Can Mobile Virtual Fitness Apps Replace Human Fitness Trainer?

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Abstract- The increased need in promoting fitness activity and rapid growth of smart-phones has urged the development of mobile virtual fitness apps (MVFA). Yet, evaluation on these MVFA has been limited and, therefore, this study attempts to conduct preliminary evaluation on randomly sampled MVFA based on our proposed system workflow using theories of social support and persuasive technology, and the American College of Sports Medicine (ACSM) guidelines for exercise professionals. Results indicated the sampled MVFA mainly covered the stages 2 and 3 of our proposed ACSM-based training workflow. In terms of social support and persuasiveness of MVFA, the average scores of these two aspects were relatively low, thus resulting in a generally low average quality of coverage scores. Therefore, MVFA cannot replace human fitness trainers, but serve as assistant to trainers and trainees. Explanations and implications to trainers, trainees and MVFA developers are presented.

I. INTRODUCTION

Convincing evidence has shown those who are physically active have longer life expectancy, lower morbidity [1], and lower the risk of having chronic diseases and premature death [2]. Workplace physical activity also has beneficial effects on employees' physical and mental health [3], and higher perception of productivity with more regular exercise [4].

Despite the many benefits of physical activity, many people still engage in sedentary lifestyles. From the reports of the U.S. [2] and U.K. [5] Governments, inactivity was and still is prevalence in the society across different age groups and genders, which has become a world-wide pattern. Reasons for inactivity include limited time and difficult access to facilities [6], inflexible work schedule, heavy work load, unawareness of fitness needs and little physical activity culture [7]. Therefore, encouraging individuals to participate in physical activity is of great importance.

To encourage physical activity adoption and adherence, researchers have used multiple approaches to identify effective methods for health behavior change. According to the Health Belief Model (HBM) [8], individual belief relating to the readiness to take health action (perceived susceptibility and perceived severity) and their belief in the value and cost of taking health action (perceived benefits and perceived barriers) constitute the individual's motivation to participate in health behavior. Furthermore, HBM postulates that relevant stimuli to individual, cues to action must occur to trigger the health action. The stimuli can be external, such as reminder, support from others and persuasive communication; or internal, such as previous personal experience. Social support from interpersonal relationships, then, can be used as a cue to action for physical activity. In fact, social support appears to be one of the important correlates to adults' participation in physical activity [9].

In sight of this, exercise professionals implement different interventions to promote healthy lifestyles. The commercial and technology markets have also developed diverse products and equipments to promote this concept to potential customers and users. The rapid growth of smart-phones has urged the development of mobile virtual fitness apps (MVFA), such as RunKeeper, iFitness and Endomondo. Nonetheless, the quality of these apps varies and evaluation of them has been limited [10]. Therefore, this study attempts to examine this research gap with reference to theories that are related to the design and evaluation of these MVFA. In general, there are two major research contributions of this study. First, we propose a system workflow for MVFA's design based on the American College of Sports Medicine (ACSM) guidelines for exercise professionals. Secondly, according to the proposed workflow, we use theories of social support and persuasive technology to develop a benchmark measurement for evaluating the current MVFA, and provide empirical evidence and implications for fitness trainers, trainees and MVFA developers. The theoretical background is presented in the next section. Then we discuss the design of our proposed workflow and evaluation benchmark, followed by result analysis and discussion for current and future MVFA.

II. Research Background

A. Social Support Theory

Various conceptual models and theories of social support have been used for studies that evidence people who receive more social support in participating physical activity are more likely to be active, sustained higher adherence rates and reduced relapse of inactivity (e.g., [4], [7]). There are several components of social relationships in the health-related studies. One of the views focuses on four functional and quality dimensions of social support. House [11] has proposed that social support can be 1) instrumental (provides tangible aid and services to assist one); 2) informational (provides information and advice to one to address problems); 3) emotional (provides empathy, care, trust and encouragement to one); and 4) appraisal (provides constructive feedback and affirmation for one's self-evaluation).

