DEVELOPMENT OF VAS APP TO IMPROVE YOUTH MENTAL HEALTH RESEARCH ENVIRONMENT

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ABSTRACT. *The importance of mental health care for youth has increased year by year. UPI, which is one of the screening test methods, has been carried out in many educational institutions in order to discover the students who have mental health problems at an early stage. However, some problems such as difficulty of expressing psychological agreement are pointed out. UPI test is two selections format, and it is sometimes difficult to express the subtle ratio of psychological agreement depending on respondents and questions. Therefore, there is a possibility that some students do not answer correctly. Accordingly, we propose to introduce Visual Analog Scale (VAS), that is easy to express psychological agreement as a continuous scale in questionnaire. However, VAS has difficulty of tabulation. To solve these problems, we have developed a VAS app called "VASpad". In order to verify the validity of VASpad, we conducted an experiment for comparison with traditional VAS. We performed subjective evaluation experiments using VASpad and traditional VAS for the 40 subjects. The results show that there is a high correlation coefficient between both VASs, and show the possibility that VASpad can be used as well as traditional VAS. We also describe the future subjects in this paper.*
Keywords: Visual Analog Scale, Mobile app for mental health, Subjective evaluation

1. **Introduction.** Our main purpose in this study is to examine the characteristics of the Visual Analog Scale (VAS) in evaluation experiments. We have especially focused on comparison of the traditional VAS that uses the question paper and VAS app that we have developed newly [1]. We describe background of this study. We made a comparative experiment about the differences of the VAS and Likert scale in the prior studies [2,3]. The experiment result shows that there exists unintended bias between LS data and VAS data. This bias seems to be caused by the following factors, such as halo effect, leniency effect, and central tendency. Likert scale is the most widely used approach to measure responses in survey research. However, in some cases, VAS is superior to LS as a subjective evaluation. Currently VAS has been actively used as an evaluation of the pain scale in the medical field. We expected that VAS should be applied in a wide range of fields. We

are planning to introduce a subjective evaluation by VAS to measure mental status of students.

2. **Problem Statement and Preliminaries.** UPI is useful, but it also has been pointed out that some factors should be improved. First, UPI test is two selections (Yes/No) format, and it is sometimes difficult to express the subtle ratio of psychological agreement depending on respondents and questions. Therefore, there is a possibility that some students do not answer correctly. The main purpose of UPI is screening students with problems in mental state, and there is no ambiguity in the questions and answers. People who think it is difficult to represent their own state in Yes/No are presented at a constant rate. UPI may not be able to find students at potential risk although its screening performance is good. Therefore, we propose introduction of Visual Analog Scale which is one of the answer methods allowing the ambiguity. It is possible to measure the value of continuous values by using VAS. It is considered that VAS can represent subjectiveness or human's sensibility more appropriately.

Secondly, the load of students and staff is large. In general, UPI will be carried out in the beginning of the fiscal year. However, this time is also a busy season. Generally, it is not said that the number of care staff in educational institutions in Japan is sufficient for all students. It is desirable to carry out test multiple times in one year [4] or record the answers for a long term [5]. It should also be considered to reduce the number of questions in one test, because there is a large burden for students to answer [6]. There is also another problem that aggregation of the measurement data of VAS is more difficult than binary or multiple-choice. VAS method requires measurement of the distance between the checked point and left edge.

There is a possibility to solve these problems by ICT-supported VAS measurement. We have developed a VAS application which runs on tablet to solve this problem. We call this application "VASpad". VASpad can reduce the burden of the measuring work greatly. We are planning an attitude survey in mental health care or education field using VASpad. See our previous work for more details of VAS [1-3].

3. **VASpad – Development of Visual Analog Scale App.** It describes the development of VAS application "VASpad" that runs on mobile devices which is familiar to students. Currently VASpad has been developed for iOS version and Android version. Figure 1 and Figure 2 show screenshots of iOS app and Android app respectively. Each development environment is Xcode and Android Studio.

