Making an Impact on the Obesity Epidemic by Deploying a Mobile Fitness Suite on the Android Market

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1. Why a Set of Fitness Applications

1.1 The Problem with Obesity

The Mayo Foundation for Medical Education and Research defines obesity as having an excessive amount of body fat, which can lead to many diseases such as coronary heart disease, diabetes, and high blood pressure [1]. Furthermore, obesity and physical inactivity increases the risk of stroke and cancers of the breast (postmenopausal), endometrium (the lining of the uterus), colon, kidney, and esophagus [2]. In fact, the leading cause of cancer these days is obesity, according to The Associated Press, with about one in twelve new cases of the disease due to excess weight [3]. Also, as of 2009, diabetes affects more than 230 million people, almost 6% of the world's adult population [4]. Obesity and a lack of physical activity are the leading causes of type-2 diabetes, responsible for 95% of the total diabetes cases in the United States [4, 5, 6]. Moreover, eating an unhealthy diet and physical inactivity are shown to contribute significantly to four of the six leading causes of death: heart disease, stroke, cancer, and diabetes [6].

Over 100,000 Americans die each year from obesity-related deaths [6], and the medical care costs of obesity in the United States, alone, are staggering. In 2008, these costs totaled about $147 billion dollars [7]. More than 72 million adults in America are obese, and 2.4 million more people were obese in 2009 compared to 2007 [7]. During the past 20 years, there has been a dramatic increase in obesity in the United States, and rates remain high. According to the Center for Disease Control and Prevention, “In 2010 no state had a prevalence of obesity less than 20%.” [8] In fact, “thirty-six states had a prevalence of 25% or more; 12 of these states (Alabama, Arkansas, Kentucky, Louisiana, Michigan, Mississippi, Missouri, Oklahoma, South Carolina, Tennessee, Texas, and West Virginia) had a prevalence of 30% or more.” [8]
More than doubling since 1980, obesity has become a worldwide epidemic [4, 9]. The World Health Organization reported in 2008 that 200 million men and nearly 300 million women were obese worldwide [9]. Also, at least 2.8 million adults die each year as a result of being overweight or obese [9]. Without drastic changes in worldwide diet and exercise habits, the International Diabetes Federation predicts that at least one in ten adults could have diabetes by 2030 [10]. It is predicted that by 2030, half of Americans will be obese [11]. Finding ways to solve this problem is, therefore, critical, and the Mobile Fitness Suite can be a great asset for helping to end this epidemic.

1.2 How the Mobile Fitness Suite can Solve the Problem

The leading causes of obesity are a sedentary lifestyle and over-consumption of high-calorie food [2, 7, 8]. An astounding 33% of adults 18 years of age and older engage in absolutely no leisure-time (outside of work) physical activity [12]. A survey was taken of the top reasons people eat fast food [13]. Among those reasons were: “They're quick”, “They're easy to get to”, “I like the taste of fast food”, “They're inexpensive”, and “I'm too busy to cook” [13]. The Mobile Fitness Suite cannot solve the problem of fast food being more convenient or inexpensive. However, through proper education provided by the Health Tips activity, it is hoped that the app can have an impact on the way people eat. People will more clearly understand how bad fast food is for them.

Understanding is a great first step in solving the problem with over-consuming high-calorie foods. People who understand just how much harm unhealthy foods can do to their bodies will, hopefully, be less likely to eat such foods at alarming rates, and that is one of the many things the Mobile Fitness Suite can provide. Aside from that, the Mobile Fitness Suite can also show how healthy eating does not necessarily mean expensive eating. For instance, one of the health tips contained in the mobile app mentions to try to cut sugar from your diet. There are typically many alternatives to high-
sugar foods that have just as much flavor as those with sugar at the same or even a reduced cost.

Recent research from Mintel Group, Ltd. shows that the top five reasons for not eating healthy are availability, cost, confusion, time constraints, and taste concerns [14]. By properly educating the public on how to eat healthy, the Mobile Fitness Suite can solve the issue of cost by showing how healthy foods can be cost-efficient. It can help clear up confusion by noting which foods are healthy and which are not. Finally, it can extinguish taste concerns by putting to rest old myths that healthy food must taste like cardboard.

The Mobile Fitness Suite can not only have an impact on nutrition by promoting healthy eating, but can also have an even more direct result on physical inactivity. The top ten reasons people don't exercise are listed as really hating to exercise, trying to exercise but always quitting, not being able to afford a gym membership, not seeing any changes in body shape, not knowing how to exercise, wanting to exercise but having kids and family to take care of, not being able to stay motivated to continue working out, exercise hurts, not being able to make a commitment to stick to an exercise routine, and not having enough time to work out [15]. More excuses for not working out include gym intimidation, it costs too much, and, in the case of the impoverished, it isn't safe [16].

Nearly all of these problems can be solved with the Mobile Fitness Suite. One highly popular website even mentions using a mobile fitness application as one of the solutions for the issue of really hating to exercise because the variety of exercises they render can help turn a simple app into a user's own personal trainer [15]. Furthermore, the time it takes to travel to and from a gym even three days a week can become frustrating. With the Mobile Fitness Suite, users can work out either at home or at the gym, which also solves the problem of not being able to afford a gym membership. The program itself costs only $4.99 with no hidden fees and free upgrades provided.

Boredom with an exercise program can lead to quitting. The Mobile Fitness Suite was created
for that very reason. Performing the same exercises in the same order, whether at a gym or at home watching a fitness video, can become tedious. The Mobile Fitness Suite has a feature that creates a random workout based on user selection of workout length, warmup and cooldown lengths, focus areas to work, break lengths and frequency, and available equipment, among many other options. Each time a new workout is started, the selection of exercises are different, and the order in which they are performed is different. With over 250 different exercises provided, it is very unlikely that a user will ever have the same exercises in the same order twice. The variety provided by the Mobile Fitness Suite makes for a new and fun exercise routine every time the program is run.

Not seeing any body shape changes usually arises from those wanting or expecting immediate results. Despite the many diet pills on the market, there is no magic pill that works overnight to undue years of overeating and lack of physical activity. The Mobile Fitness Suite is no exception to this rule, and it would be ludicrous to suggest otherwise. Those wanting immediate results will need proper education and guidance to understand the impossibility of those expectations so that they are able to stick with any exercise program once they realize the program takes hard work and dedication to see results. The Mobile Fitness Suite, accompanied by online user forums, can provide a community for support and education. Moreover, the Mobile Fitness Suite is a great way to get in shape, provided that shape is not expected overnight.

The Mobile Fitness Suite provides step by step instructions for each and every exercise in the application. Thus, not knowing how to exercise becomes a non-issue. Not only are there step by step instructions, but there are also modifications provided for most exercises to make them easier for the beginner or harder for the advanced athlete. Even knowing where to begin can be daunting, though. For instance, how is a person to know which focus areas to work on what days? On the website for the Mobile Fitness Suite, http://augmentlife.lefora.com, there are many online workout calendars for users
to choose from, each of which is different based on the user's experience or goals. This makes it easy for anyone to be able to simply pick a program to follow alongside the Mobile Fitness Suite app.

Wanting to exercise but having kids and family to take care of can be solved by either working out at home or finding a gym or health club with daycare services. Either of these options can be realized with the Mobile Fitness Suite, as the program can be used at home or in a gym. There is also nothing wrong with the entire family getting in on the workout fun. In the 1950s, late fitness expert Jack LaLanne, who, incidentally, lived a long life of 96 years, hosted a half-hour television program which always re-iterated to children that they should, “Go run and grab Mom,” for the workout [17].

Staying motivated to continue working out deals almost entirely with how strong a user's goals are in working out. If a user's primary goal is only to look better, then that goal may not be strong enough to see the workout program all the way through. A user really need to find his or her “why”, the reason they really want to work out. Most often, they will find a much better reason than just to look better. For instance, a parent could want to live long enough to see his or her children graduate from college. Many people will want to recover the energy they lost over the years, but an even stronger reason would be to have more energy than they ever had. The Mobile Fitness Suite cannot determine a user's “why”. It can, however, help to accomplish it when a user does discover what that reason is.

