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Research Article

Developing a Mobile APP-Supported Learning System for Evaluating Health-Related Physical Fitness Achievements of Students

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This study developed a mobile APP support learning system to compare the effects of two different learning approaches based on students' health-related physical fitness (HRPF) achievements, self-efficacy, and system usability. There were 90 participants from four physical education classes in an elementary school of Taiwan who were assigned to the experimental and control groups. An 8-week experiment was conducted to evaluate the two different learning approaches. The experimental results showed that a mobile APP support learning approach could improve the students' HRPF achievements. Furthermore, this study found that the self-efficacy and system operations affect the students' HRPF achievements. To sum up, the combination of traditional and a mobile APP support learning system is an effective approach that would help students to improve their HRPF achievements. The findings can provide the key factors of assisted learning design and students' HRPF achievements for the teachers and the related educators as references.

1. Introduction

Improving health-related physical fitness (HRPF) is a desired learning performance for school-aged children to achieve, and children who are physically fit are more likely to be active people [1]. According to the previous study, there is strong evidence base of physical fitness having a "protective effect" to health [2]. Moreover, World Health Organization (WHO) recommended that 5–17-year-old children should engage in 60 minutes of physical fitness training every day [3]. Schools are a valuable learning environment for promoting and attracting children's physical fitness. In particular, physical education course offers children the opportunity to engage in HRPF training and develop the fundamental movement skills [4]. The United Kingdom's Association of Physical Education has recommended that elementary school children should engage in physical fitness training for at least 50% of physical education course time [5].

In the field of HRPF, many psychological theories are utilized to improve students' motivation for HRPF achievements, and the self-efficacy theory is one among them. Self-efficacy was a key concept in Bandura's social cognitive theory and was proposed by Bandura [6], and it is considered one of the most important determinants in the context of students' learning outcomes [7]. Self-efficacy varies with individuals, and students with higher self-efficacy are more likely to overcome obstacles in the learning process. How to improve the lower self-efficacy of learning is an important issue.

In recent years, many scholars have employed mobile and cloud-based technologies as tools to assist learning. Mobile technology refers to characteristics of a device to handle information access, communication, and business transactions while in a state of motion [8]. Mobile and cloud-based technologies can assist students' learning and provide opportunities to the teachers develop learning activities

[9, 10]. Moreover, the use of mobile and cloud-based technologies can reach a greater level of learning motivation and achieve higher learning outcomes [11].

In addition, some scholars had proposed evidence that the use of assisted technology can achieve higher learning outcomes, such as use of web-based assisted learning system in education [12] and use of mobile-based assisted learning system in education [13, 14]. Further, previous research suggested that researchers could attempt to adopt with mobile devices combined with cloud database to make the peer feedback process more efficient [15]. Also Hwang et al. [16] and Sung et al. [17] reported that game-based learning approach effectively enhanced the students' learning effects, so increasing the entertainment part of APP could be considered, such as enhancing the interface affinity to make the user interface more interesting, so as to enhance students' system satisfaction.

However, there is no research to investigate whether using a mobile APP support learning influences the physical fitness of elementary school students; it indicates a knowledge gap. In order to fill this gap, this paper develops a mobile APP support learning system named My-Fitness which assists students improve their HRPF achievements. My-Fitness is a mobile phone-based system which has a simple and convenient feature, and students can upload data to the cloud and teachers can also use the Firebase on the web to assess students' learning achievement and quickly give advice and encouragement to students.

2. Literature Review

In order to set a cornerstone for understanding this study, we briefly introduce some theoretical views and information based on literature analysis.

2.1. Health-Related Physical Fitness (HRPF). Many kinds of literature attempted to define physical fitness. Pate [18] reviewed the previous literature and reported that they all focused on defining physical fitness in terms of movement capacities. In addition, according to previous studies, Caspersen et al. & Vancampfort et al. [19, 20] indicated that physical fitness was a set of attributes that people had or achieved related to the ability to perform physical activity, and it could reduce the risk of developing diseases associated with physical inactivity. Furthermore, physical fitness referred to the individual's health and energy status, enabling participation in various types of physical activity in daily life.

A study by Pate [21] reported that in the mid 1970s, a trend toward HRPF began, and in 1980, a new test was developed. Pate & Caspersen et al. [19, 21] further indicated that the health-related components of physical fitness were cardiorespiratory endurance, body composition, muscular strength, muscular endurance, and flexibility. In another study, Chen et al. [1], also pointed out that people with good physical fitness would have the characteristics of better cardiorespiratory endurance, muscle strength, muscular endurance, body composition, and flexibility.

2.2. Mobile Technology. Mobile devices were the ideal terminal to deliver the message that enabled students to access learning materials anywhere and at anytime, and it could also provide opportunities for the teachers to develop learning activities [9]. Moreover, some researchers had indicated that mobile technologies were creating a wide range of education applications, such as providing personalized learning objectives and schedules [13], understanding the unique characteristics of each communication medium [22], and providing learning support by a wireless device [23].

Other researchers reviewed 110 papers published between 1993 and 2013 that investigated the effects of integrating mobile devices into students' learning showed that the overall effect of using mobile devices appears to be effective [24]. Therefore, in this study, a mobile APP support learning approach was proposed to investigate whether it could improve students' learning achievement.

2.3. Cloud-Based Learning. Cloud-based learning has become increasingly popular in every field. Cloud-based paradigm provided a virtual resource pool (hardware, development platforms, or services) that was available through the network. Cloud services would make users more efficient and allowed users to access their information anytime and anywhere seamlessly [25]. In addition, cloud-based learning was very practical for teachers and students, and it allowed teachers to administer the entire learning process easily so that students could learn effectively [26].

