The use of video game achievements to enhance player performance, self-efficacy, and motivation

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ABSTRACT

A taxonomy of achievement design features in video game systems was created in order to evaluate the current state of the art in achievement design. The taxonomy proposed multiple mechanisms that influence player behavior. These mechanisms led to a theoretical model that served as a source of hypotheses related to improving performance, self-efficacy and motivation in players. Specific aspects of this theoretical model (expected, unexpected, before-performance and after-performance and incremental achievements) were tested in an empirical study. In addition to testing individual mechanisms of action a “combined achievement” was created with multiple mechanisms that were hand-picked. The results of the study revealed that individual mechanisms of action had little effect on players; while multiple mechanisms in a combined achievement caused significant improvements in several categories. The limitations of the current study as well as plans for future study are also discussed.

INTRODUCTION

"*A soldier will fight long and hard for a bit of colored ribbon.*" - Napoleon Bonaparte

An achievement in a video game is a reward or recognition earned by players for an in-game accomplishment. Achievements are often used in video games to extend play time by adding additional goals or by serving as extrinsic motivators added to those incumbent in the game. The concept of achievements has been in video games since games like Sea Wolf (Midway, 1976), allowed players to earn a "high score" and post their initials for other players to see. However, the terminology was not introduced until 2005 when Microsoft introduced the "Gamerscore" system for the Xbox 360 platform. The Gamerscore system coined the term "achievement" and made their use in games mainstream. The entertainment gaming industry's use of achievements today is pervasive. A game cannot be on Xbox Live or the PlayStation Network (Sony), two popular gaming consoles, without including achievements. World of Warcraft (Blizzard Entertainment), currently the world's largest pay-to-play Massively Multi-player Online game (MMO) in terms of subscribers (12 million), has 1,320 achievements and Farmville (Zynga), the most popular game on the social networking site Facebook, has 132 ribbon achievements.

The entertainment gaming industry’s quick adoption of achievements without proper study of their effects has led to backlash among some designers. They fear achievements are a threat to the inherent entertainment value of games. Achievements, in their minds, could become an exercise in behaviorism that will trick players into playing "bad games" to earn more achievements (Hecker, 2010). With little existing research to back-up concerns about any negative consequences associated with achievement use, critics have been relegated to speculation and oversimplification of studies on rewards and motivation. A common argument made by opponents of achievements is as follows: Rewards are bad because they decrease

intrinsic motivation. Achievements are rewards; therefore achievements must decrease intrinsic motivation. While these concerns are perhaps reasonable, a more thorough understanding of the elements that comprise achievements will help alleviate concerns about the use of achievements and guide future designs.

Achievements are of particular interest in the area of “serious games”. The serious games industry, which creates games that enhance performance and learning, has been much slower in their adoption of achievement systems. However, this form of feedback and reward could be beneficial to an industry that often struggles with making games entertaining as well as educational. Because time-on-task contributes to the effectiveness of a serious game, the use of achievements to affect play time might be beneficial to learning (Cannon-Bowers & Bowers 2010). Achievements may add an incentive for performing a task to a certain degree or simply result in spending more time on a given task trying to complete it. Both increased effort and increased time on task are likely useful goals of including achievements in serious games, as both are shown to increase the learning value of an experience (Fisher & Ford, 1998). However, there is no empirical evidence with which to evaluate the efficacy of achievements in creating these outcomes. Because a serious game must balance its entertainment value with its instructional value, the effect that achievements have on learning should be understood before they are put into use. An understanding of the elements that comprise achievements will enable the creation of achievements tailored to meet specific needs, in order to optimize player performance and increase learning in serious games.

Purpose of study

The purpose of this study was to develop an understanding of the role of achievements in game-based learning. This was achieved by creating a taxonomy to describe the components of achievements in video games. The taxonomy facilitated the creation of a predictive model that defined what achievement design features are likely to elicit a desired behavior that leads to increased learning. The model was then used to add achievements to an existing serious game. Finally, an experiment was performed to evaluate the changes in learning outcomes, motivation, and self-efficacy when comparing games with certain types of achievements and games with no achievements.

