effect on performance, which is a noticeable outcome for the DRACO’s original design.

Similar to the control group, the mastery goal significantly predicted all performance variables in the experiment group (Figure 11), including DRACO points ($\beta = 0.82$, $p < 0.01$), theory grades ($\beta = 0.82$, $p < 0.01$), and course grades ($\beta = 0.82$, $p < 0.01$). Remarkably, the performance-avoidance goal improved performance and predicted DRACO points ($\beta = 0.82$, $p < 0.01$) positively. This result has only been observed in collectivist societies [38], implying that lowering the competitive environment resulted in a similar pattern with collectivists. Furthermore, this pattern appears on the performance-approach goal because this orientation could not predict any of the performance variables.

As a result, the mastery goal coefficients on determining performance variables were higher when compared to the control group, and there was no prediction from performance-approach to performance, indicating a shift from comparison to mastery.

IV. DISCUSSION
A. EXPLICIT MOTIVES AND ACHIEVEMENT-GOAL ADOPTION
The result of the field study has shown that the different designs of the leaderboard and points have influenced the explicit achievement and power motives, and the selection of achievement goal orientations. One of the objectives of this research was to decrease the fear components of the motive dispositions and to minimize the selection of the performance-avoidance goal orientation, and this objective has been achieved. The fear of failure and power motives (and subsequent selection of performance-avoidance goal) have been lessened using the mechanisms of:

1. Decreasing visibility (thus the competition), as in the study of [15], [16].
2. Inclusion of positive feedback and self-observation, as in the study of [17].
3. Extra winning goals that are aligned with the main competence of the course, as mentioned in [19] and [20].

These results satisfy $H1$ since the experiment group has a lower explicit fear of failure, $H2$ because the experiment group has a lower hope for power, and partly $H3$ ($p < 0.1$) as the fear of losing power was also lower. The significantly different performance-avoidance goal selection also supports $H4$. The results of the field study eventually provided support for the research questions:

7 The TMSF results, which can be found at “end note i” also support these findings.
**R1:** The motivational affordances of the gamification elements do act as situational cues for the explicit motives, and they affect those motives.

**R2:** The design of the gamification elements plays an important role in the arousal or suppression of explicit motives.

**B. PERFORMANCE**

Similarly, to the work of Chembumroong et al., the design of the gamification elements could affect the performance result. However, particularly in this case, this effect has appeared in the actual course grades instead of the gamification activities.\(^8\) This observation (the design of the gamification systems could affect real life) indicates that the course grades and the points collected on the gamification system should be considered together to assess the design of the gamification elements. Additionally, the results of the theory grades demonstrated that emphasizing the three fundamental topics (of the course) on the design of the leaderboard and points could have a significant effect on the motivation of the students for the real course activities.

**C. LIMITATIONS**

The experiment may have been limited by the homogeneity of the population used, as most of the participants were Spanish students under 20 years old. New studies could include participants from various cultures and age or gender-segmented analyses of results to determine whether there is an interesting difference.

**D. MAIN DISCUSSION**

In conclusion, this study offers four significant contributions to the existing body of research:

1) **GAMIFICATION ELEMENTS COULD INFLUENCE EXPLICIT MOTIVE DISPOSITIONS**

First, the findings show that the motivational affordances of gamification elements can arouse or suppress explicit motive dispositions, subsequent achievement goal selection, and performance. Furthermore, the design of the gamification elements plays an important role in this change (which also means that the perceived motivational affordances of gamification elements could be adjusted through visibility). To the best of our knowledge, this is the first time these findings have been presented in a field study.

2) **THROUGH THE DESIGN OF THE GAMIFICATION ELEMENTS, THE EXPLICIT FEAR OF FAILURE AND THE POWER MOTIVES COULD BE REDUCED, AND SUBSEQUENT PERFORMANCE-AVOIDANCE GOAL SELECTION COULD BE MINIMIZED**

In this field study, the goal was to reduce the fear of failure and both the power motives of the students and to minimize their subsequent avoidance-goal selection. Mechanisms from the literature on motivational psychology have been administered to suppress the feelings of fear and power motives. In two distinct designs of the same gamification elements, they were shown to produce significantly different outcomes. Thus, the perceived motivational affordances could change their explicit motive dispositions and subsequent achievement-goal set on the specific system. The result has supported that the mechanism of goal-setting, positive feedback, and a less competitive environment have reduced the explicit motives of the experiment students and they have adopted performance-avoidance lesser compared to the control group when these mechanisms are applied to the design of the gamification system elements. In addition, the study revealed that the avoidance goal led to an improvement in performance rather than a decline in the experimental group, similar to collectivist societies, indicating yet another positive impact of these motivational mechanisms.