Exercise hurts is another reason cited for not working out. Though it is true that exercise hurts, it should not be enough pain to cause an injury. Furthermore, the human body uses glucose for energy during workouts. Because working out is intense to the body, glucose levels can become very low after exercising. There is a critical window of forty-five minutes to one hour after completing a workout to re-establish proper glucose levels and replenish nutrients. If glucose levels are not re-established, the human body attempts to convert muscle to glucose. Taking advantage of this critical window by
drinking a specially formulated recovery drink will help prevent muscle soreness and greatly improve recovery [18]. Therefore, exercising will hurt primarily during the workout instead of continuing to hurt several days after the workout. This is an example of one of the health tips provided by the Mobile Fitness Suite, which by educating users can help dispel, at least partly, the issue with believing that exercise hurts.

There are several reasons for not being able to make a commitment to stick to an exercise routine. One of those, boredom with the routine, was discussed before, and the Mobile Fitness Suite is a great solution for boredom with a program. Keeping a commitment also ties in with motivation. If a user is not motivated, the likelihood he or she will stick with the routine greatly decreases. Finding that strong reason why the user is choosing to work out, as discussed before, can help with this. In addition, many commitments are long-term, and it can be difficult to keep such a long commitment. For instance, gyms usually require a six month or one year commitment. The Mobile Fitness Suite has many different workout calendars to accompany the application, and each of these is only three months long. There are calendars for different goals, such as bodybuilding and endurance training, and there are also calendars for different skill levels, such as beginner, intermediate, and advanced. The shorter commitment period helps to ease fulfilling that commitment. And, being able to pick from many programs instead of being forced into one single formula, can help increase the enjoyment of the program. The more users enjoy the workout program, the more likely they are to complete it.

Not everyone has an hour a day to work out, and that is understandable. However, making the excuse that there simply is not enough time in the day to work out is difficult to believe, especially when the average American watches over five hours of television per day [19]. The options for workout length in the Mobile Fitness Suite app range from 15 minutes to 2 hours for this reason. In fact, there is a No Excuses workout calendar on the Suite's website which plans only 15 minute
workouts each active day. Since the application is on a mobile phone, users could even choose to work out while watching television.

Gym intimidation is an understandable dilemma. It is easy to picture those who go to the gym as muscle-bound bodybuilders, and for someone just starting out, there may be a lack of comfort with his or her self-image. Also, gyms are full of equipment most people would never see outside of a that environment and would not know how to use it. This can be a scary concept because most people are self-conscious and do not want to be made to look like a fool. Working out at home to begin with using the Mobile Fitness Suite is a perfect option. Not only does this relieve the pressure of self-image, but since the app contains step by step instructions of how to use various pieces of equipment properly, in time a user can become more confident in the knowledge of gym equipment.

Gym memberships can cost around forty to fifty dollars a month, not including sessions with a personal trainer. Equipment at home can take up a great deal of room and cost a good amount, as well. Home video workout programs can even cost quite a bit, with the ever popular P90X costing $120 (plus $20 shipping and handling) for the base package with no equipment [20], and Cathe Friedrich's Shock Training System with no equipment costing $250 [21]. The Mobile Fitness Suite, on the other hand, costs a total of $4.99. No equipment is provided for this cost; however, there are currently 2 back, 25 cardio, 14 chest, 19 core, 11 glute, 5 leg, 3 shoulder, 25 stretch, and 5 tricep routines that require absolutely no equipment. That's a total of 109 routines that do not require equipment to use the program. Also, resistance bands are relatively inexpensive pieces of equipment to purchase that take up very little room. The Mobile Fitness Suite lists modifications for using resistance bands to replace almost all other pieces of equipment for weight training including dumbbells, a pull-up bar, medicine balls, and a barbell. For those reasons, the mobile application can help with lowering costs required with working out, as well.
Exercising outside can be dangerous in large cities, especially in impoverished areas. The Mobile Fitness Suite does not require anyone to go outside to work out, though. Users can work out from the convenience and comfort of their own homes. Since it also does not require a television to use, other members of the household can feel free to continue to watch their normal daily programming or, as fitness pioneer Jack LaLanne would have wanted, to join in on the workout [17].

From this section, it can be seen that the Mobile Fitness Suite application can either directly or indirectly solve nearly all of the issues people have with working out. The few problems it cannot help find solutions for are those that users must mentally overcome. There are, literally, thousands of fitness videos on the market today, though, and many of them have been quite financially successful. In fact, in 2009 the successful fitness corporation Beachbody, LLC., producers of today's most popular workout videos, earned nearly $320 million [22]. The next section will discuss why the Mobile Fitness Suite was chosen not to be a fitness video, but to be released as a mobile phone application available on the Android Market instead.

2. Why the Android Market

There are many successful fitness videos on the market today. P90X, Cathe Friedrich's Shock Training Series, Insanity, TurboFire, and Jillian Michaels' and Georges St. Pierre's Rip:60, to name a few. Each of these comes with a set of videos that have a predetermined set of exercises to perform in the same order each time. Performing the same exercises week after week in the same order on each video can become boring after a time. Cathe Friedrich's Shock Training Series, at least, tries harder to keep routines fresh by containing forty disks, switching to a new set each week of the program. However, there is hardly any variety of moves seen when progressing weekly, and the set costs $250 just for the strength series. The cardiovascular series is sold separately.

Video disks, including DVD and Blu-Ray, are limited in that they cannot be modified once they
have data stored on them. Thus, they cannot be reprogrammed after data is burned to them. Though there are rewritable video disks, most users have only video player hardware, not hardware that supports burning new disks. Also, even rewritable video disks are highly limited on how many times they can be rewritten. On the other hand, software can easily be programmed to overcome these hardware limitations. The purpose of the Mobile Fitness Suite being produced as software was to keep exercises fresh, with a new set and order of exercises each time.

Mobile phone applications allow software to get in the hands of billions of people. As of November 2011, there are currently 5.3 billion mobile subscribers [23]. Mobile phones are portable, unlike most computers, and are easy to take with users to the gym, a park, or anywhere they wish to work out. Laptops are also portable, but they would be inconvenient to try to work out with in a gym or at a park given their large sizes. Currently, there are three major markets for distributing mobile phone applications: the iPhone App Store, the Android Market, and the Windows Mobile Marketplace.

The iPhone App Store currently reaches the largest number of users, with 37% of the mobile application user base [24]. That number is down from 74% market share in 2008, though, and the Android share has been picking up rapidly. From 0% market share in 2008, Android now has 28% of the market as of August 2011. The Windows Mobile Marketplace has been going steadily downhill and, as of May 2011, only had 6% of the mobile market share [25]. With the Android Market predicted to have as many users as Apple's App Store by the end of 2011, developing for Android is a smart choice for a developer to make [24].

There is a rigorous approval process required to become a part of the iPhone App Store, whereas publishing on the Android Market requires no approval. Android is also programmed in the familiar Java language, while Apple chose to implement a special super-set of the C programming language called Objective-C. Thus, whereas Google's Android builds on a familiar language with easy-
to-learn widgets, programming with Apple requires learning many extensions to the C language to be able to code for their mobile platform. Microsoft also created a new language, C#, but it is a much simpler language to learn than Objective-C in that it rather elegantly combines aspects of Java and C. Developing for Apple also requires the use of a Macintosh computer. Developing for Windows Mobile requires the use of a Windows computer. Android can be programmed on Macintosh, Windows, or Linux systems. The best platform to choose as a starting point for mobile development is clear. Android features no approval process, a small $25 developer fee, and the ability to reach a wide and ever-increasing number of users. Moreover, it features the ability to program in a language that is easy to learn and use and the ability to be programmed on nearly any home operating system. After deciding on a platform on which to develop, the Mobile Fitness Suite was programmed and packed full of features. The next section will discuss the design and architecture of each features. For a summarized list of each feature, see section 4. For more detailed information on each feature, see Appendix B, which contains the Mobile Fitness Suite User Guide.

3. Design and Architecture

There were four primary components that were implemented in the Mobile Fitness Suite. A health tips activity was programmed to help educate users. A BMR calculator activity was created to help users determine proper daily caloric intake. A body fat calculator activity was implemented to help users determine how close they are to accomplishing their health goals. Finally, a workout creator was programmed to allow users to work out while using the Mobile Fitness Suite.