REASERCH MODELS AND HYPOTHESES

The following taxonomy of achievement design features was developed for testing purposes.

The sections highlighted in red were tested during the study.

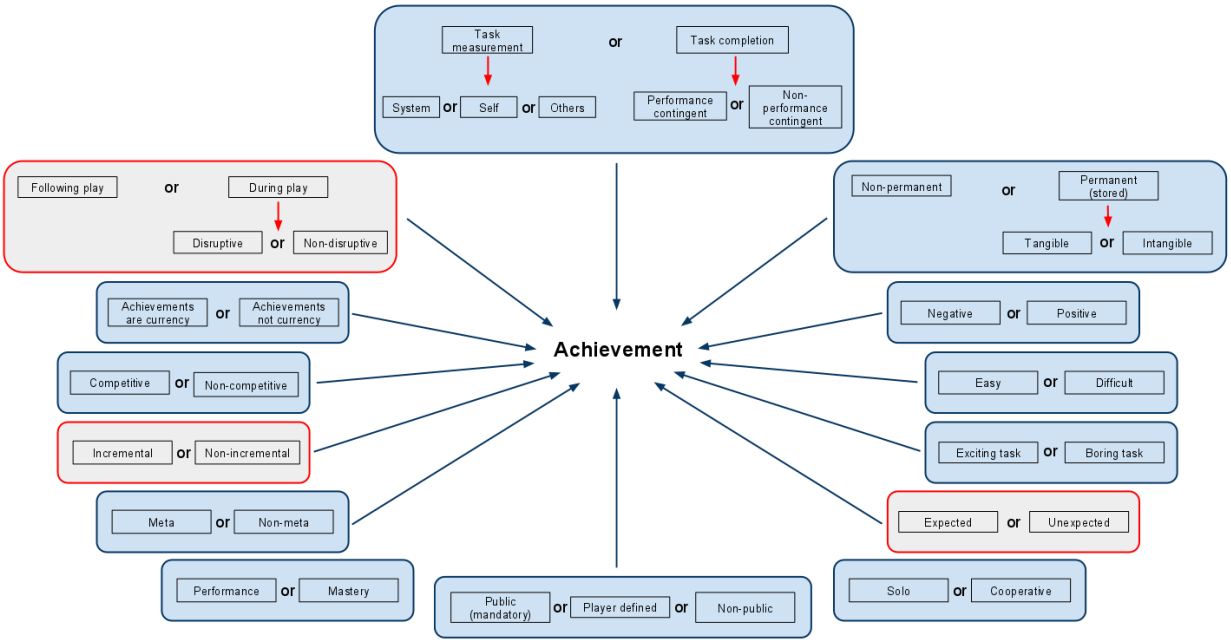

Figure 1: Taxonomy of achievement design features

From the taxonomy of achievement design features the following mechanisms of action were identified. Research has shown these mechanisms can lead to an increase in performance and learning.

