

Web-based Workplace Health Promotion

Johannes SAMETINGER

Johannes Kepler University, Altenbergerstr. 69, Linz, 4040, Austria

Tel: +43 70 2468 9435, Fax: +43 70 2468 9430, E-mail: johannes.sametinger@jku.at

Abstract: People's activities are often monotonous over long periods of time, e.g., sitting at a desk and working with a computer. Together with an inactive lifestyle, this leads to muscle weakness, postural faults and movement dysfunction, thereby increasing the likelihood of musculoskeletal problems. Ever more young people are affected by such musculoskeletal problems. Strength and weight training can both prevent and remedy these problems.

We have implemented an interactive Web-based platform as a link between people who do such training and those who supervise them. Via the platform, trainers can efficiently supervise their clients and make sure that they correctly follow their training schedule. Exercising persons get supervision without the need to physically visit their trainers all the time, yet they can communicate with the trainer, get feedback, etc. The platform is now being used for workplace health promotion to increase the effectiveness and lower the costs for the participants and their employers.

1. Introduction

Professional activities of modern people include working on assembly lines, sitting at desks, working with computers, etc. Many of these activities are done monotonously over long periods of time and either strain or neglect parts of the musculoskeletal system. This leads to discomfort and medical conditions at alarmingly low ages of affected persons. Typically, the primary motivation in seeking medical assistance or physiotherapy is to alleviate pain. It is widely accepted, though, that specific strength and weight training can both prevent and remedy these problems.

Most people lack the motivation to do any training, especially before they experience discomfort. Institutionalized health care often tries to increase motivation, e.g., by organizing training with expert trainers. However, experience has shown that motivation declines rapidly as soon as individuals are left to train on their own. Still, continued training under supervision is expensive.

This paper introduces an interactive Web-based health promotion platform that can be used to sustain motivation, to support communication between trainers and their clients, and to document the training effort. The platform is currently in use for a workplace health promotion study, which is also presented below.

2. Objectives

Damage to the musculoskeletal system that is due to monotonous work activities can be overcome with regular training. Obviously, training should be started and performed regularly before such damage occurs. However, most people have little or no motivation for such training unless they already experience discomfort.

The first step is to motivate people to start training. Once they have begun some form of exercise, they regularly need help to sustain it. There are many ways of keeping motivation up. For example, certified fitness coaches can provide motivational strategies. Simply keeping records about the training is more cost-effective and may also suffice. New technical gadgets provide a motivational aspect for technology aficionados; for example,

watches that monitor the heart rate or fitness devices that record the activity can sustain motivation, at least for some time. Social aspects are likely to be more effective, for example, training with like-minded people or, better yet, with professional trainers. The problem with the latter is the associated costs.

The term eHealth is used quite broadly to include electronic medical records, telemedicine and health services provided over the Internet. According to Eysenbach, eHealth is “in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies.” [1] The term characterizes a technical development as well as networked, global thinking. eHealth aims to improve health care by using information and communication technology.

We hypothesize that it suffices to have only limited face-to-face expert training. An Internet platform can be used to reduce the amount of supervised training while still providing constant supervision by a professional trainer. Our goal is to replace parts of supervised training with individual training that is supported by a Web-based platform. The platform can be used to monitor and evaluate the training and to serve as a communication vehicle. The communication aspect is important to ensure that the training is done as prescribed by the trainer and to keep motivation up.

3. Methodology

We suggest initial workshops for small groups of 10 to 15 clients. Clients in a group should all have about the same fitness level or experience similar problems with their musculoskeletal system. Depending on their fitness level or their problems, the trainer will select appropriate exercises, demonstrate these exercises and do initial training with the group. Based on these exercises, the trainer will also create a training schedule requiring that these exercises be done on different days of the week with different intensities and different numbers of repetitions.

After the initial workshop, each client receives login data via e-mail. Clients then do their exercises wherever and whenever they want, typically at home or in their office, and enter data about their training at the Internet platform. The exercises include flexibility exercises such as stretching and anaerobic exercises such as weight training. Flexibility exercises improve the motion range of muscles and joints. Anaerobic exercises increase short-term muscle strength.

