Serious Game Stakeholder Experience Assessment Method (SGSEAM) User Guide

Yongwen Xu, Philip M. Johnson, Carleton A. Moore, Robert S. Brewer

Collaborative Software Development Laboratory
Department of Information and Computer Sciences
University of Hawai'i at Manoa
{yxu, johnson, cmoore, rbrewer}@hawaii.edu

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1. SGSEAM Overview

One of the benefits of using a serious game framework is that, if correctly designed, it will provide useful and reusable "building blocks" with which to develop a variety of serious games. Yet how are we to know if a serious game framework has been "correctly designed"?

Serious Game Stakeholder Experience Assessment Method (SGSEAM) describes a method for assessing serious game frameworks from the stakeholder experience perspectives. The goal of SGSEAM is to identify (a) major strengths of a serious game framework, which aids the community by indicating features of the framework to emulate, and (b) major shortcomings of the framework, which aids the community by indicating features to avoid. The benefits of SGSEAM assessment are for the developers of serious game frameworks to learn and improve from the findings of the assessment.

SGSEAM is an assessment method instead of an evaluation method. The main purpose of an evaluation is to determine the quality of a program by formulating a judgment. An assessment, on the other hand, is nonjudgmental. SGSEAM does not try to judge a framework according to a standard, or to compare one framework against another. Instead, it is used to identify the major strengths and shortcomings of a framework to benefit the developers of the framework.

Figure 1.1 outlines the steps of the process of applying SGSEAM to a framework.

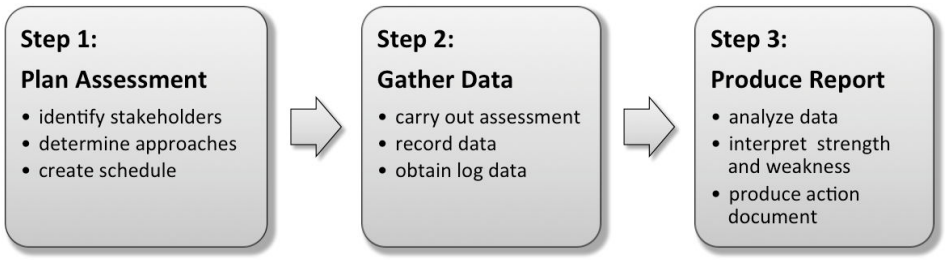

Figure 1.1: Applying SGSEAM to a framework

There are three steps in the process of applying SGSEAM. Step one is to plan the assessment, including identifying the stakeholder and participants and creating the assessment plan. The deliverable for this step is the assessment plan document. Step two is to gather data. The deliverable for this step is the assessment data repository. Step three is to produce the strength and weakness report. The deliverable for this step is the action document for framework improvement. The following chapters describe the steps in details.

2. Plan Assessment

2.1 Identify stakeholders

Identify the stakeholders in each SGSEAM stakeholder class, write down their names and roles.

SGSEAM assesses the experiences for the stakeholders listed in Table 2.1. For each stakeholder, identify the population, the name and contact if possible. It is important to be able to contact the stakeholders in some way, either via email or phone, to get the feedback from their experiences with the framework.

Stakeholder class	**Definition**	**Examples**
Players	participate in the game produced by the framework.	students, residents
System admins	install and maintain the technological game infrastructure.	system admin, IT staffs
Game designer	design the content and game mechanics.	instructional designers, content experts
Game managers	manage the game during the period of game play.	sustainability coordinators, residential staffs
Game developers	develop customization, extend and enhance the game.	programmers, internal developers

Table 2.1: SGSEAM Stakeholders

2.2 Determine assessment approach

Determine the appropriate assessment approaches for each stakeholder.

There are usually multiple assessment approaches for each stakeholder. Table 2.2 provides an overview of the assessment method and the approaches. The appropriate assessment approaches should be determined according to the resource available. The approaches for a stakeholder is additive. The more approaches applied, the higher confidence of the assessment can be achieved.