3.1.1 Health Tips Activity

Designing and implementing the Health Tips Activity required not only the knowledge of Android GUI development and API programming, but also extensive research into the best health tips to include to help users learn good eating habits. The Health Tips Activity consists of a TextView for
displaying the current tip and two Buttons for displaying the previous or next health tip. If the Volume
Up button is pressed on the phone, the text size will increase. If the Volume Down button is pressed,
the text size of the health tip TextView will decrease.

The algorithm for the Health Tips Activity is implemented as follows. First, an array of tips is
populated from an external resource file containing all the tips. A ListView is populated with the first
tip. If a user clicks the >> button, the next health tip in the array is displayed, unless the user is at the
end of the array. At that point, the first tip is loaded into the ListView. Similarly, if a user clicks the <<
button, the previous health tip in the array is displayed, unless the user is at the beginning of the array.
At that point, the last health tip is loaded into the ListView. If a user clicks the Volume Up button on
his or her phone, the text size is increased using the setTextSize function. If a user clicks the Volume
Down button on his or her phone, the text size is decreased using the setTextSize function.

3.1.2 BMR Calculator Activity

There are currently only two equations for calculating BMR, and the only one that is current is
the Mifflin-St. Jeor equation. This made implementing the BMR Calculator Activity a simple matter of
learning how to interact with the various Android components, such as the Spinner, which is similar to
a drop down or combo box, and EditText components. Once these techniques were learned, BMR
could be calculated for both males and females in U.S. or metric units. However, more difficulty came
in programming an auto-save feature, which would save previously entered information every time the
Calculate BMR button is pressed. Java has several ways of creating, opening, reading from, and
writing to files. In programming the Mobile Fitness Suite application, all of these methods were tried,
but none of them worked. It was discovered that Android uses its own file handling techniques, which
solved the auto-save issue because previous information could be entered into a file, and loaded upon
start of the program.
The algorithm for the BMR Calculator Activity was programmed as follows. The preference file would be read in, if the file exists. If it does exist, the gender Spinner, height Spinner and associated EditText fields, the weight Spinner and EditText field, and the age EditText field would be filled in with data obtained from the preference file. If a user clicks the Clear Form button, all the EditText fields will be cleared.

If a user clicks the Calculate BMR button, an error message will be displayed if any field is not filled in or if any field is filled in with invalid data. If all fields are filled in with valid data, a calculation will be performed, first converting all units to metric if they were not already entered in metric. The formula used is $BMR = (9.99 \times \text{weight} + 6.25 \times \text{height} - 4.92 \times \text{age} + s) \text{ kcal/day}$, where weight is in kilograms, height is in centimeters, age is in years, and $s$ is a value based on the sex of the user. $s$ is $+5$ for males and $-161$ for females. After the calculation is performed, the information entered into all the fields is saved to the preference file, and a Toast message, probably called so because it displays a message that pops up, is displayed to a user with the number of Calories burned per day.

3.1.3 Body Fat Calculator Activity

Unlike BMR, there are many methods for calculating body fat, each of which produces different results. After testing several equations, it was decided to use the Department of Defense's body fat equation. This is the formula used to calculate the body fat of America's entire military force, which was another contributing factor to the decision to use this equation over all the others. Programming the Body Fat Calculator Activity was very similar to programming the BMR calculator. Like the BMR calculator, it features options for U.S. and metric units, both genders, and automatically saving upon the press of the Calculate Body Fat button.

Much like the BMR Calculator, the Body Fat Calculator first reads in the information stored in
the preference file, if the file exists. If it does exist, the gender Spinner, height Spinner and associated EditText fields, the weight Spinner and EditText field, the waist Spinner and EditText field, and the neck Spinner and EditText field would be filled in with data obtained from the preference file. In the case of females, the hips Spinner and EditText field would also be filled in. It is important to note that the entire Hips field, including the TextView, EditText, and Spinner, is hidden using the setVisibility function if a user selects male as his gender. If a user selects female as her gender, these fields are set back to visible, again using the setVisibility function. If a user clicks the Clear Form button, all the EditText fields will be cleared.

If a user clicks the Calculate Body Fat button, an error message will be displayed if any field is not filled in or if any field is filled in with invalid data. If all fields are filled in with valid data, a calculation will be performed, this time converting all but the weight units to the U.S. system if they were not already entered that way. The formula used for males is % body fat = [86.010 x Log (waist – neck)] – [70.041 x Log (height)] + 36.76, where age is in years, and all other measurements are in inches. For females, the equation is % body fat = [163.205 x Log (waist + hip – neck)] – [97.684 x Log (height)] – 78.387, where age is in years, and all other measurements are in inches. The Log function is in base ten, not base e. The body fat percent is not the only data shown to the user. The user's lean body mass and total fat are also shown after clicking the Calculate Body Fat button. The formula is the same for males and females for both of those, and the calculations are performed using the equation Body Fat Weight = Total bodyweight * % body fat for the total fat and Lean Body Weight = Total bodyweight - Body Fat Weight for the lean body mass calculation. In both cases, the weight can be in either pounds or kilograms, and the result is displayed in the unit the user has selected. After the calculation is performed, the information entered into all the fields is saved to the preference file, and a Toast message is displayed to a user stating the user's body fat percent, total fat, and lean body mass.
3.1.4 Workout Creator Activity

The Workout Creator Activity was the most complex and the most time-consuming component programmed for the Mobile Fitness Suite application. Besides learning more Android components, the programming learning curve was extensive, the research for which exercises were the best to include in the application encompassed countless hours, and the image processing for associating pictures demonstrating how to perform each exercise also proved lengthy to complete.

Android's CountDownTimer class was utilized to program the total time remaining timer. The routine timer was originally also taking advantage of this class, but it proved to be much more efficient to calculate the time for one exercise to end based on the current exercise length and how long was left on the total time remaining timer. The images were stored locally and used the ImageView component, requiring no Internet access that would be needed if stored on a remote server.

Unlike the simple algorithms described in the previous sections for the Health Tips Activity, BMR Calculator Activity, and the Body Fat Calculator Activity, the Workout Creator Activity is a large and complex unit containing many features for users. The code, itself, is a little over eight thousand lines long. Therefore, it would be difficult and overly lengthy to describe how every single piece of the Workout Creator Activity was implemented. Instead, the basic algorithm and the most calculation-intensive parts shall be discussed.

To begin with, all the selections saved in the Workout Creator preference file are restored upon load of the Workout Creator Activity. These include workout length, warmup length, cooldown length, focus area selections, focus area selection method, break frequency, break length, available equipment, and whether the following are checked in the More Options dialog, available from the Activity's menu: Show Images, Confirm Close Workout, Minimize Repeat Routines, Play Routine Ending Beeps, Show Last Weight/Reps Used, and Show Notes. Each of these features is described in detail in Appendix B,
which contains the Mobile Fitness Suite's User Guide. Also available from the Menu are further options of Modify Hidden Exercise List, Quick Load Workout, Load Workout From, Save Settings, User Guide, Credits, Clear Hidden Exercise List, and Modify Exercise Lengths. After making initial selections, the user may click Start Workout to begin a new workout. If a user has selected an appropriate focus area with appropriate available equipment, the Workout Activity, which is separate from the Workout Creator Activity, is loaded. Otherwise, an error message is displayed.

At this point, an image of the first exercise is displayed at the top, if available, and Show Images is selected. Below that, the name of the current exercise, the equipment required for the current exercise, the name of the next exercise, the equipment required for the next exercise, the current routine number and time remaining in the current routine, the total number of routines and total time remaining in the workout, and the instructions for the current exercise are displayed.

Four buttons are displayed at the very bottom of the screen: Start, <<, >>, and Close. Clicking Start will start the workout timer and change the button's text to Pause. After that, clicking Pause will cancel the workout timer and change the button's text to Resume. Clicking Resume will create and start a new workout timer at the current millisecond of the workout. There is no functionality to pause or resume Android's CountDownTimer widget. Thus, the timer must be canceled to pause and a new CountDownTimer must be created to resume. Clicking << will do nothing if the user is already at the first exercise. Otherwise, it will load the previous exercise. Similarly, clicking >> will do nothing if the user is already finished with the workout. Otherwise, it will load the next exercise. The state of the workout, whether paused or not, will be maintained if a user clicks either the << or >> buttons.