Furthermore, Billings and Moos [12] suggest different functional supports may have different effects on different situations, depending on how one copes and one's perceived control of the situation. Under controllable situations, people tend to engage in problem-focused coping behaviors. Under uncontrollable situations, people tend to regulate emotion by diminishing the aversive emotions derived from these situations. Hence, informational support and appraisal support facilitate problem management, while emotional support is necessary for motivation and persistence [13]. In situations like continuous physical activity participation, it appears that both informational support and emotional support are necessary, since these situations need one's control and involve long period of time. Duncan and McAuley [14] have pointed out support from different social relationships has positive association with continued exercise participation, in which encouragement and positive feedback from exercise leaders and fellow participants are most important factors.

One form of support from others when one participates in physical activity is to work with personal fitness trainers. Roberts [15] suggests there are many reasons for people to hire personal fitness trainers, including "the need for specialized care when recovering from illness or accident, the commitment to improve their fitness levels, and the desire to have someone to motivate and educate them". True, personal fitness trainers not only provide informational support and appraisal support to their trainees by coaching the latter with exercise knowledge, but they also provide encouragement and emotional support when their trainees are going through tough exercise sets, or remind them to do exercises. What the personal fitness trainers say serves as cues to action for trainees to take part in physical activity. Moreover, by giving out health and fitness assessments to trainees, trainers provide instrumental support to trainees that can help the latter to be more aware of their perceived susceptibility and severity of current health status. In turn, this can motivate trainees to be more physically active.

Nonetheless, the effect in motivating participation of physical activity of health interventions [3] is mixed. Although the effectiveness of promoting physical activity by personal fitness trainers has found to be significant [16], would it be possible to better encourage, or persuade, physical activity participation with the help of technology?

B. Persuasive Technology Theory

Persuasive communication theory has pointed out educational messages can only be effective if people are being exposed and attentive to the information; when the messages have strong and convincing evidences; and are communicated by sources perceived to be credible and trustworthy [17]. Fogg [18] has identified a functional triad of persuasive computing technology from a user-perspective, namely tools, media and social actors, and it can be related to persuasive communication theory. Tools make target behaviors easier and more efficient to do, thus increase the capability of users to perform such behaviors. Media motivates users through providing vicarious experiences through symbolic information and sensory stimulation. Social actors can be persuasive by creating social relationships so as to provide support or assistance in modeling.

Persuasion strategies differ depend on whether which role the computer technology functions [18]. Many physical activity interventions have been focused on tools and social actors [10]. According to Fogg [18], there are seven types of persuasive technology tools: 1) Reduction simplifies complex behavior into a few simple steps so as to increase the benefit to cost ratio and self-efficacy of certain behaviors, thus motivates people to perform the behaviors; 2) Tunneling guides users through a predetermined sequence of actions or events, providing opportunities for persuasion to take place along the way; 3) Tailoring persuades people to change their attitudes and behaviors through customization by providing specific rather than generic information; 4) Suggestion builds on people's exiting motivation and suggests people to adopt certain behaviors at the most opportune moment; 5) Self-monitoring helps people to monitor themselves for modifying attitudes or behaviors and achieving predetermined goals; 6) Surveillance persuades others to modify or adopt certain behaviors through overt observation by another party; and 7) Conditioning applies principles of operant conditioning and uses positive reinforcement to shape behaviors. In order to be persuasive, mobile virtual fitness apps (MVFA) should acquire these seven principles, or at least some of them, in motivating trainees to participate in physical activity.

Evaluation on MVFA has not been extensively studied. With the popularity and convenience of smart-phones, there is a need to develop justified benchmark to validate the usefulness of these fitness applications. Moreover, to increase its persuasiveness, it is important to simulate the fitness training process of MVFA to that of real life personal fitness trainers. Therefore in this research, we attempt to propose a virtual personal fitness workflow for MVFA's design based on the American College of Sports Medicine (ACSM) guidelines for exercise professionals.

III. OUR PROPOSED VIRTUAL PERSONAL FITNESS WORKFLOW

Many internationally recognized health and fitness organizations have issued guidelines to assist exercise professionals in upholding the highest level of professional and ethical conduct when directing trainees. We have summarized the guidelines from ACSM ([19], [20]) and NASM [21] into several stages and steps, and transformed those stages into a flow chart that is comprehensible for the design of MVFA. These stages are pre-participation assessment (stage 1), pre-exercise evaluation and exercise prescription (stage 2), program monitoring (stage 3), and program evaluation (stage 4). Fig. 1 illustrates and summarizes our proposed virtual personal fitness workflow.