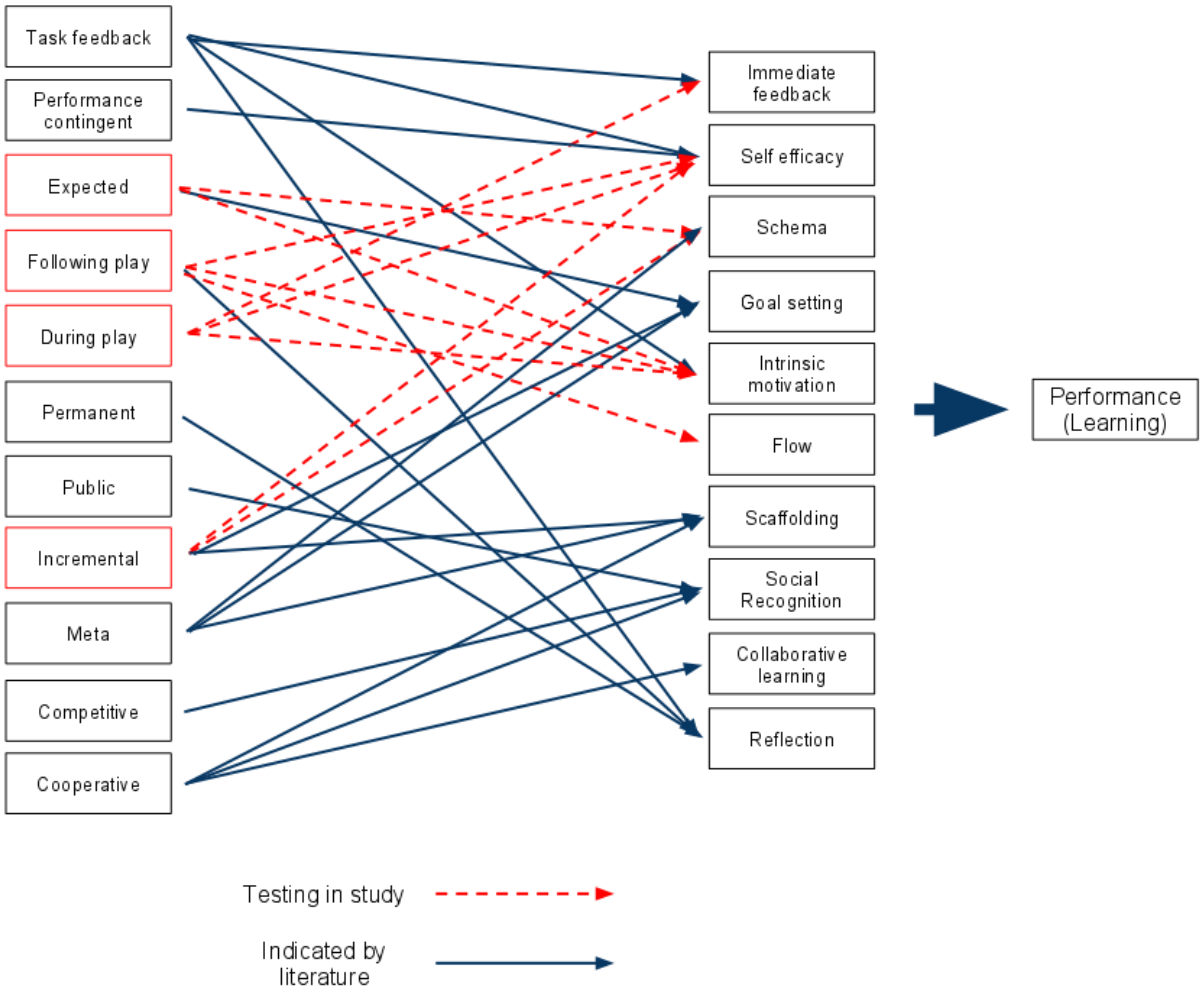

Figure 2: Mechanisms of action

Hypotheses

H1: Players who have expected achievements will perform better than those who have unexpected achievements.

H1a: Players who have expected achievements will have better retention than those who have unexpected achievements.

H2: Players who have incremental achievements will perform better than those who have non-incremental achievements.

H2a: Players who have incremental achievements will have better retention than those who have non-incremental achievements.

H3: Players who have incremental achievements will spend more time playing than those who have non-incremental achievements.

H4: Players who receive notifications after play will perform better than those who receive notifications during play.

H4a: Players who receive notifications after play will have better retention than those who receive notifications during play.

H5: Players who receive notifications after play will report more enjoyment than those who receive notifications during play.

H6: The relationship between achievements and performance will be mediated by intrinsic motivation.

H7: The relationship between achievements and performance will be mediated by self-efficacy.

H8: The relationship between achievements and performance will be mediated by the creation of schemas.

H9: Players who have the “combined achievement” will perform better than the control.

H9a: Players who have the “combined achievement” will have better retention than the control.

