MAKAHIKI AND SGSEAM: A SERIOUS GAME FRAMEWORK FOR SUSTAINABILITY AND STAKEHOLDER EXPERIENCE ASSESSMENT METHOD

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CHAPTER 1
MAKAHIKI AND SGSEAM EVALUATION

This chapter describes the way I evaluated the Makahiki framework described in **??** and the SGSEAM method described in **??**. First, I describe the Real-world case studies of Makahiki instances realized in the Kukui Cup Challenge at the different organizations, followed by the detailed assessment of applying SGSEAM to Makahiki. The evaluation is to address: (a) obtain insights about the strength and weakness of the Makahiki serious game framework, (b) obtain insights about the strength and weakness of SGSEAM serious game framework assessment method.

1.1 Real-world Makahiki Instances Case Studies

Makahiki, as a serious game framework for sustainability, had been used by different organizations to create multiple serious game instances targeting to educate and foster sustainable behavior among the communities. The first Kukui Cup Energy challenges at the University of Hawaii at Manoa (UHM) were held in 2011 for 3 weeks for over 1,000 first year students living in the residence halls. UHM subsequently held the second and third Kukui Cup Energy challenges in 2012 and 2014 for different first year students and different durations, for 9 months and 2 weeks respectively. Hawaii Pacific University (HPU) held their Kukui Cup Energy challenge in Fall 2012 and 2013 for about 200 students each year. An international organization called the East-West Center (EWC) held a Kukui Cup Energy and Water challenge for the international residents living in the residenct halls. An Hawaii private school called Holy Nativity School (HNS) held a pilot Kukui Cup challenge for the middle school students. Table Table 1.1 lists these instances and their different requirements.

Instances	Duration	Populations	Resource	Smart meters	Hosting
UHM 2011	3 weeks	1038	Energy	Yes	Local
UHM 2012	9 months	1067	Energy	Yes	Cloud
UHM 2014	2 weeks	1056	Energy	Yes	Cloud
HPU 2012	3 weeks	198	Energy	Yes	Local
HPU 2013	3 weeks	197	Energy	Yes	Local
EWC 2012	2 weeks	129	Energy and Water	No	Cloud
HNS 2013	4 weeks	10	Energy	Yes(simulated)	Cloud

Table 1.1: Makahiki Serious Game Instances

1.1.1 University of Hawaii at Manoa

1.1.2 Hawaii Pacific University

1.1.3 East-West Center

1.1.4 Holy Nativity School (Pilot Instance)

1.2 Applying SGSEAM to Makahiki

This section describes in details the application of SGSEAM to assess the Makahiki framework in order to identified the strengths and weaknesses of both the Makahiki and the SGSEAM itself.

In Spring 2012, Professor Philip Johnson at the Information and Computer Science Department of University of Hawaii used Makahiki to teach a course in serious game development. The students were seniors or graduate students majoring in computer science related fields. During the course, the students installed Makahiki, designed a serious game instance with Makahiki, and developed an enhancement to the Makahiki system.

These students participated in the assessment experiments of Makahiki, in the aspects of system admin efficiency, game designer efficiency and developer efficiency. The participation is voluntary. This is considered as an in-lab experiment since they are evaluating Makahiki in a class setting and using Makahiki in the development environments.

Stakeholder class	Tasks	Role
Player	Participate in the Makahiki games	Students living in the residential halls
System admin	Install Makahiki software, minitor and scale the system, backup, patch maintenance	IT staffs
Game designer	Design the content, configure suitable games and mechanics	Challenge organizers
Game manager	Manage the game during the period of game play.	Challenge organizers
Game developer	Develop customization, extend and enhance the game and framework.	Makahiki developers

Table 1.2: SGSEAM Stakeholders

1.2.1 SGSEAM Stakeholders in Makahiki

1.2.2 SGSEAM Approach for Makahiki

Stakeholder	Assessment approaches	Expected Outcomes
Player	Pre-post effectiveness study(**??**)	Determine effectiveness in energy literacy and resource usage reduction
	Self-reported usability metrics(**??**)	Identify problem areas in game interface
	Engagement metrics(**??**)	Determine the extent of engagement
System admin	Post-hoc admin interview(**??**)	~~Determine strengths and weaknesses in system~~ install and ma
	In-lab system admin study(**??**)	
Game designer	Determine strengths and weaknesses in facilitating the game design process.	Post-hoc designer interview(**??**); Game design log data analysis(**??**); In-lab game design study(**??**)
Game manager	Determine strengths and weaknesses in managing the game.	Post-hoc manager interview(**??**); Game management log data analysis(**??**); In-lab game management study(**??**)
Game developer	Determine strengths and weaknesses in developing system enhancement.	Post-hoc developer interview(**??**); In-lab game development study(**??**)

Table 1.3: SGSEAM approaches

1.2.2.1 Player assessment

I applied the SGSEAM player assessment mechanism to the 2011 real-world Kukui Cup instance at the University of Hawaii at Manoa to study the player's experience with the Makahiki framework. There are over 1000 eligible players for this instances. They are the first year college student living in four similar structured resident halls in close vicinity. The challenge lasted for 3 weeks. Makahiki system recorded detailed logging data from every interaction between the players and the website.

