

The Impact of Gamification on Self-Efficacy in Managers

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Abstract:

The main purpose of the article is to study the impact of gamification on the phenomenon of perceived self-efficacy in managers in their work on the set goals related to the management of their team. The paper was prepared using an intervention based on the Superbetter method. The Generalized Self-Efficacy Scale (GSES) was used to measure the level of self-efficacy before and after the intervention in the study group and twice in the control group (as a pretest and a posttest). The authors of the scale of generalized self-efficacy are as follows: Ralf Schwarzer, Michael Jerusalem, Zygfryd Juczyński. As a result of the study, it was confirmed that the use of the Superbetter intervention increased the self-efficacy among managers subjected to it as part of the intervention in the research group, and thus increased their chances of introducing changes undertaken by them as a goal.

Keywords: gamification; self-efficacy; Superbetter method.

JEL Classification: C70; D80; D83; D89; D91.

Introduction

The presented research refers to the introduction of changes by managers through increasing their self-efficacy as an important element influencing the achievement of their goal. The use of the above research material allows to analyze the importance of managers' self-efficacy for the implementation of the challenges they undertake. The content in the article may be useful for managers and organizations wishing to support their development. It implies thoughts to consider the application of gamification elements on self-efficacy in such scientific fields as economics and finance, management and business psychology, among others.

The impact of self-efficacy has continued to be discovered and implied into various scientific fields since its introduction to psychology. Recently, the subject has gained importance in the process of increasing managerial competence, although the concept of self-efficacy itself has been present in psychology for more than fifty years. The study of the impact of gamification on managers' sense of self-efficacy presented in this article proposes an interesting combination of processes for modern business psychology. This subject can definitely inspire further research and inquiry in the sphere of managerial competence development and contribute to other interesting scientific studies.

Self-efficacy is a very important element in the activities of human life, both private and professional. Knowledge of the types and mechanisms relating to self-efficacy should be updated in terms of new methods and adapted to the changing conditions of civilization (Gruszczynska, Bał-Sosnowska and Plinta, 2015) These include civilization changes related to the technological revolution in the virtual reality of computer games and the spread of the phenomenon of gamification applied to many areas and activities of people's lives.

According to a Price Waterhouse Coopers Report (2007), expenditure on computer games for the first time exceeded consumer expenditure on music. The concept of using computer games as a tool used to bring change to the real world was included in a list of the 20 most disruptive ideas published by the Harvard Business Review (Tkaczyk, 2012). Today, more than one billion people across the planet play digital games a minimum of one hour

a day. The energy and time engaged by people make one think about how significant it can be to learn well and use the positive aspects of digital game mechanics in changing behavior (McGonigal, 2017).

In modern science, there is an increasing amount of research related to the potential application of computer games in various areas of human activity. The potential of applying gamification in the processes of changing human behavior is also increasingly mentioned. It is already being used successfully in shaping human behavior in recruitment, training and motivation processes by companies such as Microsoft, IBM, Starbucks, LG and Honda (Tkaczyk, 2012). However, there is still much of its potential to be explored, including its potential impact on changing the state of self-efficacy.

The subject of this paper is the influence of computer game mechanisms, known as gamification (Tkaczyk, 2012), on managers' sense of self-efficacy, investigating whether the application of a psychological intervention based on the use of computer game mechanisms present in the Superbetter method would affect the self-efficacy of the managers studied.

In the theoretical part of the article - reviewed the literature related to the concepts of self-efficacy and gamification. Moreover, the Superbetter method used in psychological intervention, by Jane McGonigal, which was developed on the basis of mechanisms of computer games is described. It was applied in this paper to investigate whether gamification can affect the level of self-efficacy in managers.

The study of the impact of the above intervention, based on the Superbetter method, was conducted with the generalized self-efficacy scale questionnaire (Schwarzer, Jerusalem and Juczyński, 2022) used as a pretest and posttest in a randomly selected group of 60 people from among the mentees of the metamorphosis program conducted by the Lion Group company for managers. This group is described in detail in the research methodology section of the paper. There are also descriptions in the mentioned section such as: the research tool used in the study, the intervention applied and the research procedure.

The research results obtained are presented in the form of a presentation of the preliminary and main analysis. The article concludes with a descriptive discussion and reference of the described results of the study and an indication of further potential research opportunities in the application of the Superbetter method for increasing self-efficacy.

