Abstract—The aim of this study was to investigate the effectiveness of cloud physical activity promotion system (CPAPS) on high school female students’ moderate physical activity time (MPAT). A pre- and post-test quasi-experimental design was used for this study. The participants were sixty-two 10th-grade female students in two classes. The independent variable was whether the class was employed with CPAPS or not. The dependent variable was students’ MPAT per week. Chi-square and t-test were conducted to examine whether there is a difference between the two research groups. The result of this study suggests that using CPAPS could improve MPAT.

Index Terms—Cloud physical activity promotion system, accelerometer, moderate physical activity time.

I. INTRODUCTION

Due to the rapid growth of technology use and change of people’s work patterns in the present society, people tend to have a sedentary lifestyle and be physically inactive [1]. This change could cause various health problems and civilization diseases, such as unsound physical and psychological development of children and adolescents, as well as the learning performance. However, according to the national survey data, there was a main problem occurred in physical activity of school students at all levels; adolescents got the lowest proportion of meeting a sufficient amount of time on physical activity suggested by the academic standards, especially female students [2], [3]

In Taiwan, the Ministry of Education (MOE) committed to enhancing students’ physical activity and physical fitness, and also actively promoted various projects related to health promotion over the past decade. For helping students build healthy management mechanism and enhancing students’ self-understanding about their body correctly, the MOE only paid attention to promote the government propaganda and slogans for meeting a sufficient amount of time on physical activity suggested by the standards. The newest standards for school students at all levels were: accumulation of 210 minutes of moderate physical activity per week, and recommendation of moderate activity time accumulated more than 30 minutes per day [4].

Nevertheless, these promotions of the MOE did not seem to inspire and motivate students to do regular physical activity automatically. In 2010, the data from a MOE official survey [5], [6] showed that senior high school students and female students were the two groups that indicated the highest decline of physical activity time from 2009 to 2010. The researchers speculated three possible reasons for this situation: at first, high school students may be burdened with high pressure and social expectations from schools and the society, so they spend most of their time learning in schools. In addition to the two courses designed in the physical education curriculum, students rarely take the initiative to use their spare time for doing more physical activity. Secondly, schools may focus on cognitive learning, such as slogan, or add more physical education courses. Students are forced to receive these courses and therefore they are not willing to change their behavior. Thus, once the added courses are cancelled, students tend to return to their sedentary lifestyle. Finally, actively cultivating a regular physical lifestyle is difficult - it is a complicated and dynamic process. In the beginning, people would perceive the benefits of physical activity and try to overcome the obstacles faced to maintain their physical activity. However, people in some situations may lose confidence when they cannot complete physical activity so it is easy to return to their sedentary lifestyle again till he/she could maintain the habit.

Thus, how to motivate high school students, especially female students, to meet the sufficient amount of time on their physical activity suggested by the academic standards was the major issue in physics education that needs to be addressed.

With the growth of technology use and for solving the problems of physical inactivity, a physical activity promotion system combining cloud services, called cloud physical activity promotion system (CPAPS) has been developed nationally and internationally. The characteristics of CPAPS are the wearable inertial signal sensors that can record users’ biophysical signals. The most common product of inertia signal is pedometer, and through uploading the signals via the application of the system, the cloud system analyzed and displayed the date and charts as the feedback to the users. Some studies also suggest [7] that wearing such product of inertia signal could motivate users to produce active physical activity.

Moreover, CPAPS has the following advantages in the educational site to promote physical activity. Firstly, the small inertial signal sensor is easy to be worn, and can quickly measure physical activity parameters. Secondly, it is convenient to access the data at any time. Thirdly, it teachers do not need to spend extra time to learn the software and hardware as the system can provide the information for the users. However, there are few relevant empirical studies to explore the application and effectiveness of CPAPS in promoting physical activity at
school. Thus, exploring the impact of CPAPS on high school female students’ moderate physical activity time (MPAT) is the goal of this research.

More specifically, the research effort was directed to empirically investigate the following research question: will there be any difference in the MPAT among students used CPAPS or not?

II. METHOD

A quasi-experiment design was used to examine the research question previously stated.

A. Participants

There were two classes of 10th-grade female students (n = 62), from a senior high girls school by Purposive Sampling. All students and their guardians signed consent forms. Students received the same research questionnaires and school schedule, such as two PE and three self-study courses a week, and two midterm examinations. One class was designed to serve as a comparison group (C), and the other class served as the experimental groups (E). The difference of these two classes was the degree of the use of CPAPS; the comparison group did not use CPAPS, whereas the experimental group used the CPAPS. The experimental group wore the accelerometers 24 hours and uploaded their biophysical signals to CPAPS every day.

B. Measurements

The instruments for the data collection are described as follows.

1) Demographics survey

This survey was made by the researchers to make sure the baseline of the two research groups that showed no differences. It consisted six opened questions, including birth year, gender, class, student ID, whether joining the sportive clubs this semester, and whether being prohibited of doing sports because of healthy issues.

2) International physical activity questionnaire (IPAQ)

This study adopted IPAQ to measure students’ habits of general physical activity in the past seven days [8]. IPAQ was designed to target 18 through 65-year-old people and contain five questions: 1) how was your physical activity in the past seven days compared with the past three months, 2) how much time you actively spent on vigorous physical activity in the past seven days, 3) how much time you spent on moderate physical activity in the past seven days, 4) how much time you spent on walking in the past seven days, and 5) how much time you spent on sitting in the past seven days.