A. Pre-participation Assessment

To optimize the safety and effectiveness of pre-exercise evaluation and exercise prescription, pre-participation health appraisal and risk stratification of trainees are necessary. Self-guided questionnaires or instruments can be used to briefly distinguish whether trainees possess health risk when initiating exercise program, in particular for vigorous intensity programs [19]. Trainees should consult exercise professionals medical and health examination before performing more extensive health-related fitness assessment [19]. Trainees are stratified

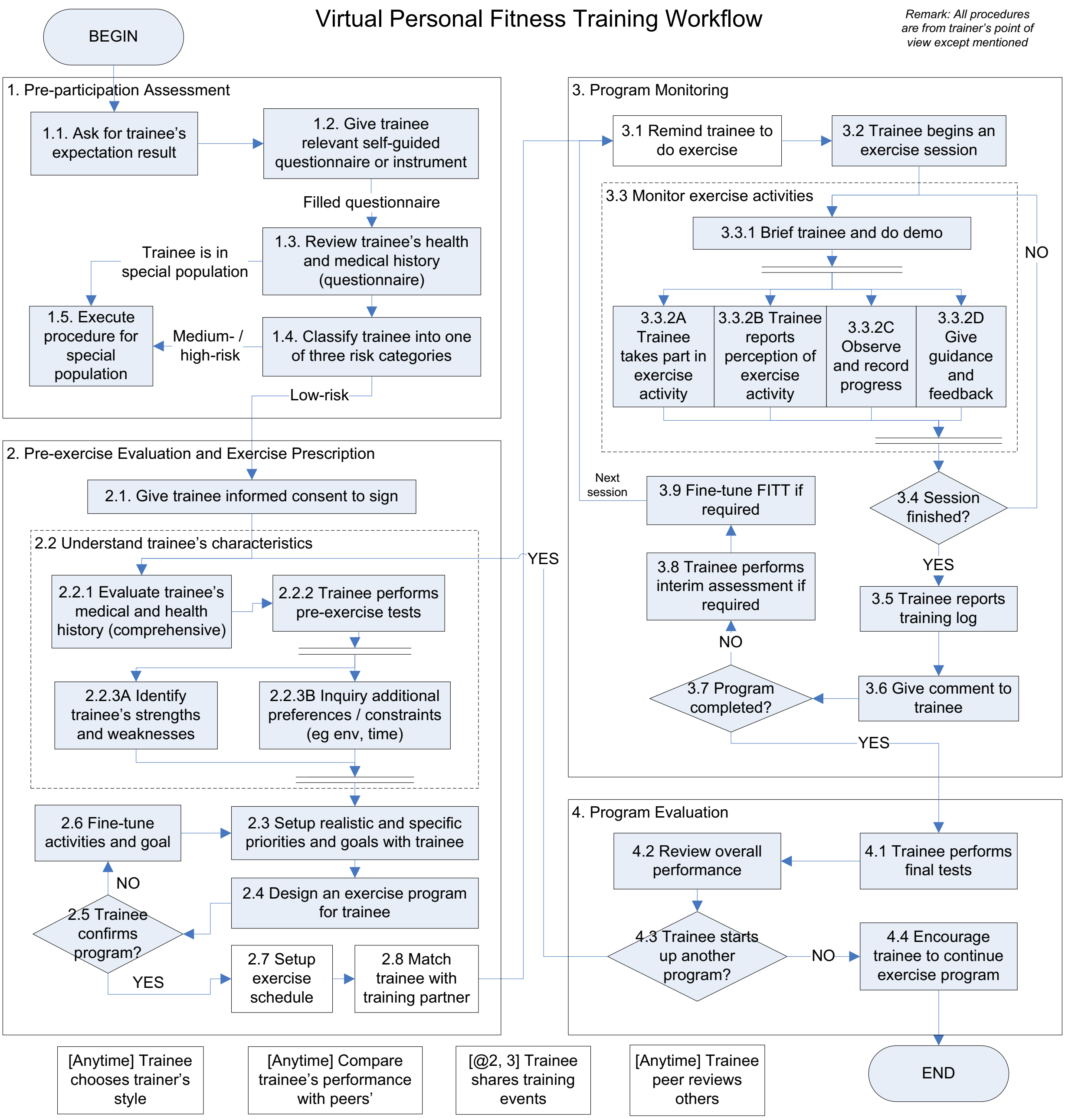

Fig. 1. Virtual Personal Fitness Training Workflow

into three risk categories (low, moderate and high) for exercise participation. By systematically gathering and evaluating trainee's health status and medical history, appropriate recommendations for further exercise evaluation and prescription can be given.