1. Literature Review

The concept of self-efficacy was first introduced into psychology by Bandura (1977). Subsequently, as a result of his research in this area, his book described a social-cognitive theory in which he pointed out that behavioral change is only possible when people have a sense of control over their actions. If people possess the belief that they have the power to make things happen, they are more willing to take on challenges (even very difficult ones) and sustain them longer over time. Self-efficacy beliefs can be based on four sources:

- the 1st one is built on a sense of self-efficacy, and the belief that a person can not only take on a challenge and meet it, but also sustain their action/activity over time;
- the 2nd source is vicarious experience - a person with similar dispositions triggers our belief that we are up to the task;
- the 3rd source is persuasion from an authority figure who, on the basis of this persuasion, convinces individuals that they can be capable of making a particular change;
- the 4th source is related to the occurrence of a state of emotional arousal and the existence of positive emotions in the person taking up the challenge. The person experiencing these states becomes convinced that he or she is up to the task (Łuszczynska, 2007)

The study of the impact of the conducted intervention in the studied group of managers, will be based on the principles of the social-cognitive theory model of a person's own beliefs. According to the social-cognitive theory, our behavioral changes are influenced by expectations regarding: the situation, as well as its effect and self-efficacy. The first two concepts refer to the consequences of an action. Self-efficacy, on the other hand, is related fully to action and its control, and forms a picture of a person's stock of competence and skills to carry out effectively planned actions (Bandura, 1997). Often combined or equated, however, self-efficacy and self-worth are different concepts. Self-efficacy is based on the fact that we trust our specific skills necessary to achieve specific goals or solve specific problems. It depends on the context in which it is considered. It can coexist simultaneously in one person's self-evaluation system, a very high state of self-efficacy for achieving professional goals and a very low state of self-efficacy for weight reduction (McGonigal, 2017). Self-efficacy is a belief that is subjective in nature, consisting of personal and situational elements (Zakrzewski, 1987).

The creator of the construct of self-efficacy, Bandura (1977), pointed out that there are three different aspects of this concept. There are as follows:

- magnitude, which refers to an assessment of the difficulty of the challenge;
- generality, which refers to the system of various activities and circumstances surrounding it;
- strength, which is a value that expresses our level of confidence in our abilities (Bandura, 1977).

Awareness of one's skills promotes success. However, it must not be based on the principles of unrealistic optimism, but entirely on the knowledge and experience derived from life experiences, which verify the state of the abilities possessed. Beliefs, related to self-efficacy, must be formed on the basis of real information about a person's capabilities in order to fully fulfill their self-regulatory function in a given area and a given situation (Zakrzewski, 1987). Perceived self-efficacy should be related to the specificity of the situation (Bandura, 1977). The specificity of this situation manifests itself in the content aspect, also formally expressing the different values of the degrees of motivation to meet the challenge (Schwarzer and Fuchs, 1996). The values of self-efficacy for a specific behavior in a specific situation can be measured (Bandura, 1977).

Popiřlan *et al.* (2018) debate some ways in which intelligent agents can be utilized in online betting management systems to monitor user behavior for signs of excessive gambling and implement responsible gambling features, such as setting betting limits or providing intervention messages when necessary. By incorporating intelligent agents, these systems can offer a more personalized, secure, and adaptive experience to users, leading to increased user satisfaction and better risk management.

Several research tools have been developed in the form of questionnaires and scales to measure self-efficacy for a specific, particular situation. There are also tools for measuring generalized self-efficacy, applicable to various areas of life. The most commonly used are two tools as follows:

- the Generalized Self-Efficacy Scale (GSES);
- the Personal Competence Scale.

The first one is the Generalized Self-Efficacy Scale (GSES), by Schwarzer and Jerusalem. It refers to Bandura's (1977, 1997) formulation of expectations and the concept of self-efficacy. It was created in 1992 in a German version. In 1993 it was translated into English, and by 1998 it had already been adopted in 21 countries, including Poland. It is a tool used in many research studies to this day (Schwarzer 1993). It has also been used in the present paper as a pretest and posttest, before and after the intervention for both the study and control groups. A full description of the Generalized Self-Efficacy Scale can be found in the following part of this article.

The second tool used to measure self-efficacy is the Personal Competence Scale, by Juczyński (2000), which is designed to measure self-efficacy in children and adolescents. The sense of self-efficacy determines our choice of whether we will turn our motivation into consistent and effective action, or, on the contrary, despite the great need and motivation, we will stop acting. If we have a high sense of self-efficacy, we are more likely to take action despite difficulties than if our sense of self-efficacy is low. This principle also applies to the duration of action. The higher one's sense of self-efficacy, the more likely one is to sustain actions over time, and thus maintain its positive changes. Willis (2019), Locke and Lotham (1990) also point out that not only the higher the sense of self-efficacy, the greater the commitment to the intended challenge, but also the sense of self-efficacy affects the quality of the cognitive processes from which knowledge is drawn to create action strategies.