So that the program will run smoothly throughout the entire workout, it is important to note that all exercises that will be performed during a workout are selected before loading the Workout Activity user interface. The algorithm for loading in a new set of routines each time the user clicks Start
Workout from the Workout Creator is different based on whether the user chooses the Focus Order Selection Method to be Ordered or Random. If Random is chosen, focus areas may repeat, but will not be the same focus area in a row unless after a break. For instance, in a workout involving Back, Biceps, and Triceps, a user could see an ordering such as Back, Biceps, Triceps, Biceps, Back, Triceps, but would not see Biceps, Biceps, Biceps, Back, Back, Biceps, Triceps, etc. in this case. Ordered, on the other hand, chooses a random order for the chosen focus areas before the routines are selected, then maintains that order. Thus, the same workout involving Back, Biceps, and Triceps could choose Biceps then Back then Triceps to be the order maintained throughout the workout, and the user would see Biceps, Back, Triceps, Biceps, Back, etc. Random and Ordered work almost exactly the same if only two focus areas are selected, but Random allows the same focus area to be worked before a break as after a break. Ordered would not see that happen. On the other hand, it is possible for Random to never work a focus area chosen by a user if three or more are selected. This would not be possible if Ordered were selected.

To further complicate the selection of routines, breaks must be considered in the exercise selection process. Breaks have both a frequency and a length, as chosen by the user. The frequency determines how often breaks occur during the workout. For instance, Every 1/4 would wait until 1/4 of the total workout time (minus the time for warmup and cooldown), after the first exercise for the first break. This is calculated to place the first break 1/4 of the total workout time after the first real exercise, not after the warmup. Thus, a one hour workout with a five minute warmup and five minute cooldown would place the first break around 17.5 minutes into the workout because 1 hour – 10 minutes = 50 minutes. 50 minutes / 4 = 12.5 minutes. 12.5 minutes + the initial warmup time of 5 minutes is 17.5 minutes. The second break would be around 35 minutes, and the third would be around 52.5 minutes. The actual algorithm used is more complicated and takes into account the length of the
next selected exercise. The algorithm favors placing a break instead of the next exercise if the next routine length goes over the 17.5 minute mark. Thus, the actual time for the first break may be more like fifteen minutes instead. Notice that there were only three breaks added for the Every 1/4 break frequency selection. This happens because the last 1/4 would be at the end of the workout, where a break would not be needed. Therefore, the amount of breaks is always one less than 1/frequency. Every 1/5 would have 4 breaks, for instance.

Calculating the current exercise time left based on the time left on the workout timer proved to be the one of the most difficult parts of the calculations in the Workout Activity. The calculation occurs on every tick of the total workout remaining timer, which is programmed to trigger every second. The equation used here was Exercise Time Left (ms) = Time Left in Total Workout (ms) - (Total Workout Length (ms) - Total Routine Length of All Completed Routines (ms)). The total workout length is stored earlier, after all the exercises are chosen for the workout. The time left in the total workout is stored internally by the CountDownTimer widget. The total routine length of all completed routines must be calculated, though, by adding up the length of each exercise up to and including the current exercise.

There are more options available from the menu in the Workout Activity. These options include Hide Routine From Now On, Quick Save Workout, and Save Workout To. The hide routine feature allows users to hide the current exercise from now on, but it does not hide the exercise for the current workout. This list of hidden exercises can be modified or cleared from the Workout Creator Activity. Saving workouts allows the user to reload a workout from any of six slots, five primary and a quick save slot. The loaded workout will contain the same set of exercises in the same order as before with the same warmup, cooldown, and break frequency and length. Most of the options selected from the More Options dialog, such as Confirm Close Workout and Play Routine Ending Beeps, however, will
be followed as selected before loading a workout. The options will not be saved into the workout, in other words. Only the exercise selection and order, including warmup, cooldown and breaks will be saved. The end result of the Workout Creator Activity featured a large amount of features and options for users to be able to fully customize their workout. A list of these features is summarized next.

4. Features Provided by the Mobile Fitness Suite

Workout Creator:
Starts a random workout based on user selections

Options:
1. Workout can range from 15 minutes to 2 hours.
2. Warmup/Cooldown can each range from 0 to 10 min.
3. Choose as many as you like up to a total of 10 different Focus Areas to work out from:
Back, Biceps, Cardio, Chest, Core, Glutes, Legs, Shoulders, Stretch, Triceps
4. Breaks can range from No Breaks to every 1/6th of the workout
5. Choose Break Length from 1 minute to 3 minutes
6. Choose the equipment you have from:
Barbell, Bench, Dumbbells, Incline Bench, Jump Rope, Medicine Balls, Pull-Up Bar, Resistance Bands, and Stability Ball
7. Exercises that require equipment you do not have will be excluded from the workout.
8. Further Options Available from the Menu Include:
   a. Quick Load Workout
   b. Load Workout From
   c. Save Settings
   d. Modify Hidden Exercise List
   e. User Guide
   f. Credits
   g. Clear Hidden Exercise List
   h. Modify Exercise Lengths
   i. More Options:
      1. Show Images
      2. Confirm Close Workout
3. Minimize Repeat Routines
4. Play Routine Ending Beeps
5. Show Last Weight/Reps Used
6. Show Notes

9. During Workouts, you can also:
   a. Hide any exercise you wish not to see again.
   b. Save the current workout to the Quick Save slot or any of the five primary save slots.
   c. (If Show Last Weight / Reps is selected) Enter the weight used and reps performed for the current exercise.
   d. (If Show Notes is selected) Enter any notes for the current exercise.
   e. Increase Text Size with Volume Up button.
   f. Decrease Text Size with Volume Down button.

Body Fat Calculator
1. Calculates Body Fat % based on Department of Defense formula.
2. Displays Body Fat %, Lean Body Weight, and Body Fat Weight.
3. Saves previous data entered automatically, and loads this data each time the activity is loaded.

BMR Calculator
1. Your Basal Metabolic Rate (BMR) is the amount of calories you burn at rest with no digestion occurring.
2. Your BMR is useful to determine proper daily caloric intake to help maintain or change your weight.
BMR calculated is based on the MD Mifflin and St Jeor equation.
3. Saves previous data entered automatically, and loads this data each time the activity is loaded.

Health Tips
1. Displays helpful nutrition tips.
2. Increase Text Size with Volume Up button.
3. Decrease Text Size with Volume Down button.

5. Deploying a Mobile Application to the Android Market

5.1 Steps in Deploying to the Android Market

The Android developer's guide lists the following steps in order to publish an app on the
Android Market: gather materials for release, configure application for release, build application for release, prepare remote servers, and test application for release [26]. Each of these shall be discussed for developers using the Eclipse development environment.

5.1.1 Gather Materials for Release

The steps described in the Android developer's guide for gathering materials for release are preparing an end-user licensing agreement (EULA), getting cryptographic keys, and creating an application icon.

An end-user licensing agreement is a contract between a licensor, or creator of the software, and an end-user of a software product [27]. The purpose of the software agreement is to attempt to hold harmless a licensor in the event that damage is caused by the software product to the licensee's data or hardware [27]. Also, the EULA determines automatic rights for the end user, such as whether they are allowed to create backup copies or resell copies of the software product. The EULA for the Mobile Fitness Suite is included in Appendix C of this document. There is a great online resource to help developers create their own EULA created by Digital River™[28].

When developing in the Eclipse environment, gathering cryptographic keys should be held off until later in the publishing stages, after configuring the application for release. The reason for this is that the Eclipse environment has a complete tool for both getting a cryptographic key and signing the application, all in one step. Thus, if a developer using Eclipse were to get a cryptographic key in this step, the step would have to be repeated during the publishing process after the configuring for release step. This step shall be detailed further in the Building Application for Release section.