METHODOLOGY

Measurements

Video Game Self-Efficacy:

The Video Game Self-Efficacy Scale (VGSES) questionnaire consists of 10 items for use with assessing perceived self-efficacy when playing video games (Pavlas, 2010). The VGSES is an adaptation of the Generalized Self-Efficacy Scale (GSE) (Schwarzer & Jerusalem, 1995) used to assess perceived self-efficacy. The GSE scale has been utilized by numerous studies since 1995 and is optimal for adults and adolescents over 12. The questionnaire was used to measure H:7.

Relevance & Usefulness:

The Relevance and Usefulness questionnaire consist of 16 items for use with assessing "motivation variables of self-efficacy, enjoyment, and learning goal orientation in order to predict the use of Web-based information systems" (Yi & Hwang, 2003). Adapted for use with video games by Evans (2009). The questionnaire contains 16 items utilizing a Likert scale measuring Usefulness, Behavioral Intention, Ease of Use, Application-Specific Self Efficacy, and Enjoyment. The questionnaire was used to measure H:5 and H:7.

Game Engagement Questionnaire:

The Game Engagement Questionnaire (GEQ) measures engagement during video game play (Brockmyer et al., 2009). The questionnaire consists of 19 items scored on a Likert scale measuring specifically absorption, flow, presence, and immersion. "Cronbach's alpha for the current 19-item version of the GEQ was .85. The Rasch estimate of person reliability (the Rasch analog to Cronbach's alpha) for the 19-item version was .83 and the item reliability was .96 (Brockmyer et al., 2009). The questionnaire was used to measure H:3, H:5 and H:6.

Intrinsic Motivation Inventory (IMI):

The Intrinsic Motivation Inventory (IMI) utilizes several sub-scales that relate to user experience during a targeted activity. For this study the Interest/Enjoyment sub-scale that contains 7 questions and the Effort/Importance sub-scale that contains 5 questions will be used.

The interest/enjoyment sub-scale is associated with self-reported intrinsic motivation. It has been utilized in the following studies: (Ryan, 1982; Ryan, Mims & Koestner, 1983; Plant & Ryan, 1985; Ryan, Connell, & Plant, 1990; Ryan, Koestner & Deci, 1991; Deci, Eghrari, Patrick, & Leone, 1994). The questionnaire was used to measure H:5 and H:6.

TPL KATS structural knowledge assessment tool:

The TPL-KATS tool (Hoeft et al., 2003) allows users to create concept maps or mental representations of schema. This tool will be used to compare the differences in player ability to create schema when given achievements are present and not present in games. The tool was used to measure H:8.

Phone Dash game variants

Figure 3: Expected Achievements

Achievement variation - Expected vs. Unexpected:

Unexpected achievements were available in a version of the game, but the players did not know that they existed or how they were earned. Expected achievements were available in another version of the game. In this version players were informed up front what the achievements were and how to earn them.

Figure 4: Incremental achievements

Achievement variation - Incremental vs. Non-incremental:

Incremental achievements consisted of a three star rating. Each star represented a different level of performance. Non-incremental achievements were given for a single accomplishment at the two star level of difficulty.

Figure 5: During play

Figure 6: After play

Achievement variation - During vs. After notifications:

During play notifications took the form of an unobtrusive pop-up. After play notifications were given out in a review screen after the game has been completed.

Achievement variation – Combined achievement

The Combined Achievement contained several design features that were hand-picked from the other variations. This achievement was created to ascertain the aggregate effect of multiple design features. The Combined Achievement was expected and incremental with notifications that occurred after the play session had ended.

Study design 1

Objective

This study looked for differences in participants' schema creation, intrinsic motivation, and performance when achievements were expect and unexpected.

Procedure

- 30 participants were randomly assigned to the condition.
- Participants were briefed about the study and provided with the waiver of documented informed consent.
- Participants were asked to complete a demographics form.
- Participants in the expected achievements group were given a screen that summarizes possible achievements they could earn before game play begins. Participants in the unexpected achievement group were not informed of the available achievements before play began.
- Participants were asked to complete the Intrinsic Motivation Inventory (IMI) questionnaire and the TPL KATS tool.
- Participants were given a pretest for the game content
- The participant played the game Phone Dash (with achievements) for as long as they liked, before a posttest was given. The amount of time they played was measured.
- The control group played a version of the game with no achievements
- Participants were given a posttest for the game content that is equivalent to but containing different content than the pretest.
- Participants were asked to complete the Relevance & Usefulness, Game Engagement, and Intrinsic Motivation Inventory (IMI) questionnaires.