B. Pre-exercise Evaluation

While pre-participation assessment provides a brief health status screening for trainees, pre-exercise evaluation aims to provide thorough understanding the physical condition of trainees and adequate information for developing an appropriate exercise prescription. It consists of medical history evaluation, physical examination identification of exercise contraindication and informed consent procedures prior to fitness testing ([19], [21]).

After fully evaluating a trainee's readiness and physical condition to participate in fitness training program, fitness testing is conducted to identify the trainee's strengths and weaknesses on the health-related fitness components ([19], [21]). Also, to assist the trainee in setting up realistic and specific goals for designing tailor-made exercise prescriptions, exercise professionals should also understand the trainee's motives, preferences, living and working environment and accessibility to exercise facilities and equipments, and constraints of participating in exercises so as to optimize exercise benefits and ensure safety ([19], [21], [22]).

***C.** Exercise Prescription*

The FITT (Frequency, Intensity, Time, and Type) principle is widely used in exercise prescription for improving the health-related fitness components including cardiovascular endurance, muscular strength, muscular endurance, flexibility and body composition [19]. Furthermore, National Academy of Sports Medicine [21] has provided specific training principles on neuromuscular fitness other than the health-related fitness components. These trainings include core-muscle, balance, reactive power, speed, agility and quickness [23].

The FITT exercise prescription for each trainee varies, depending on the trainee's characteristics and goals. In general, the program should progress through different phases [24]. In the initial conditioning phase, increases duration is recommended. Training effects such as improvements in cardiovascular endurance and decrease fatigue can be observed. In the improvement conditioning phase, further increases on duration, intensity and frequency are suggested for continual improvements. As trainees enter the maintenance conditioning phase, trainees are encouraged to continue their exercise programs for benefit maintenance ([20], [24]).

D. Program Monitoring and Program Evaluation

Program monitoring and program evaluation are two inter-related stages. Program monitoring and evaluation are important to objectively assess and judge the effectiveness of the fitness training program implemented [25]. Program monitoring and evaluation should continuously and regularly assess both short term and long term exercise goals and plans.

Program monitoring provides information and feedbacks to both the trainees and exercise professionals in identifying problems and modifying fitness training program. Studies have shown that being able to document exercise data and track trainees' progress increases exercise adherence rate, and tendency to stay motivated, by following their progress to their goals [26].

Together with constant reminder and feedback from exercise professionals, fitness program can be better implemented and more successful [27].

Constant evaluation in the form for fitness testing or surveys can help evaluate whether trainees achieve the fitness training program's effects and their exercise goals ([20], [27]). These not only help trainees to stay motivated in doing physical activities, but also make clear if program adjustment is necessary [21]. When trainees complete the fitness programs, exercise professionals should encourage them to continue exercising in another fitness program.

IV. Methodology

To investigate the usefulness of the randomly sampled mobile virtual fitness apps (MVFA), we proposed a virtual personal fitness training workflow (see Fig. 1) and used it to establish a benchmark questionnaire for MVFA evaluation based on the theories of social support and persuasive technology. The questionnaire measures how much a MVFA covers our proposed training workflow and how well it performs according to the aforementioned theories of social support and persuasive technology.

In total, we created 35 questions for examining whether the sampled MVFA cover all the stages/steps in our proposed training workflow, and 68 questions for examining the 4 aforementioned dimensions of social support (see Section II.A for details) by the MVFA, in which 8 questions on Instrumental (IS), 27 questions on Informational (IF), 13 questions on Emotional (EM) and 20 questions on Appraisal (AP). Also, we created 73 questions for examining the 7 aforementioned dimensions of persuasiveness (see Section II.B for details) of MVFA, in which 18 questions on Reduction (Rd), 6 questions on Tunneling (Tn), 14 questions on Tailoring (Ti), 17 questions on Suggestion (Sg), 10 questions on Self-monitoring (Sl), 2 questions on Surveillance (Sr), and 6 questions on Conditioning (Cn).