2.4. Self-Efficacy Theory. Self-efficacy was a key concept in Bandura's social cognitive theory and proposed by Bandura, and later he further mentioned that self-efficacy was one's belief in his or her ability to execute a particular task or behavior [6]. Self-efficacy referred to individuals' beliefs about their ability to fulfill tasks and achieve goals, while motivating individuals to represent their internal state or condition, activating their behavior, and directing their goals [27]. A study by Hsia et al. [15] indicated that self-efficacy may be a determinant of learning achievement, and they had further pointed out that observing learning progress of peers may be an important factor in influencing students' self-efficacy.

Dinthervan et al. [28] reviewed more than 30 previous studies and attempted to investigate the possible situational and instructional factors within educational contexts affecting students' self-efficacy; they found that factors such as reward, goal setting, modeling, task strategy, self-monitoring, and evaluation could improve student self-efficacy within elementary and secondary educational levels. Accordingly, we attempted to investigate the influence of students' self-efficacy on HRPF achievements.

2.5. System Usability. Holden and Rada [29] suggested that usability was especially important in the field of education, and the learning support system should be in compliance with flexibility and individual needs. In addition, Harrati et al. [30] indicated that usability was the extension by which

a product could be readily used by a particular user to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use. A system must be accepted by users; otherwise, it was easy to fail, and the accepted critical factor was system usability. Wagner et al. [31] reviewed four studies which further reported that usability was related to personal error reduction and positive attitude, and could increase the user's intention to use the computer.

Brooke [32] proposed a system usability scale (SUS) to measure usability. The SUS included 10 items which were rated on a five-point scale ranging from strongly disagree to strongly agree, five of which are positive statements and the rest are negative. Additionally, the SUS score was in the range of 0 to 100, and it was the sum of all scores for the 10 items then multiplied by 2.5, as shown in the equation as follows [30]; these scores for individual item among the 10 items did not make sense. When the SUS score was higher than 70, the SUS was acceptable by most users. The SUS has been proved of a very powerful measure of system usability [33]. The formula of SUS score was defined as follows:

$$\mathrm{SUS} = 2.5 \times \left[\sum_{n=1}^{5} \left(U_{2n-1} - 1 \right) + \left(5 - U_{2n} \right) \right]. \quad (1)$$

3. Research Method and Questions

In this section, we describe the research design, research questions, operational definitions, participants, experimental procedure and learning activities, measuring tools, and system development.

3.1. Research Design, Research Questions, and Operational Definitions

3.1.1. Research Design. This experiment was done mainly to explore whether the use of a mobile APP support system could help elementary school students to enhance HRPF achievements and self-efficacy. A research framework proposed in this study is depicted in Figure 1. In order to compare the achievement of different learning approaches, the students were randomly assigned to experimental and control group. The experimental group students randomly came from two classes including 48 students, and the control group students were from the other two classes including 41 students. In addition, the students in the experimental group were provided with a mixed learning strategy that combined with traditional and mobile APP-supported learning, and those in the control group were provided with traditional learning. In the meantime, the two groups were taught by the same teacher, and they had the same learning content and schedule. Moreover, several measuring tools were used to evaluate the students' self-efficacy, system usability, and HRPF achievements, and quantitative methods were used to analyze the collected data.

3.1.2. Research Questions. The purpose of this study focuses on the effect of different learning approaches on students' HRPF achievements. In the meantime, the demographic variables how to affect students' self-efficacy and system usability and the impact of self-efficacy and system usability on students' HRPF achievements are also explored. The research questions include:

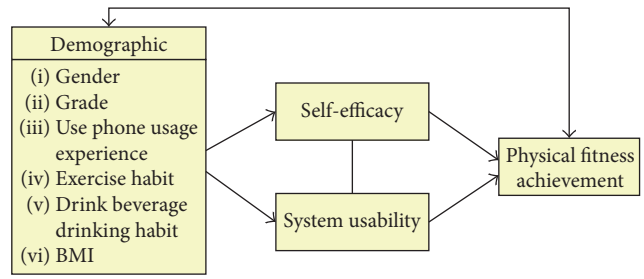

Figure 1: Research framework.

(1) Is there any difference between the different demographic variables and the students' HRPF achievements?
(2) Is there any difference between the different demographic variables and the students' self-efficacy?
(3) Is there any difference between the different demographic variables and the students' system usability?
(4) Does the students' self-efficacy affect the HRPF achievements?
(5) Does the different perception of system usability result in different HRPF achievements?
(6) Is there any correlation between the students' self-efficacy and system usability?

3.1.3. Operational Definitions. The research variables include a dependent variable of HRPF achievements and independent demographic variables, self-efficacy, and system usability. The definitions and references of variables are listed in Table 1.

3.2. Participants. The students were from four classes of the 3th–6th graders at an elementary school in southern Taiwan, and 90 students took part in a HRPF lesson. A total of 89 students fully completed the course, while one was unable to put through the activities, including 40 males and 49 females with an average age of 10.1 years.

3.3. Experimental Procedure and Learning Activities. The experimental procedure is shown in Figure 2; in this experiment, the students took learning activities for 8 weeks, which consisted of two 40-minute courses per week. At the beginning of the first week, the teacher carried out HRPF introduction including video viewing and PPT teaching. Following that, the teacher conducted HRPF achievements pretest which involved 800-meters sprinting/walking, standing long jump, one-minute bent-knee sit-ups, and sit and reach; then each student completed the self-efficacy and system usability questionnaire.

Table 1: Operational definitions.

