The Game as a Classroom: Understanding Players' Goals and Attributions from a Learning Perspective

William Martin
Georgia Institute of Technology, Atlanta, Georgia, USA
williammartin@gatech.edu

Brian Magerko
Georgia Institute of Technology, Atlanta, Georgia, USA
magerko@gatech.edu

ABSTRACT

Much work has been done on educational games, game-based learning, and gamification in recent years, exploring how games may benefit learning. However, the reverse relationship has yet to be fully explored—how can educational psychology and pedagogy influence our understanding of player experience and the design of games? A study was conducted to examine how various aspects of player experience are related to two commonly used motivational constructs in educational psychology: achievement goals and causal attributions. In the study, 165 participants were asked to play a game and fill out a questionnaire on their experiences. We found that players' achievement goals and causal attributions were both significantly correlated to various components of player experience. Additionally, we found that achievement goals and causal attributions are significant predictors of psychological flow over and above feelings of challenge and immersion. While challenge and immersion are typical considerations when seeking to design flow experiences in games, this study suggests that game designers should also consider ways in which they may inspire particular achievement goals and causal attributions in their players. These findings highlight the connection between the learning sciences and the growing field of player experience, and we hope this paper serves as an example for future translational work.

CCS CONCEPTS

• **Human-centered computing** → Human computer interaction (HCI); Empirical studies in HCI; • **Applied computing** → Computers in other domains; Personal computers and PC applications; Computer games; Education; Interactive learning environments.

KEYWORDS

Player experience, games user research, games and learning

ACM Reference Format:
William Martin and Brian Magerko. 2020. The Game as a Classroom: Understanding Players' Goals and Attributions from a Learning Perspective. In *International Conference on the Foundations of Digital Games (FDG '20), September 15–18, 2020, Bugibba, Malta.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3402942.3403027

FDG '20, September 15–18, 2020, Bugibba, Malta

ACM ISBN 978-1-4503-8807-8/20/09…$15.00
https://doi.org/10.1145/3402942.3403027

1 INTRODUCTION: GAMES AND LEARNING

Understanding player experience is of interest to both industry and academia, and it has led to the growing field of games user research. Poole [22] captures this nicely with the following: "Videogames are powerful, but they are nothing without humans to play them. So the inner life of videogames—how they work—is bound up with the inner life of the player." A lateral area of research is understanding how students experience learning environments. Learning environments are similar to game environments in that they both *frequently* include some central notion of achievement, where the player or learner can succeed or fail. There has been significant overlap between games research and educational research in recent years, including research on serious and educational games, game-based learning, and gamification [9, 12, 19, 23, 24, 27, 29].

While games are frequently applied to learning contexts in order to boost student engagement or learning outcomes, there has been a translational disparity regarding the opposite: *how can educational research contribute to our understanding of player experience?* Understanding how people experience achievement environments has been explored significantly in learning contexts [1–3, 10, 11, 17, 30]. We conducted this study to explore how this knowledge might translate to game environments. We hope that by deepening our understanding of how player experiences are similar to learner experiences, techniques and findings from learning environment design and student experience will become accessible to game designers and researchers. In the study, participants were asked to play a game and were assessed on their achievement goals (motivational reasons to achieve), causal attributions (explanations for achievement outcomes), and seven components of player experience (positive affect, negative affect, competence, sensory and imaginative immersion, flow, tension/annoyance, and challenge) [21].

2 BACKGROUND

2.1 Difficulty and Flow

Csíkszentmihályi describes *flow* as a state of optimal experience, where one is completely absorbed in a task that is *intrinsically motivating*: completed for its own sake, rather than external factors [5, 7]. Flow and intrinsic motivation have been applied to both games [25, 28] and learning [7], with Malone proposing that games are intrinsically motivating due to three factors: curiosity, fantasy, and challenge [17]. Difficulty or challenge is especially relevant in achievement contexts, having the power to both motivate and discourage. In the classroom, it has been shown that too much challenge may overstimulate the learner and can lead to lower self-esteem [7]. On the other hand, too little challenge can also result in boredom, which can stunt academic growth [1]. This balancing of difficulty has become a central component of both game design [3, 14] and pedagogy [4], and is rooted in human development [16]. However, efforts to balance perceived difficulty must also consider the unique ways in which people approach and react to difficult situations.