Here we explain the functionality of VASpad for iOS mainly. Basically VASpad is almost equivalent to the standard VAS using questionnaire. First, question statements, straight line and 2 labels on both ends of line are displayed. The check mark does not appear on the screen at this time. After user taps any point on the screen, check mark will appear on the straight line. The program gets the value of the X coordinate of a point that has been tapped. This value is normalized in accordance with the length of the straight line. That is, left end is the minimum value 0 and right end is maximum value 1. Normally a user does not see this value (display the value when the toggle switch is ON). This value can be modified until the "Confirm" button is tapped. When the confirm button is tapped, the user information and the measured values are stored. The user information included ID, age and gender. Users can access the stored data by shifting to the administrator mode.

4. **Main Results.** To examine the performance of VASpad, we performed comparative experiments with conventional VAS using a questionnaire. Question was "Has your daily life been fulfilled?". In addition to the subjective evaluation by 2 VAS styles, it was also investigated that which method is preferred. Table 1 shows the measurement result. Table 2 and Table 3 show age, gender and preferable VAS style.
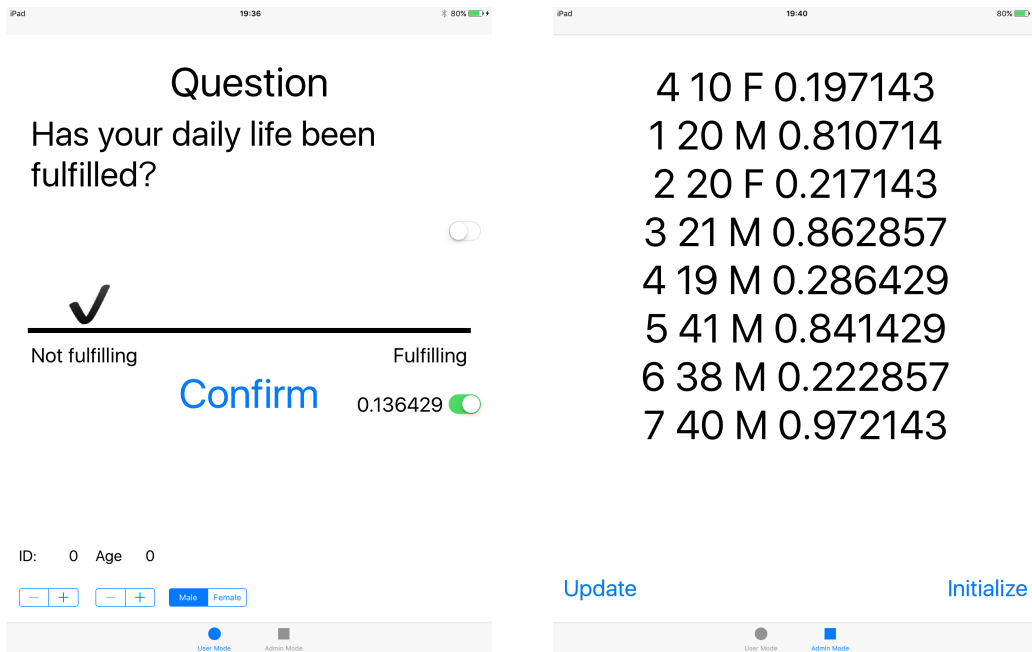
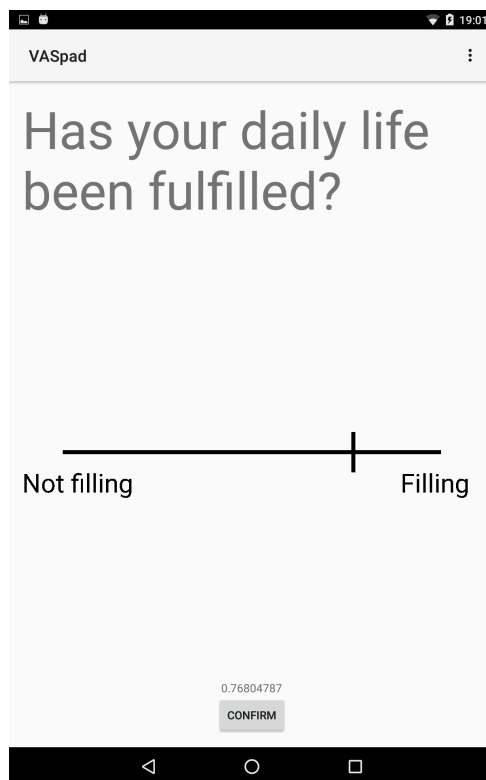FIGURE 1. Screenshots of VASpad for iOS – User mode and admin mode