To assess the effectiveness of the framework for designing games that improve player literacy in sustainability, we conducted two energy literacy surveys, one before the challenge (pre-game) and one after the challenge (post-game). SurveyGizimo is used to create the surveys which consists of the set of sustainability literacy and behavior questionnaires. The response from the two surveys are analyzed to provide insights about the player's literacy and behavior change.

To assess the effectiveness of the framework for designing games that produce positive change in sustainability behaviors, we recorded and analyzed energy consumption data before, during and after the challenge. Before the challenge, an energy usage baseline was established. The energy consumption data is examined to understand any usage pattern or reduction during and after the challenge.

To assess the usability of the game produced by the Makahiki framework, we conducted the in-game usability survey. The survey asked the questions about the players' experience about the user interface of the game. The response from the survey is analyzed to provide insights about the game usability.

In addition to the surveys and energy data measurement, the following engagement metrics is calculated based on the log data to assess the engagement level of the instance:

- active participation rate
- number of players per day
- average session time
- submissions per day

- level of social engagement
- website errors

1.2.2.2 System admin assessment

There are two approaches described in SGSEAM to assess the system admin's experience: One is the experimental case study that uses the in-lab experiments, another is the interview of the system admin of a real world instance.

In the in-lab experiments, the students in the ICS691 Spring 2013 class were tasked with installing the Makahiki system into their local computers as well as the cloud environment. In order to understand how much time it takes to install the Makahiki and what problems might be encountered, I design a Google form which details the steps of installing Makahiki both locally and in the cloud, and for each step, I ask the students to record the time they spent and the problems they encountered.

Figure 1.1 illustrates a partial google form used for Makahiki system admin assessment. Appendix B includes the complete google form.

The students were also asked to provide feedback about their installation experiences in the form of blog post. In the blog post, I ask them to discuss the following topics:

- What is the most difficult step during installation?
- What problems did you encounter during the installation?
- Have you install any database, web server or similar server products prior to this assignment? Are those installations for development or production purpose?
- If you have experience installing other servers before, How does your prior experience of installing other servers compare to the installation of Makahiki?
- What could be improved about the Makahiki installation process?
- Compare your experience of installing Makahiki in Heroku with installing it locally,

Figure 1.1: Makahiki Developer assessment Form

The qualitative data collected from the google form response and the blog post from the students will be analyzed to gain insights into how easy it is to install Makahiki, and what contributes to the efficiency of the installation.

In order to gain insights on the experience of a real world system admin who uses the Makahiki, I performed interviews to the system admins of the 2012 Hawaii Pacific University (HPU) challenges.

I will analyze qualitative data collected from the interviews and email changes. The data include:

- time taken to install the Makahiki
- time taken to maintain the Makahiki, such as backup, monitoring
- problems encountered

1.2.2.3 Game designer assessment

There are also two approaches described in SGSEAM to assess the game designer's experience: One is the experimental case study that uses the in-lab experiments, another is the interview of the game designer of a real world instance.

The students in the in-lab experiments were tasked to design a Kukui Cup like serious game using Makahiki. I designed another google form to ask students to follow the designing steps and record their time and problem encountered during their designing process. Appendix B has the complete google form for the steps the students need to follow.

The students were asked to provide feedback about their installation experiences in the form of blog post to discuss the following topics:

- What is the most difficult step during Challenge Design?
- What problems did you encounter while designed the challenge?
- What problems did you encounter while managing the challenge?
- What could be improved for the Makahiki Challenge Design process?
- What could be improved for the Makahiki Challenge Management process?

I performed interviews to the real world game designers of the 2012 Hawaii Pacific University challenges. We asked him about his game designing experiences using the Makahiki admin interface.

I analyzed both the qualitative data collected from the interviews and email changes with the game designers, and the quantitative collected from the admin interface log data. The qualitative data includes:

- How much time did you spend to configure the challenge global settings?
- how much time did you spend to setup the player data?
- how much time did you spend to design the individual games?

- What problem did you encountered?
- Did you find it difficult to configure? what is difficult?
- Did you find it difficult to design a specific game? which one, what is difficult?
- What did you like the least when using the system?

The quantitative data includes:

- time taken to configure the challenge with regarding to different designing tasks
- problems encountered in the log file

1.2.2.4 Game manager assessment

I performed interviews to the real world game managers of the 2012 Hawaii Pacific University challenges to study the experience of the game management using Makahiki.

I analyzed both the qualitative data collected from the interviews and email changes with the game managers, and the quantitative collected from the admin interface log data. The qualitative data includes:

- How much time did you spend to approving the action submissions?
- How much time did you spend to monitoring the game status?
- How much time did you spend to notifying prize winners?
- What problem did you encountered?
- Did you find it difficult to manage? what is difficult?
- What did you like the least when using the system?

The quantitative data include:

- time taken to manage the challenge with regarding to different managing tasks
- problems encountered in the log file

1.2.2.5 Developer assessment

The students in the in-lab experiment are tasked with developing an enhancement to the Makahiki instance. This involves setting up the development environment, following the tutorial to create the ”Hello world” widget using Makahiki, and finally, develop the enhancement which extends the functionality of the Makahiki system.

The students are asked to submit their development source code to the public source code repository (Github) and write a blog post to discuss their efforts to complete the development activity.

