Article

Personality Traits, Gamification and Features to Develop an App to Reduce Physical Inactivity

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Abstract: Background: Health benefits from physical activity (PA) can be achieved by following the WHO recommendation for PA. To increase PA in inactive individuals, digital interventions can provide cost-effective and low-threshold access. Moreover, gamification elements can raise the motivation for PA. This study analyzed which factors (personality traits, app features, gamification) are relevant to increasing PA within this target group. Methods: N = 808 inactive participants (f = 480; m = 321; age = 48 ± 6) were integrated into the analysis of the desire for PA, the appearance of personality traits and resulting interest in app features and gamification. The statistical analysis included chi-squared tests, one-way ANOVA and regression analysis. Results: The main interests in PA were fitness (97%) and outdoor activities (75%). No significant interaction between personality traits, interest in PA goals, app features and gamification were found. The interest in gamification was determined by the PA goal. Participants' requirements for features included feedback and suggestions for activities. Monetary incentives were reported as relevant gamification aspects. Conclusion: Inactive people can be reached by outdoor activities, interventions to increase an active lifestyle, fitness and health sports. The study highlighted the interest in specific app features and gamification to increase PA in inactive people through an app.

Keywords: gamification; app features; physical activity; personality; mhealth; health app

1. Introduction

Physical inactivity can be regarded as a major risk factor to develop chronic diseases like diabetes mellitus, high blood pressure, and cardiovascular diseases. Hence, it can be considered a global cause of death [1]. The growing incidence of cardiovascular, musculoskeletal, and mental illnesses results in medical costs amounting to billions of euros [2,3]. These negative effects have led to a global interest in reducing health risks, identifying protective factors, and promoting physical activity (PA) [1,4]. However, the main reasons for insufficient PA are complex. According to the ecological approach, the interrelation between the individual and the environment and the exchange relationship between people, values and norms of society cannot be disregarded [5,6]. If, for example, children at school observe that other children are rewarded for walking around quietly during breaks, they are likely to also walk more quietly and thereby meet the teacher's expectations (depending on the children's commitment to the school). In this way, children can learn that children who are less active enjoy a higher reputation than those with a tendency to be more active [5,6]. In addition, inactivity can be attributed, for example, to scheduling problems, unwillingness, too little awareness about the relevance of PA, s lack of access to programs and interventions and insufficient diversity [7–9]. Furthermore, other personal factors and individual motives can be prerequisites for action to increase PA. For instance, Sudeck, Lehnert and Conzelmann (2011) classified motives for health-related PA

in terms of (1) fitness/health, (2) figure/appearance, (3) activation/joy, (4) distraction, (5) aesthetics, (6) contact motive and (7) competition/performance [10,11]. This means that that different aspects might determine individuals' goal setting and encourage them to increase PA in relation to motivational factors. However, these motives might not be sufficiently addressed in common interventions. Even though programs might address individual motives, the problem of reaching inactive people remains.

A contribution to the solution might be the development of individualized mhealth (mobile health) and health applications (apps) which integrate features like pedometers and other gamification elements to increase motivation and volition [12]. Reports based on common gaming apps (e.g., Pokémon Go, Ingress and Zombie run) showed positive effects on PA by, e.g., increasing the daily number of steps [13]. In particular, the Pokémon Go app developed by Niantic 2016 has millions of active users worldwide. Therefore, this app can be considered as an intervention that might help to increase PA. The mobile game connects the Pokémon world with the real world. Its goal is to capture Pokémon through an individualized avatar. The Pokémon then are used in battles against other users, who all have the common goal of reaching new levels through various tasks and by visiting different locations [13,14]. A study by Althoff (2016) shows that by using the app an increase of more than 25% is achieved in a period of 30 days, compared to the activity level before. In particular, inactive people felt motivated by the gamification elements of the app. This motivation was irrespective of personality traits [13]. In order to maintain user motivation, newer editions of the game are planned with additional sensors, thematic challenges and rewards. The Pokémon Go exemplar demonstrates the possibilities of increasing PA through digitalization, e.g., in the form of apps [15].

However knowledge of (a) the appropriate amount of PA, (b) the influence of personality traits, and (c) suitable gamification elements and app features are necessary to develop an app that appropriately promotes PA, and reaches physically inactive people.

1.1. A. Physical Activity

The positive effects of PA on health (e.g., on self-efficacy, wellbeing and quality of life) have been widely investigated over the last decades [16,17]. A certain amount of PA supports body weight control, cognition, self-efficacy, wellbeing, quality of life and mortality [16–21]. In addition, a reduction in the development of chronic diseases such as diabetes mellitus, hypertension and cardiovascular disease has been demonstrated [19,22]. The health-promoting physiological, as well as psychological, effects of PA can be achieved if the World Health Organization's (WHO) recommendations for PA (for adults: ≥30 min of moderate daily exercise and >150 min of exercise per week) are fulfilled [23]. In accordance with Krug et al. [24], who state that three quarters of men and four fifths of women are not sufficiently active according to WHO recommendations, actual results in a study within the age groups 40–50 years showed that the majority of respondents (80.2%) did not reach WHO recommendations [25]. However, with this age group, the prevalence of developing a chronic disease like diabetes mellitus or hypertension is rising. Nevertheless, 50.2% of the respondents who did not follow the WHO recommendations consider the improvement of their health to be very important and are willing to enter into the process of health promotion. Thus, 65.6% of the respondents who did not meet the WHO recommendations wanted to improve their fitness, 60.4% aspired to an improvement in mobility, 63.2% to an improvement in endurance, 40.8% to a more active lifestyle and 47% to improved performance. Another 57.5% would like to do more outdoor activities [25]. To achieve the current WHO recommendations and to establish a sustainable level of PA, a willingness to change one's behavior, increased motivation and measures to promote sport and PA are required [23,26].

1.2. B. Personality

To enable an individualized approach in an app, it is first necessary to understand the personality traits of the app users. There are different methods to classify personality traits. A conventional personality theory is the big five personality theory, which was not used in this study because the neuropsychological approach is disregarded and does not take motives and emotions into account [27].