We have developed an interactive Web-based platform called fit123+. The platform can be used for communication between trainers and their clients; i.e., it is intended as the link between them as shown in Fig. 1. The platform describes all the exercises in detail with images, so that clients can easily recall the exercises that were presented at the workshop. They can view their training schedule and enter details of successfully completed exercises.

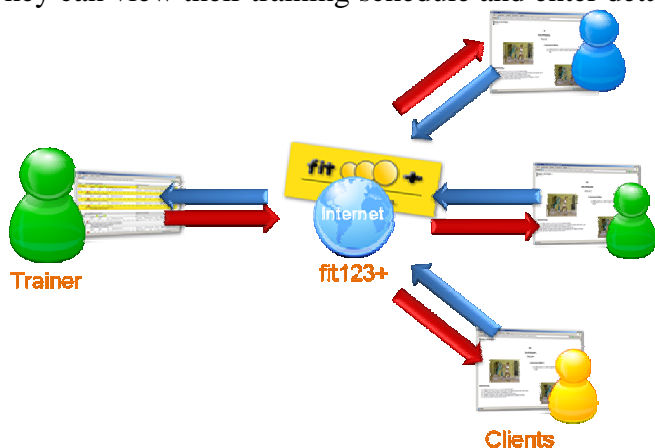


Figure 1: The Platform Fit123+ as a Link Between Trainers and Their Clients

Details include the level, the number of repetitions, series breaks, the intensity, how clients felt before and after the training, and any additional comments or questions. Information about how to enter data is provided at the initial workshop.

The trainer reviews this data on a regular basis. The platform provides help in quickly finding abnormal or deviant entries, making it more efficient for the trainer to review the training performance. The trainer also answers questions and typically comments on any deviations from the training schedule. The trainer can also modify the training schedule for a group or for individual clients. Figure 2 shows the platform’s user interface, where a trainer can edit the weekly schedule for clients. Table 1 summarizes the functionality of fit123+. General information about fit123+ and a demo version is available online [2].