Table 1: Study 1 design

Ø	10
Expected	10
Unexpected	10

*Data includes demographics, questionnaire responses, and game performance.

- Players were given a follow-up quiz one week after the play session in order to assess retention.

Study 2 design

Objective

This study looked for differences in participant's intrinsic motivation, perceptions, and performance when achievements were incremental and non-incremental.

Procedure

- 30 participants were randomly assigned to the condition.
- Participants were briefed about the study and provided with the waiver of documented informed consent.
- Participants were asked to complete a demographics form.
- Participants were asked to complete the Video Game Self-Efficacy questionnaire and the TPL KATS tool.
- Participants were given a pretest for the game content
- Participants were given a screen that summarizes the possible achievements they could earn before game play begins. Participants in the incremental achievements group played a version of the game Phone Dash that had three levels of each achievement that were awarded based on performance. Participants in the non-incremental

achievement group played a version of the game Phone Dash that had only one level for each achievement. Participants could play the game for as long as they would like, before a posttest was given. The amount of time they played was measured.

- Participants were given a posttest for the game content that was equivalent to but contained different content than the pretest.
- Participants were asked to complete the Video Game Self-Efficacy, Relevance & Usefulness, and Game Engagement questionnaires

Table 2: Study 2 design

Non-incremental	15
Incremental	15

*Data includes demographics, questionnaire responses, and game performance.

- Players were given a follow-up quiz one week after the play session in order to assess retention.

Study 3 design

Objective

This study looked for differences in participant's intrinsic motivation, perceptions, and performance depending on when notification for earning an achievement occurred.

Procedure

- 30 participants were randomly assigned to the condition.
- Participants were briefed about the study and provided with the waiver of documented informed consent.
- Participants were asked to complete a demographics form.
- Participants were asked to complete a Video Game Self-Efficacy questionnaire.

- Participants were given a pretest for the game content
- Participants were given a screen that summarizes possible achievements they could earn before game play began. Participants in the “during” group played a version of the game Phone Dash that notified them immediately when they earned an achievement. Participants in the “after” group played a version of the game Phone Dash that notified them after game play had finished which achievements they earned.
- Participants were given a posttest for the game content that was equivalent to but containing different content than the pretest.
- Participants were asked to complete the Video Game Self-Efficacy, Relevance & Usefulness, Game Engagement, and Intrinsic Motivation Inventory (IMI) questionnaires

Table 3: Study 3 design

During	15
After	15

*Data includes demographics, questionnaire responses, and game performance.

- Players were given a follow-up quiz one week after the play session in order to assess retention.

RESULTS

Demographics

The demographics breakdown of the participants for each study was as follows:

Table 4: Demographics

Condition	
Control	32
Expected	30
Unexpected	30
Incremental	10
Non-incremental	10
During	11
After	11
Combined	16
Gender	
Male	64
Female	86
Race	
Caucasian	75
African-American	22
Asian-American	11
Hispanic	28
Other	1

Performance

Hypothesis 1 predicted that players who had expected achievements would perform better than players who had unexpected achievements. Performance was assessed by number of replays, achievements earned, calls answered, and pretest/posttest scores. A MANOVA indicated the following:

- Test scores improved across test administrations, regardless of condition F (2,76) = 21.46, p < .05). However, there was no interaction between test administration and condition (F (2, 76) = .51, p = n.s.

Table 5: H1 test scores

Condition	time	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Expected (2)	1	7.767	.238	7.291	8.242
	2	9.333	.215	8.903	9.764
Unexpected (2)	1	8.200	.238	7.725	8.675
	2	9.067	.215	8.636	9.497

- No significant difference in the number of achievements earned as a function of condition (F 2,92) = 1.47, p = n.s.
- Players with expected achievements answered significantly more calls than the control.