The situation is different with the Personality System Interaction Theory (PSI), according to Kuhl [28], which takes into account both motivational and emotional components and thus allows conclusions to be drawn about the actions of personality types. Therefore, a recent study by Brand and Cheval recommends not only taking the big picture into account, but also considering the current sensations in the change of behavior and the emotions [29]. In PSI theory, the personality of an individual is divided into four dimensions [30]. According to PSI theory, there are two emotional systems and two cognitive systems. The two emotional systems are (1) the need for stimulation and (2) the need for security, the cognitive system includes (1) the need for information and (2) information processing [31]:

- The need for stimulation can be low or high. If the need for stimulation is classified as low, the person needs freedom in their life, which enables them to have strength, assertiveness and positive interactions with other people. If the need for stimulation is high, the free space is not necessarily needed, energy is drawn from the action itself.
- The need for security is also characterized by a high or low level of expression. For example, if the need for security is low, goals, structures and plans are perceived as obstructive. In addition, people quickly deviate from their goals and strategies. In contrast, structures and plans are regarded as beneficial and adhered to by individuals with a high need for security when implementing goals.
- Persons who, when difficulties arise, attribute the errors to themselves and justify them can be assigned to the specific information intake. Persons with specific information acquisition have a distinctive eye for detail in comparison to automatic information acquisition, to which a perception of the big picture and the recognition of obstacles provide the potential for action.
- Information processing can be based on objective or personal perception. A person with the personality trait of objective information processing conducts conversations on a factual level, acts with foresight and on the basis of an analytical approach. The characteristic of personal information processing is ascribed to people with a great need for harmony and high importance in communication [30].

These findings about personality theory can be used to ensure targeted communication in digital applications [31]. Moreover, the integration of these aspects in combination with health behavior change theories and gamification might increase adherence to the long-term use of applications to increase PA [32].

1.3. C. Digitalization, Appfeatures and Gamification

In addition to club sports or fitness studios, digitalization already plays an essential role in prevention and health promotion and enables new access to PA [33,34]. Digitalization through e-health or mhealth creates a low-threshold offer and cost-efficient interventions [35–38]. A common form of application is the smartphone, into which additional applications can be integrated. Possible applications include health apps, which can support a health-promoting lifestyle, improve care, promote self-help, provide information and autonomy [39,40].

According to the Motivation-Volition (MoVo) process model [41], the continuous perception of a movement intervention, in this context an app to increase PA, depends on the patient's state of health. The model depends on five psychological factors (strong goal intention, high self-accordance of the goal, realistic implementation plan, strategies of action control, and expectation of positive consequences) [41]. Furthermore, motivation should not be ignored. The self-determination theory of Deci and Ryan identifies three essential needs for intrinsic motivation: self-determination/need for autonomy, characterized by free choice (e.g., without pressure to choose an intervention that increases PA), the need for competence with optimal challenge and feedback, and social integration [42] and can be satisfied by the use of gamification [43].

For a targeted approach to the individual in a health app, an analysis of personality structures can reveal the necessary contents of individualization aspects in an app. For example, a study by Fahr

and Stevanovic (2018) [44] shows that the personality traits of a person (e.g., personal information processing) are decisive in their usage behavior when it comes to apps. According to Becker (2013), the interest in an app decreases after a short time, which can result in a high drop-out rate in app usage [45,46]. The individualization of content through the targeted implementation of personality theories makes it possible to reduce the drop-out rate in app usage [38]. App developers are thus faced with the great challenge of increasing the user's motivation to commit to an app.

In addition to the individualization of an app and a targeted approach, app features can maintain the motivation to use the app through an interesting interface, technically flawless use, intuitive operation and automated customization. Furthermore, content and features such as gamification elements are recommended to increase motivation [47]: Gamification is defined as "[…] the use of game design elements in non-game contexts" [48] (p. 2) and describes the use of game content to integrate people into processes and motivate them to act, solve problems or learn [49]. A variety of game-based elements are used, such as reminders, level upgrades, avatar design, leaderboards and competitions. The positive effects on motivation and behavioral change through gamification have been shown in various studies [50–54]. In summary, gamification is used in many apps to motivate app users to change their behavior, e.g., to increase PA, and to ensure their motivation for the long-term use of the app.

The German CASPAR study (coaching app for setting oriented prevention work) examined in more detail the gamification elements that can lead to an increase in PA among users [25] and came to the conclusion that the currently available game elements of an app mainly reach those who already meet the WHO recommendations on PA. Contrary to expectations, the target group that has PA as its goal but does not meet the guidelines cannot be addressed in the same way with the existing elements [25]. Here, a lack of health literacy is to be assumed, which would enable the individual to behave in a healthy way and positively influence his or her own health [25,55]. According to the Physical Activity-Related Health Competence Model (PAHCO), the competences include movement competence, control competence and self-regulation competence [55]. These enable the implementation of motor skills, the training of specific knowledge and regular PA [55]. The study also left open the question of whether the motivational aspects that can lead to an increase in PA depend on the personality type [25]. This contribution follows up this open topic. For the development of an app to increase PA for inactive people, the most important research questions of this study are:

(1) Which PA activities are of the most interest for physically inactive participants?
(2) Are desires for PA programs dependent on personality traits?
(3) Which factors (e.g., personality aspects) determine the resulting interest in features and gamification and which elements are especially relevant for physically inactive people?

