2A4U: A Visual Reward System Development

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Abstract

This paper describes a visual reward web-based system that can be used by parents to educate and motivate their children to achieve great performance in terms of good behavior and good academic achievement. Our research methodology was based on design and development research (DDR). We used the evolutionary prototyping model for the system development. To ensure that the system shall satisfy our targeted users, eight parents were involved in a few cycles of the development. Their requirements were collected through interviews and that information was used to build a prototype for the first cycle. The prototype was designed and developed based on a web-based architecture pattern. Then, in the following cycle, the prototype was used before the users' feedback was collected, and the information was used to improve the prototype. Quantitative data were collected from respondents (parents) using a questionnaire, contained a 5-Likert scale and open-ended questions, right after they had tried the prototype on their children. In general, the findings showed that our users were satisfied with: (i) the clear user instruction feature (100%), (ii) the user interfaces, system navigation and flexibility (100%), (iii) the system ability (100%), (iv) the response time for displaying pages and saving data (87.5%), and (v) the contents provided were sufficient (75%). Our users also shared some of their experiences. In addition, we also found that the reward value exhaustion issue is real. Hopefully, our efforts through this system will encourage parents to be involved actively in nurturing, educating, and motivating their children, and create a healthy environment at home.

Keywords: visual reward web-based system, evolutionary prototype, extrinsic motivation, parents, children motivation.

INTRODUCTION

Children usually get easily motivated to do tasks they were asked for when there were rewards given. For example, children were found to spend more time learning when there was a reward than none (Mohd Shukri & Howes, 2014).

According to Cerasoli et al (2014), motivation among children can be divided into two major types, which are; (i) intrinsic motivation, and (ii) extrinsic motivation. For intrinsically motivated tasks, it is generally enjoyable, purposeful, well-being, and provides happiness, which provides sufficient reason for one to persist whether with or without reward (Legault, 2016). Whereas, for an extrinsically motivated task, it is likely to be non-complex and repetitive. It means that reward is needed as a driving mechanism that motivates the children to complete their tasks (Cerasoli et al., 2014; Mohd Shukri & Howes, 2014).

Extrinsic motivation can play high dominance on someone's behavioral performance. A person is willing to modify his or her behavior either to perform better or complete the task given. Bijleveld et al. (2012) found that people become more motivated and tend to spend more effort and time when there is a value on the reward. The higher the incentive value, the greater the motivation for them to do their work. However, according to Tarullo et al. (2018), the type of rewards should not be the same as it may also affect encouragement for a longer time.

Typically, to nurture good behaviors or encouraging repetitive tasks among children or to encourage children to do house chores, or to do their schoolwork (which are things they do not usually get the intrinsic type of motivation to do by themselves), extrinsic kind of motivation is required. Although there are plenty of reward systems available today, all limited free version applications are only about completing chores and collecting stars. None of them provides functions related to the type of rewards. Parents need to know what to do when the reward is no longer there or the value of the reward is exhausted. Hence, we were very keen to develop a reward system that allows parents to set or change the type of rewards whenever they assign new tasks to their children. They can also insert a visual of the reward that they have promised to their children to further motivate their children. Therefore, parents can have a good discussion with their children beforehand about which rewards would be suitable for the tasks or can excite them in completing their tasks from time to time and hopefully will avoid exhausted reward's value issues. We called this visual reward web-based system the 2A4U system.

LITERATURE REVIEW

Reward as Motivation

Parents play a strong role in raising, nurturing, and educating their children in daily life. According to Bornstein et al. (2018), parents can create a healthy environment at home by practicing a good parenting approach. Hence, their children will be likely to become better people.

A reward is always connected to motivation. Using rewards to motivate children to do tasks is among the common approaches used by many parents. Usually, rewards were given to encourage children to do tasks they do not like much or not fun for them. For example, a child needs a reward to encourage him or her to do a house chore like sweeping, throwing trash, or make his or her bed

every morning either because the task is not fun or it is boring. However, a child usually does not need a reward to encourage him or her to play outdoor like running, skipping, or jumping around because it is enjoyable.

Motivation can be divided into intrinsic motivation and extrinsic motivation. According to Legault (2016), intrinsic motivation is a natural human tendency – that is, people will actively endeavor to do the things they find interesting or pleasant. Intrinsic can be enhanced when the behavior stems from personal choice. Nevertheless, for intrinsic motivation to thrive, it has to be nurtured by the social environment. Constructive feedback can affect one's desire for competence, which can in turn improve intrinsic motivation. According to Fong et al. (2019), feedback can be a behavior catalyst as people can self-regulate their learning progress. However, it may be different for small children and we were more interested in extrinsic motivation.