There are several guidelines for creating an application icon, also called a launcher icon. The launcher icon appear on a user's home screen when loading the application. First, there should be icons
created for different density screens [29]. There are currently four different screen densities: low, medium, high, and extra-high densities. Low density screens require a 32x32 pixel application icon. Medium density screens require a 48x48 pixel image. High density screens require a 72x72 pixel icon, and extra-high density screens require a 96x96 pixel icon. Furthermore, if a developer wishes to publish to the Android Market, a fifth high-resolution 512x512 pixel application icon must be created. The icons should be placed in the res/drawable-ldpi, res/drawable-mdpi, res/drawable-hdpi, and res/drawable-xdpi folders, respectively. Creating all these icons ensures that the launcher icon will look appropriate on all screen sizes.

Aside from the pixel size requirement, icons should also promote the brand, tell the story of the app, help users discover the app in the Android Market, and function well in the launcher. [26]. Developers can promote the brand and tell the story of the app by creating a unique and memorable icon, using an icon that fits well with the application's color scheme, creating a simple instead of an overly complex icon, and avoiding including the application name in the icon because the application name will always be displayed next to the icon [29]. Creating a high-quality app that is well-designed will encourage users to find out more about the application, and they will more than likely assume the application is of similar quality as the initial icon they see [29]. Keep in mind that the icon is the first impression a user receives on the Android Market. Developers should try to make this impression a lasting one. Because a user will interact with the icon most frequently on the launcher, the icon should be made to look nice next to other icons and on different background color schemes [29]. It should also be top-lit to match the lighting of the launcher. The icon for the Mobile Fitness Suite is shown beside this paragraph. Other suggestions by the Android developer's guide are icons should not be overly complicated, icons should not be cropped, icons should not be thin, and icons should make use of the alpha channel [29]. There is also an easy-to-use online launcher icon creator.
that can help facilitate this process [30].

5.1.2 Configure Application for Release

The steps described in the Android developer's guide for configuring an application for release are choosing a good package name, turning off logging and debugging, cleaning up project directories, reviewing and updating the project manifest, addressing compatibility issues, updating URLs for servers and services, and implementing licensing [26].

Choosing a good package name that is unique and fitting to a developer's application is an important step in the development process. Once published to the Android Market, the package name is permanent for that application. If the package name is changed and published, no user will see that as an update to the currently existing application. It will be considered an entirely new application. The package name, however, should be considered at the very beginning of the development process instead of as a publishing step. Renaming a package in Eclipse can have undesirable consequences that essentially break an application and cause general frustration until the package is fixed. Many files, both Java and Android, depend on package name consistency. Working with a large number of classes and resource files can also cause the renaming process to take a considerable amount of time to complete. Therefore, it is better to start out with a good package name instead of waiting until publishing.

Developers must turn off logging and debugging by removing calls to the Log function in source code and either removing the debuggable="true" line from the package manifest, or changing the line to debuggable="false". In addition, project directories should be cleaned up of unnecessary files to make distribution size of the application as small as possible. After that, the project manifest should be updated to require only permissions that the application must absolutely need in order to run properly, and other manifest attributes should be specified. The attributes android:icon, android:label,
android:versionCode, and android:versionName are all required to be published on the Android Market [26]. The android:icon attribute specifies the name of the resource containing the icon. It is typically something similar to “@drawable/ic_launcher”. The android:label attribute specifies the name of the resource containing the application name. In this case, it is “@string/app_name”, which is defined as “Mobile Fitness Suite”. Both android:icon and android:label are located in the <application> element in the project manifest. The android:versionCode and the android:versionName attributes are contained outside the <application> element as a part of the <manifest> element. The android:versionCode attribute specifies a unique identifier for the version of the software code being published. It is an integer that must increment each time the application is updated and published. It is not displayed to users; users see only the versionName attribute, which specifies a string containing the current version of the code, like “1.0.0”. It is quite common and easy to implement the versionName attribute as simply the versionCode attribute without any decimal points. In the case mentioned, the versionName would be “1.0.0”, whereas the versionCode would be “100”.

Compatibility issues must also be addressed. To easily support multiple screens, the density-independent pixel (dp) unit should be used for layout widths and heights instead of pixels. This will cause layouts to scale up for larger screens automatically or scale down for smaller screens. Similarly, the scale-independent pixel (sp) unit should be used for text size. Multiple languages should be a consideration of every developer from the beginning of the coding process. It is a great asset to place all button, label, and in-application text in external resource files in the res folder instead of hard-coded in layout files. The Android system uses the res folder to distinguish between different languages and compatible screen sizes. For instance, the res/values folder would provide reference strings, such as the application name, in the default language set by the user's phone. Putting values in the res/values-fr folder would provide French reference strings if the user's phone were set to the French language, and
placing values in the res/values-ja folder would provide Japanese reference strings if the user's phone were set to Japanese. Even if multiple languages only become a feasibility for an app years down the line, not a single line of code will have to be reprogrammed if all the text is placed in external resource files.

Once compatibility issues have been solved, URLs should also be checked to ensure any testing or local URLs are changed to remote URLs. Licensing is, also, an important consideration for paid applications. With proper licensing, a developer can determine how many times a user can run the program unlicensed, how many devices in which a user may install the application, and prevent piracy by having the service check a user's credentials to ensure the user that installed the application is the same user that paid for the application [26]. Licensing is optional, even if publishing through the Android Market [26]. The Mobile Fitness Suite does not currently make use of the licensing feature.

5.1.3 Build Application for Release

All Android applications must be digitally signed, and the private key must be held by the application developer [31]. The application can be self-signed and does not require to be signed by a certificate authority [31]. The purpose of the certificate is to serve as a means for the Android back-end to identify the author and establish trust relationships between applications, but it does not determine which applications a user can install [31]. The key should be secure, and it should only be in the possession of the application developer. It is crucial that the key should be both private and secure because a third party could find the key and distribute malicious software using the developer's identity that attack other applications, attack the Android system, or even steal user data [31].

The Eclipse environment, accompanied by the Android SDK, has a built-in project export wizard that makes generating a cryptographic key and signing an application a simple step. The steps for a developer to use this feature are as follows. First, right-click on the package name, and then, click
Export. From the dialog box that appears, expand the Android folder, and click Export Android Application. Next, select the project to export. The correct project should already be selected. Click Next, and create a new keystore.

If publishing on the Android Market, a further requirement for the certificate is that its expiration date must be past 22 October 2033 [31]. It is suggested that the application have a validity period of at least twenty-five years. Once the password and keystore are created, click Next. On the screen that appears, the only requirements to be filled out are the alias name, password, and validity (in years). The alias name is just a general name to recognize the key by, and only the first eight characters are used in the key. Once this step is complete, the final step before publishing is to generate the .apk (Android Package) file. Choose a location to store the file and click Finish. The application is now properly signed and ready to be published on the Android Market. At this point, the developer could also distribute the .apk file through e-mail or on a website; however, this functionality is limited. A user would have to allow third party installation of software, which is disabled by some cell phone networks. The user would be unable to receive automatic notification of any update using this method, and the program may need to be uninstalled and reinstalled each time there is an update. The one benefit to this method is that the Android Market takes 30% of profits made by the seller, and that would not be the case if distributing through e-mail or a website instead.

5.1.4 Prepare Remote Servers

The next step in preparing for publishing is to make sure that any remote servers that distribute and serve content for online services or in-app products to the application are ready to be used. Once this step is complete, the final step before publishing to the Android Market is to test the application on multiple devices.
5.1.5 Test Application for Release

The application can be tested on multiple devices through use of the Android emulator. As many virtual devices, of as many types, can be installed as a developer wishes using the emulator. The emulator, though, is currently filled with bugs, requires a large memory overhead, and runs barely fast enough to be considered usable by most applications. The Mobile Fitness Suite could not even make use of the emulator because of how incredibly slow and buggy the emulator is. The best way to test the software is on real devices. The Mobile Fitness Suite was tested on different phones instead of using the emulator, and all tests were passed.

5.1.6 Deployment on the Android Market

Google requires a $25 developer's fee to be paid in order to publish applications on the Android Market. Also, for paid applications, a merchant account must be set up through Google Checkout to enable a developer to receive payment for application sells. Past those two primary steps, a website must for the app must be provided, and a developer name must be chosen. Then, a developer is ready to publish the app.