3) **THROUGH THE DESIGN OF THE GAMIFICATION ELEMENTS, THE AGENT’S PERFORMANCE ON THE DETERMINED TOPIC COULD BE AFFECTED**

The reduced fear of failure and power motives reflected themselves in the behavior change, as the course and theory grades of the experiment students were significantly higher compared to the control. Thus, the results indicate that the design of the gamification element could affect the performance outcomes, as in the study of Chembumroong et al., which emphasizes the importance of the design phase. Borrowing mechanisms from motivational psychology and applying them in the design phase enhanced the real-world performance of the students. In particular, administering the visibility of the relevant skills in the design reflected its effect on the theory grades of the students, which is another remarkable result.

4) **SPANISH TRANSLATION OF THE UMS-3 QUESTIONNAIRE**

As an additional result, this article presents a systematic translation of the UMS-3 questionnaire, which, to the best of our knowledge, has not previously been produced. The questionnaire is openly offered to the research community and can be found in APPENDIX B. It is intended to support future studies of Spanish-speaking countries in relevant research lines.

**V. CONCLUSION**

The explicit motive dispositions are the psychological needs that situational cues arouse or suppress. This arousal or suppression plays a predictive role in goal selection and drives the agent’s behavior.

The motivational mechanisms (situational cues) to stimulate explicit motive disposition are comparable to the motivational affordances of gamification elements, but the connection between the two has not been thoroughly studied. By bridging this gap, gamification designers could evaluate the perceived effects of motivational affordances on agents’

\(^8\)The TMSF results, which can be found at “end note i” also support these findings.
perception, leading to more effective designs that facilitate the desired behavior.

With this object, this article has presented the connection between the motivational affordances of gamification elements and the explicit motive dispositions in the field study. The interface of the leaderboard and gamification elements of DRACO was redesigned by implementing motivational mechanisms to reduce students’ fear of failure and power motives, and a controlled experiment was carried out. The study revealed that the motivational affordances of the gamification elements serve as situational cues for explicit motivations and significantly affect these motivations. Furthermore, the design of gamification elements has a significant impact on this stimulation or suppression of explicit motives.

This connection has the potential to lead to improved designs of gamification elements by allowing to measure not only the effect of the designs on the performance of the students, but also on their explicit motive dispositions. Borrowing mechanisms from motivational psychology, applying these mechanisms on the design of the gamification elements, and discovering which ones reduce the fear of failure and the power motives could lead agents towards relevant behaviors and, the risk of the failure of gamification systems could be mitigated.

APPENDIX A

Appendix A-1: 1st translation of the “Statements” section of the UMS questionnaire; “Item S” indicates that the translations did not change in the second round. “Item RP” indicates the items that have been removed and replaced from the UMS questionnaire pool. “Item RT” denotes the ones that were re-translated.

| English Version | Spanish Version |
|----------------|----------------|
| (a)fAch Item S  | Me siento incómodo haciendo algo si no estoy seguro de tener éxito |
| (b)fAch Item RP | Tengo miedo de fallar en situaciones complicadas, cuando hay mucho que depende de mí |
| (c)nAff Item S  | Encontrarme con otras personas me hace feliz |
| (d)nAff Item RT | Intento estar en compañía de amigos, tanto como sea posible |
| (e)fAff Item S  | Que me den de lado, cuando me acerco a extraños, me hace sentir inseguro |
| (f)fAff Item S  | Cuando conozco gente nueva, a menudo temo que me rechacen |
| (g)nPow Item RP | Me gusta decir la última palabra |
| (h)fPow Item S  | Empiezo a preocuparme enseguida, cuando me doy cuenta de que no tengo influencia sobre ciertas cosas |
| (i)fPow Item RP | Me asusto cuando pierdo el control sobre las cosas |

Appendix A-2: 1st translation of the “GOALS” section of the UMS questionnaire; “Item S” indicates that the translations did not change in the second round. “Item RP” indicates the items that have been removed and replaced from the UMS questionnaire pool. “Item RT” denotes the ones that were re-translated.

| English Version | Spanish Version |
|----------------|----------------|
| (a)nAff Item S | Participar en muchas actividades con otras personas |
| (b)nAch Item RT | Mantener altos estándares de calidad en mi trabajo |
| (c)nAch Item S | Continuamente mejorar mi self |
| (d)nAch Item RP | Participar en proyectos que me desafíen hasta el límite de mi capacidad |
| (e)nPow Item RT | Tener la oportunidad de ejercer control sobre un grupo u organización |
| (f)nPow Item RP | Poder ejercer influencia |
APPENDIX B

Appendix B-1: The final version of the UMS questionnaire’s “Statements”; each item of this questionnaire is a statement with which a person may agree or disagree. For each item, the students indicate their motive dispositions on a 6-point Likert scale from 1 (“strongly disagree”) to 6 (“strongly agree”).