Extrinsic Motivation

Extrinsic motivation refers to behavioral success which is essentially dependent on the achievement of a result that is separable from the action itself (Legault, 2016). It is typically considered as an instrumental that drives behavior by external rewards such as money, fame, grades, and praise (Fischer et al., 2019; Locke & Schattke, 2019; Legault, 2016). In extrinsic motivation, it is assumed that rewards are given so that person will modify its motivation or behavior to achieve higher performance in completing the task (Bijleveld et al., 2012). However, Benabou and Tirole (2003) also stated that extrinsic motivation also includes other external achieving factors such as fulfilling parental expectations, following other trusted role models, and earning potential other than to achieve good grades in the study and academic performance.

Among other important features related to extrinsic motivation discussed by many researchers include the following:

a) Extrinsic motivation vs. intrinsic motivation: According to Legault (2016), extrinsic motivation arises from outside of the individual and it is the opposite of intrinsic motivation because intrinsic motivation arises from inside of the individual. Extrinsic motivation sometimes can help to promote action tasks that are not intrinsically motivated. Ryan and Deci (2002) as cited in Legault (2016) stated that extrinsic motivation requires less effort and it produces immediate results compared to intrinsic motivation. Nonetheless, Biehler and Snowman (1990) as cited in Legault (2016) claimed that extrinsic motivation can also decline students' intrinsic motivation.

b) Effects on behavior: According to Benabou and Tirole (2003), extrinsic motivation can improve effort and performance because the reward serves as a positive outcome for the desired behavior. Extrinsically motivated tasks were said to play more directly in the person's behavioral performance. However, Mohd Shukri and Howes (2014) found that, while a reward can motivate children to do their tasks, there are still might be less effective towards the children's behavior.

Nonetheless, we believe that the effects might be different in a long term. It might be hard to be proven effective in the short run because such experiments related to inculcated behaviors might require years to be completed.

c) Suitable for repetitive tasks: Tasks that are extrinsically motivated are more likely to be repetitive because they require reward feedback as a driving mechanism for tasks to be done. For example, children were found to spend more time learning when there was a reward (Mohd Shukri & Howe, 2014). Learning is a repetitive task. Thus, this kind of motivation is suitable to encourage children to do house chores or schoolwork due to its repetitive events.

d) Types of rewards rely on conditions: People become more motivated and tend to spend more effort and time when there is a value on the reward but sometimes a reward still has less effect on the performance. According to Tarullo et al. (2018), extrinsic motivation can be very effective but the types of rewards to be offered should rely on specific conditions. For some people, the advantages of external incentives inspire consistent high-quality work. For others, profits as rewards are more inspiring. Thus, not all extrinsic motivation has the same characteristic. Extrinsic motivation is a wide variety of motives, ranging from the degree to which they are autonomous and rather than being a one-dimensional construct (Legault, 2016). Therefore, we have to allow the type of rewards to be changeable or flexible whenever suitable.

e) Value of reward can be exhausted: According to DeLong & Winter (2002) as cited in Tarullo et al. (2018), extrinsic motivation might not work in a long term. Tarullo et al. (2018) found that in his study, children rewarded with felt tip pens in a game did not want to play again once they have received the reward although they were happy with the reward at first. Hence, parents must know that the value of reward can be exhausted. We should provide information as a piece of advice to parents.

f) Reward dependence: There might be a possibility that people may only depend on the reward (DeLong & Winter, 2002, as cited in Tarullo et al., 2018). A child might only tend to focus on achieving higher grades when there is a reward and lose motivation to complete the task once the reward is removed. Nonetheless, we believe that extrinsic motivation brings greater benefits and worth to be applied.

Reward System Examples

There are several reward system applications available either online, App Store (iOS), or Play Store (Android). To get some ideas about reward system applications, we took a look at two different applications: (i) iRewardChart: Chore Tracker and (ii) Chore, Reward, and Sticker Chart. We explored their features and identified their strengths and weaknesses as presented in Table 1 below.