The assessment approaches is categorized into in-vivo and in-vitro assessments. The in-vivo approaches, such as pre-post test, in-game surveys and post-hoc interviews, assess the real world instance of the game. The in-vitro approaches use in-lab experiments in a simulated

Stakeholder	Assessment goal	Assessment approaches
Player	Determine the extent the framework affect and engage players.	Pre-post effectiveness study(2.2.1.1); Self-reported usability metrics(2.2.1.2); Engagement metrics(2.2.1.3)
System admin	Determine strengths and weaknesses in system install and maintenance.	Post-hoc admin interview(2.2.2.1); In-lab system admin study(2.2.2.2)
Game designer	Determine strengths and weaknesses in facilitating the game design process.	Post-hoc designer interview(2.2.3.1); In-lab game design study(2.2.3.2)
Game manager	Determine strengths and weaknesses in managing the game.	Post-hoc manager interview(2.2.4.1); In-lab game management study(2.2.4.2)
Game developer	Determine strengths and weaknesses in developing system enhancement.	Post-hoc developer interview(2.2.5.1); In-lab game development study(2.2.5.2)

Table 2.2: SGSEAM approaches

environment. Different assessment approaches will have different levels of rigor or validity. For example, the in-lab experiments (in-vitro) can enlist several subjects to perform the same pre-defined tasks and collect comparable data in a more controlled setting. It is rigor because of the generality achieved from the larger population of participants under study. On the other hand, in-game surveys or interviews in the in-vivo approach typically collect data from different uncontroled settings with less rigor. But the in-invo data reflect the real world interaction between the stakeholders and the framework, thus provides better insights in the real world settings.

The following sections describe in detailed the different approaches for each stakeholder. Each assessment approach describes the goal of the assessment, what data to collect, how to collect the data and how to analyze the data to obtain insights about the strengths and weaknesses of the framework from each stakeholder's perspective.

2.2.1 Player assessment

The goal of player assessment is to determine the effectiveness of the game framework from player's perspective. It is essential that a game produced by a serious game framework could achieve its intended "serious" purpose. The intended purposes of serious games are always subject specific. For example, the desired effect of a serious game for energy education and conservation is to increases players' energy literacy and reduces their energy consumption during (and, hopefully, after) the game. A serious game for language learning would have a very different desired effect. SGSEAM proposes three approaches for assessing the effectiveness from player's perspective.

2.2.1.1 Player assessment approach: Pre-Post effectiveness study

This approach requires users of SGSEAM to first determine a set of domain-specific questions to assess the desired effects of their serious game. For example, a set of questionnaires on

sustainability literacy, such as knowledge of power and energy, is used to assess the effectiveness of a serious game for sustainability education.

Once the domain-specific questionnaires are determined and designed, present this questionnaires as a survey to a random selection of the players before the game starts. After the game ends, present the same survey to the same players again. Compare the two set of survey response data to study if the game has an impact on the players regarding to the survey subjects. The extent of the changes reflected in the survey result indicates the degree of effectiveness of the serious game for this subject.

Serious games often engage players with resources of various types (energy, water, waste, etc.). Collect these measurements before, during, and after the game in order to acquire evidence regarding the potential impact upon player use of these resources.

2.2.1.2 Player assessment approach: Self-reported usability metrics

This approach interviews players about their self-reported experiences with the game. Administrate the interview through online survey or face-to-face conversation, although we found that online survey is more cost effective than face-to-face conversation. If possible, implement the online survey as an activity inside the game. For example, the Makahiki serious game framework implements an online survey activity which incentivizes players to complete the survey by rewarding game points for the activity.