I reviewed their source code to compare their code to the reference implementation, analyze the blog post from the students, as well as any email correspondence from students discussing problems during the development.

1.2.3 Choose Assessment Participants

CHAPTER 2
RESULTS

2.1 Real World Case Studies

The successful creation of serious game challenges by three different organizations provides evidence that the Makahiki serious game engine can be tailored to the differing needs of separate organizations. First, UH uses smart meters by Electro-Industries Inc., while HPU uses smart meters by EGauge Inc., and EWC collected their energy data manually. Second, while UH and HPU challenges involved only energy consumption data, the EWC challenge involved both energy and water consumption data (which was also collected manually). Third, the IT infrastructure at UH and HPU provided authentication services using CAS and LDAP, while EWC used the built-in Django authentication. Fourth, the user interface was customized to "brand" each challenge with the logo, thematic elements, and the education contents of the sponsoring organizations.

Instances	**UHM (2011, 2012, 2014)**	**HPU (2012, 2013)**	**EWC 2012**	**HNS 2013**
Duration	(3 weeks, 9 months, 2 weeks)	3 weeks	2 weeks	4 weeks
Players	1000	190	130	10
Resource	Energy	Energy	Energy and Water	Energy (simulated)
Smart meters	Yes	Yes	No	Yes
Learning actions				
Prizes	Yes	Yes	No	No
Quest Mechanics	Yes	Yes	No	Yes
Authentication	CAS	LDAP	CAS and internal	internal
Hosting	(Local, Cloud, Cloud)	Local	Cloud	Cloud

Table 2.1: Different Configuration of Makahiki Instances

2.2 SGSEAM assessment

The following Figure 2.1 provides the overview of applying SGSEAM to Makahiki.

This chapter reports the results of the application of SGSEAM to the Makahiki framework.

We have used Makahiki to create four different Kukui Cup Energy Challenges. Kukui Cup Energy challenges were held at the University of Hawaii (UH) in 2011 and 2012 for over 1,000

Stakeholder	Assessment	Completed	Proposed work
Players	Pre Post effectiveness study	UH KC 2011	
Players	Self-reported usability metrics		UH KC 2011, 2012, 2014
	Engagement metrics		UH KC 2011, 2012, 2014
System admins	In-lab installation study	ICS691 2013	
	Post-hoc system admin interview		HPU KC 2012, 2013
Game designers	In-lab game design study	ICS691 2013	
	Post-hoc game designer interview		HPU KC 2012, 2013
Game managers	In-lab game management study	ICS691 2013	
	Post-hoc game manager interview		HPU KC 2012,2013
Developers	In-lab game development study	ICS691 2013	
	Post-hoc game developer interview		UH 2014

Figure 2.1: Status of Makahiki assessment

first year students living in the residence halls. Hawaii Pacific University (HPU) held a Kukui Cup Energy challenge in Fall 2012 for about 200 students. An international organization called the East-West Center (EWC) held a Kukui Cup Energy and Water challenge for approximately 600 international residents living in their residence halls. Since the halls did not have internet-enabled meters, resource consumption data had to be entered by the game managers manually.

The successful creation of serious game challenges by three different organizations provides evidence that Makahiki can be successfully tailored to the needs of different organizations. First, UH and HPU used different metering infrastructure, and EWC collected their resource data manually. Second, while UH and HPU challenges involved only energy consumption data, the EWC challenge involved both energy and water consumption data. Third, the IT infrastructure at UH and HPU provided authentication services using CAS (Central Authentication Service) and LDAP, while EWC used the built-in Django authentication. Fourth, the user interface was customized to "brand" each

challenge with the logo, thematic elements, and the education contents of the sponsoring organizations.

Besides the real world usage of Makahiki in the series of Kukui Cup challenges, we performed in-lab assessment experiments in 2013. Makahiki was used in a serious game development course in Spring semester of 2013 at the Information and Computer Sciences Department of the University of Hawaii at Manoa. There were a total of 8 students who participated in the experiments. The participants were either senior undergraduates or graduate students majoring in Computer Science. During the course, the students installed Makahiki, configured and designed a serious game instance with Makahiki, and finally developed an enhancement to the Makahiki framework. We asked the students taking the course to voluntarily participate in the assessment experiments of Makahiki, using SGSEAM.

2.2.1 Makahiki Player Assessment

We applied SGSEAM to assess player effectiveness during the 2011 Kukui Cup Challenge at the University of Hawaii at Manoa, a serious game implemented using the Makahiki framework. There were over 1000 eligible players for this challenge, who were mostly first year college students living in the resident halls. The challenge lasted for 3 weeks. Makahiki recorded detailed logging data from every interaction between the players and the website.

To assess the effectiveness of the framework for designing games that improve player literacy in sustainability, we conducted two energy literacy surveys, one before the challenge (pre-game) and one after the challenge (post-game). 24 players completed both surveys. Out of the total 19 energy literacy questions, the average number of questions answered correctly is 7.54 before the challenge, and 8.96 after the challenge. This result indicates an 18% improvement on the energy literacy. We also surveyed non-players as a control condition, and found that their literacy did not change, indicating that the improvement in player literacy was indeed due to the game.