Table 1: Differences between iRewardChart: Chore Tracker and Chore, Reward and Sticker Chart

Application Name	Features	Strength	Weakness
iRewardChart: Chore Tracker	How to use it? 1. Set children's names 2. Pick few tasks from app suggestion 3. Stars will be earned for completing each task. 4. Reward with a single tap when the children accomplish all their tasks. 5. Children can pick suggested rewards or parents can set up their custom rewards.	1. Easy to use. 2. Allow users to set up abstract goals. 3. Include backup and sync service so parents and children can share their charts across multiple devices.	1. Limited free version. 2. Not include functions related to the type of rewards.
Chore, Reward, and Sticker Chart	1. Almost the same functions as the above app like insert children's names, assign tasks and provide rewards when they have accomplished all tasks.	1. Provides document contract function in case children forgot what chores they were assigned. 2. Has daily reminder and notification – alerts parents or children to open the app and provide starts for daily accomplishments at specific times. 3. Protects from unauthorized use.	1. Limited free version. 2. Not include functions related to the type of rewards

METHODOLOGY

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Research design

We designed and developed a visual reward web-based system based on the design and development research (DDR) methodology. The system prototype was built based on the Evolutionary Prototype Model (see Figure 1) to allow us to get sufficient feedback from our potential users.

Our research design involved the following: requirements collected through interviews with eight parents whom we randomly picked in our residence as our potential users. All the parents had children between four to nine years old. Once requirements had been analyzed, we used the information to derive design artifacts and built the initial prototype. The prototype was used alongside a set of the questionnaire contained 5-Likert scale and open-ended questions to collect feedback from our potential users. The feedback information was then analyzed and used to improve the prototype. This process was repeated until the system was deemed adequate by the users.
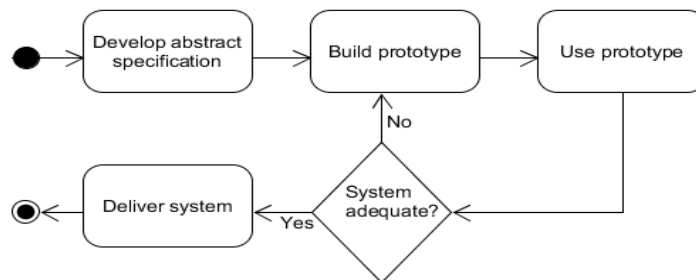
Evolutionary Prototype Model

Figure 1: Evolutionary Prototype Model

a) Develop abstract specification
    In this phase, we outlined all requirements needed for the 2A4U system. Interviews were conducted with several parents about how they want to see their children's performance in completing given tasks. We analyzed the requirements, and alongside information from the literature, we created an initial use case diagram (see the finished use case diagram in Figure 2), user access table, functional table, as well as constraint and quality tables, and logical database diagram.
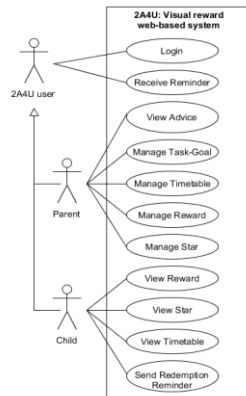
Figure 2: The use case diagram for the 2A4U system

b) Build prototype

An architecture diagram was first drawn and several interfaces were sketched before we proceed to develop our initial prototype based on the requirements and design artifacts. As 2A4U was a web-based system, its architecture diagram was based on web architecture patterns (see Figure 3). We chose HTML5, PHP, MySQL, and bootstrap for the prototype development. Figures 4 to 6 show some examples of user interfaces that we built into the system.
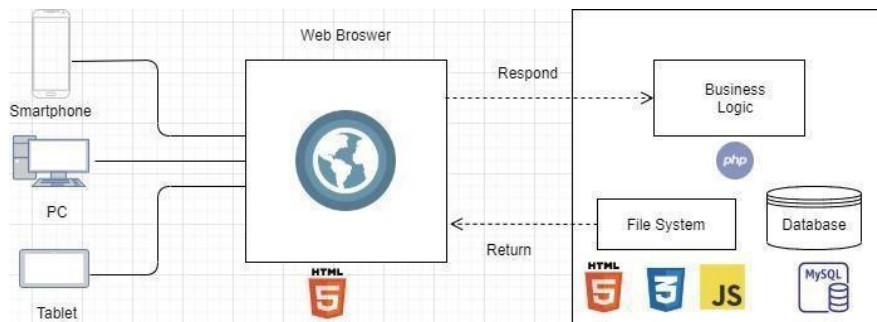

Figure 3: Our architecture diagram for the 2A4U system is based on the web architecture pattern

c) Use prototype

The prototype was then presented to the parents for evaluation to find its strengths and weaknesses. Comments and feedback were gathered and analyzed using a questionnaire contained 5-Likert scale and open-ended questions. We had to go back to step 2 (building prototype) three times to improve our requirements and design specifications, and to our prototype based on the feedback. We also added suggested chores based on children's age as requested by one of the parents.

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d) Deliver system

The system was ready to be used. (Note: unfortunately, the domain subscription had not been renewed recently).