Use the usability questionnaires in Figure 2.1 in the online survey or face-to-dace interview:

1. What did you like most about the game?
2. What did you found confusing?
3. What issues did you have while using the game?
4. What was the thing you liked the least about the game?
5. What can we do to improve the game?
6. It was easy to find what I was looking for on the website.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
7. The website was responsive.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
8. The website provided adequate help in teaching me how to play.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
9. I understood how to play.
   Strongly disagree - Disagree - Neutral - Agree - Strongly agree
10. this is something my friends should participate in.
    Strongly disagree - Disagree - Neutral - Agree - Strongly agree

Figure 2.1: Player self-reported usability metrics questionnaires

2.2.1.3 Player assessment approach: Engagement metrics

This approach calculates the engagement metrics to assess the extent of engagement from players and the impact of the game. The more engaging the game is, the more potential impact could be to the players.

Calculate as many as possible the player engagement metrics described in Figure 2.2 by analyzing the data from system log or other channels provided by the framework. The more metrics obtained, the better understanding of the extent of player engagement.

Metric	Definition	Mesure
participation	percentage of players who play the game	the level of involvement from players
player	number of players per day	the frequency of players interact with the game
play time	play time of a player per day	the frequency of players interact with the game
submission	submissions of all player per day	the rate of players' completion of game activities
social interaction	social interaction of all player per day	the rate of in-game social interactions between players
game error	game errors per day	the rate of errors encountered by players during the game

Figure 2.2: Player engagement metrics

With the exception of the game error metric, the higher value these metrics are, the higher engagement level the game has.

2.2.2 System admin assessment

System administrators are responsible for installing and maintaining the software infrastructure for the game. Their tasks include the framework and dependency installation, maintain the database, backups, and so forth. The goal of system admin assessment is to determine to what extent the framework facilitates the system administration tasks from system admin's perspective. SGSEAM assesses how much time is required to install and maintain an instance of a serious game using the framework and the problems encountered during the system admin process.

SGSEAM proposes two assessment approaches.

2.2.2.1 System admin assessment approach: Post-hoc admin interview

This approach assesses the system admin's experience using the post-hoc interview. The system admins are asked about their experience with the framework after they completed the installation and maintanence in the production system. The interview questions are described in Figure 2.3.

The interview should be tape-recorded. Once the interview is completed, qualitative data analysis is performed against the interview data by doing: (1) transcribing the recordings; (2) coding (categorizing) the time and problems or difficulties encountered. These data reveal the strengths, weaknesses and the areas of improvement for the framework.

1. How much time did you require to install the system and the dependencies?
2. What problems did you encounter when installing the system and the dependencies?
3. How much time did you require to maintain the system?
4. What problems did you encounter when maintaining the system?
5. Did you find it difficult to admin the system? What was difficult?

Figure 2.3: System admin interview questionnaires

2.2.2.2 System admin assessment approach: In-lab system admin study

This approach assesses the system admin's experience using the in-lab experimental study. First identify a group of participants who have some levels of system administration experience. Second, provide instructions on each installation steps, ask the participants to install the system according to the instructions, and ask them to record the time spent and problems encountered as they complete each step.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

2.2.3 Game designer assessment

A game designer uses the serious game framework to design and create a serious game. A serious game framework normally provides tools or interfaces for game designers to facilitate the design of a game. For example, the framework provides interface to configure the game period, set up players, and tools to design individual game elements.

The goal of SGSEAM game designer assessment is to determine the strengths and weaknesses of the framework regarding to the game design process. SGSEAM assesses the game designer stakeholder by addressing the following two questions: (a) How much time is required to design an instance of a serious game using the framework? and (b) How many, and how problematic are the errors that designers encounter during the design process?

There are two approaches for game designer assessment:

2.2.3.1 Game designer assessment approach: Post-hoc designer interview

This approach interviews the game designer(s) after they had completed the design of a serious game using the framework in a production system. The interview includes the questions described in Figure 2.4.

1. How much time did you spend to complete each design task?
2. What problems did you encounter?
3. Did you find it difficult to configure? What was difficult?
4. Did you find it difficult to design a specific game? Which one, and what was difficult?

Figure 2.4: Game designer interview questionnaires

The interview should be tape-recorded. After the interview, transcribed the recordings, code and categorize the reported time and problems to identify the strengths and weaknesses.