To assess the effectiveness of the framework for designing games that produce positive change in sustainability behaviors, we recorded and analyzed energy consumption data before, during and after the challenge. Before the challenge, an energy usage baseline was established. During the

challenge, compared to the baseline, 12 out of the total 20 teams reduced their energy consumption, with the highest reduction of 16.1%. However, 3 teams actually increased their energy consumption, with the highest increase of 11.7%. Overall, the average reduction of the 20 teams was very low—approximately 2%.

To assess player engagement of the game, we calculated a variety of engagement metrics. The results are shown in Figure 2.2:

Measurement	MIN	AVG	MAX
Participation rate	13%	37%	74%
Number of players per day	43	85	147
Play time per day	1 min	27.7 mins	8.5 hours
submissions per day	32	266	1110
social interactions per day	51	208	468
website errors per day	0	0.6	4

Figure 2.2: Makahiki Engagement Metrics

The participation rate of this challenge is 37%, which is good compared to other sustainability challenges. Over the course of the challenge, an average player spent about 27.7 minutes per day on the website. One player spent 8.5 hours on one day. There were an average of 266 activity submissions and 208 social interactions between players per day.

In summary, SGSEAM indicates that Makahiki can be successful in achieving player engagement and literacy improvement. SGSEAM could not provide evidence of positive change in behavior.

2.2.2 Makahiki System Admin Assessment

System admin assessment was done using an in-lab experiment. Students in a serious game class were tasked with installing the Makahiki system into their local computers. In order to understand how much time it takes to install Makahiki and what problems might be encountered, we designed a Google Form explaining the steps required to install Makahiki. We asked the students to record the time they spent completing each step and the problems they encountered. We also asked the students to provide feedback about their installation experiences in the form of blog posts. [2] describes in detailed the Google Form that is used in this assessment.

The results from the Google Form responses show that the average total time to successfully install Makahiki was 1.4 hours, with a maximum time of 2 hours and the minimum time of 0.9 hour. Figure 2.3 shows the average time for each installation step.

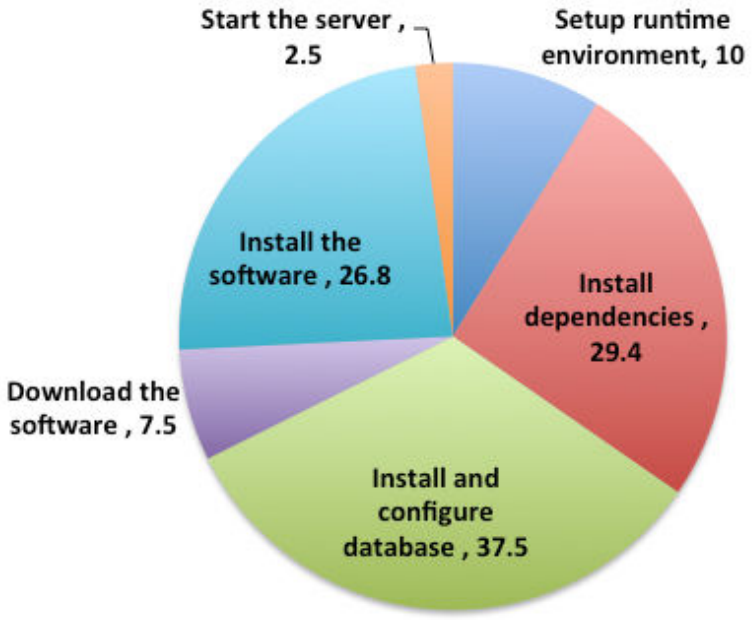

Figure 2.3: Average time (minutes) for installation steps (n=8)

We coded and categorized the descriptive problems reported by the students in both the Google Form and their blog posts. Figure 2.4 shows the result of the analysis from the feedback of the 8 students that participated in the experiment.

Problem encountered	**Number of participants**
Cannot find configuration file to edit during database installation	4
Documentation of install script is confusing about creation of the DB user	2
More parts of installation could be covered by install script	2

Figure 2.4: Makahiki Installation Analysis (n=8)

From the above analysis, we identified that the "Install and configure database" step has the longest average time. It is also has the most participant reported problems. This reflects the issues encountered by students during the configuration process. This assessment determines the areas for future improvement are (1) to improve documentation on DB installation, and (2) to improve the

install script to automate more installation tasks.

In summary, SGSEAM identified database installation as a weak point in installation. Otherwise, SGSEAM indicates generally positive results regarding Makahiki with respect to installation.

2.2.3 Makahiki Game Designer Assessment

We also used the in-lab experiment to assess the game designer experience of Makahiki. One of the class assignments for the students in the experiment was to design a serious game using the Makahiki framework. We asked the students to follow specific design steps and record the time required and any problems encountered during their design process, using a Google Form similar to the one used for the system admin assessment. In addition, students were asked to provide feedback about their design experiences in the form of blog posts. [2] describes in detailed the Google Form that is used in this assessment.

The game designer assessment was generalized into 7 tasks corresponding to distinct types of administrative tasks and game design planning. The time for each task is calculated from the Google Form results. The most time consuming task is "Smart Grid Game Design", which took average 107.9 minutes (56% of total time) to complete, while the least time consuming tasks is "Raffle Game Design", which took average 7.9 minutes (7% of total time) to complete.