HRPF achievements	The HRPF achievements are evaluated by the Sports Administration Ministry of Education (SAMOE) normative physical fitness scores [34]
Demographic gender	There are gender differences in information technology use and implementation [35]. Gender differences will produce different results in rehabilitation [36]
Demographic grade (experimental and control group)	Nursing students who were older had better physical fitness [37]. The participants who had assistant system support would have a better learning achievement [14]
Demographic phone usage experience	Participants' experiences in using similar gaming systems. Experience will affect a user's self-efficacy [6]
Demographic exercise habit	Exercise habit will affect a person's confidence [38]. Exercise training should be beneficial to physical fitness [39]
Demographic beverage drinking habit	A caffeine-containing energy drink might be an effective ergogenic aid to improve physical performance and accuracy in male volleyball players [40]
Demographic BMI	With lower BMI had better physical fitness [37]. Fitness capacity therefore decreased progressively as the BMI increased [41]
Self-efficacy	Holden & Rada (2011) said that both self-efficacy and perceived usability had a positive correlation in education [29]
System usability	Usability is not a quality that exists in any real or absolute sense [32]

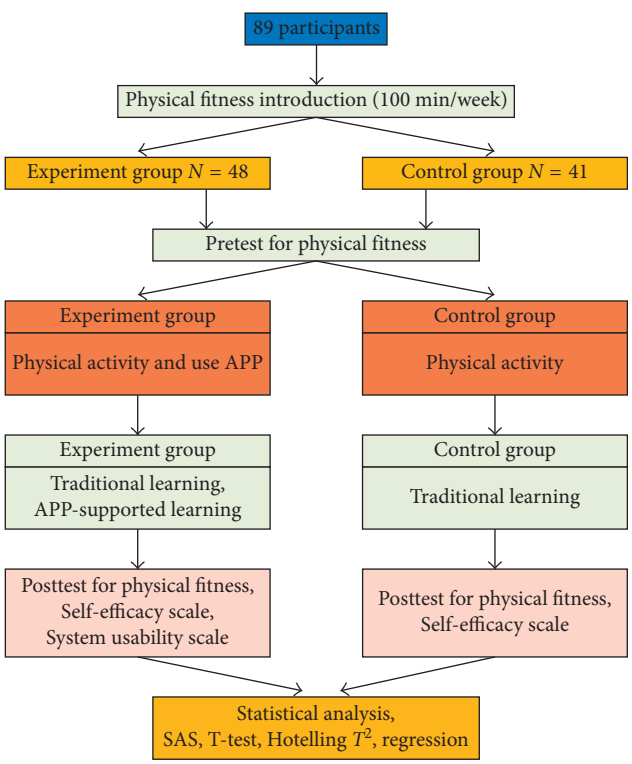

Figure 2: Flow of the two learning activities.

In the second to seventh week, the teacher in the experimental group randomly assigned 3 or 4 students into a team, in which they were equipped with a mobile phone to interact with the APP. Furthermore, each team was asked to elect a team leader who was responsible for handling mobile phone and arranging the use of mobile phone. In the meantime, the students were asked to present their achievement weekly and upload them to the cloud by the APP. Then they could browse and compare their achievement with those of the other classmates on the mobile phone. Moreover, the teacher used the mobile phone or cloud to assess their HRPF achievements over the past week and then provide comments and encourage to them.

On the other hand, the control group students were guided by the same teacher to practice and complete their learning tasks. In the meantime, their HRPF achievements over the past week were recorded in the manuscript and commented by the teacher. Finally, in the last week, the posttest for HRPF achievements, self-efficacy, and system usability was conducted after the learning activities were completed.

Table 2: Demographic variables.

Variable	Statement
Gender	Denote the student gender: male or female
Grade	Denote the student grade: 3–6
Experience in using phone	How many times does the student use phone per week?
Exercise habit	How many minutes does the student exercise per week?
Beverage drinking habit	How many cans of beverages does the student drink per week?
BMI	Denote the student BMI: low BMI or high BMI

3.4. Measuring Tools. These measurement tools include demographic scale, SAMOE normative physical fitness scores, self-efficacy scale, and SUS as shown in each section.

3.5. Demographic Scale. In this study, the demographic variables included gender, grade, phone usage experience, exercise habit, and beverage drinking habit that are employed to explore the demographic relationship with self-efficacy and system usability. Table 2 describes the demographic variables.

3.6. Evaluation of HRPF. In order to evaluate the HRPF achievements, this study uses the SAMOE normative physical fitness scores as shown in Table 3 to measure the

Table 3: HRPF-based test.

HRPF items	Activities	Descriptions
Body composition	Body mass index	The weight in kilogram/the square of height in meters
Body flexibility	Sit and reach	The students sat on a wooden board with their feet apart (about 30 centimeters) and kept knees straight. Place the measuring tape between the students' legs and their heels were aligned with the 25 cm mark of the measuring tape. The students naturally stretch forward as far as possible and then measure the score. A higher score indicates greater flexibility
Muscular strength	Standing long jump	The students stand behind the take-off line on the ground then attempt to jump as far as possible. Measure the distance from the take-off line to the nearest contact landing point (heel). Three attempts are allowed and the longest distance in the three attempts is then recorded
Muscular endurance	One-minute bent-knee sit-ups	The students were asked to lie on the floor with the knees bent to form a 45 degree angle and two hands across the chest and palms on the shoulders. During one minute of testing, hold the students' ankles to keep the heel in contact with the floor and make them to try their best to complete the sit-ups test
Cardiorespiratory endurance	800-meter sprinting/walking ability	To measure 800-meter sprinting/walking ability. The teacher encouraged the students to do their best and complete the test. When the students were unable to run they could replace to walk. The shorter the time, the better the cardiopulmonary endurance

Table 4: Self-efficacy scale.