FIGURE 2. Screenshots of VASpad for Android

Then we compared and analyzed two VAS styles using the experimental results. Figure 3 shows histogram of evaluation values by two VASs. Table 4 shows mean, SD, max and min of measured subjective evaluation values by two VAS styles. Figure 4 shows scatter plot of evaluation values. The correlation coefficient of two VAS styles is 0.989. It was confirmed that there is a strong correlation in the evaluation results of the two VAS systems.
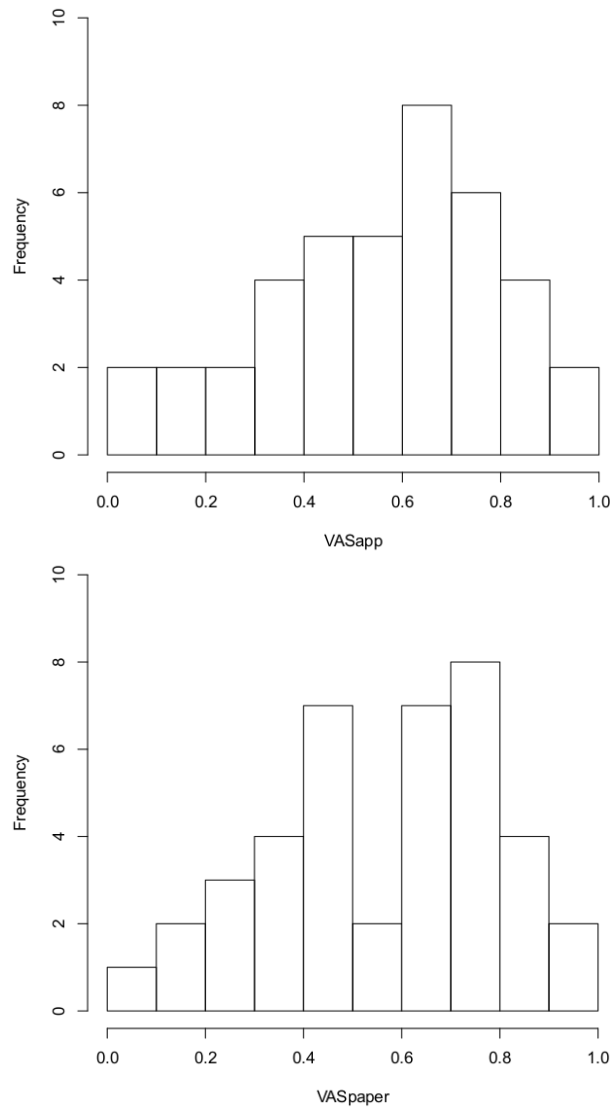
FIGURE 3. Histogram of evaluation values by VAS App and Paper ($n = 40$)
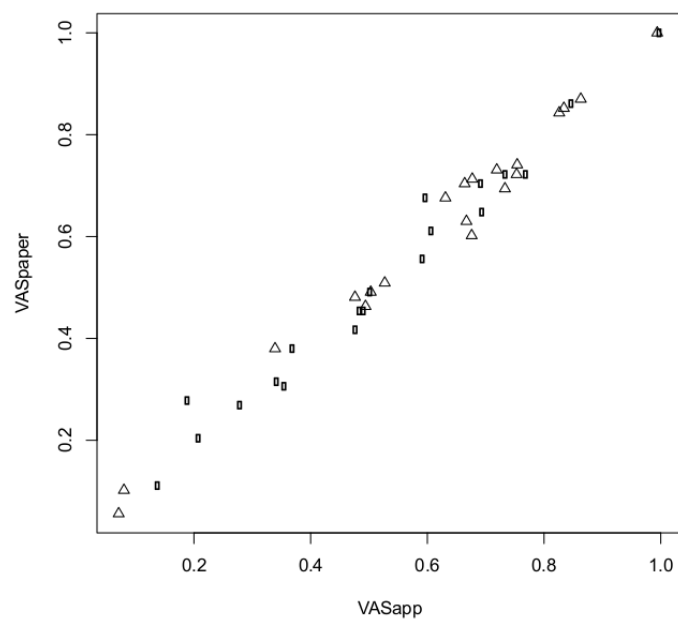