2.2 Achievement Goals

Achievement goals are the motivational reasons for why people participate in difficult activities [10]. Two types of achievement goals have been frequently used to describe behavior: *mastery goals* and *performance goals*. Mastery goals refer to motivations to complete an activity that are rooted in feelings of mastery or competence. Performance goals, on the other hand, are based on social comparison. Mastery and performance goals can be further designated as *approach*, where one is focused on achieving positive outcomes, or *avoidant*, where one is focused on avoiding negative outcomes [10]. From this 2x2 classification, we see the following four achievement goal types: *mastery-approach* (attaining mastery of a task), *mastery-avoidant* (avoiding self-referential task incompetence), *performance-approach* (performing better than others), and *performance-avoidant* (not performing worse than others).

Achievement goals are widely used in educational psychology for explaining student motivations and behaviors. Differences in individual achievement goals have been tied to differences in student self-efficacy, metacognition, and academic performance [6], with mastery-approach goals generally being the most preferred, and performance-avoidant the most detrimental to learning. Achievement goals have also been explored within the context of games. Heeter et al. [13] created a measure for gaming achievement goals, and they found that performance goals were the primary motivator of avid gamers. They also found differences in players' preferences for achievement or exploration, based on their achievement goal orientations. Quick and Atkinson [18] have since expanded on this work, connecting gaming achievement goals to particular game design elements.

2.3 Causal Attributions

Causal attributions help define the ways in which people explain outcomes and how these explanations can affect motivation and behavior [30]. After doing poorly on a test, a student might attribute the cause to a particular factor of their situation, and the same can be said for players in games. Causal attributions can be broken down into the following four characteristics: *internality* (whether the outcome is attributed to internal or external forces), *stability* (the likelihood of the outcome to change or stay the same in the future), *controllability* (the extent to which one feels that they can control the outcome), and *globality* (whether the cause of the outcome is viewed as unique to the particular scenario or applicable to all scenarios).

Each of these characteristics can prompt unique emotional responses [11]: internality has been linked to pride and self-esteem; stability has been shown to be related to feelings of hopelessness and apathy; high feelings of controllability are related to guilt (feelings directed towards the action), while low levels of controllability are more related to shame (feelings directed towards the self). Additionally, students who tend to respond to failure with more stable, uncontrollable, and global attributions, tend to have ill-defined academic and personal goals, perform worse in school, and utilize learning strategies poorly [11]. Depping and Mandryk previously created a measure of player causal attributions [8], but more work needs to be done on how causal attributions are related to specific components of player experience.

3 STUDY INFORMATION

3.1 Research Design

This study employed a correlational design to investigate how four achievement goals types (mastery-approach, mastery-avoidant, performance-approach, and performance-avoidant) and four components of causal attributions (internality, stability, controllability, and globality) are related to seven components of player experience (positive affect, negative affect, competence, sensory and imaginative immersion, flow, tension, and challenge). This design was implemented to answer the following two research questions: *1.) How are achievement goals and causal attributions related to specific components of player experience?* and *2.) Are particular achievement goals and causal attributions predictors of flow?*

3.2 Participants

An online survey was distributed to 165 undergraduate students enrolled in psychology classes at a large technical university in the southeastern United States. All participants in this study were volunteers and were compensated for their time with extra credit. 45% of participants identified as female, 53% as male, 0% as non-binary, and 2 participants chose not to identify. Additionally, 50% of the participants stated that they generally identify with the title "gamer."

3.3 Materials and Procedures

All materials in the study were delivered remotely through an online survey, beginning with a statement of informed consent that outlined the study's procedures, risks, and benefits. Afterwards, player achievement goals were measured using a modified 13-item questionnaire of educational achievement goals [10], in which the context of the questions was changed from the classroom to games. For example, an item that originally read "my goal is to do better in my class than other students" was changed to "my goal is to do better than other players in the game." Heeter et al. used the same approach in an earlier study on player achievement goals [13].

Participants were then instructed on how to download and install *Super Crate Box* [15]. *Super Crate Box* is a 2D, single-player, "shoot-em-up" game. The game was chosen due to its simple goals, commercial success, and accessibility to players with low-spec computers. Additionally, this game was chosen due its difficulty: players fail a lot, regardless of skill. This feature was particularly important due to the importance this study places on reacting to achievement and failure. Participants were asked to play for 15 minutes before returning to and continuing the survey.