1. I believe I will receive an excellent grade in this physical fitness test
2. I'm certain I can master the skills being taught in this physical fitness program
3. I'm certain I can understand the most difficult part presented in the physical fitness program
4. I'm confident I can understand the most complex part presented by the instructor in this physical fitness program
5. I'm confident I can catch the basic movements taught in this physical fitness program
6. I'm confident I can do an excellent job on the movements in this physical fitness achievement
7. I expect to do well in this physical fitness test
8. Considering the difficulty of this physical fitness program, the teacher, and my skills, I think I will do well in this achievement

HRPF level by students. In addition, we use the physical fitness test items published by Taiwan Ministry of Education, and the content was listed on the website [34]. The students' HRPF results will be converted into scores based on the SAMOE normative physical fitness scores.

3.7. Self-Efficacy Scale. This self-efficacy questionnaire was obtained from Wang and Hwang [12]; then this study was modified as self-efficacy questionnaire of HRPF achievements, as shown in Table 4. This self-efficacy scale has 8 items and uses a five-point Likert-type scale where 1 represents "strongly disagree" and 5 "strongly agree." After calculating the score for each student's response, the higher the participants' rating score is obtained, the higher the self-efficacy is achieved. Self-efficacy is concerned with the achievement capability of individuals.

3.8. System Usability Scale. The SUS is based on the mobile APP system and developed by John Brooke at Digital Equipment Corporation in the UK [32], including 5 items of positive response in odd-numbered items and 5 of negative response in even-numbered items, as given in Table 5. The SUS is a simple questionnaire rated by 5-point Likert-type scale, where 5 represents "strongly agree" 1 represents "strongly disagree," is employed to evaluate the usability of a mobile APP system. The higher the rating score the mobile APP system gets, the higher the acceptance it has.

Table 5: System usability scale [32].

Questionnaire item	Strongly disagree	Strongly disagree
(1) I think that I would like to use this system frequently	1	5
(2) I found the system unnecessarily complex	1	5
(3) I thought the system was easy to use.	1	5
(4) I think that I would need the support of a technician to be able to use this system	1	5
(5) I found that various functions of this system were well integrated	1	5
(6) I thought there was too much inconsistency in this system	1	5
(7) I would imagine that most people would learn to use this system very quickly	1	5
(8) I found the system very cumbersome to use	1	5
(9) I felt very confident using the system	1	5
(10) I needed to learn a lot of things before I could use this system	1	5

3.9. System Development. Mobile devices have been widely used in various fields, and in this study, we use Android Studio and Eclipse as development tools to develop the mobile APP named My-Fitness on the mobile platform. Table 6 describes the system development process. The interface of the mobile APP is simple, clear, in which the functions consist of HRPF input, HRPF historical record, HRPF ranking, and HRPF related knowledge, and the students can easily learn how to use correctly.

Table 6: APP development lifecycle.

(1) Analyze
(i) Develop tool (Eclipse and Android Studio)
(ii) Program language (Java)
(iii) SDK (Android SDK)
(iv) Database selection (Firebase)
(v) Functional planning
(2) Design
(i) Interface of the HRPF APP (on screen)
(ii) Design the system process of the HRPF APP
(3) Develop/implement
(i) Use the selected tools, program language, and SDK to develop the HRPF APP
(4) Testing
(i) Recruit volunteers for testing the HRPF APP usability
(ii) Bug fixes

Furthermore, the mobile APP provided hyperlinks of physical fitness-related knowledge and interesting games. We arranged suitable hyperlinks for the students to inquire and also provided many hyperlinks of interesting physical fitness games that could inspire students' curiosity and learning motivation. The physical fitness games consist of introduce activity games, development activity games, and recovery activity games, in which the students could get a lot of physical fitness knowledge and right learning methods by using the mobile APP, so as to enhance HRPF achievements. The interface and content of the mobile APP are shown in Figures 3–5. During the learning activities, we allow the students to use the afore-mentioned functions freely.

Additionally, the students could enter their fitness scores and view their present and historical record achievement by the mobile phone. During the learning activities that the system will rank students' HRPF ordering, they could compare the achievement with those of other classmates and know their own ranking in class timely. Meanwhile, their own achievement could be compared with the SAMOE normative physical fitness scores to know their own relative position of physical fitness. Moreover, the teacher could view and manage students' login status and evaluate their achievement by the Firebase on the web. The system architecture is given in Figure 6.

4. Results and Findings

In this study, the students' self-efficacy and system usability are measured, and the effects of different groups on HRPF achievements are analyzed. After analysis, the internal consistency Cronbach's alpha of the self-efficacy scale reaches 0.9 in the collected questionnaire. The descriptive statistics include frequencies, means, and standard deviations, to present the trends of demographic variables; furthermore, the Hotelling T^2 method, t-test method, and regression analyses are used to analyze the collected data. In addition, all of the research questions are statistically tested by using SAS software.

4.1. Analysis of HRPF Achievements in the Different Demographic Variables. For investigating the effects of different demographic variables on students' HRPF achievements, the analysis of Hotelling T^2 method is adapted. The analysis results show that all demographic variables (gender, grade, phone usage experience, exercise habit, beverage drinking habit, BMI) have different effects on students' HRPF achievements as shown in Table 7. Different groups on grade, exercise habit, BMI have significant differences on HRPF achievements ($P < 0.05$). The students who accepted a mobile APP-supported learning approach (mean = 66.56) have better HRPF achievements than those who learn in traditional learning approach (mean = 50.73). In addition, the mean values for exercise habit group and low BMI group for the questionnaire rating are 66.02 and 63.51, respectively, and 55.09 and 45.53 for no exercise habit group and high BMI group, respectively. The results reveal that the students with exercise habit or low BMI will achieve better HRPF achievements.

