

A User Research for Developing an Augmented Reality-based Teachware

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Abstract

While Augmented Reality(AR) and AR teachwares including word cards, books and blocks become very popular. existing AR teachwares only focus on repeating the same content without changing level of difficulty and/or interest of changing planer images into 3D images. Because of this, users feel fun only in earlier phases of the life cycle, thus continuous education could not be promoted. Above all, most existing teachwares are developed for 3 to 5 year old children, for whom smart devices are not allowed by their parents. To do specific research and to identify additional user needs of corresponding problem, I have identified an overall trend of teachware through Town Watching and seller interview. In addition, I have analyzed with Affinity Diagram through an interview conducted towards the student parents that have used an Augmented Reality teachware. The problems of the existing Augmented Reality teachware and the contents that was analyzed with Affinity Diagram derived through this study will be suggested as an important indicator to solve the problem of existing teachware and in designing Augmented Reality teachware.

Keywords: Augmented Reality, Teachware, User Research, South Korea.

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Introduction

According to the 2018 research of strategy consulting and investment financial company 'digi-capital', the global market scale of Augmented Reality and Virtual Reality is expected to grow in a scale to \$105 billion in 2022. In addition to these predictions, the interest of the general public for Augmented Reality are also getting bigger as Augmented Reality applies to various industries such as medicine, education training, architecture, tourism, game, art, shopping recently.

In particular, the teachware that uses the Augmented Reality is increasing and the actual sale is also made recently. The teachware that uses Augmented Reality is mostly made up of books or work cards. It is possible to do an education with reality by overlapping the three-dimensional shapes of the materials involved when showing the corresponding book or word card with a smartphone or the camera of a tablet PC. Moreover, the educational contents that are difficult to realize in the textbook and teachware can be solved easily by showing the overlapping three-dimensional graphics. Due to these reasons, the products converged with Augmented Reality that expresses hard-to-see object in existing life form teachware are being researched.

However, in case of the Augmented Reality that appears in books or work cards, there is a problem that the consistency time of education is short, and the targeted age is young as people focus on the fun of the corresponding two-dimensional content that looks realistic in three-dimensions.

Like this, the teachwares that use the Augmented Reality is being developed, but there are parts that need to be improved. We would like to research these problems more in depth and derive various problems additionally that were not discovered. In addition, to develop a teachware that could improve the problems and give much higher educational effect, we would like to conduct a user research and analyze with an Affinity Diagram.

Research Process

Since the Augmented Reality teachware is a product that is actually sold, there is a need to look at trends in stores and conduct a deep research on the subject that actually uses or purchase. For this, the lifestyle and trend of consumer group need to be identified. Therefore, I have done Town Watching research by visiting to a store where I could meet an actual product, consumers, and sellers. I have studied the product that the purchaser wants, and the teachware with high sales rate. For the UCD (User Centered Design), I have progressed in depth interview with the seller and the purchaser of the Augmented Reality teachware. The problem of existing Augmented Reality teachware was identified and organized through an interview. The organized contents were analyzed with Affinity Diagram.

Town Watching

1) Method

Prior to this experiment, I have decided to conduct the Town Watching to understand how consumers buy on the site where the teachware is sold. The detailed observation

items of the Town Watching were set with the contents obtained by the literature search and after discussion by 2 designers. To search the trend in detail, it was conducted by dividing into 2 times. In the first time of Town watching, the overall trend was searched. In the second time of the Town Watching, the error was minimized with repetitive observation and the seller interview was also conducted.

Table 1: Town Watching 1

Item	Contents
Lead time	4 hours
Place	Book store, Toysrus (Seoul, Korea)
Researchers	Two graduate students
Target	Teachware, Teachware Purchaser
Method	Observation of products, Observation of purchaser
Note	-

Table 2: Town Watching 2

Item	Contents
Lead time	5 hours
Place	Book store, Toysrus(Seoul, Korea)
Researchers	Two graduate students
Target	teachware, teachware seller
Method	Observation of products and seller, seller Interview
Note	-

2) Purpose

The purpose was to establish a rationality of the research subject. It is possible to know the trends of teachwares' sales desk. In addition, it is possible to know the actual behavior of purchasers that purchases the teachware.

3) Results

In case of large book stores, a staff that was in charge of selling the teachware was assigned. Moreover, the intellectual development teachware was arranged by making a sales desk called, 'Our child intellectual development teachware'. Through this, it was possible to confirm that the sales of intellectual development teachware were high. In case of the student parents, they were focused on an intellectual development when purchasing a teachware. The focus for children and lower grade students of an elementary school was set on a package that cause interest or a teachware that can be touched. Mostly, the teachware that the children chose were purchased.

