

# Debriefing a Health-Related Educational Game

## A Case Study

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This study sought to evaluate the utility of a Web-based game on the topic of immunity, based upon the work of Nobel Prize winner Ileya Mechnikov. This was accomplished through postgame written debriefing with an oral debriefing follow-up. A qualitative case study was conducted in a nonformal home setting. The participant learned new information, such as the capability of cells to alert the body to foreign pathogenic attack. Game dissatisfaction was described by the participant as well as suggestions for game improvement. The written debriefing response was generally briefer than the oral debriefing responses. While the participant gleaned information about immunity from the game without facilitator assistance, postgame debriefings aided the participant in reflection about the game. This was the first study to utilize a combination of postgame written and oral debriefing in the Nobel Prize Web-based game genre. It illustrates the value of postgame debriefing as an enhancement of the learning experience related to the health-related educational game.

**Keywords:** *debriefing; game improvement; health-related educational game; immunity; learning; oral debriefing; Web-based games; written debriefing*

An awareness of immunity is essential to understanding the prevention of disease and also the promotion of health. Immunity concepts were integrated into school curriculum. Glik et al. (2004) demonstrated that immunity concepts can be taught in the school curriculum to increase not only knowledge about immunity and immunization but also positive attitudes about immunization. A trading-card game study among middle and high school students demonstrated statistically significantly increased knowledge about topics related to immunity and host defense (Steinman & Blastos, 2002). However, more innovative educational strategies are needed to address immunity for the secondary school-age population.

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The Nobel Foundation (2006) developed the Web-based IMMUNE SYSTEM DEFENDER Game (ISD Game) as an educational game designed for those 15 years and older to address basic immunity concepts and requiring no background knowledge about immunity. The ISD Game was based on the discovery of Nobel Prize laureate Ilya Mechnikov, a pioneer of the immune system and discoverer of phagocyte cells (Nobel Foundation, 2006).

Crookall (1992) expressed the importance of postgame debriefing. Educational games employ debriefing as an expanded learning opportunity (Lederman, 1992). Thiagarajan (1992) stressed the importance of debriefing as a means of facilitating the reflection process, essential for the learning process. Peters and Vissers (2004) emphasize the utility of debriefing to relate to “experiences in real-life situations” (p. 70). Yet the ISD Game (Nobel Foundation, 2006), as well as other Nobel Foundation games, was devoid of postgame debriefings (Nobel Foundation, 2005). Lennon (2006) demonstrated the utility of oral debriefing with the Nobel Foundation’s MOSQUITO Game and PARASITE Game with a participant younger than age 14. However, Petranek (2000) valued written debriefing as a higher level of reflection and learning experience than oral debriefing. Oertig (in press) utilized a written postgame debriefing within an online format. This approach not only promoted participant reflection but also facilitated discussion between participants.

Thiagarajan’s (1992) debriefing format included a game improvement component. In this way, debriefing may influence future game design or game modifications. As examples, participants in various game debriefing studies expressed insights about possible game design changes in board games as well as Web-based electronic games (Lennon, 2006; Lennon & Coombs, 2005). Kriz and Hense (2006) further suggest that debriefing promotes insights for ongoing game improvement.

Csikszentmihalyi and Csikszentmihalyi (1990) proposed flow theory to explain how an individual is optimally absorbed in an activity. It is exemplified by a high level of personal focus. Habgood, Ainsworth, and Benford (2005) stress that flow is optimally achieved in electronic games with continuous play. So, any educational or learning content should not result in interruptions or hindering the game’s play. Cowley, Charles, Black, and Hickey (2008) further stressed that flow is achieved in electronic games when there is a correlation between complete game immersion and high play motivation. The ability to achieve complete immersion may depend upon such factors as the players’ perception of game complexity or their personal desire to achieve a certain level of challenge.