4.2. Analysis of Self-Efficacy in the Different Demographic Variables. For investigating the effects of different demographic variables on students' self-efficacy, analysis of the Hotelling T^2 method is adapted. The results show that all demographic variables (gender, grade, phone usage experience, exercise habit, beverage drinking habit, and BMI) have different effects on students' self-efficacy as shown in Table 8. Exercise habit group has a significant difference on students' self-efficacy ($P < 0.05$). The mean value for exercise habit group is 4.42, and 3.74 for no exercise habit group. The result reveals that the students with exercise habit would have better self-efficacy.

4.3. Analysis of System Usability in the Different Demographic Variables. For testing the effects of different demographic variables on students' system usability, the statistical t-test is performed. The analysis results show that all demographic variables (gender, grade, phone usage experience, exercise habit, beverage drinking habit, and BMI) have different effects on students' usability as shown in Table 9. Exercise habit group and BMI group have significant differences in students' perception of system usability ($P < 0.05$). The mean values of exercise habit group and low BMI group were 78.5 and 77.1 for the questionnaire rating, respectively, and 69.7 and 64.7 for no exercise habit group and high BMI group, respectively. The results reveal that the students with exercise habit or low BMI would have more confidence in learning an unfamiliar system. In addition, most of the student's system usability scores are greater than 74, indicating that My-Fitness is a successful and accepted system.

4.4. Regression Analysis of Self-Efficacy on HRPF Achievements. A linear regression analysis is employed to predict the results of students' self-efficacy and HRPF achievements in the pretest and posttest, as shown in Table 10. The results reveal that students' self-efficacy significantly predicted HRPF achievements in the pretest ($R^2 = 0.131$, $P < 0.01$) and posttest ($R^2 = 0.083$, $P < 0.01$). This implies that the higher the self-efficacy they obtain, the better HRPF achievements they present.

Figure 3: The interface of APP.

4.5. Regression and Hotelling T^2 Snalyses of System Usability on HRPF Achievements. A linear regression analysis is utilized to predict the result between students' system usability and HRPF achievements in the posttest, as shown in Table 11. The result reveals that the students' system usability significantly predicted HRPF achievements in the posttest ($P < 0.01$).

Figure 4: The content of APP. Note: The APP provided hyperlinks of physical fitness related knowledge and interesting games [42]. The students could get a lot of physical fitness knowledge and right learning methods by using the mobile APP [43].

In addition, the Hotelling T^2 method is performed to test the statistically significant difference in different system usability on students' HRPF achievements, as shown in Table 12. The low perception of system usability and high perception of system usability have a significant difference on students' HRPF achievements ($P < 0.01$). The mean value