Following gameplay, participants were given the Game Experience Questionnaire (GEQ) [21], a widely used measure of player experience. The GEQ contains 34 Likert scale items, scoring player

Table 1: GEQ and Achievement Goals/Causal Attributions Pearson Correlations

GEQ Component	M-Ap.	M-Av.	P-Ap.	P-Av.	Int.	Con.	Sta.	Glo.
Positive Affect	.311**	.062	.054	-.078	.381**	.357**	.205**	.284**
Negative Affect	-.204**	.104	.002	.156*	-.290**	-.372**	-.060	-.072
Competence	.311**	.129	.209**	-.008	.207**	.184**	.137	.322**
Sensory and Imaginative Immersion	.229**	.079	-.002	.063	.146	.189*	.125	.201**
Flow	.297**	.146	.126	.062	.123	.185*	.091	.127
Tension	-.185*	.042	.075	.141	-.244**	-.262**	-.016	-.181*
Challenge	.058	.020	.182	.104	-.038	.000	-.010	-.068

* $p < .05$ ** $p < .001$

"M-Ap": Mastery-approach. "M-Av": Mastery-avoidant. "P-Ap": Performance-approach. "P-Av": Performance-avoidant.

"Int": Internality. "Con": Controllability. "Sta": Stability. "Glo": Globality.

experience along seven constructs: positive affect, negative affect, competence, sensory and imaginative immersion, flow, tension/annoyance, and challenge. Afterwards, participants were given the Game-Specific Attribution Questionnaire [8]. The questionnaire contains 14 items that assess the internality, controllability, globality, and stability of game-specific causal beliefs.

Finally, participants were asked questions pertaining to their familiarity with games, frequency of play, and whether they identify with the title *gamer*.

4 RESULTS

4.1 Correlating GEQ and Achievement Goals

Overall, most components of player experience were significantly related to certain achievement goal types. Mastery-approach achievement goals showed the strongest relationship with components of the GEQ (see Table 1). Mastery-approach goals showed significant positive correlations with feelings of positive affect (r = .311, p < .001), competence (r = .311, p < .001), sensory and imaginative immersion (r = .229, p < .001), and flow (r = .297, p < .001). Mastery-approach goals showed significant negative correlations with negative affect (r = -.204, p < .001), and feelings of tension (r = -.185, p < .05).

Performance-approach achievement goals were only significantly correlated with feelings of competence (r = .209, p < .001), and were not significantly related to any other component of the GEQ. Likewise, performance-avoidant achievement goals were only significantly correlated with feelings of negative affect (r = .156, p < .05), and were not associated with other components. Mastery-avoidant goals were not significantly correlated with any components of the GEQ, and feelings of challenge were independent of achievement goal orientation.

4.2 Correlating GEQ and Causal Attributions

Similar to achievement goals, most components of player experience were related to players' causal attributions. The controllability subscore of players' causal attributions showed the strongest relationship with components of the GEQ (see Table 1). Attributional controllability showed a significant positive correlation with positive affect (r = .357, p < .001), competence (r = .184, p < .001), sensory and imaginative immersion (r = .189, p < .05), and flow (r = .185, p < .05). Controllability showed a significant negative correlation with tension (r = -.262, p < .001) and negative affect (r = -.372, p < .001).

Attributional internality had a significant positive correlation with positive affect (r = .381, p < .001) and competence (r = -.207, p < .001) and a significant negative correlation with tension (r = -.244, p < .001) and negative affect (r = -.290, p < .001). Attributional globality had a significant positive correlation with positive affect (r = .284, p < .001), competence (r = .322, p < .001), and sensory and imaginative immersion (r = .201, p < .001). Globality was not significantly related to negative affect or flow but did continue the trend of a significant negative correlation with tension (r = -.181, p < .05). Attributional stability was only significantly related with one component of the GEQ, showing a significant positive correlation with positive affect (r = .205, p < .001). Feelings of challenge were independent of causal attributions.

4.3 Modeling Flow

Flow was significantly correlated with two other GEQ components, challenge (r = .524, p < .001) and immersion (r = .352, p < .001). Flow was also correlated with causal controllability (r = .185, p < .05) and mastery-approach goals (r = .297, p < .001). A hierarchical linear regression [26] was conducted to further explore the impact that these other factors have on flow, with flow as the dependent variable and challenge, immersion, causal controllability, and mastery-approach goals as the independent variables. Before running the regression, our data was found to meet the necessary assumptions of normality, homoscedasticity, and collinearity (minimum tolerance = .879).