The underlying research hypothesis of this study was the assumption that PA is not determined by personality, whereas the interest in app features and gamification elements is associated to personality traits.
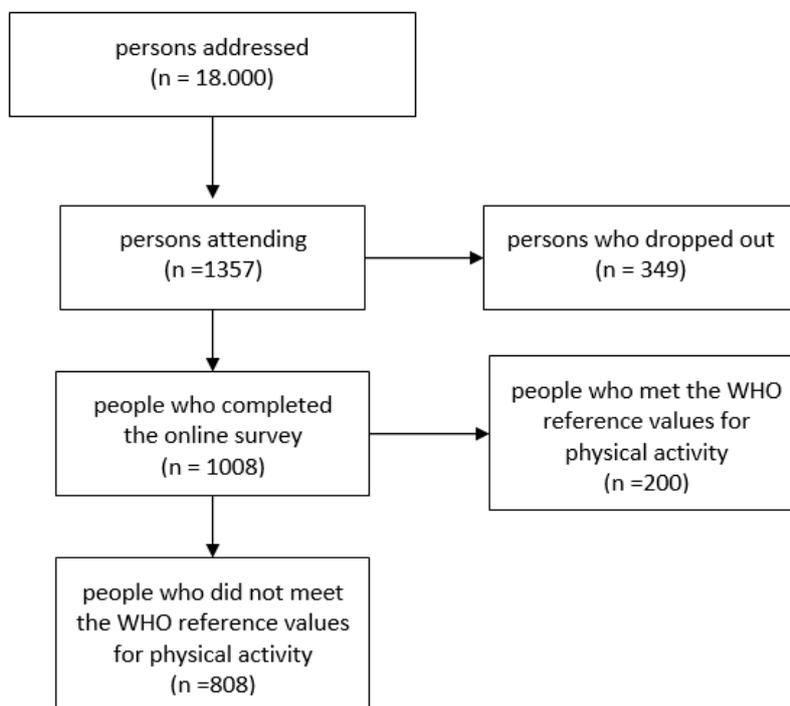
2. Materials and Methods

2.1. Study Design

The cross-sectional study was part of a project which aims to develop a health app and to design health promotion offers in a sustainable manner. This study design procedure was approved by the local ethics committee (file reference: AZ: 2019_270).

2.2. Sample

A German health insurance company recruited the study participants in the summer of 2019. A total number of N = 18,000 insured persons were contacted via email. Included participants had to be adults and had to be contractually capable. A number of n = 808 (80.2%) of the 1008 respondents did

not comply with WHO recommendations and were integrated into the analysis of this study (Figure 1).

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┌─────────────────────┐
│  persons addressed  │
│    (n = 18.000)     │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐        ┌─────────────────────────┐
│  persons attending  │───────▶│  persons who dropped out │
│     (n =1357)       │        │       (n = 349)          │
└─────────────────────┘        └─────────────────────────┘
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│ people who completed│        │   people who met the WHO │
│  the online survey  │───────▶│   reference values for   │
│     (n = 1008)      │        │    physical activity     │
└─────────────────────┘        │       (n =200)           │
           │                   └─────────────────────────┘
           ▼
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│ people who did not meet│
│ the WHO reference values│
│  for physical activity │
│      (n =808)          │
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Figure 1. Study process.

2.3. Measures

The web-based questionnaire was tested, improved and validated by a research team from the University of Hamburg. The questionnaire integrates the reference values of the WHO [23] and the German Society for Nutrition [56]. Furthermore, the questions are based on the CALO-RE Taxonomy of Behaviour Change [57] and the Baecke questionnaire for the measurement of a person's habitual physical activity [58]. Moreover, relevant key aspects related to personality traits and requirements for app features and gamification were extracted from 36 qualitative interviews. Furthermore, these interviews were used to validate the determination of the personality traits by using the Visual Questionnaire (ViQ) [30]. In the last step, the online questionnaire was finalized with an expert rating by six experts of different disciplines (psychology, sports science, app development, health insurance). The resulting instrument was divided into five sets of questions (the questionnaire can be requested from the authors).

(1)　Sociodemographic (4 items): The sociodemographic questions covered the number of the respondents living in the household, their age and sex.

(2)　Health status and fields of action (5 items), included physical activity (6 items), nutrition (6 items) and relaxation (6 items): In the health status and fields of action thematic block, a survey was conducted on health potentials and deficits in the areas of exercise, nutrition and stress/relaxation (including compliance with WHO criteria). Further questions in the individual fields of action reflected the interest and objectives of the interviewee.

(3)　Personality and motivation (4 items): The personality questions were derived from previous qualitative interviews and checked for construct validity in a validation study using the Visual Questionnaire (ViQ) [30]. The ViQ is a validated survey instrument. The results showed a high correlation between the two survey instruments. The implied personality analysis included health-specific questions, which resulted in a manifestation in the four personality dimensions (need for stimulation, need for security, information acquisition and information processing).

(4) Smartphone use (2 items): The questionnaire section on smartphone use was designed to generate information about which mobile devices the participants own and whether health apps are already in use.

(5) App feature (3 items): The questions were aimed at the wishes, ideas and needs of the respondents to design the app in a user-friendly way, adapted to their needs. These were relevant functions, such as the possibility of linking the app with other devices (trackers, smartwatches).

(6) Gamification (3 items): The question block gamification asked about the interest in gamification elements, such as the possibility of progress control or a level increase.

(7) App usage (9 items): The block on app usage enabled an assessment of the interviewee's usage time, intensity and preferences.

This study focused mainly on interests in PA, personality, app features and gameplay elements. For the evaluation of gamification elements and app features, the results of the previous evaluation were used [25]. In this evaluation, the interest in different gamification elements was retrieved. A story in an app, the creation of an avatar, rating other users, comparing rankings, sharing results and tasks and completing tasks under time pressure were of little interest (mean value < 3). For this reason, only those elements that the majority of respondents considered interesting were considered further (mean value > 3). These were:

- receiving feedback,
- immaterial rewards,
- leveling up,
- monetary incentives,
- diaries or strategy documentation,
- suggestions for activities,
- earning points,
- fulfilling weekly goals and tasks,
- information or instruction videos,
- reminders,
- knowledge about a healthy lifestyle,
- connection to their health insurance company's bonus program,
- progress,
- individualization of app content.

In addition, individuals' wishes for improvements in the field of PA were collected in the first step. For further investigation, in the second step, they were combined into four groups: fitness offers, outdoor exercise, a more active lifestyle, and health sports. In a previous publication [25], respondents who did not meet the WHO recommendations expressed a desire to improve fitness, mobility, endurance and performance. These were summarized here in the category "fitness". Further goals that were named were a more active lifestyle as well as increased outdoor activity and health sports. These three headings were adopted to the additional analysis of this article.