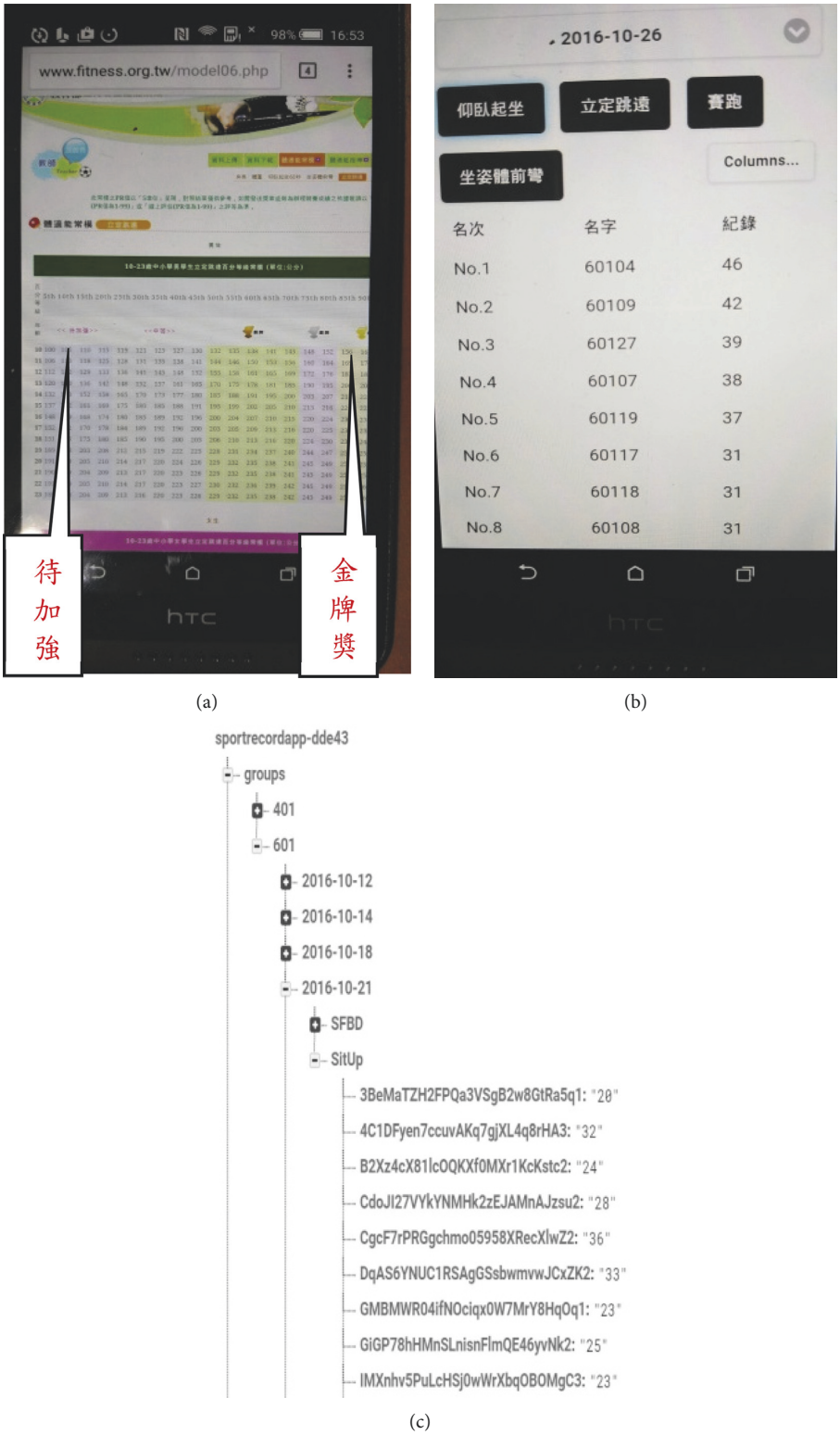

Figure 5: Ranking scores. Note: The students check the normative physical fitness scores table based on gender, age to know their own relative position of physical fitness. HRPF ranking offers the students a place to view and compare the achievements with the other team members and classmates and could timely know their own ranking in the class. The teacher could assess their achievements by the Firebase on the web. Firebase is a mobile and web application platform that includes tools and infrastructure and is designed to help people build high-quality APP.

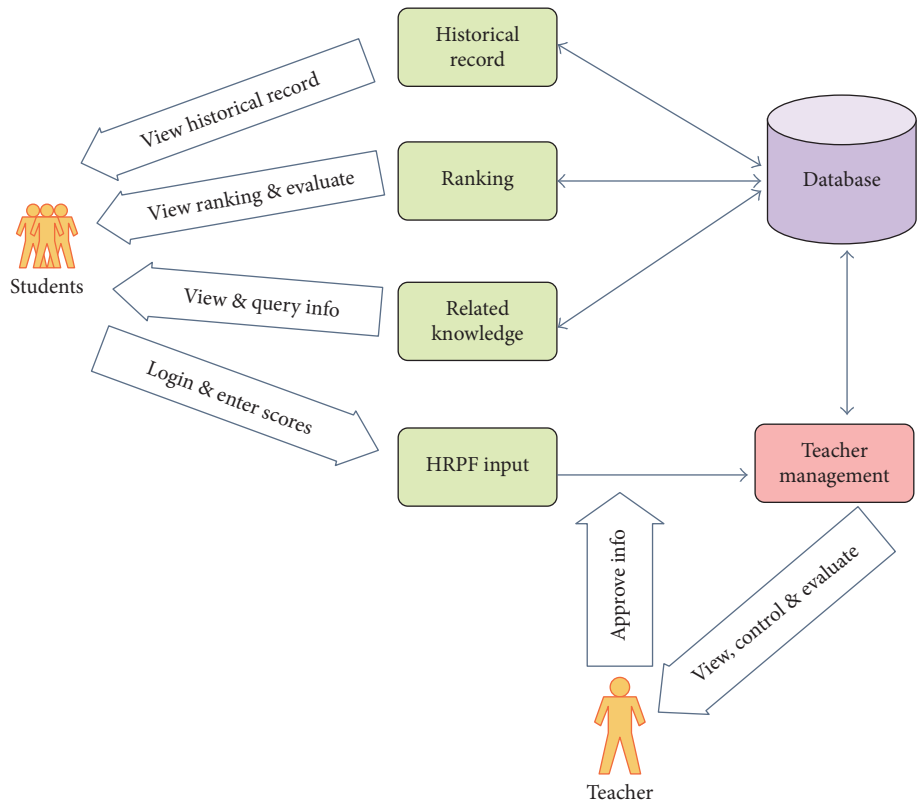

Figure 6: The system architecture.

Table 7: The results of Hotelling T^2 of students' HRPF achievements for the demographic variables (all participants).

Variables		Descriptive statistics			Hotelling T^2	
		N	Mean	SD	F value	P
Gender	Male	40	55.37	21.30	1.42	0.23
	Female	49	62.44	18.50		
Grade	Grade 3, 5	41	50.73	16.61	10.02	0.01*
	Grade 4, 6	48	66.56	19.92		
Phone usage experience	Weekly phone using times <5	54	56.85	20.73	0.59	0.66
	Weekly phone using times ≥5	35	63.00	18.51		
Exercise habit	Weekly exercise minutes ≤80	55	55.09	18.59	2.68	0.03*
	Weekly exercise minutes >80	34	66.02	20.63		
Beverage drinking habit	Beverage consumption per week (cans) <3	55	58.45	18.49	0.22	0.92
	Beverage consumption per week (cans) ≥3	34	60.58	22.47		
BMI	BMI ≤ 2	68	63.51	17.72	11.65	0.01*
	BMI > 2	21	45.53	21.22		

Grade 3, 5: control group, grade 4, 6: experimental group; exercise habit: weekly exercise minutes >80, no exercise habit: weekly exercise minutes ≤80; low BMI: BMI ≤ 2, high BMI: BMI > 2, divide by the median, $^{*}P < 0.05$, $^{**}P < 0.01$.

of low perception of system usability group is 51.02 for the questionnaire rating, and 79.71 for the high perception of system usability group. This implies that the higher the perception of system usability, the better HRPF achievements they present. In addition, usability average score is more than 74 points, which indicates that most students are satisfied with My-Fitness. And this study employs the usability average score to assign students to two groups.

4.6. Correlation Analysis between Self-Efficacy and System Usability. A Pearson correlation coefficient is used to test the relationship between self-efficacy and system usability, as shown in Table 13. There is a significant and positive correlation between the self-efficacy and system usability ($r = 0.41$, $P < 0.01$). This implies that the students had the higher self-efficacy would handle the mobile APP system more easily.

4.7. Effects of Different Learning Approaches on Students' Self-Efficacy and HRPF Achievements. In terms of different learning approaches on students' self-efficacy and HRPF achievements, they are utilized to prove that students will

Table 8: The results of Hotelling T^2 for the demographic variables on students' self-efficacy (experimental group).