In addition, if possible, collect the system log data related to the game designing tasks, analyze the logs to find out the time spent and error encountered during the game designing tasks. Use the log data to verify the findings from the interview data.

2.2.3.2 Game designer assessment approach: In-lab game design study

This approach assesses the game designer experience using the in-lab experimental study. First identify a group of participants who are somewhat familiar with the subject domain of the game. Second, provide instructions on each designing steps, ask the participants to design the game according to the instructions, ask them to record the time spent and problems encountered as they complete each step.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

2.2.4 Game manager assessment

A game manager uses the serious game framework interface to manage the serious game that the game designers created. It is possible that a game manager is also the game designer. The examples of game management tasks includes managing player submissions, monitoring the game state, entering manual resource data, notifying winners of the game, etc.

The goal of SGSEAM game manager assessment is to determine the strengths and weakness of the framework regarding to the game management process. Similar to the assessment of the game designer, SGSEAM assesses the game manager stakeholder on the time it required to manage an instance of a serious game using the framework and the problems encountered during the managing process.

SGSEAM proposes three approaches for assessment game manager's experience.

2.2.4.1 Game manager assessment approach: Post-hoc manager interview

This approach interviews the game manager(s) after they had managed a serious game using the framework in a production envrionment. The interview questions are described in Figure 2.5.

1. How much time did you spend to complete each managing task?
2. What problems did you encounter?
3. Did you find it difficult to manage? What was difficult?

Figure 2.5: Game manager interview questionnaires

The interview should be tape-recorded. After the interview, transcribed the recordings, code and categorize the reported time and problems to identify the strengths and weaknesses.

In addition, if possible, collect the system log data related to the game managing tasks, analyze the logs to find out the time spent and error encountered during the game managing tasks. Use the log data to verify the findings from the interview data.

2.2.4.2 Game manager assessment approach: In-lab game management study

This approach assess the game manager's experience using the in-lab game management study. First identify a group of participants who are somewhat familiar with the subject domain of the game. Second, provide instructions on each managing tasks, ask the participants to complete the tasks following the instructions, ask them to record the time spent and problems encountered as they complete each task.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

2.2.5 Game developer assessment

The game developer stakeholder is different from the game designer stakeholder, in that the game designer stakeholder tailors the framework without requiring any software development, while the game developer stakeholder enhances, corrects, and extends the system by manipulating code.

To investigate how easy it is to understand, extend, and debug a serious game framework from a developer's perspective, SGSEAM assesses how much time it takes to develop an enhancement to the game framework, and how many errors are encountered during the development process.

2.2.5.1 Game developer assessment approach: Post-hoc developer interview

This approach interviews the game developer(s) to assess their experiences of developing the game using the framework. The interview questions are described in Figure 2.6.

1. How much time did you spend developing a customization using the game framework?
2. What problem(s) did you encounter?
3. Did you find it difficult to understand, extend and debug the system? What was difficult?

Figure 2.6: Game developer interview questionnaires

2.2.5.2 Game developer assessment approach: In-lab game development study

This approach assess the game developer's experience using the in-lab game development study. First identify the general development skills that the framework requires, such as the programming language. Second, identify a group of participants who have some levels of the required development skills. Third, provide requirement specification or instructions on how to develop a new enhancement to the system, ask the participants to complete the task, record the time spent and problems encountered as they works on the task.

Once the experiment data is collected, categorize the reported problems and correlated with the reported time data to identify the areas of strength (less time spent) and weakness (more time spent and problems or difficulties).

2.3 Choose participants

Identify participants from each stakeholder class, Contact them and get consents for their participation.

Once the assessment approaches are determined for each stakeholder class, the next step is to choose participants. Identify the people from the each stakeholder class that may be willing to participate in the assessment, contact them and get consents for their participation.