- **Model 1:** *Flow = Intercept + Challenge*
- **Model 2:** *Flow = Intercept + Challenge + Immersion*
- **Model 3:** *Flow = Intercept + Challenge + Immersion + Causal Controllability*
- **Model 4:** *Flow = Intercept + Challenge + Immersion + Causal Controllability + Mastery Approach Achievement Goals*

Each subsequent model accounted for significant additional variance in flow. Model 1 had a significant regression equation, F(1,163) = 61.713, p < .001, with challenge accounting for 27.5% of the variance in flow. Adding immersion as a predictor in Model 2 explained an additional 5.8% of the variance in flow, $F(2,162) = 40.409$, $p < .001$. Model 3 added causal controllability as a predictor, which accounted for an additional 2% of the variance in flow, $F(3,161) = 29.242$, $p < .001$. Lastly, Model 4 completed the hierarchal regression by adding mastery-approach goals as a final predictor, which accounted for an additional 4.1% of the variance in flow, $F(4,160) = 26.024$, $p < .001$. In the final model, challenge, immersion, and mastery-approach goals all had significant beta coefficients, $p < .01$, while causal controllability did not, $p = .063$. From these results, we see that achievement goals and causal attributions are significant predictors of flow, over and above the traditional design foci of challenge and immersion.

5 DISCUSSION

Both achievement goals and causal attributions were generally related to player experience. This was expected, falling in line with earlier work on student experiences in the classroom [6, 11]. However, this study also investigated how achievement goals and causal attributions affect *specific* components of player experiences.

A key finding of this study is that players' experiences with flow during gameplay were not only based on feelings of challenge and immersion but were also reliant on two individual player characteristics: achievement goals and causal attributions. **Based on these results, we suggest that game designers who wish to promote flow experiences not only design for challenge and immersion, but also design experiences that encourage players to form mastery-approach achievement goals and feelings of causal controllability.**

This problem is already being tackled in educational contexts. Attributional training has been implemented in the classroom, which seeks to influence student experience by introducing new attributions or changing old ones. Attributional training typically involves inducing failures in students with maladaptive attributions and then directly instructing more adaptive ways to respond to that failure; doing so has shown improvement in student experience and performance in the classroom [20]. Educators have also had success with interventions to improve maladaptive student achievement goals [2], fostering mastery-approach goals through communicating the importance of learning.

Exploring how attributional training and achievement goal realignment might be implemented either within gameplay or within player communities is an exciting next step for future research. Based on this study, doing so may allow for players to reach flow states more easily within game experiences.

REFERENCES

[1] Acee, T.W. *et al.* 2010. Academic boredom in under- and over-challenging situations. *Contemporary Educational Psychology.* 35, 1 (Jan. 2010), 17–27. DOI:https://doi.org/10.1016/j.cedpsych.2009.08.002.

[2] Anderman, L.H. *et al.* 2011. How Do Teachers Support Students' Motivation and Learning in Their Classrooms? *Teachers College Record.* 113, 5 (2011), 969–1003.

[3] Anderson, C.G. *et al.* 2019. Building Persistence Through Failure: The Role of Challenge in Video Games. *Proceedings of the 14th International Conference on the Foundations of Digital Games* (New York, NY, USA, 2019), 34:1–34:6.

[4] Azevedo, R. *et al.* 2004. Does adaptive scaffolding facilitate students' ability to regulate their learning with hypermedia? *Contemporary Educational Psychology.* 29, 3 (Jul. 2004), 344–370. DOI:https://doi.org/10.1016/j.cedpsych.2003.09.002.

[5] Beck, L.A. 1992. Csikszentmihalyi, Mihaly. (1990). Flow: The Psychology of Optimal Experience. *Journal of Leisure Research.* 24, 1 (Jan. 1992), 93–94. DOI:https://doi.org/10.1080/00222216.1992.11969876.

[6] Coutinho, S.A. 2007. The relationship between goals, metacognition, and academic success. *Educate~.* 7, 1 (Jun. 2007), 39–47.

[7] Csikszentmihalyi, M. 1997. Flow and Education. *NAMTA Journal.* 22, 2 (1997), 2–35.

[8] Depping, A.E. and Mandryk, R.L. 2017. Why is This Happening to Me?: How Player Attribution Can Broaden Our Understanding of Player Experience. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2017), 1040–1052.

[9] Deterding, S. *et al.* 2011. Gamification. Using Game-design Elements in Non-gaming Contexts. *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, 2011), 2425–2428.