2.4. Procedures

The online questionnaire (created with the software Questback) was introduced with notes on participant information, anonymity, voluntariness and data protection. The participants received an invitation to complete the questionnaire via mail. Completing the questionnaire took about 30 min. Only surveys that were completely filled out were included in the data analysis.

2.5. Analyses

The evaluation was carried out using descriptive statistics and mean value comparisons. The data analysis was conducted in four steps:

1. A frequency analysis and a chi-square calculation of the desires for sports (fitness, more active lifestyle, nature activities and health sports) and the appearance of personality traits was carried out.

2. The personality traits were then examined with regard to their sport desires using the chi-squared test.

3. In a further step, a one-way ANOVA (personality trait, app feature or gamification) was performed to find out which personality traits determine the resulting interest in app features and gamification. For the evaluation, personality traits, app features and gamification elements were divided into three blocks:

    Block I: Personality traits (stimulation needs, security needs, information acquisition and information processing).

    Block II: App features (individualization of app content, coupling the app with trackers or smartwatches, diaries or strategy documentation, suggestions for activities, information or instruction videos, reminder, e.g., setting targets, knowledge about a healthy lifestyle, connection to a health insurance company's bonus program).

    Block III: Gamification elements (comparison in a ranking or ladder format, progress checks, earning points, collecting points with family, immaterial rewards, monetary incentives, connection to a health insurance company's bonus program, own avatar, tasks under time pressure (e.g., countdown), level advancement, sharing and comparing goals, history in the app, auditory, haptic or visual feedback, evaluating other family members).

4. In the final step, a logistic regression analysis was performed to check the correlation between the identified variables.

    The statistical calculations were done with SPSS Statistics (IBM SPSS Statistics, Version 25.0, NY).

3. Results

The analysis of preferred sports activities showed that 97% of the participants would like to increase their fitness, 75% would like to do more outdoor activities, 54% would like to be more active in their lifestyle and 49% would like to do health sports.

The sports goals do not differ from the personality traits (Table 1). People with a high level of information processing show the most interest in sports goals (41% fitness, 45% more active lifestyle, 42% nature activities, and 44% health sports).

Table 1. Targets for an increase in physical activity depending on personality traits.

Personality Trait	Fitness	More Active Lifestyle	Nature Activities	Health Sports
need for security	23%	21%	24%	22%
information acquisition	9%	8%	9%	9%
need for stimulation	6%	5%	5%	5%
information processing	41%	45%	42%	44%
Not quoted	21%	21%	20%	20%
Chi-squared value (x^2); Significant (p); Coefficient of contingency (C)	$x^2 = 7353$ $p = 0.118$ $C = 0.096$	$x^2 = 7535$ $p = 0.110$ $C = 0.097$	$x^2 = 3200$ $p = 0.525$ $C = 0.063$	$x^2 = 4163$ $p = 0.384$ $C = 0.072$

The desire for app features and gamification elements in an app to increase PA is also independent of personality traits.
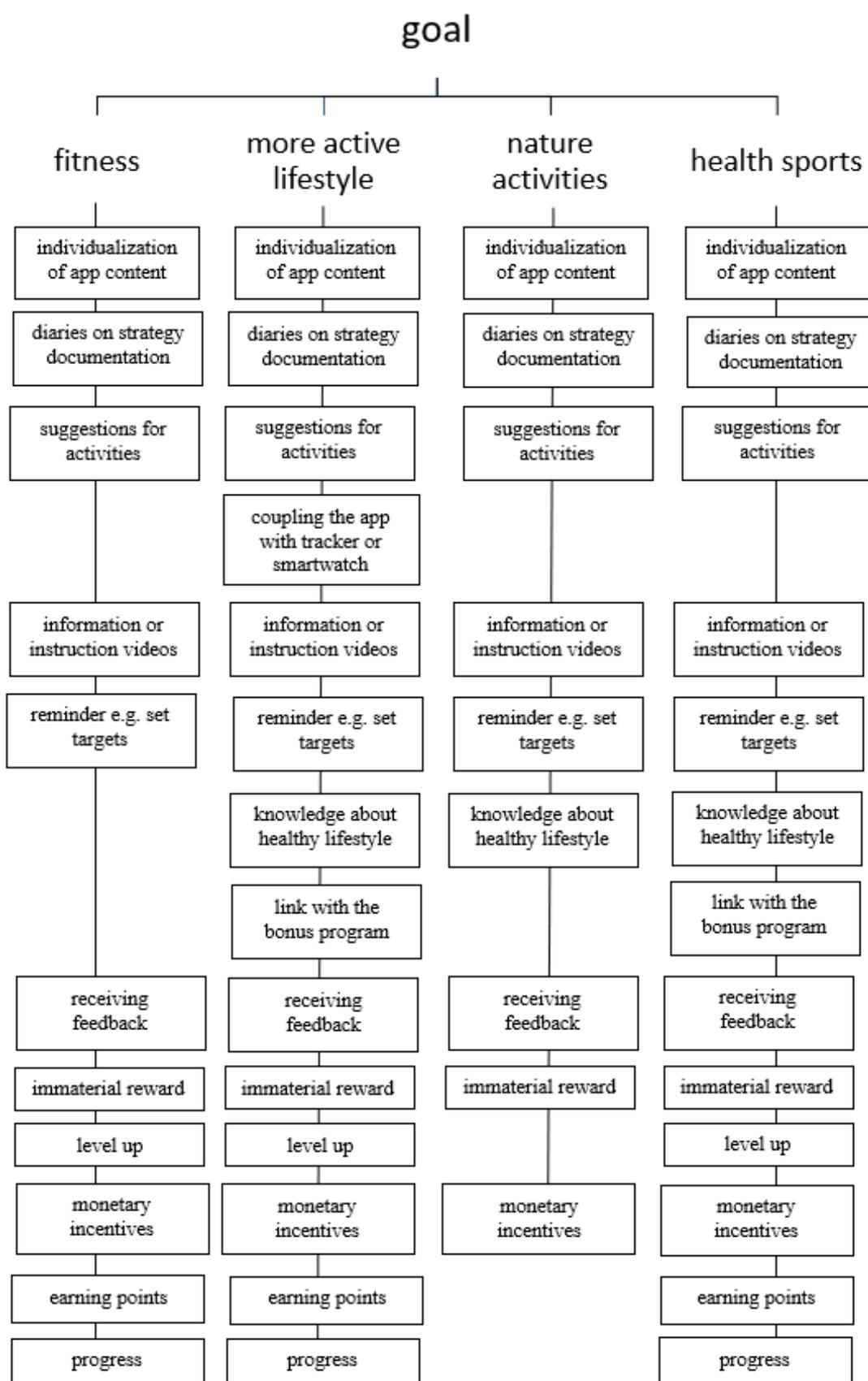
Further analysis of whether the interest in app features and gamification content can be traced back to the type of sports objective yields significant results, which can be seen in Table 2.