Table 3: Town Watching data

Item	Contents
Place	<ul style="list-style-type: none"> - 'Our children intellectual development teachware' sales desk was prepared separately at a bookstore - There was a separate seller that sells only the teachware in a bookstore. - In the toy store, it was subdivided as drawing teachware, science teachware, and making teachware - In the toy store, various parts were managed together by the staffs. - There was augmented reality teachware, but unusual.
Parents	<ul style="list-style-type: none"> - Intellectual development teachware was searched when only the students' parents have visited (for present) - Buys a product that the children like - If the children ask to buy, the form of ordering as lowed price was seen after searching the internet.
Child	<ul style="list-style-type: none"> - Children showed interest on a shape that cause interest and on a product package - Showed interest on a textware that is made to be touched - In case of boys, they showed interest on game, dinosaur, and animals - In case of girls, they showed interest on colorful teachware and doll

Seller Interview

1) Method

The questionnaire was written by synthesizing the information obtained at Town Watching. The seller who was working constantly until now was interviewed to see the recent trend. In addition, the teachware sales experience was selected for a seller that have more than 3 years' experience.

Table 4: Seller Interview

Item	Contents
Lead time	45 minutes
Place	Book store(Seoul, Korea)
Researchers	Two graduate students
Target	teachware seller
Method	Interview based on research
Note	Sales experience : 4 years work experience

2) Purpose

The purpose was to verify the contents researched at Town Watching. It was checked whether the purchase and sale of the intellectual development teachware such as spatial perception capability was made actively. The interview on a seller that have met various consumers in teachware store was interviewed. Through this, it was possible to know the purchase propensity of consumers and various sales experience that could not be obtained only by the observation.

3) Results

There isn't much Augmented Reality teachware yet, and it was possible to know that the market was not big yet and is in developing status as it was released as a form of book and work card from 1 year ago. In case of Augmented Reality teachware, there were students' parents who did not purchase as the smart phone and smart pad was used, but it was shown that it was purchased as the children enjoys it. There was not much difference compared to other teachware for the sales amount of Augmented Reality teachware, and it was shown that the Augmented Reality book form was sold a lot.

In case of general teachware preference, the teachware that each boy and girl preferred were different. In case of boys, not a plane but they liked 3D teachware that were 3D such as an animal and dinosaur. In case of girls, it was shown that they liked planes such as Tangram or beads puzzle or cute shapes and various colors.

Parent interview

1) Method

The questionnaire was written by synthesizing the information obtained by the Town Watching and seller interview. To find out the inconvenience experience that comes out when actually using the Augmented Reality, the interview was conducted only on the students' parents that have an experience of actually using the Augmented Reality teachware with children after purchase.

Table 5: Purchaser Interview

Item	Contents
Lead time	30 minutes per session, 720 minutes in total
Place	Book store, Toysrus(Seoul, Korea)
Researchers	Two graduate students
Target	24 parents who have bought AR teachwares
Method	Interview based on research
Note	-

2) Purpose

It is an interview to derive the Affinity Diagram and to find out that inconvenience in actually using the Augmented Reality teachware. It is possible to know the various experiences when actually using the Augmented Reality teachware, which could not be obtained with only the observations and seller interview.

3) Results

As a result of students' parents purchasing the Augmented Reality teachware and using with children, the satisfaction rate was high as it gives different fun and surprising at first. However, the focus was only on the things that the shape made of word card and book image or block was shown as 3D Augmented Reality, and there

was a boredom of simple repetition. The issues were organized by summarizing the main cases as below.

Story 1. When the Augmented Reality teachware were firstly used, the children showed a response of, “Wow! Cool”. However, there was no other special things after that, and similar patterns were repeating. So, we only saw it few times, and does not see it anymore.

Story 2. Most of the parents tries to not give a mobile phone to young children (young child.) However, I am reluctant to buy to young children(child) as the Augmented Reality teachware age limit is low mostly.

Story 3. It is good to see an object up, down, and side in three-dimensional through Augmented Reality. However, in case of toys, it is possible to touch but in case of Augmented Reality, it is pity that it can't be touched or so.

Story 4. I have bought it because the children like it, but as the Augmented Reality teachware uses an application, I am worried for their health when using it for a long time.

Story 5. There are times that an error occurs as it plays on other location not an Augmented Reality teachware. Also, the coloring is not recognized when it springs out, and the Augmented Reality tend to not play. Also, when the coloring can't be done, the shape get's weird, so it is not that good.

Research Analysis

1) Method

Two researchers have participated and analyzed for three days. The environmental and behavior characteristics were extracted from 24 users interview and the problems that was derived was classified using the Affinity Diagram. The requirements and goal were derived after classifying the ideas through screening after recording the ideas that was enormously listed on a post-it memo paper.

Based on the results obtained through user research, the 30 responses content like below Table. 6 was groupage using the Affinity Diagram technique. In the classifying process, the duplicate content or similar terms such as an opinion that the learning method is simple or the opinion that the Augmented Reality teachware is easy were excluded.

2) Purpose

The purpose was to derive a common value and requirements that is on across the user by combining the user interview results. It was possible to derive the key words that could become a requirement by groupage of the things that are relevant or the similar ones, and by combining the response contents that the meaning duplicates. New facts could be inferred and found by arranging the response contents that are enormously listed by groupage of the interviews.