To publish the application, screenshots should be taken. Two screenshots are required, and six more are optional. The currently supported screenshot pixel sizes are 320x480, 480x800, 480x854, 1280x720, and 1280x800. The images are supported in 24-bit JPEG or PNG with no alpha channel. A 512x512 pixel application icon is required, as is a description of the program, the application type, the application category, the copy protection, the content rating, and the price of the application. For the Mobile Fitness Suite, all eight allowed screenshots were uploaded in 480x800 pixel size. Many more screenshots were uploaded to the Mobile Fitness Suite's website. Nearly all of the 5000 limit description was taken up. The application type was selected as Applications (the other type available is Games). The application category was chosen as Health & Fitness. The copy protection was set to
Off. The other options for copy protection are licensing and On. The Mobile Fitness Suite was not set to On because there is a disclaimer that the On option will soon be deprecated in favor of the licensing option. The content rating was set to Everyone. The pricing was set to $4.99. Additional promotional materials are allowed, such as a video URL containing a demonstration of the product in action, a promotional graphic, and promotional text.

It is important to note that if publishing a paid app, the Google Checkout Merchant Account should be set up first, before entering in any information, such as a product description or screenshots. The reason for this is that if the developer chooses to enter the information first, all of that information will be lost after the Google Checkout account is set up and will have to be re-entered. Before any information is allowed to be entered, first the .apk file must be uploaded and made active. Then, after setting up the Google Checkout account, all the other information should be entered, saved, and published.

5.2 Comparison to the Top Competitor's Product

JEFIT Pro Workout Application for Android is the closest mobile app relative to the Mobile Fitness Suite on the Android Market. Both apps are marketed at a price of $4.99. JEFIT Pro features a workout routine planner, automatic logging of input weight and reps when doing exercises, two-way synchronization with the online JEFIT profile, a quick timer for single exercises, 500+ exercise instruction and tips, uploadable progress photos, and a resting timer for breaks between sets [32].

There are a number of features available on JEFIT that the Mobile Fitness Suite currently does not contain. For instance, the workout routine planner allows users to create custom exercises. The Mobile Fitness Suite does not have an online profile for synchronization, nor does it have the ability to upload progress photos. The detailed logging provided by JEFIT is also not available in the Mobile Fitness Suite application.
On the other hand, the Mobile Fitness Suite's primary feature, the workout creator, is something that JEFIT is lacking and something that users have requested on the JEFIT reviews page on the Android Market [33]. Though JEFIT can create a single timer for a single exercise, this can be time consuming when performing an entire workout. The JEFIT program also requires users to pick and choose each exercise the user wishes to perform, then enter a new timer for each one. The Mobile Fitness Suite chooses a random set of exercises based on user options, but users never have to choose a single exercise on their own. After choosing basic options, like workout length, break length and frequency, and focus areas to work out, the user then is able to just click Start Workout. That puts together an entire set of exercises for the user, which is a new set chosen in a new order each time the user starts a new workout. This should provide much more convenience for users and provide a new and exciting experience each time they use the program. In the future, a customize workout feature is also a planned upgrade to the Mobile Fitness Suite to allow users to pick and choose exercises if they so choose.

The Mobile Fitness Suite also contains several features that the JEFIT app does not. The Body Fat and BMR Calculators provided by the Mobile Fitness Suite are not a part of JEFIT. The Health Tips activity, which has great potential for helping users make healthier eating choices, is not a part of JEFIT. In fact, JEFIT contains no nutritional section whatsoever. Fitness and nutrition need to be combined to provide a complete package for helping users to live a healthy lifestyle. The Mobile Fitness Suite has a generous amount of customization options not provided by JEFIT, as well, but most of those deal with the Workout Creator activity, something that JEFIT does not contain. Furthermore, JEFIT requires full Internet permissions and the ability to write to USB storage to use the program. The Mobile Fitness Suite requires no extra permissions, meaning that if a user is working out in a home gym in his or her basement with no cell phone service or Internet availability, that user is still able to
use the Mobile Fitness Suite. JEFIT would not work under such conditions.

On comparable features, JEFIT contains 500+ exercises, instructions, and tips, whereas the Mobile Fitness Suite has only half that number. When researching which exercises to include, there were an enormous amount that could have been included in the Mobile Fitness Suite. However, including ones that do not work the focus areas as well as other exercises was decided against. It was decided that only the best of the best, based on user ratings and reviews, would be included in the Mobile Fitness Suite. Therefore, just because JEFIT contains 500+ exercises does not mean that most of those exercises would have made the quality cut used in the Mobile Fitness Suite. JEFIT also includes automatic tracking of reps performed and weights used for each exercise. On the other hand, the Mobile Fitness Suite provides an option for tracking weights used and reps performed, so that users can choose whether or not they wish to track these numbers for a particular workout. That way, if a user is having an off day and wishes the numbers not to be recorded, they are not forced into it.

Both JEFIT and the Mobile Fitness Suite have fitness goals in mind. JEFIT focuses on bodybuilding, but the Mobile Fitness Suite focuses on workouts for the beginner, the intermediate, and the advanced user, bodybuilders and endurance trainers included. JEFIT does provide a great number of logging tools the Mobile Fitness Suite does not contain, but most of those are planned upgrades to the Mobile Fitness Suite. The Mobile Fitness Suite provides a Body Fat Calculator and BMR Calculator to help with the nutrition aspect of the program. The Health Tips section is also a key nutrition feature lacking in JEFIT. Despite their differences, JEFIT and the Mobile Fitness Suite can both prove to be viable tools in the war against obesity, and because there is no one formula that can fit every person's desires, it is beneficial to have more than one fitness application available. In the next section, the planned upgrades mentioned and the current development road map for the Mobile Fitness Suite are listed.
6. What Lies Ahead

There have already been several updates since the release of the Mobile Fitness Suite. Version 1.0.1 increased the default font size seen during the workout. Version 1.0.2 eliminated the restriction of only being able to choose a maximum five focus areas to work out during any one time. Now, users can work out as many focus areas as they wish at a time. Version 1.1.0 enhanced the Save Workout and Load Saved Workout features. Now, there are six slots—five primary and one quick slot—in which to load and save workouts. Version 1.1.1 updated the User Guide to reflect the new Slotted Load/Save features. Several pieces of hard-coded text were also moved to external resource files in order to prepare the way for Customize Workout and Modify Timings features expected in future updates (as well as opening up multilingual possibilities in the future).

Version 1.2 added a new menu option, Modify Hidden Exercise List, which allows users to select entries to remove from the hidden exercise list or clear the entire list so that those exercises will be shown again. Before, there was only a Clear Hidden Exercise List menu option. Version 1.2.1 changed the Modify Hidden Exercise List feature to display the list as sorted in alphabetical order.

Version 1.3 disabled available equipment options for focus areas that don't use the equipment and further paved the way for the 2.0 version of the program. Version 1.3.1 was the first bug workaround released, due to issues with Motorola Bionic devices not supporting dynamic adapter changes. The fix addressed an issue when changing to or from 15 minute workout lengths. At that point, the Mobile Fitness Suite would change the Spinner adapters set for the Warmup and Cooldown lengths to be a maximum of five minutes instead of the normal ten minutes for all other workout lengths. The Motorola Bionic device did not support this feature, though, and the workaround was to display a message to users stating, “The maximum Warmup and Cooldown length for a 15 minute workout is 5 minutes,” if the user attempts to start a fifteen minute workout with a Warmup or Cooldown length.
longer than five minutes. Versions 1.3.2 and 1.3.3 provided a bug fix for the 1.3 issue instead of just a work-around. The fix involved major changes to the Workout Creator layout, duplicating the Warmup and Cooldown Spinners and text labels, setting the adapter for the second set to the shorter adapter, hiding the first set of spinners and labels when a 15 minute workout was selected, and hiding the second set when any other workout length was selected.

The 1.4 version implemented a new menu option available from the Workout Creator. The new option, Modify Exercise Lengths, allows users to change the length of any exercise from the default values to a value they choose from fifteen seconds to five minutes in fifteen second increments. Along with that, a button to reset the lengths to their default values was implemented. This version also corrects a small problem that would cause the bottom half of the Workout Activity layout to scroll to the last reps and notes sections if either of those are enabled during workouts, possibly hiding important information like the name of the routine and the equipment required for the routine.