Figure 2.5 shows the average time for each design tasks:

We aggregated the problems reported in the feedback of the 7 students that participated in the experiment. Figure 2.6 shows the result of the analysis:

In summary, SGSEAM revealed two shortcomings with Makahiki configuration: "Smart Grid Game Design" and "Configure Challenge Settings". Issues encountered in "Smart Grid Game Design" included 1) difficulty and lack of documentation on the predicate system used to define dependencies between game activities, and 2) difficulty in generating event attendance codes for game activities. Issues encountered in "Configure Challenge Settings" included 1) a bug in the processing of Ajax queries caused by consecutive clicks on the same interface button, and 2) a bug that prevented users with username containing capital letters from logging in.

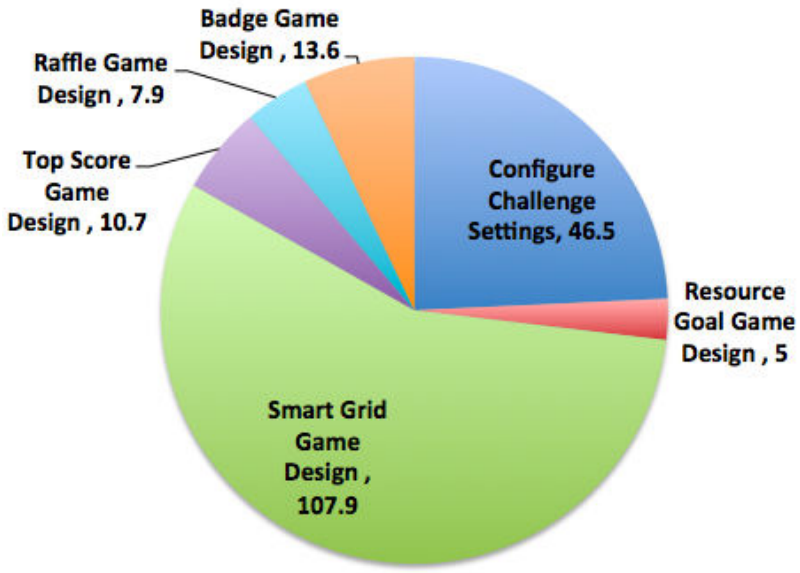

Figure 2.5: Average time (minutes) for design tasks (n=8)

Problem encountered	Number of participants
Difficulty in understanding predicate system and unlock condition	7
A bug that prevented users with usernames containing capital letters from logging in	2
A bug in the processing of Ajax queries	1
Difficulty in generating event attendance codes for game activities	1

Figure 2.6: Makahiki Game Design Analysis, (n=8)

2.2.4 Makahiki Developer Assessment

We assessed developer experience using an in-lab experiment. One of the class assignments for the students in the experiment was to develop an enhancement to Makahiki. This involved setting up a development environment, following the tutorial to create a "Hello world" widget using Makahiki, and finally, developing an enhancement to extend the functionality of Makahiki.

The students were asked to submit their development source code to the public source code repository (GitHub) and write a blog post to discuss their efforts to complete the development activity.

All 8 students reported that the first task of creating the simple "Hello world" widget was easy, while the enhancement development was hard. Only one student successfully completed all 5 re-

quired features, while the rest successfully completed 1 or 2 features. The main problem students reported was the lack of documentation for the development libraries. One student stated in his blog that he decided to choose Makahiki framework to develop his own serious game because of Makahiki's features and possibility of reducing development effort by using the framework.

In summary, SGSEAM reveals significant problems with developer efficiency. Analysis is still ongoing regarding the specific causes of problems and how best to address them.

APPENDIX A
IN-GAME QUESTIONNAIRE

This appendix details the contents of the questionnaire made available to participants via the in-game questionnaire during the challenge.

When participants filled out the questionnaire via the SurveyGizmo [1] website, the questions were broken into pages. Each page provided participants the ability to move forward to the next page in the questionnaire, but not back to previous pages.

A.1 Gamification

This section primarily covers questions about the game aspects of the challenge.

22. Have you made any commitments through the website during the game?

○ Yes

○ No

[If Yes] Did you change your behavior during the competition based on the commitment(s) you made?

○ Yes

○ No

○ Not sure

23. Which of the followings Kukui Cup achievements would you want to share on Facebook? (choose all that apply)

□ made a commitment

□ participated in an activity

□ attended an event or excursion

□ earned a badge

□ current leader in the scoreboard

□ other

24. How much time do you usually spend on the following activities?

[Options for each activity:]

1. 3 or more hours a day
2. about 1 hour a day
3. about 1 hour a week
4. 1 hour a month or less
5. never

List of activities:

- Playing games on a laptop computer
- Playing games on a game console (Xbox, PS3, Wii)
- Playing games on a handheld game device (DS3, PSP)
- Playing games on a mobile phone
- Checking Facebook
- Checking Twitter

25. How would you describe the Kukui Cup? (check all that apply)

□ Fun

□ Educational

□ So-so

□ Boring

□ Not useful

□ Difficult

□ Addictive

□ Other

26. The Kukui Cup website shows energy data updated every 15 seconds. Did you find this helpful in conserving energy?

○ not really, updating the data daily would be enough

○ not really, updating the data hourly would be enough

○ not really, I only care about the final result of the competition

○ yes, it is helpful to see the energy usage changing in real time

27. Which of the following do you wish there were more of in the game? (choose all that apply)

□ events

□ excursions

□ commitments

□ videos

□ social activities

□ physical activities

□ online activities

28. On average, how many minutes a day did you spend on the Kukui Cup website?

29. On average, how many hours a week did you spend at Kukui Cup events?

A.2 General Feedback

This section covers feedback on the challenge overall.