3) Results

For the Augmented Reality teachware, the problems such as simple repetitive education, subtraction of learning difficulty, the production of only the teachware for infant, and the matters that need to be improved such as various interaction, team play function, the correction of recognition error were derived. In addition, the necessity such as an education through wearable device, the method of using the healthy Augmented Reality teachware, Augmented Reality of friendly image, and operation and maintenance of an application was also derived. Through this, the goals that requires consideration when producing the Augmented Reality teachware ultimately were derived. The contents are as below Table 6.

Table 6 : Affinity Diagram

Purpose	Requirement	Response Contents
Providing educational method out of simple repetitive education	People should not get tired of simple learning repeats	<ul style="list-style-type: none"> - It only repeats to see the Augmented Reality that is seen over the teachware - There aren't any special elements other than Augmented Reality - They are having interest only in the beginning and gets bored soon - the learning process is too simple
	The next Augmented Reality contents that will be shown on the teachware is expectable	<ul style="list-style-type: none"> - It only repeats the process that transforms the plane image to 3D - It is possible to expect the Augmented Reality by seeing the word cards only
Producing Augmented Reality teachware for subjection various ages	It requires learning stage by level	<ul style="list-style-type: none"> - There is no level of difficulties in the teachware - It is impossible to learn by the level of the user - The age range is narrow
	It requires an Augmented Reality teachware for a much higher age	<ul style="list-style-type: none"> - The target age of Augmented Reality teachware is young, but it is hard to use as it needs to use the smart phone - Existing Augmented Reality teachware are too easy - Mostly, people don't give smart phone to infants(1~6 age)
Provides an improved function related to Augmented Reality	More free interaction is required	<ul style="list-style-type: none"> - It is pity because it is impossible to touch the Augmented Reality - I would like to communicate more freely with the Augmented Reality characters
	It would be nice to do it together	<ul style="list-style-type: none"> - It can't be used together - There is no feeling of doing together with other people

	The recognition error of Augmented Reality must be minimized	<ul style="list-style-type: none"> - There are times that the Augmented Reality operated in weird place - When the color of the drawing teachware goes out, it does not recognize - When using the block type teachware, the location of Augmented Reality and the block does not match
Provide Augmented Reality education through Wearable device	It is cumbersome to run the application	<ul style="list-style-type: none"> - It is cumbersome to run the application - Later on, I only read the books without using the Augmented Reality
	There is a need for an Augmented Reality device that is more convenient than smart phone	<ul style="list-style-type: none"> - It is cumbersome as there is a need for machine when seeing the Augmented Reality - It would be nice to see the Augmented Reality even without smart phone
Suggest healthy usage method of Augmented Reality	Worried about the health due to the use of smart phone	<ul style="list-style-type: none"> - I am worried about children's eye health - I am worried about the electromagnetic waves of smart phone - I think children are addicted to smartphones if used for a long time
Provide Augmented Reality of friendly image	It should be improved as a 3D graphic of friendly image	<ul style="list-style-type: none"> - They are scared as the Augmented Reality is too realistic - We don't use it as the Augmented Reality animal is scary
Produce as an application that is also possible offline	The maintenance of an application is not done well	<ul style="list-style-type: none"> - The application does not work as the population of the product is lost - The Augmented Reality application does not work as the production company went bankrupt

Conclusion

This research was researched through Town Watching and the teachware seller interview of the Augmented Reality teachware that are actually sold on the store, and the questionnaire was made based on this. The student's parents that have used the Augmented Reality teachware with child was interviewed based on this questionnaire. The contents of the interview was analyzed by an Affinity Diagram.

Through this, it was found that the Augmented Reality teachware was made according to the focus of simple fun that the Augmented Reality is played. Due to this, the problems such as simple repetitive education, subtraction of learning difficulty, the production of only the teachware for infant, and the matters that need to be improved such as various interaction, team play function, the correction of recognition error were derived. In addition, the necessity such as an education through wearable device, Augmented Reality of friendly image, maintenance of an application, and the method of using the healthy Augmented Reality teachware was also derived. Through this, the goals that requires consideration when producing the Augmented Reality teachware ultimately were derived.

The Affinity Diagram produced based on the user interview content helps the understanding of the user, and it possesses a useful value in the point that it could be used as an important indication when making and opinion decision and development directions on a development project of an actual Augmented Reality teachware.

However, this research cannot be seen that it substitutes the total users, but shows only the needs, behaviors, attitudes of a user. Moreover, this is a survey progressed in South Korea, which it could be researched differently in accordance with the culture, society, economical situation of other country, and there is a limitation that this research could be applied differently.

In the future follow-up study, I would like to produce a user modeling and user scenario based on the user research. I am planning to progress teachware design and make prototyping based on the arranged contents. I am planning to measure the effects whether the user satisfaction rate or the learning consistency have increased than the existing Augmented Reality teachware through experiment for the produced teachware.

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