  F(1,88) = 8684.407, p < .001, eta2 = .990

  F(2,88) = 3.164, p < .047, eta2 = .067

Players with unexpected achievements did not perform better than the control.

Table 6: H1 performance

Condition	level	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control	1	7.871	.227	7.420	8.322
	2	9.129	.240	8.651	9.607
	3	9.774	.235	9.307	10.241
Expected (2)	1	8.933	.231	8.475	9.391
	2	9.533	.244	9.048	10.019
	3	10.133	.239	9.658	10.608
Unexpected (2)	1	7.967	.231	7.509	8.425
	2	9.667	.244	9.181	10.152
	3	10.067	.239	9.592	10.542

Hypothesis 2 predicted that players who had incremental achievements would perform better than players who had non-incremental achievements. A MANOVA indicated the following:

- No significant difference in the number of achievements earned.
- Test scores improved from pre-test to post-test ($F(1,18) = 26.00$, $p < .01$; $M = 8.1$ and 9.6, respectively). However, there was no interaction between condition and trial ($F(1, 18) = .62$, p = n.s.
- Players answered more calls from level 1 to level 2 ($F(1,18) = 13.1$, $p < .05$; M – 7.1 and 9.2 respectively), but there was no interaction with condition ($F(1,18) = .16$, p = n.s.).

Hypothesis 4 predicted that players who had notifications after game play would perform better than players who had during game play. A MANOVA indicated the following:

- No significant difference in the number of achievements earned.

- Participants, regardless of condition, improved in the test scores from pre-test to post-test ($F(1,19) = 41.997$, $p < .001$, eta2 = .689). However, there was no difference as a function of condition ($F(1,19) = .208$, $p < .653$, eta2 = .011)
- Regardless of condition, players answered more calls from pre-test to post-test ($F(2,40) = 11.437$, $p < .001$, eta2 = .364). Players who received notifications during play showed a greater increase in calls than did the "after" group. $F(2,40) = 3.698$, $p < .034$, eta2 = .156

Retention

Hypotheses H1a, H2a, and H4a predicted the retention differences between conditions. These hypotheses were evaluated using repeated measures ANOVA's with the following results:

- When investigating expected vs. unexpected achievements, there was a main effect of time ($F (1,38) = 5.67$, $P < .05$, $p < .05$. The post-test mean was 9.3 while the retention test mean was 8.5. There was, however, no difference between the groups when considering condition ($F (1,38) = 1.42$, $p < .05$).
- While all groups decreased in learning from post-test to retention test ($F (1,9) = 16.12$, $p < .05$; M = 9.5 and 8.3, respectively), there was no difference as a function of incremental feedback($F (1,9) = .13$, p = n.s.
- While all groups showed a decrease from post-test to the retention ($F (1,11) = 4.36$, $p < .05$; M = 9.6 and 8.7, respectively), there was no difference as a function of the timing of feedback ($F (1,11) = .89$, p = n.s.

Enjoyment and time spent

Hypothesis 3 predicted that incremental achievements would cause players to spend more time playing the game. This was evaluated with an ANOVA revealing that players who had incremental achievements did not spend significantly more time playing than those who had non-incremental achievements.

Table 7: H3 time spent

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.200	1	.200	.086	.773
Within Groups	42.000	18	2.333		
Total	42.200	19			

Hypothesis 5, which predicted players who received notification after play would have more enjoyment, was also evaluated with an ANOVA. This test revealed no significant difference was found in reported enjoyment between players who received notification during and those who received notification after.

Table 8: H5 enjoyment

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.050	1	.050	.084	.775
Within Groups	10.700	18	.594		
Total	10.750	19			

Mediation

Hypotheses 6, 7, and 8 all predicted that the relationship between achievements and performance (pre, post, retention) would be mediated by an outside factor. All three hypotheses were evaluated using a series of mediated multiples regressions which revealed the following:

- Hypothesis 6 - The relationship between achievements and performance (pre, post, and retention) was not significantly mediated by intrinsic motivation.