Also, all these questions are measured using an ordinal scale of 0 to 7. A score of 7 means the rater "strongly agrees" with the statement of the question, while 1 means "barely agree." A score of 0 means "disagree."

In this study, 9 free MVFA were randomly sampled from the list of most popular "health & fitness" MVFA in Apple App Store and were installed into two iPads, in which there are four MVFA on gym exercises, three on cardio / running exercises, and two on stretching and yoga. Two raters, one is an Olympic-grade athlete and the other is an experienced software developer, independently rated all the sampled MVFA with the benchmark questionnaire. Both of them did not use any of the MVFA before. After independent evaluation, the raters held a discussion session to resolve disagreements and finalized the scores.

V. RESULT

Table 1 shows the coverage score of all sampled MVFA, labeled as MVFA 1 to MVFA 9, in each stage/step of our proposed training workflow. It also presents scores with top-two levels of detail. More specifically, for the step having sub-steps, such as Step 2.2 with sub-steps of Step 2.2.1, Step 2.2.2, Step 2.2.3A and Step 2.2.3B, the presented score is the unweighted average of the scores of all sub-steps.

The percentage of coverage (at step level) is calculated by the number of MVFA with positive coverage value over the total number of sampled MVFA in such step. On the other hand, the percentage of coverage (at stage level) is calculated by the number of steps with positive value of % of coverage over the total number of step in such stage.

The average quality of coverage (at step level) is calculated as the unweighted average of all the positive scores in such step. On the other hand, the average quality of coverage (at stage level) is calculated as the unweighted average of all the positive scores in such stage.

In Table 2, each empty cell (with no score) corresponds to a specific step of training workflow which is not relevant to a specific dimension of social support or persuasiveness. As Table 1, it also presents scores with top-two levels of detail.

More specifically, Table 2 shows the scores of specific social support and persuasiveness in each stage/step of our proposed training workflow, which is the unweighted average of the scores (with non-empty value) of specific social support and persuasiveness amongst all 9 sampled MVFA.

The average score of overall social support or persuasiveness (at step level) is calculated as the unweighted average of all the non-empty scores in such step. On the other hand, the average of overall social support or persuasiveness (at stage level) is calculated as the unweighted average of all the non-empty scores in such stage.

TABLE 1. The coverage scores of the randomly sampled Mobile Virtual Fitness Apps (MVFA)

Stage/Step of Training Workflow	Name of Stage/Step of Training Workflow	MVFA 1	MVFA 2	MVFA 3	MVFA 4	MVFA 5	MVFA 6	MVFA 7	MVFA 8	MVFA 9	% of Coverage	Average Quality of Coverage
Stage 1	Pre-participation Assessment										25%	2.25
1.1	Ask for trainee's expectation result	0	2	0	2	0	0	3	2	0	44%	2.25
1.2	Give trainee relevant self-guided questionnaire or instrument	0	0	0	0	0	0	0	0	0	0%	
1.3	Review trainee's health and medical history (questionnaire)	0	0	0	0	0	0	0	0	0	0%	
1.4	Classify trainee into one of three risk categories	0	0	0	0	0	0	0	0	0	0%	
1.5	Execute procedure for special population	0	0	0	0	0	0	0	0	0	0%	
Stage 2	Pre-exercise Evaluation and Exercise Prescription										100%	3.3
2.1	Give trainee informed consent to sign	0	0	3.5	3.5	0	0	0	0	0	22%	3.5
2.2	Understand trainee's characteristics	0	0.5	0	0.5	0.75	0	0.25	1	0	56%	0.6
2.3	Setup realistic and specific priorities and goals with trainee	0	3	2	0	0	0	0	0	0	22%	2.5
2.4	Design an exercise program for trainee	0	2	3	4	5	3	2	5	4	89%	3.5
2.5	Trainee confirms program?	0	2	6	0	6	0	1	6	5	67%	4.33
2.6	Fine-tune activities and goal	1	6	3	0	4	2	1	4	3	89%	3
2.7	Setup exercise schedule	4	0	2	0	3	4	0	7	0	56%	4
2.8	Match trainee with training partner	0	0	0	3	0	0	7	0	0	22%	5
Stage 3	Program Monitoring										86%	3.18
3.1	Remind trainee to do exercise	6	0	0	0	0	0	0	7	0	22%	6.5
3.2	Trainee begins an exercise session	0	1.33	0.33	1	1.33	1.33	2.33	4	1.33	89%	1.63
3.3	Monitor exercise activities	1.8	2.8	3.8	2.2	3.2	3.4	3	2.2	1.6	100%	2.67
3.5	Trainee reports training log	0	3.5	2	2	4.5	5	3.5	4.5	3.5	89%	3.56
3.6	Give comment to trainee	0	5	0	0	0	2	3	0	1	44%	2.75
3.8	Trainee performs interim assessment if required	0	0	0	0	0	0	0	0	0	0%	
3.9	Fine-tune FITT if required	0	0	0	0	2	0	0	0	0	11%	2
Stage 4	Program Evaluation										25%	3.33
4.1	Trainee performs final tests	0	0	0	0	0	0	0	0	0	0%	
4.2	Review overall performance	0	0	0	0	0	0	0	0	0	0%	
4.3	Trainee starts up another program?	1	4	5	4	3	4	1	4	4	100%	3.33
4.4	Encourage user to continue exercise program	0	0	0	0	0	0	0	0	0	0%	