The sense of self-efficacy influences the choice of behavior (accepting or rejecting the challenge depending on the assumed consequences). At the same time, awareness of one's competence determines the strength of commitment and persistence. Of the above-mentioned variables, only sense of efficacy is motivational in the full extent of this meaning. The other two variables are related to the option of action (volitional option), in which the modification of intention into particular activities takes place. The initiation of an action requires effort, while the maintenance of the action taken requires an outlay of persistence, these elements fit perfectly into the problem of behavioral change (Juczyński, 2000).

Definition of Gamification

The neurobiological nature of gamification has become the focus of researchers in the last three decades. The first and at the same time revolutionary breakthrough in this research became a study conducted in 1998 by a group of British scientists, which proved that video games cause a powerful increase in levels of dopamine, known as the pleasure neurotransmitter in the mesolimbic dopaminergic pathway, the so-called reward system in the brain (Koepp 1998). The mesolimbic pathway is responsible not only for pleasure, or addiction to it, but also for supporting memory, learning and motivation processes, which offers great potential for applying its mechanisms to educational processes in many areas (Willis, 2019).

Clearly, the mechanisms of computer games have gained their application in the real world, while also constituting an important element of gamification. Various concepts of gamification have also emerged. The most popular current definition of the term gamification in Polish psychology was given by Paweł Tkaczyk, a well-known researcher and author of numerous publications on this phenomenon. According to Tkaczyk (2012, 10): "gamification is a broad process of transferring mechanisms known from computer games to reality in order to change human behavior".

Similar to the above is the definition of the concept of gamification proposed by (Jacek Jankowski 2012), who pointed out that gamification is the use of game mechanics and rules to change behavior in other areas. Yet another takes on gamification is found by (Jacek Woźniak, 2019), who put it as a process of enriching something, e.g., a service, with an element with which we consciously make a stimulation of the gaming process and further behavioral consequences.

In all of the above concepts of gamification, the common element beyond the use of the gaming mechanism is the goal, i.e., behavioral change. The aforementioned rewarding of effectiveness, no punishment for failures, the possibility of repeating the task without consequences, striving for the goal, with the awareness of "Attentive life optimism"; this is how the creator of the Superbetter method Jane McGonigal (2007) writes about one of the basic competencies of a computer gamer.

Games teach that in them there are no impossible tasks, and that everything is a matter of time and the player's experience. This knowledge that success is within reach strengthens the player's sense of self-efficacy in taking on new challenges. The role of gamification is increasingly being recognized and implemented in many areas of life - for example, in team and customer relationship building, as well as in recruitment processes. Companies such as IBM, Microsoft, Starbucks and Honda officially confirm that they are using gamification mechanisms in the recruitment and training of their managers. IBM, together with a team of researchers at Stanford University, studied the impact of playing computer games on leadership skills. The results of this research were published in the article: *Virtual World, Real Leader* (2009). According to this report, 50% of the managers surveyed said that their playing of computer games improved their leadership skills. And 75% of those surveyed indicated that the methods and mechanisms of computer games can be successfully transferred to the real world.

2. Description of the Superbetter Method and Its Various Methods of Application

The author of the method, Jane McGonigal, was listed by MIT Technology Review as one of the 35 people who are changing the world through technology in the most innovative ways. Fast Company magazine, listed her as one of the 100 most creative people in the business world. She is also the first person in the world to earn a Ph.D. in psychology, studying how competencies gained in computer games in gamers are reflected in the way they solve problems and challenges outside the game world.

During ten years of teaching game psychology at the University of California, Berkeley, she observed, and then researched, the principle that computer games can assist people in taking on challenges, not only by enhancing creativity, but also by stimulating their sense of self-efficacy and flowing optimism when taking on new challenges (including those in the real world). In 2009, as a result of experiencing the severe effects of post-concussion syndrome, she decided to apply the game mechanisms she knew to combat the pain and discomfort whose presence was causing discomfort in various areas of her life. As she repeatedly mentions in her book *Superbetter*, she decided to "awaken the gamer in her" and use it to meet the challenge she faced in the real world. So, she created a simple game aimed at her recovery. She called it Jane-Hobgoblin (McGonigal 2017). At first, the game was simple and based on the principle of finding allies and fighting against disadvantages.