- Hypothesis 7 - The relationship between achievements and performance (pre, post, and retention) was not significantly mediated by self-efficacy.
- Hypothesis 8 - When testing for incremental vs. non-achievements, schemas were a significant moderator between achievements and performance (pre, post, and retention). F(1,7) = 5.813, p < .047, eta2 = .454

  However, after the mediator was taken into account there was still no significant relationship between achievements and learning.

Combined achievement

The combined achievement trial players had significantly higher improvements in the pre to post test scores than the control group (F(1,45) = 9.73, p < .003, eta2 = .178).

Table 9: Combined Achievement test scores

	Condition	Mean	Std. Deviation	N
Number Correct on Pre-Test	Control	8.5806	.71992	31
	Combined	7.7500	1.48324	16
	Total	8.2979	1.10168	47
Number Correct on Post-Test	Control	9.3548	.79785	31
	Combined	9.6250	.80623	16
	Total	9.4468	.80240	47

The combined achievement trial players had significantly higher improvements in knowledge organization than the control group (F(1,38) = 4.35, p < .044, eta2 = .103).

Table 10: Combined Achievement knowledge organization

				95% Confidence Interval	
Condition	time	Mean	Std. Error	Lower Bound	Upper Bound
Control	1	.809	.017	.775	.843
	2	.879	.011	.856	.901
Combined	1	.786	.022	.742	.830
	2	.919	.014	.889	.948

There was a significant difference between the combined achievement trial players (M=4.36, SD=0.9) and the control group (M=3.73, SD=1.04) in perceived relevance; t(46)=-2.04, p=.047

There was a significant difference between the combined achievement trial players (M=3.63, SD=0.83) and the control group (M=2.92, SD=1.06) in behavior intention; t(46)=-2.33, p=.024

The combined achievement trial players had significantly higher improvements in intrinsic motivation than the control group (F(1,46) = 4.21, p < .046, eta2 = .084).

Table 11: Combined Achievement intrinsic motivation

				95% Confidence Interval	
Condition	time	Mean	Std. Error	Lower Bound	Upper Bound
Control	1	4.696	.164	4.366	5.027
	2	5.656	.164	5.327	5.985
Combined	1	4.938	.232	4.470	5.405
	2	5.295	.231	4.829	5.760

DISCUSSION

The intention of this study was to measure the effect that different types of video game achievements have on player's performance and attitudes. Improvements in performance and retention were the predicted outcomes (H1, H1a, H2, H2a, H4, H4a) of using expected and incremental achievements as well as notifications after play. Improvements in performance were also predicted for the "combined achievement" (H9). Enjoyment, another important consideration for video games, was expected to be affected by certain design decisions (H3, H5). Incremental achievements causing extended playtimes and notifications after play encouraging flow states were both expected to improve enjoyment. The relationship between achievements and performance was expected to be mediated by intrinsic motivation, self-efficacy, and schemas (H6, H7, H8).

For Hypotheses 1, 2, and 4 the performance of all groups improved from pre-test to post-test. However, this improvement did not differ as a function of achievement condition. It was noted that the overall number of calls answered was significantly higher in the expected achievement condition, which may provide partial support for Hypothesis 1. This finding indicates that players increased their effort because they saw what achievements they could potentially earn. In contrast, players who had unexpected achievements did not put forth as much effort, resulting in fewer answered calls. However, by levels 2 and 3 the expected and unexpected conditions became roughly the same in number of calls answered. A potential cause of this could be that after level 1, players in the unexpected group earned an achievement. Once players were aware that achievements could be earned by performing well their level of effort could have increased.

Players that received notification of an earned achievement during play had an increased number of calls answered when compared to those who received notification afterwards.

Hypothesis 4 predicted that the opposite result would be observed due to the notifications during play being disruptive and breaking the player's flow state. The "during" play notifications in this case, however, were implemented in such a way to not be disruptive. Without being disruptive they did not affect the player's flow and instead acted as immediate feedback, which in turn increased their effort, leading to an increase in the number of calls answered. Immediate feedback, in this case, could have also increased efficiency (Schooler & Anderson, 1990). The enjoyment predicted by Hypothesis 5 showed a similar, contrary result, due to the non-disruptiveness of the "during notifications". The predicted difference in enjoyment would have been caused by the same anticipated break in flow. Because there was no break in flow, players reported almost identical enjoyment between the two conditions.