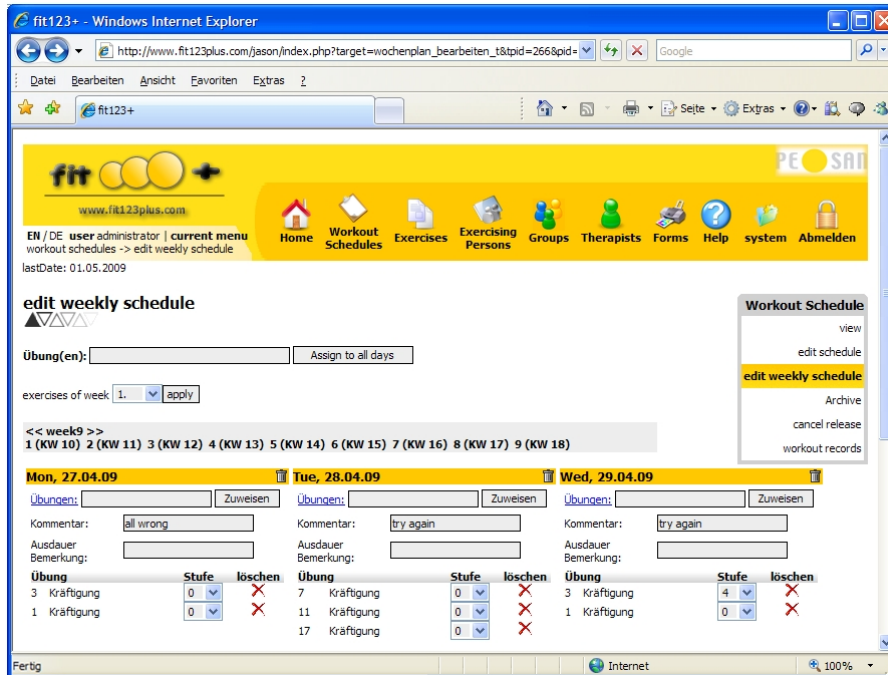


Figure 2: fit123+ User Interface in Web Browser

Table 1: Fit123+ Functionality

	Trainers	Clients
Administration	<ul style="list-style-type: none"> manage individual clients as well as client groups 	—
Exercises	<ul style="list-style-type: none"> create and manage exercises with descriptions and images 	<ul style="list-style-type: none"> review exercise descriptions and images of exercises that are part of the training schedule
Training	<ul style="list-style-type: none"> assign individual clients or client groups to training schedules improve, modify, switch training schedules manage training schedules and assignments of schedules to clients or client groups 	<ul style="list-style-type: none"> review training schedule perform training enter data about completed exercises
Communication	<ul style="list-style-type: none"> review completed exercises provide various feedback, e.g., <ul style="list-style-type: none"> comment on exercises answer clients’ questions 	<ul style="list-style-type: none"> make comments about exercises ask trainer questions

4. Health Promotion

The government of the province of Upper Austria has launched initiatives to increase employee awareness about health conditions. “Fit on the job” is one such initiative [3]; here

companies receive financial support in order to provide health improvement activities to their employees. Also, there is a newly funded institute of health and social competence [4]. The institute and the provincial government have supported a pilot project where employees are taught an exercise program and are then supervised by means of fit123+.

The training is supervised by a physiotherapist. Workshops for employees are typically held in a room provided by the employees' company. Exercises for this workshop are aligned with the requirements stemming from their job descriptions. For example, employees doing computer work will do exercises concentrating on their back and their neck.

On the one hand, some clients were put off by inputting data on the Internet about their personal training. On the other hand, most people considered it motivating to not only fill in a prescribed training schedule but also to have it supervised by a therapist who makes comments, answers questions, or even adapts and modifies the training schedule. From time to time the therapist invites a participant to in-person training. Such an extra unit might be needed in order to adjust the training or to ensure that the exercises are done correctly.

So far about 200 employees have participated in these health care activities. After the initial workshop, four to six weeks of supervision was provided. So far, around 2000 training days have been prescribed, of which about half were actually performed and entered via the platform.

5. Technology

The platform was implemented in PHP [5]. It runs on a Web server and can typically be reached under the URL of a specific trainer. Data about the training and the exercises are collected in MySQL, which is an open source relational database management system that uses SQL (structured query language) and is freely available [6]. On the client side, cascading style sheets are used to guarantee uniform presentation of all fit123+ pages [7]. Additionally, JavaScript is used for client-side scripting [8].

Initial requirements for the platform were specified by a professional trainer. In an initial development cycle, a core system with the basic requirements was implemented. Subsequently an agile development process with short cycles improved and extended the system. At that time the trainer already had the platform in use and provided constant feedback about problems. He also made numerous comments and suggestions for better usability and other improvements.

The implementation process was straightforward without any significant problems. We incorporated the model/view/controller (MVC) architecture pattern [9]. The model contains all the data that are stored in the MySQL database. Different views are used to present this data to different types of users, i.e., administrator, trainers and clients. The controller is used to manipulate the data.

The database contains information about clients' training. This information is not as critical as information in medical records, for example. Nonetheless, security is important. Of course, client information must be available at any time and it must be neither seen nor modified by unauthorized third parties. Security was not considered for the first working prototype. The prototype contained various vulnerabilities such as cross-site scripting and SQL injection (see [10]). We have since taken extra precautions to ensure that the platform does not contain any security holes. For example, when clients input data, they might include harmful code that reveals data from the database or that destroys data therein. Therefore, this data undergoes careful inspection before it is entered into the database.

6. Discussion

In order to obtain feedback from clients, we asked them to complete a questionnaire that contained general questions about gender and age, the initial workshop, the daily training, the platform fit123+, the client's general well-being, and future plans. The number of completed questionnaires is still too low to draw conclusions with any statistical significance. Nevertheless, the feedback has provided some useful information and insights.