Therefore, this study sought to evaluate the use of written postgame debriefing with an oral follow-up after the play of the ISD Game (Nobel Foundation, 2006). This debriefing explored the participant’s views about the game, learning about immunity, and game improvements as well as examined written debriefing for games in this format.

## Materials and Method

### Design

This study employed a descriptive case study method through postexperience debriefing after the play of one Web-based electronic game.

### Participant

The study's lone participant was a 15-year-old American who lived in a midwestern U.S. city and had studied in the U.S. system for the entirety of his life. The participant had just completed his second year of high school at the time of the study. The participant had no prior experience playing any game related to immunity nor any educational game related to Nobel Prize winners (Nobel Foundation, 2005). The participant had experience playing on both Xbox and PSP (PlayStationPortable) as well as eight years of playing CD-ROM games. Both active parental consent as well as participant assent was obtained prior to the beginning of the study. The participant was selected for his experience as a gamer as well as for being known to the researcher. This was a convenient sample of a highly experienced game player with familiarity with multiple gaming systems. Rather than involving multiple players initially, it was felt that the insights of this experienced player may yield comments on the game's playability and capability to challenge a player at the experienced game level, while allowing for the possibility of increased levels of awareness and knowledge of the game's content area.

### Game

The ISD Game consists of two phases. It has its primary objective to move phagocytes in the form of yellow-colored granulocytes in the first phase of the game to eliminate bacteria in the form of green-colored dots. The action of moving a granulocyte or macrophage over a green dot results in an eaten or destroyed bacterium. A point-and-click action of the computer mouse moves the granulocyte or macrophage. The game's play scene takes place when a sharp, thorn-like splinter protrudes in the blood stream. The objective for winning the first phase is to eliminate enough bacteria until a safe level of bacteria in the blood stream is achieved. This mission phase is timed. The players may know their speed in comparison to the fastest players of the game that week. Losing the game occurs when there is bacteria overload. During the second phase, or mission, of the game, phagocytes in the forms of aquamarine-colored cells, called macrophages, and blue-colored cells, called dendrite cells, continue to eliminate bacterial cells by "eating" them. Once sufficient bacteria are eliminated, the macrophages and dendrite cells flash as an alert. In the final play of

the game, these phagocytes need to alert the rest of the immune system. The brain, heart, and lymphatic system are presented here. In order to win, the player needs to select the correct organ or systems, in this case, the lymphatic system, to which these cells should be sent (Nobel Foundation, 2006).

Two horizontal bar indicators lay adjacent to the play fold of the game. A mini-map bar indicates the presence of bacteria and phagocytes (granulocytes during the first mission and granulocytes, macrophages, and dendritic cells during the second mission) along the entire bloodstream of the game. A rectangular area along the bar indicates the specific area of the field of play at that moment. The bacteria level bar ranges from *safe* to *overload*. When the indicator extends to *overload*, it indicates excessive bacteria, resulting in severe illness, and the game abruptly ends. A shorter play time indicates greater effectiveness in eliminating the bacteria threat. After the successful completion of both sections of the game, the player is given a bonus question. When correctly answered, each bonus question reduces the total play time by 30 seconds (Nobel Foundation, 2006).

## Debriefing

The debriefing followed the seven-point debriefing patterns used in the dengue game study (Lennon & Coombs, 2005) and the malaria games study (Lennon, 2006). In this debriefing, the word *game* was substituted for the word *malaria* or *dengue* of the previous debriefing studies. Also, an eighth question about game interest was included. See the appendix for the debriefing questionnaire.

## Procedures

The researcher obtained parental consent and the participant's asset prior to the initiation of the study. Pregame orientation, game play, and debriefing were accomplished in a home setting. Prior to the play of the ISD Game, the participant read briefly for three minutes an information section about immunity provided by the game's Web site (Nobel Foundation, 2006). The participant read the game rules and then played the game for approximately eight minutes. The participant played the granulocyte portion of the game, followed by the macrophage portion of the game. After the game's play, the participant completed the debriefing form for approximately three minutes (see appendix). After the written debriefing, the researcher conducted a follow-up oral debriefing for approximately five minutes. The researcher asked the participant to elaborate if possible with answers to questions, such as by asking, "What did you mean by that?" or "Can you add to what you just wrote?" The participant's comments were recorded by the researcher after the oral debriefing. The play of the game and debriefing were conducted in an informal setting.