TABLE 2. The social support and persuasiveness scores of the randomly sampled Mobile Virtual Fitness Apps (MVFA)

Stage/Step of Training Workflow	Social Support					Persuasiveness							
	Instrumental (IS)	Informational (IF)	Emotional (EM)	Appraisal (AP)	Average Score of Social Support	Reduction (Rd)	Tunneling (Tn)	Tailoring (Ti)	Suggestion (Sg)	Self-monitoring (SI)	Surveillance (Sr	Conditioning (Cn)	Average Score of persuasiveness
Stage 1					0	1							1.25
1.1				0	0	2	0	1.75					1.25
1.2													
1.3													
1.4													
1.5													
Stage 2					1.1	1.32							2.37
2.1		4			4	2.25							2.25
2.2	0.8	0	0	0.27	0.27	1.73	0.4	3.6	0	0.5			1.25
2.3				0	0			1.5	1				1.25
2.4		0			0			3					3
2.5				0	0			3.83					3.83
2.6		0.25		0	0.13	4.63			0				2.31
2.7	2.4				2.4	3.2							3.2
2.8	3		1		2	3.5		3	3		0	0	1.9
Stage 3					1.88								2.41
3.1		6.5	3		4.75			6	6.5			3	5.17
3.2		0.88		0	0.44			0.88	0.88	0			0.58
3.3	2.22	3.19	0.67	0	1.52	2.44		1.33	2.11	1.5	1	1.56	1.66
3.5	4.38		4.5	0	2.96	3.94				2.56			3.25
3.6		1.06	1.5	0	0.85			2.25	0.63			1.5	1.46
3.8													
3.9		1.5		0	0.75	5		2	0				2.33
Stage 4					0.44								3.11
4.1													
4.2													
4.3		0.44			0.44				3.11				3.11
4.4													

VI. Discussion and Implication

According to the results, all the MVFA evaluated mainly covered ACSM stages 2 and 3, but only 25% of them covered stage 1 (pre-participation assessment) and stage 4 (program evaluation). The MVFA mainly focused on designing exercise programs (step 2.4), setting up exercise schedules (step 2.7), indicating exercise sessions have started for trainees (step 3.3), recording trainees' progresses automatically (step 3.5) and eventually asking trainees to begin another physical activity program (step 4.3). However, only some of them asked trainees for expectation results (step 1.1) and neglected other steps in stage 1. Besides, none of them did pre-exercise evaluation. These undermine the importance of health appraisal and risk stratification, posing questionable safety concerns when the trainees follow the MVFA to do exercise. Thus, the average "quality of coverage" scores for each stage were not high, ranging from 2.25 to 3.33.

Drilling the collected data down to the question level (not reported in Tables 1 and 2), 44% of MVFA could automatically record and monitor trainees' progresses through the use of equipments such as GPS, heart rate monitors and pedometers. Yet, the sampled MVFA could not fully monitor and evaluate the trainees' performances unless they conducted pre-, interim- and post-exercise program testing, in which no MVFA did so. Also, 66% of MVFA could not let trainees to report their perceptions during and after exercise activities, hence decreased opportunities for trainees to adjust their exercise programs. Furthermore, none of the sampled MVFA provided immediate evaluative feedback during exercises, which neglected appraisal support and could delay learning on appropriate training methods.