30. What can we do to improve participation in the Kukui Cup website?

31. What was the best thing you liked about the Kukui Cup so far?

32. What was the thing you liked the least about the Kukui Cup so far?

33. If you were able to play the Kukui Cup next year, would you?

○ Yes

○ I enjoyed it, but I wouldn't play again

○ I didn't enjoy it, and I wouldn't play again

○ No, because: _____

34. How likely would you be to recommend playing the Kukui Cup to a first year student in Fall 2012?

○ Very Likely

○ Likely

○ Neutral

○ Unlikely

○ Very Unlikely

○ Not Applicable

35. Is there anything else you would like to tell us about your experience playing the Kukui Cup that this survey didn't ask?

APPENDIX B
GOOGLE FORMS FOR IN-LAB EVALUATION EXPERIMENTS

This appendix lists the google forms that are used by the students voluntarily participated in the in-lab assessment experiments for system admin and game designer experiences.

B.1 System admin Assessment

There are two forms to assess the system admin efficiency.

B.1.1 Makahiki Local Installation Log

Please follow the steps outlined in this form to install Makahiki locally (including Virtualbox Linux Guest) and log the time you spent for each step. Please choose the closest value from the list that best matches the time you spent during the installation.

Thank you!

* Required

2.1.1.1.1.2. Install Python *

Complete the "Install Python" section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/en/late
makahiki-unix.html#install-python), record the time you spent for this section only:

- 0 minute (come with the OS install)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing Python:

2.1.1.1.1.3. Install C Compiler *

Complete the ”Install C Compiler” section in Makahiki Local Installation Manual(http://makahiki.readthedocs.org/en
makahiki-unix.html#install-c-compiler), record the time you spent for this section only:

- 0 minute (come with the OS install)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing C compiler:

2.1.1.1.1.4. Install Git *

Complete the ”Install Git” section in Makahiki Local Installation Manual(http://makahiki.readthedocs.org/en/latest/in
makahiki-unix.html#install-git), record the time you spent for this section only:

- 0 minute (come with the OS install)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing Git:

2.1.1.1.1.5. Install Pip *

Complete the ”Install Pip” section in Makahiki Local Installation Manual(http://makahiki.readthedocs.org/en/latest/in
makahiki-unix.html#install-pip), record the time you spent for this section only:

- 0 minute (Already installed from previous assignments)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing Pip:

2.1.1.1.1.6. Install Virtual Environment Wrapper *

Complete the ”Install Virtual Environment Wrapper” section in Makahiki Local Installation Manual(http://makahiki.r
makahiki-unix.html#install-virtual-environment-wrapper), record the time you spent for this section
only:

- 0 minute (Already installed from previous assignments)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record the problem you encountered when installing virtual environment wrapper:

2.1.1.1.1.7. Install Python Imaging Library *

Complete the ”Install Python Imaging Library” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/en/latest/installation-makahiki-unix.html#install-python-imaging-library), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing Python imaging library:

2.1.1.1.1.8. Install PostgreSQL *

Complete the ”Install PostgreSQL” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/e
makahiki-unix.html#install-postgresql), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing PostgreSQL:

2.1.1.1.1.9. Install Memcache *

Complete the ”Install Memcache” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/en
makahiki-unix.html#install-memcache), record the time you spent for this section only:

- 5 minutes

- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing Memcache:

2.1.1.1.1.10. Download the Makahiki source *

Complete the ”Download Makahiki source” section in Makahiki Local Installation Manual (http://makahiki.readthedo
makahiki-unix.html#download-the-makahiki-source), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record the problem you encountered when download the Makahiki source:

2.1.1.1.1.11. Workon Makahiki *

Complete the ”Workon Makahiki” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/en
makahiki-unix.html#workon-makahiki), record the time you spent for this section only::

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when activating Makahiki virtual environment:

2.1.1.1.1.12. Install required packages *

Complete the ”Install required packages” section in Makahiki Local Installation Manual (http://makahiki.readthedocs
makahiki-unix.html#install-required-packages), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when Installing required packages:

2.1.1.1.1.13. Setup environment variables *

Complete the ”Setup environment variables” section in Makahiki Local Installation Manual (http://makahiki.readthed
makahiki-unix.html#setup-environment-variables), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record the problem you encountered when setting up environment variables:

2.1.1.1.1.14. Initialize Makahiki *

Complete the ”Initialize Makahiki” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/e
makahiki-unix.html#initialize-makahiki), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when initializing Makahiki:

2.1.1.1.1.15. Start the server *

Complete the ”Start the server” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/en/lat
makahiki-unix.html#start-the-server), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when starting the server:

2.1.1.1.1.16. Verify that Makahiki is running *

Complete the ”Verify that Makahiki is running” section in Makahiki Local Installation Manual (http://makahiki.readthedocs.org/en/latest/installation-makahiki-unix.html#verify-that-makahiki-is-running), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes

- 1+ hour

Record any problem you encountered when verifying that Makahiki is running:

Your UH email: *

B.1.2 Makahiki Local Installation Log

Please follow the steps outlined in this form to install Makahiki on Heroku and log the time you spent for each step. Please choose the closest value from the list that best matches the time you spent during the installation.