**Table 2.** Targets for an increase in physical activity and interest in app features and gamification.

App Feature	Fitness	More Active Lifestyle	Nature Activities	Health Sports
individualization of app content	$F(5.818)$; $p = $ **0.016** $eta^2 = 0.007$	$F(15.888)$; $p = $ **0.000** $eta^2 = 0.020$	$F(3.921)$; $p = $ **0.048** $eta^2 = 0.005$	$F(5.411)$; $p = $ **0.020** $eta^2 = 0.007$
diaries or strategy documentation	$F(4.181)$; $p = $ **0.041** $eta^2 = 0.005$	$F(22.032)$; $p = $ **0.000** $eta^2 = 0.027$	$F(13.181)$; $p = $ **0.000** $eta^2 = 0.016$	$F(12.478)$; $p = $ **0.000** $eta^2 = 0.016$
suggestions for activities	$F(4.506)$; $p = $ **0.034** $eta^2 = 0.006$	$F(36.159)$; $p = $ **0.000** $eta^2 = 0.044$	$F(17.938)$; $p = $ **0.000** $eta^2 = 0.022$	$F(12.778)$; $p = $ **0.000** $eta^2 = 0.016$
connect the app with tracker or smartwatch	$F(2.306)$; $p = 0.129$ $eta^2 = 0.003$	$F(9.445)$; $p = $ **0.002** $eta^2 = 0.012$	$F(2.556)$; $p = 0.110$ $eta^2 = 0.003$	$F(3.747)$; $p = 0.053$ $eta^2 = 0.005$
information or instruction videos	$F(4.617)$; $p = $ **0.032** $eta^2 = 0.006$	$F(24.998)$; $p = $ **0.000** $eta^2 = 0.030$	$F(19.048)$; $p = $ **0.000** $eta^2 = 0.023$	$F(12.566)$; $p = $ **0.000** $eta^2 = 0.016$
reminders, e.g., to set targets	$F(8.812)$; $p = $ **0.003** $eta^2 = 0.011$	$F(33.138)$; $p = $ **0.000** $eta^2 = 0.040$	$F(18.958)$; $p = $ **0.000** $eta^2 = 0.023$	$F(18.457)$; $p = $ **0.000** $eta^2 = 0.023$
knowledge about healthy lifestyle	$F(.923)$; $p = 0.337$ $eta^2 = 0.001$	$F(11.946)$; $p = $ **0.000** $eta^2 = 0.015$	$F(6.938)$; $p = $ **0.009** $eta^2 = 0.009$	$F(12.083)$; $p = $ **0.001** $eta^2 = 0.015$
connection to a health insurance company's bonus program	$F(2.505)$; $p = 0.114$ $eta^2 = 0.003$	$F(13.370)$; $p = $ **0.000** $eta^2 = 0.016$	$F(3.563)$; $p = 0.059$ $eta^2 = 0.004$	$F(14.127)$; $p = $ **0.000** $eta^2 = 0.017$
Gamification				
receiving feedback	$F(8.646)$; $p = $ **0.003** $eta^2 = 0.011$	$F(25.367)$; $p = 0.000$ $eta^2 = $ **0.031**	$F(12.652)$; $p = $ **0.000** $eta^2 = 0.016$	$F(6.289)$; $p = $ **0.012** $eta^2 = 0.008$
immaterial rewards	$F(5.032)$; $p = $ **0.025** $eta^2 = 0.006$	$F(17.322)$; $p = $ **0.000** $eta^2 = 0.021$	$F(4.048)$; $p = $ **0.045** $eta^2 = 0.005$	$F(17.713)$; $p = $ **0.000** $eta^2 = 0.022$
level up	$F(5.003)$; $p = $ **0.026** $eta^2 = 0.006$	$F(14.677)$; $p = $ **0.000** $eta^2 = 0.018$	$F(3.303)$; $p = 0.070$ $eta^2 = 0.004$	$F(1.778)$; $p = $ **0.002** $eta^2 = 0.183$
monetary incentives	$F(12.339)$; $p = $ **0.000** $eta^2 = 0.015$	$F(11.885)$; $p = $ **0.001** $eta^2 = 0.015$	$F(4.150)$; $p = $ **0.042** $eta^2 = 0.005$	$F(14.741)$; $p = $ **0.000** $eta^2 = 0.018$
by earning points for my performance	$F(3.929)$; $p = $ **0.048** $eta^2 = 0.005$	$F(23.492)$; $p = $ **0.000** $eta^2 = 0.029$	$F(2.566)$; $p = 0.110$ $eta^2 = 0.003$	$F(12.964)$; $p = $ **0.000** $eta^2 = 0.016$
by monitoring my progress	$F(9.084)$; $p = $ **0.003** $eta^2 = 0.011$	$F(21.869)$; $p = $ **0.000** $eta^2 = 0.027$	$F(0.84)$; $p = 0.772$ $eta^2 = 0.000$	$F(7.706)$; $p = $ **0.006** $eta^2 = 0.010$

According to statistical ANOVA calculations, the individualization of an app, a diary function, videos and reminder functions as well as suggestions for activities, turned out to be mandatory for all four target areas. For the target areas of fitness, nature activities and health sports, linking the app to a tracker or a smartwatch was not of interest. For the target area fitness, the acquisition of knowledge for a healthier lifestyle via an app was not relevant. A link to a bonus program was also not relevant for those interviewees who had the aim to increase their fitness and who pursued activities in nature. Gamification elements considered relevant were feedback, level ups, immaterial rewards, monetary incentives, point accumulation, and progress towards the goals of fitness improvement, more active lifestyles and more health sports. Level advancement, collecting points and progress were considered irrelevant to nature activities (Figure 2).