Along with these updates, there are already many planned upgrades to the Mobile Fitness Suite. What follows is the current development road map. Each small upgrade is expected to take less than three months to complete and release. The larger upgrades may take longer or be modified in time to become simpler sequential upgrades to fall in line with the three month time period:

1.5 Edition
-Describe how to do all the Back Pull-Ups and Bicep Curls with Resistance bands.

1.6 Edition
Think about adding to Legs:
- 5th Position Demi-Plie' to Releve'
- Changement
- Stiff Leg Deadlifts (Standard)
Core:
-Frog Sit-Ups

Back:
- Around the World Pull-Ups
-Take pictures of all the moves with all the possible equipment.

1.7 Edition
- Add more health tips

1.8 Edition
- Combine Body Fat and BMR Calculator Tabs into one Calculators Tab
  - Add Ideal Body Weight Calculator to Calculator Tab
  - Add Calories Required Per Day Calculator to Calculator Tab
  - Add 1 Rep Maximum to Calculator Tab

1.9 Edition
- Look into onLongPress for switching image with instructions and instructions with image.

2.0 Edition
- Look into changing Routine (xx) and Total (xx) fields to one line with:
  (xx) 2:25 of (xx) 50:25 left

2.1 Edition
- Menu: Customize Workout (able to pick and choose from all routines by pressing the menu button)

2.2 Edition
- Add capability to Add to Hidden Exercise List from ModifyHiddenExerciseList activity.

2.3 Edition
- Goal Tracking (Able to input current stats and update stats)

2.5 Edition
- Add Specialized programs (H.I.I.T., P.A.P, and perhaps Synergistics, for example)

3.0 Edition
- Change Health Tips tab to Nutrition Tab
  - Add Recipes activity
  - Add Meal Planner activity
- On Health Tips Activity
  - Menu: Search Health Tips (displays clickable list of results after searching)

3.5 Edition
- Add Tracking capabilities (Track Workout option, Graphs produced from tracked workouts, etc.)

4.0 Edition
- Add pre-programmed workouts (bicep/chest strength, for example)
- Try to hire animator to redo pictures as animations.
- Multi-user capabilities
- Multilingual capabilities
- Port to IPhone
- Menu: Workout Calendar

7. References


Appendix A. Mobile Fitness Suite Screenshots
Appendix B. Mobile Fitness Suite User Manual

Workout Creator: This is used to create a workout and then proceed to work out. Note that you should consult a physician before starting any exercise program, including this one. I am not one of those, so reading this does not count as consulting a physician. Also, I am not to be held responsible for any injury you may suffer during the course of the work out--like if you accidentally drop your phone on your foot, that's not my responsibility.

- **Workout Length:** How long you want the workout to be, including warmup and cooldown. For instance, if you select a 1 hour workout, 5 minute warmup, and 5 minute cooldown, the workout itself will be 50 minutes. Note here that times are approximate because not all exercises are equal length in time. Also, I chose to favor going under the time requested rather than over (58 minutes 30 seconds versus 1 hour 2 minutes, for instance).

- **Warmup Length:** How long you want the warmup to be.

- **Cooldown Length:** How long you want the cooldown to be.

- **Focus Area:** This is the area you wish to focus on during your work out. You can select as many focus areas as you want to work out.

- **Focus Area Selection Method (Ordered vs Random):** Ordered chooses a random order to begin with of all the focus areas selected and keeps that order throughout the entire workout. For instance, if you chose Back, Shoulders, and Triceps, it would choose some order at random, perhaps Triceps, Back, Shoulders, then that would be the order for that entire workout (Triceps, Back, Shoulders, Triceps, Back, Shoulders, Tri...you get the drift). Random, on the other hand, would have chosen a random order throughout the entire workout. For random, I do make sure that if more than one focus area is chosen, the same focus area is not selected twice in a row. You wouldn't get a back exercise followed by a back exercise, for instance, unless there was a break in between them. A possible ordering from the Random algorithm is Triceps, Back, Triceps, Back, Triceps, Shoulders, Back, Triceps, Back. Notice that you may see one or more of the chosen focus areas hardly at all, and it is possible if choosing 3 or more focus areas with the Random selection method that you may not even see one of the focus areas you selected in the beginning. This is the exact reason I implemented the Ordered method. If choosing two focus areas, Random and Ordered act exactly the same except after breaks, in which Random could have Back, Break, Back, but Ordered would not have this happen.

- **Breaks:** How often do you want to have breaks in your workout: Every 1/6th of the workout, every 1/5th? Note that since there are no breaks at the end of the workout, choosing every 1/6th would result in having 5 breaks, every 1/5th would have 4 breaks, and so on. Also, note that I start the first break 1/6th of the actual workout in, not 1/6th of the time warming up plus a bit of the workout. This will prevent you from having a break when you just barely started working out. Breaks are not available for 15 minute workouts.

- **Break Length:** How long you want each break to be.

- **Available Equipment:** The equipment you have and wish to use during your workout. Note that Biceps requires at least a Barbell, Dumbbells, or a Resistance Band. Also, the more equipment you have, the more routines you will see, and, frankly, the better results you'll see.
• **Start Workout:** Now that you've gotten through the hard part of choosing all the options you wish to use during your workout, it's time to actually do the workout.

Additional options are available if you click the Menu button:

• **More Options:**

  ○ **Show Images:** You might get tired of looking at me, so you can see just the descriptions instead of images if you so choose. If you check this, descriptions are shown below the basic workout information.

  ○ **Confirm Close Workout:** I noticed during several workouts, I managed to hit the Close button, which was really annoying. If you select the Confirm Close Workout option, the program will ask you to confirm you really meant to close out the workout. The only exception is if the workout is displaying a "Congratulations!" message. Since you are finished with the workout at that point, I decided not to ask if you wanted to close it, regardless of if Confirm Close Workout is selected.

  ○ **Minimize Repeat Routines:** Without this selected, you may see the same exercise more than once during your workout, or several times during a workout. With this option selected, you will most likely see any particular routine only once. However, there are a limited number of routines, and if you have already seen all of the routines for a focus area you have selected and there is still time left in your workout, you will see a repeat at that point.

  ○ **Play Routine Ending Beeps:** With this selected, a beep will play 30 seconds from the time a routine is ending, and a double beep will play when the routine has ended, indicating that the next routine will now be starting. For every focus area other than Core, Cardio, and Stretch, I timed the workouts to give you the last 30 seconds for resting from the current routine and setting up the next routine. Core, Cardio, and Stretch can all be used this way, but you'll probably only need about 10-15 seconds for set-up there. Also, for the strength training routines, I tend to give you enough time after you've finished your reps so that you'll have about a minute to a minute and a half to let you rest before starting the next routine. You'll need longer recovery times for strength training, so this is good practice, but feel free to hit the Next button if you're ready to start, or the Pause button if you feel you need more time.

  ○ **Show Last Weight/Reps:** Displays the Last Reps/Weight you used during your workout and allows you to update these values during the workout.

  ○ **Show Notes:** Displays the Last Notes entered for each routine and allows you to update the notes during the workout.

• **Modify Hidden Exercise List:** You are able to hide exercises you don't want to perform by starting a workout, scrolling to the bottom, and clicking the Hide Exercise From Now On button (this applies to the next time you work out, not the current workout). The Modify Hidden Exercise List allows you to select entries to remove from the list or clear the entire list so that those exercises will be shown again.

• **Quick Load Workout:** Loads a workout that you have saved by clicking Menu during a workout.
• **Load Workout From:** Loads a workout that you have saved by picking from a Save Slot created by clicking Menu during a workout.

• **Save Settings:** Saves all the selections you've made and will reload them the next time you load the program.

• **User Guide:** Displays this guide.

• **Credits:** Displays the credits for the program.

• **Clear Hidden Exercise List:** You are able to hide exercises you don't want to perform by starting a workout, scrolling to the bottom, and clicking the Hide Exercise From Now On button (this applies to the next time you work out, not the current workout). The Clear Hidden Exercise List removes all entries from this list so that all exercises will be shown again.