3) Three-day physical activity log (3-D PAL)

3-D PAL [9] was used to measure the time of moderate physical activity. This log consisted of 96 blanks a day, and each log indicated 15 minutes. Students wrote down codes 1 to 9 into each blank, and then the researchers transformed the codes into metabolic equivalent (METs) and calculated the total amount of time on their moderate physical activity. For example, activities that counted 3–6 METs were categorized as moderate physical activity. For example, if there were 4 blanks that were categorized into 3–6 METs activities, it meant that the time of moderate physical activity was 60 minutes a day (i.e., 4 blanks multiply 15 minutes).

4) CPAPS

This study adopted a CPAPS for promoting students’ physical activity. This CPAPS included one accelerometer and one physical activity promotion website which provides biophysical signals and analysis for users. The experimental group wore the accelerometer and uploaded their data via Bluetooth into the cloud server. After 5 minutes later, students could view their biophysical signals and analysis, such as steps, calories burned, and activity intensity proportions in the website.

C. Research Procedures

This study adopted a pretest and posttest quasi-experimental design with two research groups. The duration of the experiment was 16 weeks. For both research groups, students completed the demographics survey and IPAQ as pretests at the beginning of the semester (in weeks 1 and 2). Afterwards, they completed the same IPAQ as posttests in weeks 15 and 16. Moreover, in week 2, the researchers arranged one meeting with two research groups to explain how to write 3-D PAL. Afterwards, the researchers kept in touch with the class instructor to understand students’ reactions to this study.

The experiment started from week 3 to 14. For comparison group, students only needed to write 3-D PAL every week. However, the experimental group not only wrote 3-D PAL but also used the CPAPS. Moreover, the experimental group received one training course of CPAPS in week 3 to make sure all the students knew how to wear accelerometers and use CPAPS regularly, such as uploading biophysical signals, and logging into the website. Also, if students had problems about accelerometers or the website, they could simply use Q&A function provided by the website to contact the website administrator.

D. Data Analysis

This study used SPSS 20.0 to complete the quantitative analyses. Chi-square test and t-test were used to compare the pretests (the demographics survey and IPAQ) and posttest (IPAQ) between the two groups. Also, the 12-week data of 3-D PAL was shown as a line chart to further explain students’ change of physical activity each week (see Fig. 1).

III. RESULTS AND DISCUSSIONS

A. The Pretest of Demographics Survey

According to the demographics survey, there were no differences between the two research groups in participating in sports-related community or school team ($\chi^2 (1, n=60) = .02, p = .90$), and in being prohibited of doing sports because of healthy issues ($\chi^2 (1, n=60) = .00, p = 1.00$).

B. The Pretest of IPAQ

The results of IPAQ showed that there were no differences between the two research groups in physical activity in the past seven days compared with the past three months ($\chi^2 (2, n=57) = 2.40, p = .30$). Moreover, the t-test also pointed out there were no differences between the two
The Trends of 12-Weeks MPAT

Fig. 1 indicated the trends of MPAT for two weeks from the two groups. At first, the comparison group spent 19.03 minutes doing moderate physical activity per day in week 3 and 27.19 minutes in week 14. Moreover, in weeks 7, 8, and 13, the comparison group achieved the sufficient amount of time on physical activity suggested by the academic standard, which recommends students to cumulate moderate physical activities for more than 30 minutes per day.

The researchers found that the trend of the comparison group echoed the school schedule; students spent less time on moderate physical activity when preparing the midterm exams in weeks 5 and 11. Although the time increased after midterm exams week, it declined again a few weeks later. This kind of loop seemed totally match the lifestyle of senior high school student; students believed that it was more meaningful to study instead of doing physical activity. To further explanation, if 10th-grade students could not spend time doing physical activity, then their MPAT would decline even more when they moved up to 11th- or 12th-grade, when they will need much more time to prepare themselves for the university entrance exams.

In addition, the experimental group spent 39.53 minutes doing moderate physical activity per day in week 3 and 43.52 minutes in week 14. They achieved the sufficient amount of time on physical activity suggested by the standards every week, besides of weeks 11 and 13. Slootmaker, Chinapaw, Seidell, van Mechelen, and Schuit (2010) in their study stated that [7], wearing the accelerometers and watching the feedback of biophysical signals would increase users’ motivation and behavioral change of physical activity.

Nevertheless, the trend of the experimental group declined from week 9 and became unstable afterwards. The researchers and class instructor assumed that the reason might be students’ loss of interests and being feeling in later period, even several students seemed to withdraw from the study. In other words, despite the CPAPS had practical and ease-of-use characteristics, if there was no intervention of behavioral change strategies involved, the CPAPS only helped maintain students’ motivation for a short time.

This study gave the researchers very important lessons and reflections due to the downward trend of the experimental group. Would students react differently if implementing behavior change strategies into CPAPS? In addition, future studies need to alleviate the burden of the experimental groups as students were not willing to take 3-D PAL every week, and it was less convenient than wearing a small accelerometer for a long term study. Finally, a more appropriate statistical analysis could be conducted for analyzing such trend data.

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REFERENCES


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