## Findings: Details of Responses

1. Written debriefing: As a review, in your own words, what was the game activity all about?

“It was an overview on the body’s immune system and how it reacts to invaders such as viruses.”

Oral debriefing (follow-up):

“Also, germs and bacteria.”

2. Written debriefing: How did you feel after the game?

“Not satisfied.”

Oral debriefing (follow-up):

“Because in the playing, I didn’t learn anything. The information [before the game] gave me the learning content. . . . From the play aspect, the play seemed repetitive. It wasn’t difficult. It was not a test of information, but a test of clicking ability. Probably, my 12-year-old sibling could do this.”

3. Written debriefing: Did you like the game? Why or why not?

“It was the same thing over again, which was a little boring.”

Oral debriefing (follow-up):

“Because it was very simple and short, with a couple levels. A high schooler probably wouldn’t enjoy playing it for fun.”

4. Written debriefing: Did the game cover anything about the game’s topic that is important to you? If so, please explain.

“No.”

Oral debriefing (follow-up):

“Not from the game’s play. But, from the reading [prior to the game’s play], yes. The game reinforced some of the things I already knew, such as how the defenders go to attack the invaders.”

5. Written debriefing: Did you learn some new things about the game’s topic? If so, please explain.

“The way the body’s cells alert the rest of the body to foreign invaders.”

Oral debriefing (follow-up):

“Some specific names, such as helper T cells. But, it wasn’t clear their proper role. Their description didn’t really help in the playing.”

6. Written debriefing: Are there some more things you would like to know about the game’s topic?

“The pioneers in research of the immune system.”

Oral debriefing (follow-up):

“Perhaps integrate this [about immune system pioneers] more into the game. Also, how viruses invade and attack. It was mentioned briefly. But, wish it got into more detail. Maybe, add different things that attack, and actual names of the bacteria.”

7. Written debriefing: Is there anything you can suggest to make the game better?

“Change the game play. It was the same both times. The directions were a little unclear.”

Oral debriefing (follow-up):

“Basically it was a 2D scroller. I would like more information as I play. The directions seemed confusing.”

Also the participant wanted to know,

“How many of the invaders there were? They didn’t explain the health threat clearly. They assumed too much on the germ bar. I would like to see more action in response to the invader, like fever, like a form of a cold on a flu to combat. Maybe, I would like to see how an antibody or medicine affects the germs. Also, how the germs mark the cells.”

8. Written debriefing: What is your favorite game?

“HALO game. It is played on the Xbox. I played this for one to two years.”

Oral debriefing (follow-up): Why?

“Because you can do other actions besides point and click. You can throw, fly, ride vehicles, and have different levels. You can also play online.”

Learn anything from it?

“No, but I was able to learn basic strategy.”

## Discussion

The participant neither enjoyed nor was satisfied with the ISD Game. For the participant, the game seemed repetitive, simple, and below the participant's age and ability. The participant further complained that the game was not multileveled. Though the game had two scenarios or missions, the rather repetitive play activities were simple compared to the participant's play experience with other gaming systems. This was in contrast to the experience of the participant in the malaria games debriefings, who enjoyed the games (Lennon, 2006).

Game playing skill apparently was not a factor in enjoyment perceptions about the games by the participant of the ISD Game and the participant of malaria games, as both participants were experienced gamers. Perceptions of faster game play, clearer rules, success in winning, and multiple game obstacles contributed to the participants' enjoyment of the malaria games (Lennon, 2006), whereas those attributes and perceptions were absent according to the participant of the ISD Game.