In the next step, all metrically scaled app features and gamification variables were converted into four binary logistic regression models. For the four overall models the following values were obtained: fitness ($chi^2(18) = 20{,}267$, $p = 0.317$, n = 705, pseudo $R^2 = 0.125$); active lifestyle ($chi^2(18) = 56.754$, $p = 0.000$, n = 705, pseudo $R^2 = 0.103$); outdoor activities ($chi^2(18) = 53.53$, $p = 0.000$, n = 705, pseudo $R^2 = 0.111$) and health sports ($chi^2(18) = 39.524$, $p = 0.002$, n = 705, pseudo $R^2 = 0.073$). Within the model for fitness goals, "monetary incentives" proved to be a significant coefficient (forest (1) = 7.301, $p = 0.007$, b = 0.489); for goals of a more active lifestyle, the coefficients "suggestions for activities" (forest (1) = 12.222, $p = 0.000$, b = 0.255) and "receiving feedback" (forest (1) = 0.124, $p = 0.049$, b = 0.124) were significant. For the model on nature activity objectives, the coefficients "proposals for activities" (forest (1) = 8.200, $p = 0.004$, b = 241) and "reminder function" (forest (1) = 6.306, $p = 0.012$, b = 276) were significant. The coefficient "progress" is, in contrast to this, a negative significant regression coefficient in this model (forest (1) = 11.051, $p = 0.001$, b = −0.310). None of the coefficients integrated in the model are significant for the target area of health sport (Figure 3).

goal

fitness	more active lifestyle	nature activities	health sports
individualization of app content	individualization of app content	individualization of app content	individualization of app content
diaries on strategy documentation	diaries on strategy documentation	diaries on strategy documentation	diaries on strategy documentation
suggestions for activities	suggestions for activities	suggestions for activities	suggestions for activities
	coupling the app with tracker or smartwatch		
information or instruction videos	information or instruction videos	information or instruction videos	information or instruction videos
reminder e.g. set targets	reminder e.g. set targets	reminder e.g. set targets	reminder e.g. set targets
	knowledge about healthy lifestyle	knowledge about healthy lifestyle	knowledge about healthy lifestyle
	link with the bonus program		link with the bonus program
receiving feedback	receiving feedback	receiving feedback	receiving feedback
immaterial reward	immaterial reward	immaterial reward	immaterial reward
level up	level up		level up
monetary incentives	monetary incentives	monetary incentives	monetary incentives
earning points	earning points		earning points
progress	progress		progress

Figure 2. Interest of inactive persons in app features and gamification elements in an app to increase physical activity.
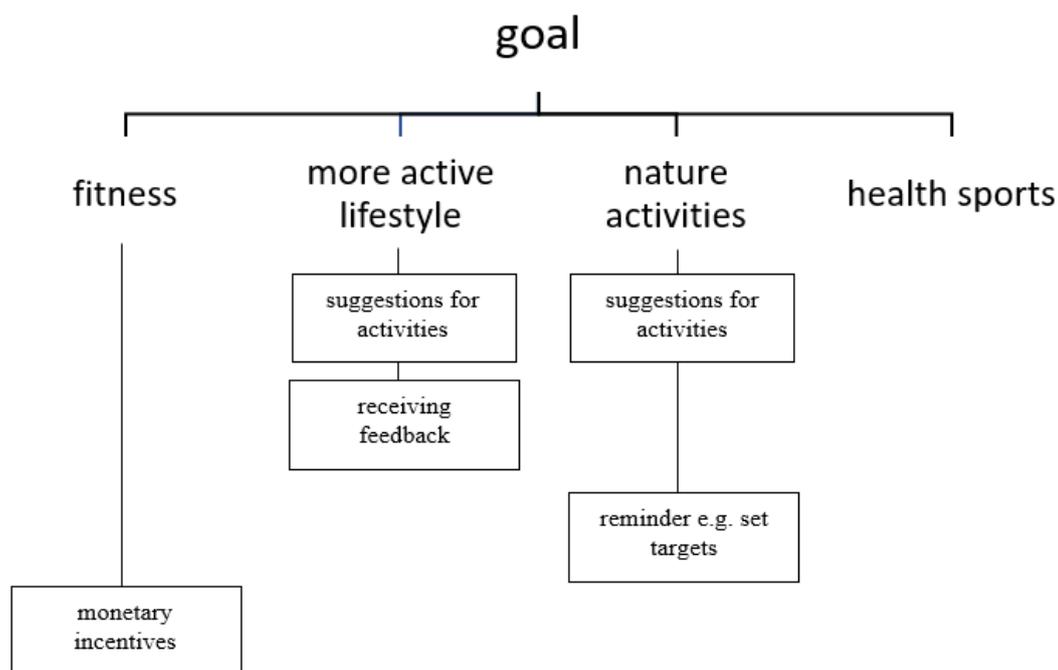
Figure 3. Interest of inactive persons in app features and gamification elements in an app to increase physical activity after conducting a regression analysis.

4. Discussion

For the development of an app to increase PA in inactive persons, the goals to increase PA that existed among the inactive persons who took part in the survey were investigated. In a further step, participants' wishes for a sports program were analyzed by taking personality traits into consideration. Furthermore, we examined whether personality traits determined participants' interest in app features and gamification elements and which features and elements are relevant for physically inactive persons to increase PA. The underlying assumption was that PA is not determined by personality and that personality traits determine the interest in app features and gamification elements.