Hypothesis 3 predicted that players would spend more time playing if they had incremental achievements; which are designed to increase overall playtime by providing scaffolded goals. There was however no observed difference in playtime between incremental and non-incremental achievements. One explanation for this could be the time span that was used to evaluate playtime. The evaluation was performed on what would be considered one play session. An additional measure that may have yielded better results could have been the option for players to return to the game at a later date. Incremental achievements may not have increased the length of time for a single play session but they may increase the likelihood of returning for additional play sessions.

The results of the combined achievement were by far the most successful. In the combined trials the achievements were incremental, expected, and notifications occurred after play. The design features used in the combined achievement seemed to have a more powerful effect in unison than when they were measured independently. The expected incremental stars may have made it apparent to the players that in order to achieve mastery of the game they would

have to play frequently and seriously. This would account for the significant finding in the behavior intention measure. The expectation and anticipation caused by the expected incremental achievements may have been intimidating to players, which would explain the lower intrinsic motivation.

The increase in knowledge organization is difficult to explain because the content of the expected achievements was unrelated to the information in the card sort. This can only be explained by an increase in effort indicated by the behavior intention measures.

CONCLUSIONS

The intent of this study was to illustrate the potential use of video game achievements to enhance player performance and attitudes. Although there were unexpected circumstances that may have limited the results, the significant findings for several design features should indicate not only the strength of the case for using achievements but the necessity for future study. With the popularity of serious games on the rise and the recent trend in gamification sweeping multiple industries the need for a standardized system of achievement design should be apparent. Hopefully this study will lay the groundwork for what can hopefully be a much larger body of research in a quickly growing field.

Limitations

The content of the game was originally intended to be about UCF campus services. Content of this type would have been familiar to students and hopefully increase their sense of relevance. The content was created as planned and then tested in a quick trial. Mean scores from the trial run were too high and it was determined this would make the knowledge performance measures unusable. The UCF content was replaced with content about mental health issues relevant to military veterans. This content tested better than the UCF content but was probably still not difficult enough to prevent a ceiling effect. Other studies intended to replicate or improve upon the findings of this study should consider using content relevant to the population but difficult enough to prevent a ceiling effect.

One of the benefits of using a game like Phone Dash is the simplicity of play. Users could pick up the game relatively quickly and become proficient. However, the simplicity limited how achievements could be implemented into it. The simplicity of the game, in addition to the content type, may have limited player's motivation. A more robust game that required more investment from players may have yielded more positive results.

This study was done with relatively short playtimes and provided no opportunity for players to return on their own. The amount of information that can be absorbed by players in that short amount of time was most likely not effective enough to foster retention. Returning to the game for a second play session could have also increased the retention test results. Giving players the ability to go back later and play the game on their own would also have been a better indicator of their dedication than a survey.

Although the study yielded several significant results, the performance measures related to knowledge acquisition and retention may have been stifled by a ceiling effect. This was the result of higher than expected means on the pretest scores. The higher pretest scores did not leave room for overall improvement in the post and retention tests. This caused the knowledge performance measures, which were used to make predictions in H1, H2, H4, H6, H7, and H8, to have a limited or negligible effect. This also could have affected the retention hypotheses H1a, H2a, and H4a.

Future study

Numerous future studies could come out of this initial research. Different combinations of design features from the taxonomy could be implemented and tested to see which are the most effective. The combined achievement portion of this study is an indicator of how complex and unpredictable the interactions between features are. Public achievements, which could not be feasibly implemented into this study, should be of particular interest to designers given the recent wave of popular social media sites and social games.

The environments in which the achievements are studied also have great potential for future work. Non-game environments like social media sites or gamification efforts, which are now growing in popularity, show great potential for future study.

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