| Item | English Version | Spanish Version |
|------|-----------------|-----------------|
| fAch Item 1 | I feel uneasy doing something if I am not sure of succeeding. | Me siento incómodo haciendo algo si no estoy seguro de tener éxito. |
| fAch Item 2 | If I do not understand a problem immediately, I start feeling anxious. | Si no entiendo un problema de inmediato empiezo a sentir ansiedad. |
| nAff Item 1 | I spend a lot of time visiting friends. | Paso mucho tiempo visitando amigos. |
| nAff Item 2 | Encounters with other people make me happy. | Encontrarme con otras personas me hace feliz. |
| nAff Item 3 | I try to be in the company of friends as much as possible. | Intento estar en compañía de amigos el mayor tiempo posible. |
| fAff Item 1 | When I get to know new people, I often fear being rejected by them. | Cuando conozco gente nueva, a menudo temo que me rechacen. |
| fAff Item 2 | Being given the cold shoulder when approaching strangers makes me feel insecure. | Que me den de lado, cuando me acerco a extraños, me hace sentir inseguro. |
| nPow Item 1 | I would like to be an executive with power over others. | Me gustaría ser un ejecutivo con poder sobre los demás. |
| fPow Item 1 | I start worrying instantly when I notice that I don’t have an impact on some things. | Empiezo a preocuparmelo enseguida, cuando me doy cuenta de que no tengo influencia sobre ciertas cosas. |
| fPow Item 2 | The idea of not having any control in a situation frightens me. | La idea de no tener ningún control sobre una situación me asusta. |

Appendix B-2: The final version of the UMS questionnaire’s “GOALS”; each item of this questionnaire is a GOAL that can be more or less important to the respondents. The students indicate their motive dispositions on a six-point Likert scale from 1 (“not important to me”) to 6 (“extremely important to me”).

| Item | English Version | Spanish Version |
|------|-----------------|-----------------|
| nAff Item 4 | Engage in a lot of activities with other people. | Participar en muchas actividades con otras personas. |
| nAch Item 1 | Maintaining high standards for the quality of my work. | Mantener un alto nivel en la calidad de mi trabajo. |
| nAch Item 2 | Continuously improve myself. | Mejorar continuamente. |
| nAch Item 3 | Personally, producing work of high quality. | Personalmente, realizar un trabajo de alta calidad. |
| nPow Item 2 | To be in a leadership position in which others work for me or look to me for direction. | Estar en una posición de liderazgo en la que los demás trabajen para mí o busquen mi dirección. |
| nPow Item 3 | The opportunity to exercise control over an organization or group. | La oportunidad de ejercer control sobre una organización o grupo. |

APPENDIX C

Appendix C: Spanish version [28] of the Achivement Goal Orientation Questionnaire [29]; Students indicated their goal orientation in Draco experience on a 5-point Likert scale from 1 (“strongly disagree”) to 5 (“strongly agree”).

| Item | English Version | Spanish Version |
|------|-----------------|-----------------|
| Mastery-approach Item 1 | My aim is completely master the contents presented in the Draco. | Mi objetivo es completamente maestra los contenidos presentados en el Draco. |
| Mastery-approach Item 2 | My goal is to learn as much as possible. | Mi objetivo es aprender todo lo posible. |
| Mastery-approach Item 3 | I am striving to understand the contents presented in the Draco as thoroughly as possible. | Estoy striveendo entender los contenidos presentados en el Draco lo más completamente posible. |
| Performance-approach Item 1 | I am striving to do well compared to other students. | Estoy striving para hacer bien comparado con otros estudiantes. |

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The second field study was held in the spring semester of 2021-2022, and the same experiment was carried out as in the current paper for testing purposes (the only difference was the topic of the course, thus the relevant skills). In the experiment there were total of 50 DRACO users (control N=21, experiment N=29) and 29 (Control N=9, Experiment N=20) of them were respondent. According to the results of Active Draco users (N=50), the theory grade (control $\bar{x} = 6.17$, experiment $\bar{x} = 7.65$; p=0.02), course grade (control $\bar{x} = 6.54$, experiment $\bar{x} = 7.61$; p=0.03), and DRACO points (control $\bar{x} = 2734.67$, experiment $\bar{x} = 3828.07$; p=0.09) were significantly higher in the experiment group than in the control group, which is consistent with the current study. The results of the respondents (N=29) also supported the current study, as the fear of failure (control $\bar{x} = 3.66$, experiment $\bar{x} = 2.97$; p=0.04), fear of losing power (control $\bar{x} = 3.77$, experiment $\bar{x} = 3.10$; p=0.04), and selection of performance-avoidance goal (control $\bar{x} = 3.25$, experiment $\bar{x} = 2.23$; p=0.01) were significantly lower in the experiment group, and there was no significant difference in the students' performance that could lead to bias.