The participants' age was uniformly distributed from 20 to 50 years. There were about twice as many females as males. Most participants were comfortable with the initial workshop, i.e., about how the exercises were explained, the type of exercises, and the number of exercises. Most participants did their training more than twice a week to the prescribed extent and agreed that they were feeling better after the training. They did not have any problems using the platform. About half of them indicated that they were having some sort of discomfort with their musculoskeletal system before they started the training program. Almost all of them agreed with the statement "I have recognized improvements with my musculoskeletal system." Interestingly, the statement "I generally feel much better than before" found less agreement. Quite interesting information was provided in the section about future plans. While the majority was thinking about continuing the training, the majority was not prepared to bear any expenses.

The platform enables any trainer to supervise the exercises of clients. However, it is frustrating to communicate with an anonymous supervisor and even more frustrating if the supervisor varies over time. Therefore we have ensured that the trainer doing the initial workshop also supervises the respective clients.

fit123+ presently supports text-based communication only. Additional features such as video conferencing have been considered but not implemented yet. Video conferencing is useful for clients because they can obtain remote help from their trainer when they have questions about executing specific exercises. For example, trainers can remotely watch their clients performing an exercise and give specific advice or assess training progress. Also, trainers can again demonstrate the correct performance of exercises when they see that clients have problems with them. On the one hand, such features increase motivation of clients and make it easier for trainers to monitor training progress. On the other hand, trainers must spend considerably more time supervising a specific amount of clients. We envisage additional features such as video calls with extra charges.

To expand our program from employees to other clientele, we need to consider additional parameters; for example, elderly people are less likely to use the Internet. Mobile devices could also improve the usability of the system. It is already possible to use the platform via mobile devices providing Internet access; however, the platform will have to be optimized for mobile devices. Also, additional software for such devices could enable partial automation of the data transfer process.

Another potential application domain of our system is ambient assisted living (AAL), which is aimed at impaired persons and the growing group of elderly and includes health and activity monitoring [11]. The share of elderly people in our population is growing continuously. AAL covers a far wider range of monitoring than just training; examples of AAL include safety and quality of life. Safety can be increased by automatically switching off cooking stoves when residents leave home. Quality of life can be improved by automatically adjusting room lights and temperatures. In the sense of AAL, a platform like fit123+ can also contribute to providing a service to more people at lower costs. In this case, not only would the functionality of fit123+ itself have to be expanded, for example, by considering the heart rate during the training; improved communication features would also be needed to facilitate the use of fit123+. For example, rather than browsing the fit123+

website, we imagine a touch screen where exercises for a day are listed and can easily be marked as completed.

The term Web 2.0 refers to the second generation of the Web that is characterized as facilitating user participation, information sharing and collaboration [12]. In this sense, fit123+ is still a Web 1.0 application with its limited communication feature. We imagine Web 2.0 features that increase clients' motivation. For example, group statistics that can be seen by each group member could allow comparison of one's own training with that of others in the group. Extended communication and information features among all group members rather than only between trainer and client would also motivate the use of the platform and consequently promote training on a regular basis.

7. Related Work

We are not aware of any system that is directly comparable to the fit123+ platform. However, there are systems that cover various parts of fit123+'s functionality. For example, PhysioTools can be used to create personalized exercise and information handouts [13].

PhysioTools offers annual subscriptions with professional sets of exercises that have descriptive images with clearly written instructions. PhysioTools can be installed as a local application but can also be used over the Internet in a Web browser. Over a period of already 20 years, the exercise library of PhysioTools has expanded to thousands of exercises in various languages. In contrast, fit123+ comes with a set of over 100 predefined exercises so far. However, we provide an easy mechanism for adding new exercises with textual descriptions and images. The focus of fit123+ is primarily on the training itself. One of our requirements was to let trainers easily add new exercises because trainers and therapists like to have their own sets of exercises. Predefined exercises are often rejected when they do not exactly match the trainers' liking.