For example, in the case of pre-post effectiveness study approach for player assessment, this step randomly chooses a group of players and present a consent form before the online survey. In the case of post-hoc game designer interview approach, the game designer of a real world game instance of the framework should be identified, contacted and consent for the participation in the assessment. When the in-lab game development experiment study is chosen, a group of game developers that meet the required development skills of the framework should be identified and contacted.

2.4 Create assessment plan

Create a schedule for each assessment, produce the assessment plan document.

Once we decide what the assessment approaches and who the participants are, the next step is to create the assessment schedule and produce the assessment plan document. The document should include the detailed assessment plan for each stakeholder class.

Depends on the assessment approach, the actual tasks of the assessment are different. The player pre-post effectiveness study requires the administration of online survey before and after the game. The game designer post-hoc interviews requires administration of interviews to the real world game designers of a production system. Figure 2.7 shows an example of the assessment schedule broken down in the tasks in the plan document.

Game design assessment approach: in-lab experiment study		
Task	**Estimated Start date**	**Estimated End date**
Design the in-lab experiment instruction		
Ask participants to follow the instruction		
Collect response data from participants		
Obtain log data		
Analyze the data		
Interpret strength and weakness		
Produce action document		

Figure 2.7: Assessment schedule in the plan document

3. Gather Data

This step carries out the assessment, record the data, obtain log data, and refine the assessment plan if necessary. The output of this step is a data repository contains all the assessment data that can be analyzed in the next step.

3.1 Carry out the assessment

Carry out the assessment as described in the assessment plan.

For each assessment approach, complete the tasks outlined in the assessment plan, gather the data when carrying out the assessment. In the case of game designer post-hoc interview approach, record the interview and take notes if necessary. Store all the data into a central data repository.

In the example of the in-lab game design experiment study, a google form is designed to give detailed step by step instructions for the participants to design games using the framework. Participants are asked to record the time they spent completing each step and the problems they encountered. They are also asked to provide feedback about their design experiences in the form of blog posts.

3.2 Obtain log data

Obtain the log data from the framework, including all the interaction log from the each stakeholder.

Talk to the technical staffs of the framework to find out what kind of log data is available. Obtain the log data in a format that is easy to analyze. For example, if the log data is in a database table, ask for the access to the table, or the CSV export of the table data. If the log data is in a log file, ask for the access to the file. Store the log data into the central data repository.

4. Produce Strength and Weakness Report

This step analyzes all the data gathered from previous steps, interpret the strengths and weakness of the framework, and produce the action report regarding to what areas of the framework needs to improve on.

4.1 Analyze data

Analyze the data from the data repository.

This step performs the data analysis from the data repository obtained from the previous step. For game designer assessment, perform queries from user interaction log data to find out the completion time for a certain user interaction task, for instance, the time for a game designer to complete the configuration of global game settings. For player assessment, calculate the engagement metrics from the game log. For post-hoc interview assessment approach, first transcribe the interview recording into text, code and categorize the responses from the interview questions.

In the example of the in-lab game design experiment study described previously, the assessment data is generalized into 7 tasks corresponding to distinct types of game design tasks. The time for each task is calculated from the Google form responses. The problems reported from the participants are coded and aggregated into the the problems areas.

4.2 Interpret strength and weakness

Interpret strengths and weaknesses of framework from the data analysis.

From the data analysis step, identified the problem areas which are indicated by having the most reported problems and the longest completion time.

In the example of the in-lab design experiment study, there may be a problem area that had been reported by the most numbers of participants, and this problem happened in one of the tasks that took the longest time to complete, we could identify a weakness area of the framework from the perspective of game designer. If there were no problem reported in some game design tasks and the time to complete is short, we could consider those areas are the strengths of the framework.

4.3 Produce reports with actionable steps

Produce the action reports for any improvement identified from the strength and weakness analysis.

Once the strength and weakness of the framework are identified from the data analysis, an action report should be produced. This report includes the weakness areas that can be improved and actionable steps on how to improve from each stakeholder's perspective. It also includes the strength areas that the framework needs to maintain.

By producing the report with actionable steps to improve the framework, the SGSEAM assessment is completed.