In terms of social support, many MVFA directed trainees to set up exercise schedules (step 2.7). Only one MVFA provided exercise reminders to trainees (step 3.1). Five MVFA gave encouragements and helped trainees to log their training during exercises (step 3.5), with some allowed the sharing of training logs and comments between trainees on the MVFA's interfaces. Nevertheless, the average scores for social support in each stage were quite low, ranging from 0 to 1.88. The MVFA put emphasis on instrumental, informational and emotional supports, but with limited immediate and evaluative feedback, they could not give much appraisal support to trainees. These supportive features still needed to be improved in order to help trainees in adopting and maintaining their exercise routines.

In terms of persuasiveness of MVFA, the sampled MVFA had average scores ranging from 1.25 to 3.11. Out of the seven principles, only a few of them were frequently used, namely reduction, tailoring and suggestion. Reduction was mainly applied in confirming trainees' exercise program (step 2.5), automatically logging trainees' progresses (step 3.5) and ending the exercise session (step 3.9). In particular for step 3.5, this made record keeping easier and more convenient for trainees. For tailoring, it was mainly used in stage 2 for exercise planning, such as letting trainees to choose their preferred physical activities and durations and intensities of such activities. Consolvo and colleagues [28] also state the importance of tailoring in taking account of setting individualized goals and considering personal constraints when planning for physical activities. Suggestion was mainly used in reminding trainees to exercise (step 3.1) and suggesting trainees to participate in future physical activities (step 4.3). Though there was only one MVFA having the reminder function, we think it is crucial to incorporate reminder in MVFA's design as a cue to action [8] to encourage trainees in doing physical activities.

Also, we found that MVFA gave trainees stimulating sensory experiences, like video and audio cues, to attract or motivate trainees in participating physical activities. Therefore, app designers should achieve a balance between the persuasive technology triad. Also, it is valuable to examine the persuasive media aspect and include it in evaluation of MVFA in future studies.

The relatively low scores in the average scores for social support and persuasiveness of MVFA resulted in a generally low average quality of coverage scores for the sampled MVFA. If future MVFA can combine social support features with persuasive technology principles, more significant effects can be observed in inducing cognitive and behavioral changes of people to be physically active. Therefore, future development of MVFA should encompass theory-based design requirements from these two theories.

To summarize, our results have several implications. Firstly for mobile virtual fitness app developers and designers, the system workflow and benchmark serve as guidelines in designing future apps, in such raising the social supportive feature and persuasiveness of apps to promote fitness activity participation. Secondly for trainers, the exercise professionals, the MVFA can be a supplementary tool to assist them in coaching trainees and so enhance the training effects, especially in the stages 2 and 3 of our proposed ACSM-based training workflow. Lastly for trainees, the MVFA users, they can have more insight when selecting fitness apps with reference to our proposed system workflow and benchmark.

VII. Limitation and Future Direction

The study is not without limitations. First, in this study we only studied nine randomly sampled free mobile virtual fitness apps (MVFA). The generalizability of our results is limited since it does not apply to all other free MVFA and particularly paid MVFA that may have more features and functions, e.g. choosing trainers and their training styles as mentioned in our proposed training workflow. Secondly, the benchmark questionnaire developed in this study mainly focuses on the social support and persuasiveness of sampled MVFA. The benchmark can be further extended by including other related dimensions, like the persuasive media aspect of the functional triad of persuasive computing technology [18], artificial intelligent support for exercise prescription design and social media (e.g. Facebook connectivity) for fitness program monitoring and evaluation etc., which are not effectively covered by current MVFA.

VIII. Conclusion

To conclude, this paper proposes a fitness training workflow based on the ACSM guidelines for exercise professionals, and develops a benchmark measurement for the evaluation of MVFA based on the theories of social support and persuasive technology. Our results indicate that the sampled MVFA covered mainly on the stages 2 and 3 of our proposed ACSM-based training workflow. In terms of social support and persuasiveness of MVFA, the average scores of these two aspects were relatively low, thus resulting in a generally low average quality of coverage scores. More emphasis is needed on improving these features of current MVFA. Also, MVFA can serve as an assistant to personal fitness trainers rather than replacing them. It has a great potential of using MVFA in guiding individuals to be physically active and change to lead a healthier lifestyle with further refinement.

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