Many technical gadgets like sports watches that are used for biking and running nowadays come with GPS, heart rate monitors, pedometers, etc. Therefore it is easy to collect data such as heart rate, current location, time and distance. Collected data can easily be transferred to computers and analyzed with software that helps to tailor workouts to meet specific goals and objectives. Web portals like the Polar Personal Trainer [14] additionally offer communities to find like-minded people and share the training with them. The focus of such training software is to help users improve their fitness and work on specific parts of the training. The focus of fit123+ is on flexibility exercises such as stretching and anaerobic exercises such as weight training rather than endurance training. This focus makes it more difficult to automatically transfer data about the training. Additionally, these exercises require more supervision than running or biking. Therefore direct feedback as offered in fit123+ is important to ensure that the training is performed correctly and to ensure timely reaction if any problems are encountered by clients.

The term *virtual physiotherapist* is used for various approaches. For example, specific movements to be made in an exercise can be shown on a monitor by a virtual physiotherapist rather than a real one. Also, sensors can be placed on various parts of the client's body; the client's movements can then be shown on the monitor. They can also be analyzed and compared with the virtual movement [15]. Virtual physiotherapists are also offered as diagnostic tools that provide information and directions for injury management [16]. fit123+ offers a simpler approach by providing information about exercises and by providing a communication platform between trainers and their clients, yet it is highly effective and efficient.

8. Conclusions

We have implemented an interactive Web-based platform for the administration of exercises and training schedules as well as for the supervision of training. The platform is now being used for workplace health promotion. Using the platform for such promotion increases the effectiveness and lowers the costs for the participants and their employers.

Therapists and trainers benefit from a platform like fit123+ because they can efficiently supervise clients and ensure that they follow their training schedules as expected. Clients benefit from supervision without the need to physically visit their trainers, yet they can communicate with an expert about their training, obtain feedback, etc. Companies can contribute to their employees' health at low cost. With fit123+, we offer packages to companies at much lower costs than previously.

It is neither useful nor possible to replace supervision by a therapist in general. However, often after a series of treatments, a patient is sent home with a package of exercises and there is no further check of whether these exercises are done as the therapist expects. fit123+ offers a solution to this problem.

So far the platform has been used and thoroughly tested by a single trainer with many clients. The next steps will be to make the platform available to other trainers, to further improve usability, and to extend communication mechanisms.

References

- [1] Eysenbach (2001) What is e-health? J Med Internet Res 2001;3(2):e20, doi:10.2196/jmir.3.2.e20
- [2] fit123+, <http://fit123plus.com>
- [3] Fit im Job, http://www.land-oberoesterreich.gv.at/cps/rde/xchg/ooe/hs.xsl/39468_DEU_HTML.htm (in German)
- [4] IGUS: Institut für Gesundheits- und Sozialkompetenz, <http://igus.or.at>
- [5] Lerdorf R. et al. (2006) Programming PHP, O'Reilly Media
- [6] MySQL Tutorial, <http://www.siteground.com/tutorials/php-mysql/mysql.htm>
- [7] Meyer E A (2004) Cascading Style Sheets: The Definitive Guide, 2nd Ed., O'Reilly.
- [8] Flanagan D (2006) JavaScript: The Definitive Guide, O'Reilly.
- [9] Stump J (2005) Understanding MVC in PHP, O'Reilly, <http://oreilly.com/php/archive/mvc-intro.html>
- [10] McGraw G (2006) Software Security: Building Security In, Addison-Wesley
- [11] Ambient Assisted Living, <http://www.aal-europe.eu>
- [12] Kwei-Jay L (2007) Building Web 2.0, IEEE Computer, vol. 40, no. 5.
- [13] PhysioTools, <http://www.physiotools.com>
- [14] Polar Personal Trainer, <http://www.polarusa.com>
- [15] Kastelic P, et al. (2007) Motion Training Control, http://www.fhv.at/res/uct/publikationen/schriften/uDay2007_03.pdf (in German)
- [16] PhysioAdvisor.com, Virtual Physiotherapist, <http://www.physioadvisor.com.au>