Figure 4: This user interface allows parents to view advice provided in the system such as suggested chores that are appropriate for their children based on their age
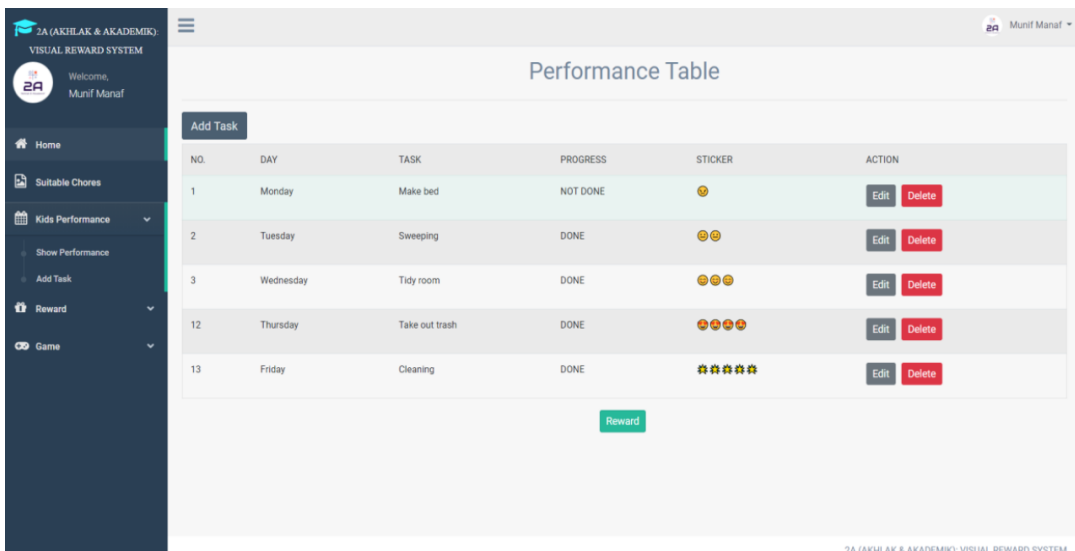

Figure 5: This user interface allows parents to update their children's performance (by giving stars) based on the timetable set previously. Once updated, their children will be able to view their latest performance (collected stars) on their screen
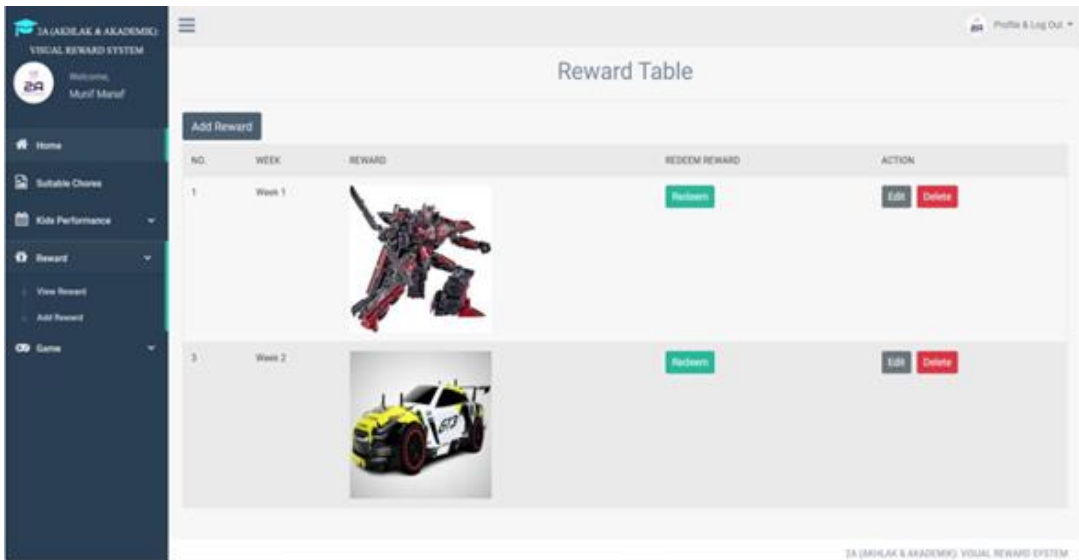
Figure 6: This user interface allows children to see the type of rewards set by their parents for specific sets of tasks. They can redeem rewards once they have completed their chores. They can click on the 'Redeem' button to send a notification to their parents

RESULTS AND DISCUSSION

The demographic information of our respondents is shown in Table 2. There were eight parents, which consist of five females (62.5%) and three males (37.5%). Four respondents (50%) indicated that they were between the ages of 41-50, two respondents (25%) were below 30, one respondent (12.5%) was between the ages of 31-40 and one respondent (12.5%) was above 50 years old. They all had children between four to nine years old.