Thank you !

* Required

2.1.1.2.1. Install Heroku *

Complete the ”Install Heroku” section in Makahiki Heroku Installation Manual (http://makahiki.readthedocs.org/en/l
makahiki-heroku.html#install-heroku), record the time you spent for this section only:

- 0 minute (Already installed from previous assignments)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered when installing Heroku:

2.1.1.2.2. Add your SSH keys to Heroku *

Complete the ”Add your SSH keys to Heroku” section in Makahiki Heroku Installation Manual (http://makahiki.readthedocs.org/en/latest/installation-makahiki-heroku.html#add-your-ssh-keys-to-heroku), record the time you spent for this section only:

- 0 minute (Already installed from previous assignments)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when adding your SSH keys to Heroku:

2.1.1.2.3. Verifying your Heroku account *

Complete the ”Verifying your Heroku account” section in Makahiki Heroku Installation Manual (http://makahiki.readthedocs.org/en/latest/installation-makahiki-heroku.html#verifying-your-heroku-account), record the time you spent for this section only:

- 0 minute (Already installed from previous assignments)
- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when verifying your Heroku account:

2.1.1.2.4. Setup Amazon S3 *

Complete the ”Setup Amazon S3” section in Makahiki Heroku Installation Manual (http://makahiki.readthedocs.org/e
makahiki-heroku.html#setup-amazon-s3), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when setting up S3:

2.1.1.2.5. Setup environment variables *

Complete the ”Setup environment variables” section in Makahiki Heroku Installation Manual (http://makahiki.readth
makahiki-heroku.html#setup-environment-variables), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when setting up environment variables:

2.1.1.2.6. Download the Makahiki source *

Complete the ”Download the Makahiki source” section in the Makahiki Heroku Installation Manual
(http://makahiki.readthedocs.org/en/latest/installation-makahiki-heroku.html#download-the-makahiki-
source), record the time you spent for this section only:

- 5 minutes

- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when download the Makahiki source:

2.1.1.2.7. Initialize Makahiki *

Complete the ”Initialize Makahiki” section in the Makahiki Heroku Installation Manual (http://makahiki.readthedocs.
makahiki-heroku.html#initialize-makahiki), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when initializing Makahiki:

2.1.1.2.8. Start the server *

Complete the ”Start the server” section in the Makahiki Heroku Installation Manual (http://makahiki.readthedocs.org/
makahiki-heroku.html#start-the-server), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when starting the server:

2.1.1.2.9. Verify that Makahiki is running *

Complete the ”Verify Makahiki is running” section in the Makahiki Heroku Installation Manual (http://makahiki.readthedocs.org/en/latest/installation-makahiki-heroku.html#verify-that-makahiki-is-running), record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered when verifying that Makahiki is running:

Your UH email: *

B.2 Game designer Assessment

There is one form to assess the game designer efficiency.

B.2.1 Makahiki Configuration and Management Log

Please follow the steps outlined in this form to configure and manage Makahiki, and log the time you spent and problems encountered for each step. Record the time you actually spent doing the tasks by choosing the closest value from the list that best matches the time you spent. The Makahiki manual referenced below may use the local instance 127.0.0.1 as the example. For this assignment, you should use the Makahiki instance you deployed in Heroku instead of your local instance.

Thank you !

* Required

0. Update your Heroku Makahiki instance *

Read the "Updating your Makahiki instance" section in Makahiki Manual (http://makahiki.readthedocs.org/en/latest/i
makahiki-heroku.html#updating-your-makahiki-instance). Follow the instructions to update your
Heroku instance with any changes from the Makahiki Git repository. Record the time you spent for
this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered in this step:

1. Getting to the challenge design page *

Read the "Getting to the challenge design page" section in Makahiki Manual (http://makahiki.readthedocs.org/en/late
design.html#getting-to-the-challenge-design-page). Then go to the challenge design setting page of
your Heroku instance. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem(s) you encountered in this step:

2. Design the global settings *

Read the ”Design the global settings” section in Makahiki Manual (http://makahiki.readthedocs.org/en/latest/challeng
design-name-settings.html). In your Heroku instance, change the ”Name” of the challenge and the ”Logo” fields to ones of your choosing. Test that your change is in effect by checking the Logo image and label at the top of any page. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

3. Design the teams *

Read the ”Design the teams” section in Makahiki Manual (http://makahiki.readthedocs.org/en/latest/challenge-design-teams-settings.html). In your Heroku instance, add a new team called ”Lehua-C” with the same group membership as the other teams in the default instance. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

4. Set up users *

Read the ”Set up users” section in Makahiki Manual (http://makahiki.readthedocs.org/en/latest/challenge-design-players-settings.html). Add two new users of your choosing to the team ”Lehua-C”. Make

sure you assign the players to their team by going to the user's profile link. Test your changes by logging in as one of the new players, and verifying that the player is on the right team. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