4.1. Physical Activity Interests of the Inactive Participants

Overall, the results showed that 97% of the inactive people wanted to improve their fitness and 75% wanted to increase their PA through outdoor activities. Nearly half wanted to achieve a more active lifestyle and engage in health sports. These results fit to the contents of most apps for increasing PA and addressing fitness in the form of running and workouts or by increasing the number of steps in everyday life [15,59–61]. However, it remains unclear why the existing apps to increase PA were not used by our participants. The reasons for this observation might be complex and could be interpreted through certain aspects of the ecological approach [5,6]. However, this integrative concept was not the main focus in the area of app development and design. On the other hand, the specified requirements and needs of the individual were addressed in order to identify relevant contents for app development. Thus, a central aspect might be that the first step, the motivation and volition to increase one's own fitness with an app, is not fulfilled; however, this is only speculative. Another aspect might be the missing knowledge about relevant or suitable apps. Third, the development of apps does not always follow the concept of user integration [62], a lot of apps are not based on an analysis of user-specific requirements and the effects on PA are not always evaluated sufficiently [63]. In addition, the increase in PA through nature activities and lifestyle changes has been found to be low so far, but by moving around outdoors, e.g., in the Pokémon Go app, positive effects are shown, especially among inactive people [15].

4.2. Influence of Personality Traits on PA Goals

The statistical analysis revealed that the sports goals of the inactive participants are not dependent on personality traits. The four personality traits were equally distributed within this group of inactive participants. Therefore, goals for physical activity might not depend on these personality aspects. This leads to the assumption that individual interests and motives for behavioral changes as well as the pursuit of competence, autonomy and social integration are more important than personality traits [10,42]. Following a recent review to understand persuasion contexts in health gamification [32], an understanding of the contextual factors makes gamification successful. We hypothesized that these factors are mandatory for increasing PA as well. Moreover, other theoretical models might help to explain the motivation to be active or inactive, e.g., a behavioristic learning perspective, in which motivation is influenced by positive and negative reinforcements from the past [43]. Cognitive motivation theories also assume that motivation depends on situation-specific goals or expectations and internal processes [43]. In addition, the perspectives of interests, motives and individual preferences, which might include contextual aspects, have to be considered [11,43]. Therefore, one might conclude that, for the sports goals of these inactive participants, motivational as well as contextual aspects are more important than personality traits.

4.3. Factors Determining Interest in Features and Gamification to Increase PA

The results regarding app features and gamification elements again did not show an association to personality traits. These results are in line with findings by Rasche and colleagues, who examined different aspects on the motivation to play the Pokémon Go game, including personality traits [4]. Exergaming aspects like leveling up or doing activities with family and friends were more important than personality traits [4]. Moreover, new features and unknown technologies, as well as features linked to real life activities, can promote the motivation to use an app [4]. Furthermore, an appealing app design and the consideration of individual preferences as well as contextual factors are crucial [4,32]. In contrast to our results, previous studies found a correlation between the interest in app features or gamification elements and personality traits [64,65]. However, these studies were conducted according to the big five model and analyzed player types, not physically inactive participants [64,65]. To create a successful app, including features and gamification aspects to increase health-related behavior, Alahäivälä and Oinas-Kukkonen [32] described eight relevant aspects in the conclusion of their systematic literature review. These are:

(1) Identifying potential outside persuaders, (2) deciding and/or recognizing what change is targeted and which gamification strategy has to be used based on it, (3) understanding the area of application, and finding the right actions to apply gamification, (4) being mindful of the potential effects of user demographics, (5) deciding which technologies to use, based on contextual factors, (6) using appropriate persuasion routes, (7) using theories of health behavior change for guidance, (8) choosing gamification strategies based upon the aforementioned matters. In summary, we suggest including these aspects into the development of an app to increase PA.

Our results, after performing the one-factorial ANOVA on the elements and features that are especially relevant for physically inactive persons, highlighted that these contents need to be regarded with respect to the individual's goals for PA (fitness, nature, lifestyle or health). For example, "Pairing the app with a tracker or smartwatch", "knowledge about a healthy lifestyle," and "connection to a health insurance company's bonus program" were considered to be relevant for increasing an active lifestyle (cf. Figure 1). In contrast, to increase PA through nature activities, these features, except "knowledge about a healthy lifestyle", were irrelevant. Most apps for increasing PA include feedback, self-monitoring and goal setting as elements for behavioral change and show positive effects on PA and weight reduction [65–68]. These elements were also rated as relevant by the participants of this study. Moreover, according to Deci and Ryan's theory of self-determination, the use of features and gamification elements can satisfy needs by, for example, using the gamification element "feedback" to satisfy the need for competence, the creation of an "avatar" or the "choice of one's own paths in a story"

to satisfy the feeling of autonomy and "team tasks" to fulfill the need for social inclusion [43,51,69]. The most desired gamification elements highlighted in this study could be considered as "connection to a health insurance company's bonus program", "immaterial reward" and "monetary incentives". We assume that including these elements would also increase the extrinsic motivation to increase PA in our study population. "Instructional videos", "imparting knowledge", "level ascent" and "feedback" might enable orientation to help participants choose the right amount and content of PA. Moreover, these aspects could help to can satisfy the need for competence in the form of intrinsic motivation. Finally, app features like individualization will address the need for autonomy.

Interestingly, gamification elements that address social interaction like comparing one's own results with others or competitions were not considered to be relevant by our study participants. This might be explained by different aspects. First, one might assume that people who are inactive might have a lower health literacy and are more likely to neglect WHO recommendations than those who fulfil them [25]. In turn, they might be more unfit and afraid to compare their results to highly active participants. Moreover, they might have less health competencies (movement, control and self-regulation) according to the PAHCO model [25,55]. Thus, the motivational elements in an app (such as level up) and elements that enable competence development (feedback, instruction videos) are more relevant than competitions. Overall, the use of comparative or competitive features should be avoided for inactive persons. These features might confront the participants with negative emotions about their own performance or unfavorable behavior [70]. In addition, various studies provided evidence that a fear of threats and experience can occur in a competitive environment [71]. In the interaction between different complex negative experiences, users' emotions can be negatively affected. However, the emotions of the user are related to the experience and long-term use of an app [43]. As various studies have already shown that gamification can positively influence motivation and behavioral change [26,33,51], negative emotions according to inappropriate gamification elements or app features should be avoided [43]. In addition, behavior patterns also depend on external factors [6]. Knowledge or the development of competences can be influenced by external factors, e.g., by the community, school and parental home. The extent to which the environment can be involved in the promotion of PA via an app remains undetermined.