Table 2: Demographic analysis results

No	Gender		Range of Age				Child's Age		
			Below 30	31-40	41-50	Above 50	4-5	6-7	8-9
1	Male	3 (37.5%)	1 (12.5%)	1 (12.5%)	1 (12.5%)	0	1 (12.5%)	1 (12.5%)	1 (12.5%)
2	Female	5 (62.5%)	1 (12.5%)	0	3 (37.5%)	1 (12.5%)	1 (12.5%)	2 (25%)	2 (25%)
		8 (100%)	2 (25%)	1 (12.5%)	4 (50%)	1 (12.5%)	2 (25%)	3 (37.5%)	3 (37.5%)

Table 3 showed the results from the 5-Likert scale section in our questionnaire from data collected during the last cycle of the prototype development. 100% of the potential users have strongly agreed that all user instructions in the 2A4U system were easy to understand. 87.5% have strongly agreed and 12.5% have agreed that the user interface, system navigation, and flexibility were good. 75%

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have strongly agreed and 25% have agreed that the 2A4U system has successfully been fulfilled as a visual reward web-based system. In terms of performance, 87.5% have agreed that the response time for displaying pages and saving data was good. 75% have agreed that content in the 2A4U system was sufficient.

Table 3: Heuristic evaluation results during the last prototyping cycle

No	Heuristic Evaluation	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	User instruction feature	0	0	0	0	8 (100%)
2	User interface, navigation and flexibility	0	0	0	1 (12.5%)	7 (87.5%)
3	System ability	0	0	0	2 (25.0%)	6 (75.0%)
4	Response time for displaying pages and saving data	0	0	1 (12.5%)	2 (25.0%)	5 (62.5%)
5	Content	2 (25.0%)	0	0	1 (12.5%)	5 (62.5%)

Followings are the results from the open-ended sections:

a) Suitable for repetitive tasks

From data collected from our open-ended section, we found that all eight parents agreed that 2A4U is suitable to be used to encourage their children to do house chores or schoolwork which are part of repetitive tasks that happen in daily life. Some of them have also listed examples of chores they had assigned to their children like sweeping, throwing trash into the dustbin, and making their bed every morning. They also like the chore suggestion based on children's age provided in the system.

b) Types of rewards rely on conditions

Most of the parents like the flexibility in the system that allowed them to set different rewards for different children. They also can make changes to the reward they had set previously, hassle-free.

c) Value of reward can be exhausted

Almost all parents were comfortable with the system because they can discuss with their children before they set the task-goal and the timetable. Hence, they did not have any problem with exhausted reward's value. Two parents were aware that there was a piece of advice related to the exhausted reward's value issue provided in the system. However, we have discovered an extended issue. One parent had experienced a different situation of exhausted reward's value problems. His children keep requesting to change reward whenever they got a star although they had not yet accomplished all the tasks given that qualified them to receive a reward. Perhaps we need to include a written rule to ease the problem or find some other better solutions.

d) Reward dependence

Three of the parents mentioned how their children got very excited to use the app to get a reward. Anyway, the parents do not know whether their children will be very dependent on rewards or not, but no one denied the possibility.

From our findings, the 2A4U systems that we proposed to provide functions related to the type of rewards and to avoid the exhausted reward's value issue, was well accepted by the parents. However, the extended issue of the exhausted reward's value that has occurred in a different situation may require further attention. Additionally, when we analyzed the open-ended sections, we also found that all 25% of parents, who strongly disagree about the content previously, had insisted to have additional content to make sure that the system can also cater to some other different user needs such as slow learner children or children with autism or Down syndrome. This finding may have opened to another horizon of research areas that might interest other researchers.

CONCLUSION

In conclusion, we have described our 2A4U visual reward web-based system's design and development in this paper. Eight parents were involved in our development process through several cycles of prototype development. Based on their cycles of feedback, we managed to get all the requirements and also made a significant improvement to our 2A4U system.

To cater to the exhausted reward's value issue, we also introduced functions related to the type of rewards where parents can set and change the type of rewards in the 2A4U system. We also provide a piece of advice for them which was to have a good discussion with their children before they set the reward in the 2A4U system. Parents can also insert a visual image of the rewards that they have promised to their children. The children may also send reminders to their parents for redemption. We received good feedback on the 2A4U system from the parents. Nonetheless, we have also mentioned in this paper other issues that might require further attention such as children with special needs and the extended exhausted reward' value issues. We hope that our efforts will encourage parents to be involved actively in nurturing, educating, and motivating their children, and create a healthy environment at home.

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