[10] Elliot, A.J. and Mcgregor, H. 2001. A 2 X 2 achievement goal framework. *Journal of personality and social psychology.* 80, 3 (2001), 501–519. DOI:https://doi.org/10.1037/0022-3514.80.3.501.

[11] Graham, S. 1991. A review of attribution theory in achievement contexts. *Educational Psychology Review.* 3, 1 (Mar. 1991), 5–39. DOI:https://doi.org/10.1007/BF01323661.

[12] Hamari, J. *et al.* 2014. Does Gamification Work? – A Literature Review of Empirical Studies on Gamification. *2014 47th Hawaii International Conference on System Sciences* (Jan. 2014), 3025–3034.

[13] Heeter, C. *et al.* 2011. Beyond player types: gaming achievement goal. *Proceedings of the 2011 ACM SIGGRAPH Symposium on Video Games* (Vancouver, British Columbia, Canada, 2011), 43–48.

[14] Hunicke, R. 2005. The Case for Dynamic Difficulty Adjustment in Games. *Proceedings of the 2005 ACM SIGCHI International Conference on Advances in Computer Entertainment Technology* (New York, NY, USA, 2005), 429–433.

[15] Ismail, R. and Nijman, J.W. *Super Crate Box.* Vlambeer.

[16] Kidd, C. *et al.* 2012. The Goldilocks Effect: Human Infants Allocate Attention to Visual Sequences That Are Neither Too Simple Nor Too Complex. *PLOS ONE.* 7, 5 (May 2012), e36399. DOI:https://doi.org/10.1371/journal.pone.0036399.

[17] Malone, T.W. 1981. Toward a theory of intrinsically motivating instruction. *Cognitive Science.* 5, 4 (Oct. 1981), 333–369. DOI:https://doi.org/10.1016/S0364-0213(81)80017-1.

[18] Quick, J.M. and Atkinson, R.K. 2014. Modeling Gameplay Enjoyment, Goal Orientations, and Individual Characteristics. *International Journal of Game-Based Learning.* 4, 2 (Apr. 2014), 51–77. DOI:https://doi.org/10.4018/ijgbl.2014040104.

[19] Nicholson, S. 2015. A RECIPE for Meaningful Gamification. *Gamification in Education and Business.* T. Reiners and L.C. Wood, eds. Springer International Publishing. 1–20.

[20] Perry, R.P. *et al.* 1993. Enhancing achievement motivation and performance in college students: An attributional retraining perspective. *Research in Higher Education.* 34, 6 (Dec. 1993), 687–723. DOI:https://doi.org/10.1007/BF00992156.

[21] Poels, K. *et al.* 2007. D3.3: Game Experience Questionnaire: development of a self-report measure to assess the psychological impact of digital games. Technische Universiteit Eindhoven.

[22] Poole, S. 2000. *Trigger Happy: Videogames and the Entertainment Revolution.* Arcade Publishing.

[23] Prensky, M. 2003. Digital game-based learning. *Computers in Entertainment (CIE).* 1, 1 (Oct. 2003), 21. DOI:https://doi.org/10.1145/950566.950596.

[24] Rieber, L.P. 1996. Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research and Development.* 44, 2 (Jun. 1996), 43–58. DOI:https://doi.org/10.1007/BF02300540.

[25] Ryan, R.M. *et al.* 2006. The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion.* 30, 4 (2006), 347–363. DOI:https://doi.org/10.1007/s11031-006-9051-8.

[26] Schmettow, M. 2015. *Tutorial: Modern Regression Techniques for HCI Researchers.*

[27] Shu, L. and Liu, M. 2019. Student Engagement in Game-Based Learning: A Literature Review from 2008 to 2018. *Journal of Educational Multimedia and Hypermedia.* 28, 2 (Apr. 2019), 193–215.

[28] Sweetser, P. and Wyeth, P. 2005. GameFlow: A Model for Evaluating Player Enjoyment in Games. *Comput. Entertain.*3, 3 (Jul. 2005), 3–3. DOI:https://doi.org/10.1145/1077246.1077253.

[29] Walz, S.P. and Deterding, S. 2015. *The Gameful World: Approaches, Issues, Applications.* MIT Press.

[30] Weiner, B. 1979. A theory of motivation for some classroom experiences. *Journal of Educational Psychology.* 71, 1 (1979), 3–25. DOI:https://doi.org/10.1037/0022-0663.71.1.3.