Variables		Descriptive statistics			Hotelling T^2	
		N	Mean	SD	F value	P
Gender	Male	22	4.22	0.67	0.75	0.64
	Female	26	4.02	0.64		
Grade	Grade 4	21	4.00	0.73	1.25	0.29
	Grade 6	27	4.20	0.78		
Phone usage experience	Weekly phone using times <5	25	4.10	0.62	1.06	0.41
	Weekly phone using times ≥5	23	4.12	0.70		
Exercise habit	Weekly exercise minutes ≤80	22	3.74	0.62	5.10	0.01**
	Weekly exercise minutes >80	26	4.42	0.50		
Beverage drinking habit	Beverage consumption per week (cans) <3	24	4.12	0.69	1.04	0.42
	Beverage consumption per week (cans) ≥3	24	4.10	0.63		
BMI	BMI ≤ 2	38	4.13	0.64	1.20	0.32
	BMI > 2	10	4.01	0.73		

Exercise habit: weekly exercise minutes >80, no exercise habit: weekly exercise minutes ≤80, divide by the median, $^{*}P < 0.05$, $^{**}P < 0.01$.

Table 9: The results of t-test for the demographic variables on students' system usability (experimental group).

Group		Descriptive statistics			t-test	
		N	Mean	SD	T value	P
Gender	Male	22	75.0	15.21	0.21	0.83
	Female	26	74.1	12.84		
Grade	Grade 4	21	75.2	14.7	0.31	0.75
	Grade 6	27	73.9	13.3		
Phone usage experience	Weekly phone using times <5	25	74.3	13.3	−0.12	0.90
	Weekly phone using times ≥5	23	74.7	14.6		
Exercise habit	Weekly exercise minutes ≤80	22	69.7	11.7	−2.29	0.02*
	Weekly exercise minutes >80	26	78.5	14.4		
Beverage drinking habit	Beverage per week (cans) <3	24	75.2	11.7	0.34	0.73
	Beverage per week (cans) ≥3	24	73.8	15.8		
BMI	BMI ≤ 2	38	77.1	13.7	2.67	0.01**
	BMI > 2	10	64.7	9.1		

System usability is only rating in posttest, and it's score is a number, exercise habit: weekly exercise minutes >80, no exercise habit: weekly exercise minutes ≤80; low BMI: BMI ≤ 2, high BMI: BMI > 2, $^{*}P < 0.05$, $^{**}P < 0.01$.

Table 10: Regression analysis between students' self-efficacy and HRPF achievements (all participants).

Dependent variable	Independent variables	R^2	P.E.V.	Std. error	T	Sig.
Pretest-fitness	Self-efficacy	0.131	9.808	2.703	3.630	0.000
Posttest-fitness	Self-efficacy	0.083	7.684	2.728	2.820	0.006

P.E.V.: parameter estimated value, $^{**}P < 0.01$.

Table 11: Regression analysis between students' usability and HRPF achievements (experimental group).

Dependent variable	Independent variables	R^2	P.E.V.	Std. error	T	Sig.
Fitness	Usability	0.511	1.030	0.148	6.950	0.000

P.E.V.: parameter estimated value, system usability is only rating in posttest, it's score is a number, $^{**}P < 0.01$.

Table 12: The result of Hotelling T^2 between students' system usability and HRPF achievements (experimental group).

Dimension	Group	Descriptive statistics			Hotelling T^2	
		N	Mean	SD	F value	P
Fitness	System usability ≤ 74	22	51.02	16.1	13.44	0.01**
	System usability > 74	26	79.71	11.6		

Low perception of system usability ≤ 74, high perception of system usability > 74, divide by the median, $^{**}P < 0.01$.

Table 13: Correlation between students' self-efficacy and system usability.

	Self-efficacy	
	r	P value
Usability	0.41	0.01**

**$P < 0.01$.

have more confidence to complete the learning process and achieve better HRPF achievements. A Hotelling T^2 is employed to examine the statistically significant differences on students' self-efficacy and HRPF achievements, as shown in Table 14. The results show that the different learning approaches have significant differences on students' self-efficacy ($P < 0.05$) and HRPF achievements ($P < 0.01$).

4.7. The Findings. This study attempts to investigate how self-efficacy levels affect HRPF achievements and reinforce self-efficacy by using a mobile APP system to make the process more interesting in order to enhance the HRPF achievements. The students in the experimental group were provided with a mixed mode that combined with traditional learning and a mobile APP-supported learning to assist their learning, and those in the control group were provided with traditional learning that attempts to ascertain whether the use of a mobile APP system is significantly effective to enhance the HRPF achievements. From data analysis and results, there are three main findings as follows.

4.7.1. Demographic Variables. The demographic variables related to these discussions are summarized as follows:

(1) There is no significant difference in different genders on the students' HRPF achievements, self-efficacy, and system usability.

The experimental results are quite different from that of scholars [35], who reported that men were more confident and had better achievement and be able to learn information technology than women. The possible reason may be due to the different ideas between elementary school students and other age groups.

(2) A mobile APP-supported learning approach (grade 4, 6) help the students enhance HRPF achievements

The students who accepted a mobile APP-supported learning approach would have better HRPF achievements than those who learned with traditional learning approach. The result conformed to the study of [14], the participants who had assistant system support would have a better learning achievement.

(3) There was no significant difference in different phone using experiences on the students' HRPF achievements, self-efficacy, and system usability.

The experimental results were different from that of scholars [35], who indicated that experience in using information system would affect user's self-efficacy. The reason for the difference might be due to the attitude toward using. Elementary school students might only use the phone for fun or entertainment.

(4) Exercise habit help the students enhance HRPF achievements, self-efficacy, and have more confidence in learning an unfamiliar system.