5. Specify the games to appear in your challenge *

Read the "Specify the games to appear in your challenge" section in Makahiki Manual (http://makahiki.readthedocs.o
design-game-admin-enable-disable.html). Disable the "Water Game", and leave the other games enabled. You should see that the "Drop Down" page disappears from the top navigation bar. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

6. Learn about how to design the resource goal games *

Read the "Design the Resource Goal Games" section in the Makahiki Manual (http://makahiki.readthedocs.org/en/lat
design-game-admin-resource-game.html). Record any questions or confusion that arises from reading this section:

6.1. Configure the Energy Goal Game for your new team *

Change the energy goal setting for the team ”Lehua-C” to use manual data, and specify a time for the manual data input time. Test your changes by logging in as a player of Lehua-C, then go to ”Go Low” page. You should see the calendar view of the daily energy goal game instead of the stop light visualization. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

7. Learn about how to design Smart Grid Games *

Read the ”Design the Smart Grid Game” section in the Makahiki Manual (http://makahiki.readthedocs.org/en/latest/c
design-game-admin-smartgrid-game.html). Record any questions or confusion that arises from reading this section:

7.0. Design on paper *

The default installation defines a Smart Grid Game (SGG) with 3 levels. For this task, design a new Level 4 that extends the existing SGG. Level 4 will have a total of four actions: 3 new actions (Activity, Event, Commitment) that you create yourself, and one old action that you choose from the existing library of actions in the default installation. Design Level 4 with a 2x2 grid layout, including 2 categories of your choice. For this step, you will only design your Level 4 on a piece of paper or a spreadsheet, as described in Makahiki Manual (http://makahiki.readthedocs.org/en/latest/challenge-design-game-admin-smartgrid-game.html#designing-your-smart-grid-game). Specify the unlock conditions for each action to achieve some kind of unlocking sequence(”path”), such as depending on the completion of other actions. Record the time you spent in this step:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

7.1. Create a Level *

Add a new level ”Level 4”, with priority higher than Level 3, and some unlock condition depending on some actions from Level 2. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

7.2 Create a new Activity action *

Create a new activity action with your own content. Make the content meaningful. Fill in the required fields. You will also specify the level (should be level 4), category (your choice), as well as the unlock condition field, which determines the action ”path” of your SGG design as described in step 7.0. Record the time you spent for this step only:

- 5 minutes
- 10 minutes

- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

7.3 Create a new Event action *

Create a new event action with your own content. Make the content meaningful. Fill in the required fields. You will also specify the level field (should be level 4), category field (your choice), as well as the unlock condition field, which determines the action ”path” of your SGG design as described in step 7.0. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

7.4 Create a new Commitment action *

Create a commitment action with your own content. Make the content meaningful. Fill in only the required fields. You will also specify the level field (should be level 4), category field (your choice), as well as the unlock condition field, which determines the action ”path” of your SGG design as described in step 7.0. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes

- 1+ hour

Record any problem you encountered in this step:

7.5 Finalize the grid *

At this point, you should have created 3 new actions and put them in Level 4 of your SGG. For this step, find the final action to complete your 2x2 grid.. Go to the admin interface, find an action in the action library, and modify the level, category and unlock condition field according to your SGG design. Play-test your grid by logging in as normal player, go to the "Get Nutz" page, unlock Level 4 and all actions in Level 4. Record the time you spent for this step only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

8. Design the Top Score Game *

Read the "Design the Top Score Game" section in the Makahiki Manual (http://makahiki.readthedocs.org/en/latest/ch design-game-admin-topscore-game.html), create a new topscore prize of your choice. Test your changes by going to the "Prizes" page to see your newly created prize. Record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes

- 1+ hour

Record any problem you encountered in this step:

9. Design the Raffle Game *

Read the ”Design the Raffle Game” section in the Makahiki Manual (http://makahiki.readthedocs.org/en/latest/challe
design-game-admin-raffle-game.html). Create a new raffle prize of your choice. Test your changes by going to the ”Prizes” page to see your newly created raffle prize and you can add raffle ticket to it. Record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record any problem you encountered in this step:

10. Design the Badge Game Mechanics *

Read the ”Design the Badge Game Mechanics” section in the Makahiki Manual (http://makahiki.readthedocs.org/en/l
design-game-admin-badge.html). Create a new badge with an award trigger type of ”smartgrid”. Specify some kind of awarding condition depending on the smartgrid operations. Verify that your badge shows up in the badge catalog page and you can be awarded the new badge by doing the specified smartgrid action. Record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes

- 1+ hour

Record any problem you encountered in this step:

11. Manage Action submissions *

Read the ”Manage Action submissions” section in the Makahiki Manual (http://makahiki.readthedocs.org/en/latest/ex
manage-smartgrid-game.html#manage-action-submissions). Approve some actions submitted by you during your playtesting. Record the time you spent for this section only:

- 5 minutes
- 10 minutes
- 30 minutes
- 1+ hour

Record how many actions you approved, and record any problem you encountered in this step:

Your UH email: *

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[1] SurveyGizmo. Surveygizmo website. http://www.surveygizmo.com/, 2013.

[2] Yongwen Xu. Approach to access system admin and game designer experiences in makahiki. Technical Report CSDL-13-04, Department of Information and Computer Sciences, University of Hawaii, Honolulu, Hawaii 96822, June 2013.