The participant indicated that important information about the immune system's defense was obtained from the pregame reading material but not from the game's play. From the participant's perspective, the game reinforced prior knowledge from the game activity the participant learned about the role of immune cells in alerting the rest of the body to foreign invading cells as well as new terms, such as helper T cells. While the role of immune cells to alert the body of foreign invaders was identified by the participant, it was curious that its importance was not acknowledged.

The role of the helper T cells was unclear to the participant. It was not so stated in the ISD Game. Likewise, the Nobel Foundation (2005) presented T cells and macrophages in its PARASITE Game. However, the specific roles of these immune cells were also not discussed or demonstrated within the game.

Nobel Foundation's (2006) ISD Game paralleled Mechnikov's experiment where phagocytes formed around a thorn inserted in a sea star larva. This information would not be known to participants if they did not read the information section about pioneers on the Web page. Since the participant indicated that he would like to know more about the immune system pioneers, perhaps explicit information about the immune system pioneers could be included in the game content or connected directly to the game as a postgame feature option.

To improve the game, the participant wanted a further explanation of the health threat. Also, to improve the play of the game, the participant wanted to give variety to the play of the game. For example, the participant suggested the inclusion of a variety of pathogens, such as viruses, in addition to bacteria. It was interesting that the participant suggested that the fever response to an invading pathogen ought to be included for one of the game's scenarios. The participant also wanted to inject some realism into the game, for example, showing the body's combat of an actual illness, such as the common cold, and the effects of medicines on pathogens.

The ISD Game lacked content checks during the play of the game. This followed flow theory concepts, where it is suggested that uninterrupted activity optimizes experience (Csikszentmihalyi & Csikszentmihalyi, 1990; Habgood et al., 2005). To the contrary, the participant suggested as a game revision to provide additional information during the game's play. This appeared contrary to flow theory. However, the inclusion of informational enhancers during the play of the game may be done without interrupting the game, thus consistent with flow theory.

Written debriefing resulted in generally longer responses for the participant with the ISD Game compared to another participant's oral debriefing responses to the PARASITE Game, though not to those responses to the MOSQUITO Game (Lennon, 2006). Written debriefing responses to Debriefing Items two and four were strikingly brief, two words and one word, respectively. However, the oral debriefing follow-up produced overall longer responses than those of the written debriefing to the ISD Game as well as the responses to the MOSQUITO Game and the PARASITE Game (Lennon, 2006). Perhaps the written debriefing provided a framework for the participant to initially concentrate or organize their thoughts. The follow-up was necessary to bring out the participant's thoughts after the initial reflection. This study demonstrated the utility of debriefing to enrich the learning experience as well as generate ideas for game design improvement through participant reflection. While written debriefing was valuable to initiate the reflection process, a later follow-up debriefing—in this case, an oral debriefing—clarified and expanded the participant's comments. Further research will be helpful to explore the manner of the most appropriate follow-up debriefing, written or oral.

Written debriefing is a helpful tool, though immediately postgame, it may not generate sufficient responses. However, debriefing, particularly, written debriefing with a second-step follow-up, is valuable for games such as the ISD Game or any of the Nobel Foundation games. Debriefing of the ISD Game should be conducted either by a facilitator or by an online component connected to the game. Finally, facilitators or the game itself should include multiple postgame evaluative questions about immunity and about how immunity may protect and enhance one's health.

## Appendix Debriefing Questionnaire

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1. As a review in your own words, what was the game activity all about?
  2. How did you feel after the game?
  3. Did you like the game? Why or why not?
  4. Did the game cover anything about the game's topic that is important to you? If so, please explain.
  5. Did you learn some new things about the game's topic? If so, please explain.
  6. Are there some more things you would like to know about the game's topic?
  7. Is there anything you can suggest to make the game better?
  - \*8. What is your favorite game? \*Asked only in oral debriefing.
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