This finding is consistent with the viewpoint of other scholars [38, 39] who had indicated that the participants with regular exercise habit would have more confidence in learning an unfamiliar system and get better results.

(5) There was no significant difference in different beverage drinking habit on the students' HRPF achievements, self-efficacy, and system usability.

This result was different from the viewpoint of other scholars [40].

(6) Low BMI help the students enhance HRPF achievements and had more confidence to learn an unfamiliar system

The students who have low BMI would have the confidence to complete the instructional process and learn a new system. This result is consistent with the viewpoint of other scholars [37, 41] who had indicated that the participants with lower BMI had better physical fitness.

4.7.2. Effects of Different Learning Approaches on Students' Self-Efficacy and HRPF Achievements. In order to test whether My-fitness is helpful for students' self-efficacy and HRPF achievements, a control group was utilized to compare with the experimental group. The results indicate that the experimental group will have more confident to complete the learning process and achieve higher HRPF achievements, as shown in Figure 7. This implies that a mobile APP-supported learning approach is effective and successful in the physical education course of an elementary school.

4.7.3. Self-Efficacy and System Usability. The result shows that there is a positive correlation between self-efficacy and system usability, as shown in Table 13. When these students think that My-Fitness is acceptable, accepting a new learning approach make them feel that it is not difficult, which will give students a higher confidence to complete the learning process. This is consistent with previous studies which arrived to similar conclusions that self-efficacy and perception of system usability had a positive correlation [29].

4.7.4. The Results of Different Learning Approaches on Students' Pretest and Posttest HRPF Achievements. We found that two different learning approaches can improve students' HRPF achievements, but a mobile APP-supported learning approach (experimental group) has a much better effect than the traditional learning approach (control group), as shown in Table 14. The increased mean value of experimental group

Table 14: The results of different learning approaches on students' self-efficacy and HRPF achievements (all participants).

Dimension	Group	Descriptive statistics			Hotelling T^2	
		N	Mean	SD	F value	P
Fitness	Control group	41	43.62	18.20	3.38	0.01**
	Experimental group (pretest)	48	54.76	21.96		
	Control group	41	50.73	16.61	10.02	0.01**
	Experimental group (posttest)	48	66.56	19.92		
Self-efficacy	Control group	39	3.99	0.84	2.14	0.04*
	Experimental group	47	4.09	0.65		

We removed 3 outliers during the Self-efficacy analysis process, $^{*}P < 0.05$, $^{**}P < 0.01$.

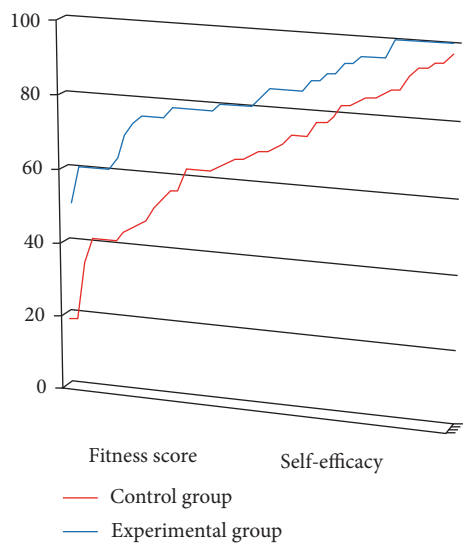

Figure 7: The difference of HRPF score and self-efficacy between the control group and the experimental group.

was 11.8, and 7.11 for the control group. The result conformed to the study of [14], the participants who had assistant system support would have a better learning achievement.

5. Conclusions and Suggestions

This study has developed a mobile APP-support learning system named My-Fitness which assists students to improve their HRPF achievements. It allows students to strengthen their self-efficacy based on the mobile phone-based environment and give them a more efficient and complete learning process. In addition, My-fitness is a mobile phone-based system which has a simple and convenient feature, and students can upload data to the cloud; teachers can also use the Firebase on the web to evaluate students' learning achievement and quickly give advice and encouragement to students. The results showed that most students were satisfied with the system and confirmed that My-Fitness did enhance their learning achievement.

This study explores several factors of HRPF achievements, such as self-efficacy, a user-friendly system, and various demographic variables. The results confirmed that these factors actually affect students' learning achievement. My-Fitness is indeed able to enhance students' self-efficacy and improve their learning achievement. In addition, this study found that regular exercise can achieve better HRPF achievements.

These findings can provide a good reference for assisted tool design of relevant studies and help teachers implement efficient instruction and improve students' HRPF achievements. This paper aims to investigate how My-Fitness improves students' HRPF achievements and effectiveness. The contributions of this paper are listed as follows:

(1) A mobile APP-supported learning system was proposed to improve students' learning achievement and make students to easily use it.

(2) The HRPF achievements by proposed system were investigated.

(3) The self-efficacy and system usability influence effectiveness of HRPF achievements and the students' acceptance of a mobile APP support learning approach.

To sum up, the major contribution of this study is to propose a new application of a mobile APP-supported learning system in the field of physical fitness with elementary school children.

In the future, a mobile APP-supported learning approach can be further improved by providing a database with categorized candidate feedback through which students are able to receive an immediate feedback from the system, and the system can be a good support to improve students' HRPF achievements. Furthermore, a new perspective can enhance the work. Fu et al. [44] found that efforts to improve user satisfaction will increase the therapeutic impact, and Kaipio et al. [45] also indicated that physicians' low ratings for their electronic health record (EHR) systems considerably hinder the efficiency of EHR use and physician's routine work. Therefore, it is worth trying to explore students' perceptions using other questionnaire tools, such as Questionnaire for User Interaction Satisfaction (QUIS) suggested by Johnson et al. [46] to make the APP more reliable.

Conflicts of Interest

The authors declare that there are no conflicts of interests regarding the publication of this paper.

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