FIGURE 4. Scatter plot of evaluation values by two VAS styles (App and Paper) ($n = 40$)

TABLE 1. The measurement results by two VAS styles (App and Paper)

Age	Gender	App	Paper	Favorite	Age	Gender	App	Paper	Favorite
20	M	0.493	0.454	Paper	19	F	0.849	0.861	App
18	M	0.494	0.463	App	20	M	0.677	0.713	App
20	M	0.771	0.722	Paper	20	M	0.191	0.278	App
19	M	0.071	0.056	Neither	19	M	0.834	0.852	Neither
20	M	0.486	0.454	Paper	21	M	0.210	0.204	App
20	M	0.826	0.843	Paper	20	M	0.733	0.694	Paper
19	F	0.140	0.111	App	21	F	0.371	0.380	App
20	M	0.676	0.602	Neither	20	M	0.476	0.481	App
22	F	0.357	0.306	App	21	M	0.609	0.611	App
18	M	0.754	0.741	Paper	21	F	0.753	0.722	Paper
20	F	0.599	0.676	App	21	F	0.736	0.722	Neither
21	M	0.503	0.491	App	20	F	0.667	0.630	Neither
18	M	0.504	0.491	App	21	M	0.479	0.417	App
22	M	0.994	1.000	Paper	20	M	0.631	0.676	App
19	M	0.694	0.704	Neither	20	M	0.696	0.648	App
21	M	0.339	0.380	Paper	19	M	0.719	0.731	Paper
21	M	0.281	0.269	Paper	20	M	0.594	0.556	App
19	F	0.080	0.102	App	20	M	0.527	0.509	App
23	M	0.344	0.315	Paper	20	M	1.000	1.000	Neither
20	M	0.664	0.704	Paper	20	M	0.863	0.870	App

TABLE 2. Ages of subjects

Age	18	19	20	21	22	23	Mean: 20.075
Number of people	3	7	18	9	2	1	Total: $n = 40$

TABLE 3. Favorite style

	Favorite Style		
Gender	App	Paper	Neither
Male	14	12	5
Female	6	1	2

TABLE 4. Subjective evaluation values by two VAS styles (App and Paper) ($n = 40$)

	Mean	SD	Max	Min
VAS by App	0.567	0.237	1.00	0.071
VAS by Paper	0.561	0.239	1.00	0.056

5. **Conclusions.** We have developed a VAS measurement app for mobile devices for the purpose of improvement of student mental health care environment. We performed a measurement experiment of subjective evaluation value actually. It was confirmed that VAS app can be used for subjective evaluation as well as conventional VAS using the question paper. However, this study has just begun, and there is a need for further comparative study of two VAS styles. In addition, comparison of the Likert scale app also seems necessary. Development of VAS application was meaningful, but left many

functions that should be implemented, such as storing the measured data to the server. We are working on research to continue in the future.

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