Single-factor ANOVA considers the variables independently, explaining the number of variables that were identified as relevant. The additional regression analysis provided an indication of the main internal subjective effects. It revealed the variables that are essential and must be integrated into an appropriate app design. These are monetary incentives, suggestions for activities, receiving feedback and reminders, e.g., to set targets. However, it seems to be obvious that these variables might influence each other. This aspect resulted in less significant values in comparison to the more conservative ANOVA analysis. Interestingly, only four game elements are relevant to achieve the goals for PA: monetary incentives, suggestions for activities, receiving feedback and reminders, e.g., to set targets. Gamifying elements to encourage more PA in the form of health sports seem uninteresting for the inactive respondents. This may be due to the fact that, in Germany, health sports in particular, e.g., in the form of bonuses for health behavior from statutory health insurance, are already available [72]. However, to fulfill the criteria of individualization [12,38], the ANOVA analysis revealed additional relevant aspects that have to be taken into account for successful app development.

Overall, this study indicates that inactive persons, regardless of their personality traits, can be addressed by the appealing design of an app that includes app features like suggestions for activities, information or instruction videos, diaries and gamification elements like immaterial rewards, monetary incentives, progress and level ups in order to achieve the goal of increasing PA. Nevertheless, these elements are dependent on the PA goals. However, it remains unclear whether gamification elements and features have a different relevance in inactive persons depending on gender and age. Other features, such as calendar functions, could also be included in further studies. These aspects were not controlled within this study design. Further studies could also aim to confirm the results found here in a targeted manner, using a comprehensive battery of questionnaires. The questionnaire

of this study used only contained parts of validated questionnaires (e.g., the Baecker questionnaire with a sufficiently high degree of reliability [58]) and was further developed with a team of experts and adapted to the needs and requirements of the health insurance company. The full use of the original questionnaires (e.g., the Coventry, Aberdeen, and London – Refined (CALO-RE) Taxonomy of Behaviour Change) would probably have resulted in a large number of respondents not feeling addressed by the questions. This would probably have led to a significantly smaller sample size. As an outlook for further investigations, the validation of game elements could be achieved in the form of an analytical factor reduction. Future studies should also address the extent to which gamification elements in other digital media and channels, e.g., streaming services or YouTube channels, are suitable to increase PA in inactive persons. A design of how an app for inactive persons could be designed is shown in Figure 4.
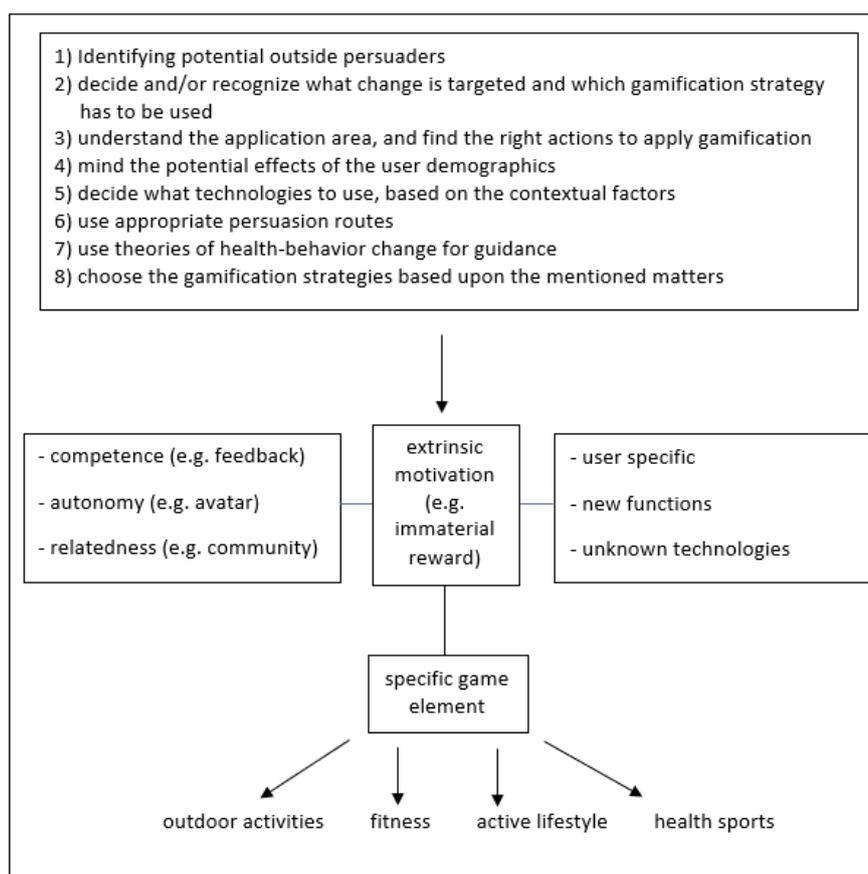
Figure 4. Design of an app to increase the physical activity (PA) of inactive persons.

In addition, further studies for sustainable app development and to support behavioral change processes should identify the competencies as well as the environmental aspects that may have an impact on inactivity and objectives.

5. Conclusions

This study determined the interest of inactive individuals in sporting goals to increase PA and whether personality traits determine interest in sporting goals, app features and gamification. The results show that interest is mainly in the area of fitness, followed by the goal of increased outdoor activities and a more active lifestyle. This study also shows that, in addition to the goals of increasing PA, interest in app features and gamification elements is not determined by personality traits. On the other hand, the perceived relevance of the elements and features are related to the goals for PA. For a demand-oriented approach, gamification elements and characteristics are highly relevant to achieving

goals in the areas of fitness, outdoor activities, lifestyle and health sports. These elements and features enable the provision of feedback and competence promotion (e.g., through instructional videos) and the prospect of rewards in the form of monetary incentives or immaterial rewards. At this point, the study shows that gamification and app functions that promote competence development can provide hints and guidance and, taking into account motivational aspects (both intrinsic and extrinsic), can arouse interest in PA in inactive individuals. There is a need for further research in this area to provide sustainable evidence of gamification aspects, with the goal of developing health competences according to age and gender requirements and to enable a transfer to other digital media.

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