• **Modify Exercise Lengths:** This feature allows you to change the length of any exercise from the default values to a value you choose from fifteen seconds to five minutes in fifteen second increments. Along with that, there is also a button to reset the lengths to their default values.

**Workout Activity:** This is the actual workout that you can perform or just watch if you get bored. Remember to consult that physician I mentioned earlier before starting any exercise program. Also, modify what you have difficulties with or find too easy. I try to give modifications after the instructions for both people just starting out and people that are more advanced. There are some routines that I couldn't really think of a way to modify it. If you have difficulties with those, you can simply hide that routine from now on, skip it, or do what you can with it until you are able to perform it properly.

• An image or description of the routine will display at the top of the screen depending on whether Descriptions or Images were selected in the Workout Creator.

• **Current:** This is the name of the current routine being performed as well as the focus area for that routine.

• **Equipment:** This displays the equipment required for the current routine, if any.

• **Next:** This displays the name of the next routine to be performed as well as the focus area for that routine.

• **Equipment:** This displays the equipment required for the next routine, if any.

• **Routine (##):** This displays the time remaining in the current routine. The ## represents the current routine number.

• **Total (##):** This displays the time remaining in the entire workout. The ## represents the total number of routines, not including Warmup/Stretch, Cooldown/Stretch, or Breaks.

• **Last Weight:** This is displayed only if Show Last Weight/Reps is selected in the More Options section of the Workout Creator, and the current routine uses or can use Weights. It holds the last weight you used for the routine and can be edited to update for next time.

• **Last Reps:** This is displayed only if Show Last Weight/Reps is selected in the More Options section of the Workout Creator. It holds the number of repetitions you performed the last time you did this exercise and can be edited to update for next time.
• **Last Notes:** This is displayed only if Show Notes is selected in the More Options section of the workout Creator. It displays any notes you have taken for the current routine and can be edited for next time.

• If Images was selected in the Workout Creator, a step by step instruction guide for the current routine will be displayed below all the other workout information fields.

• **Start/Pause/Resume:** This button starts the workout timer if it hasn't been started and can pause the workout or resume the workout after that.

• **<<:** This button loads the previous exercise if you are not at the beginning.

• **>>:** This button loads the next exercise if you are not at the end.

• **Close:** This button closes out the current workout and returns the Fitness Suite to the Workout Creator section. If Confirm Close Workout is selected in the More Options section of the Workout Creator, it will ask you to confirm that you really wish to close the workout first.

• **Volume Up/Down button on phone:** The Volume Up button (not in the app, but a physical one on the phone) will increase the text size. The Volume Down button will decrease the text size.

Additional options are available if you click the Menu button:

• **Hide Routine From Now On:** There may be times where you find a routine you particularly don't like or find too difficult or for whatever reason wouldn't like to see it in any future workout. Click this button to hide this routine from now on. Warmup/Stretch, Cooldown/Stretch, and Breaks cannot be hidden.

• **Quick Save Workout:** Saves all the routines from the current workout in case you wish to finish it later or really liked this particular set of routines and want to do this exact exercise again later by clicking Quick Load Workout available from the Menu button in the Workout Creator.

• **Save Workout To:** Saves all the routines from the current workout to one of six different slots, five primary and a quick save slot, in case you wish to finish it later or really liked this particular set of routines and want to do this exact exercise again later by clicking Load Workout From available from the Menu button in the Workout Creator.

**Body Fat Calculator:** This is used to calculate your body fat percent, lean body mass, and lbs/kg of fat you have on your body. There are many formulas for determining body fat. If you're curious, I chose the Department of Defense's formula. I figured if it was a good enough standard for our military, it's good enough for me to use here.

• **Gender:** It's pretty self explanatory, male or female. Pick one. If your sex is more complicated than that, use your best judgment.

• **Height:** How tall are you? You can select Feet/Inches or Centimeters. If choosing centimeters, only fill in the first box in the height field.

• **Weight:** How much do you weigh? Don't worry, you can be honest. No one's looking. Note that your weight actually has no effect on that body fat percentage calculation. It is only used to determine your lean body mass.
• **Waist (naval/minimal):** If you selected male, measure your waist at your naval line. If you selected Female, measure at your smallest point.

• **Neck (below apple):** Measure at your Adam's apple. If you don't have one of those, measure at the spot where your Adam's apple would be.

• **Hips (widest):** This is only for females. Measure at the widest point of your hips.

• **Clear Form:** This will clear all the information in all the fields I just described.

• **Calculate Body Fat:** This will calculate your body fat percentage, along with your lean body mass (which is your body weight with 0 lbs/kgs of fat on it) and the total lbs/kgs of fat you have.

• Note that the information you entered will be saved in the phone's internal memory so you don't have to re-enter all that information every time you use the Body Fat Calculator.

Additional options are available if you click the Menu button:

• **User Guide:** Displays this guide.

• **Credits:** Displays the credits for the program.

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**BMR Calculator:** Your Basal Metabolic Rate is a good indicator of the number of calories you need to intake each day to prevent your body from going into starvation mode. It is, basically, the energy you need to maintain vital organ health. My suggestion--and take this with a grain of salt and consult a physician, dietician, or nutritionist instead of me--for losing weight is to eat just above your BMR and work out to make your total calories for the day (calories eaten minus calories burned from working out) less than your BMR. To maintain weight, you'll need your total daily calories (calories eaten minus calories burned from working out) to stay right around your BMR level. And to gain weight, you'll need to eat more or work out less (but those calories might not come out looking as pretty if you work out less). Note that unlike Body Fat formulas, where there are tons of different ones around, there are only two BMR calculations and one of those is just around for historical reasons. I use the Mifflin-St Jeor equation. Again, any advice I give is to be taken with a grain of salt, as I am not a medical doctor, dietician, nutritionist, etc.

• **Gender:** Some people also call this "Sex", but I figured if I labeled it that, I'd have to make, "Yes, please!" one of the options. Anyway, whichever you happen to feel most comfortable choosing, male or female, pick that one.

• **Height:** You put how tall you are in this spot. If you select centimeters instead of feet/inches, use only the first box. You have to anyway because I hide the second one if you select centimeters.

• **Weight:** Don't be shy. The BMR Calculator isn't going to judge you. You can enter this information in Lbs or Kgs.

• **Age:** Put your age in years here, not dog years, though, as that wouldn't be accurate unless you happen to be a dog, but no, not even then.

• **Clear Form:** This button clears all the information from the fields I just described.
• **Calculate BMR:** This button will display your BMR or an error message if you forgot to fill out one of the fields.

• Note that the information you entered will be saved in the phone's internal memory so you don't have to re-enter all that information every time you use the BMR Calculator.

Additional options are available if you click the Menu button:

• **User Guide:** Displays this guide.

• **Credits:** Displays the credits for the program.

**Health Tips:** This will display health tips. Note that although I do a tremendous amount of research in the nutrition field, I am not a medical doctor, dietician, or nutritionist. Consult one of those to get official health advice. My health advice is not to be used to treat or prevent any medical condition. It's just there to look pretty.

• **Text box with info:** This displays stuff to read for fun.

• <<: This button loads the previous health tip and will wrap to the end if you are at the beginning.

• >>: This button loads the next health tip and will wrap to the beginning if you are at the end.

• **Volume Up/Down button on phone:** The Volume Up button (not in the app, but a physical one on the phone) will increase the text size. The Volume Down button will decrease the text size.

Additional options are available if you click the Menu button:

• **User Guide:** Displays this guide.

• **Credits:** Displays the credits for the program.

**Appendix C. EULA**

END-USER LICENSE AGREEMENT FOR Mobile Fitness Suite

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Appendix D. Medical and Personal Injury Disclaimer

Chad Richards is not a licensed physician, personal trainer, or certified nutritionist. Consequently, any advice given by Chad Richards is not intended or meant to replace any medical advice you’ve received from your doctor or physician. As with any and all other matters of health and fitness and any other health related issues, always consult your physician before starting any fitness or weight training program. Always consult your physician before making any radical changes to your diet plan, exercise routine or various supplements you choose to consume.

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**Appendix E. Credits**

Lead Programmer: Chad Richards

Photography: Dr. Shelly Bursick, Ph.D.