This game helped her a lot in her personal struggle - that was her original goal. It was only with the encouragement of friends and students that Jane McGonigal published the rules of the game on the Internet, and the game began to grow, gaining a host of allies who began to adapt it to different challenges. Information flowing in from people all over the world who were using the method to achieve their goals led the author of the method to undertake research on it, also focusing on the area of its effect on strengthening people experiencing difficulties and traumatic experiences. After two years of research into the method's operation, it was also confirmed that traumatic events well worked through with the method can have positive effects. It turned out during the course of the research that the application of the method can also be extended to people who want to take on a life challenge that is important to them, but without having had a difficult or traumatic experience. On the principle of the phenomenon of post-ecstatic growth, translated into Polish as "poekstatyczny".

This concept was introduced by clinical psychologist, Roepke (2013) of the University of Pennsylvania. On the ground of Polish psychology, its appearance was signaled by Juczyński (2019). The principle of operation is the same as in the case of post-traumatic development, but with the difference that you have to take on the challenge yourself. In the course of comparing studies of the processes in the development of people who used

the method, being in the framework of post-traumatic or ecstatic development, the author managed to distinguish seven ways of thinking and acting, which originated from the mechanism of computer games and were the basis of the method (still retaining its game-related character).

These are as follows: taking challenge, collecting and activating (points, bonuses, recharges, etc.), recognizing villains and fighting them, inventing and completing tasks, acquiring allies; adopting a secret identity, reaching for an epic victory. The name of the method also changed. Due to the fact that the common feature of these challenges regardless of their scale and the area involved was to feel better - the SuperBetter name emerged: Supperbetter translated into Polish: Super Lepiej, due to the state of baseline improvement always expected.

This was a common element in the very diverse challenges for which the method began to be used. The principle of basing the method on game mechanisms also remained common and unchanged. It turned out that their area of application is very wide, that it can even be boldly described as unlimited. The Superbetter method has won supporters all over the world. The community of people using this method, its author Jane McGonigal (2017), estimated at more than 400 thousand players. The examples of research conducted on the method include a randomized controlled trial at the University of Pennsylvania, a clinical trial at Ohio State University's Wexner Medical Center and at Cincinnati Children's Hospital (Cole 2009). It is used by, among others, the well-known journalist Oprah Winfrey and Colonel Bat Masterson, chief physician of the US armed forces.

At the same time, it should also not be forgotten that the method is gaining new users all the time, whom it supports in a huge variety of challenges within the ecstatic process, such as, for example, running a marathon, writing a book, starting your own business, or increasing your sense of effectiveness as a manager. The principles of the superbetter method are based on the same principles as in computer games - challenges are taken on the basis of the feeling that they are achievable. There is no limit on attempts and no penalties for mistakes, and each attempt brings new information about the game and your ability to cope. With each attempt, one is more successful, and thus one's sense of self-efficacy grows.

Dopamine release from the onset of play supports processes: cognitive, the search of allies, community building, of being rewarded for fighting against difficulties, obtaining an epic victory. So far, research reports suggest that the Superbetter Method, which is based on gaming mechanisms, can be a tool for enhancing self-efficacy. It can be especially attractive for people such as managers, whose work can provide them with many challenges.

2.1. Purpose of the Study and Research Question

The purpose of the study was to see if the application of an intervention based on the Superbetter method would have an impact on increasing self-efficacy. Based on this objective, the research question was formulated:

R_q Does an intervention based on the Superbetter method have an effect on increasing self-efficacy in managers?

Research hypothesis

It was hypothesized that participation in a mixed-method intervention based on the Superbetter method would have an effect on increasing the sense of self-efficacy in managers.

Characteristics of the study variables

The dependent variable in the study is the level of efficacy associated with changes in managers' behavior. This is a quantitative variable, measured according to the index from the GSES questionnaire. The independent variable in the study is the self-efficacy enhancement intervention in the process of behavior change in terms of the actions taken, based on the superbetter method. The variable was manipulated by selecting randomize individuals to the experimental group (participating in the training) or the control group (being on the waiting list). Because of the measurement scale used - the independent variable can be categorized as a nominal variable.

Characteristics of the people surveyed

The study included 60 people drawn from a group of 150 participants in the Metamorphoses program organized by Lion Group declaring that they work as managers in various business sectors. The study group consisted of 40 (66.7%) women and 20 (33.3%) men between the ages of 20 and 55 ($M = 36.92$; $SD = 9.73$). The majority of the subjects ($n=39=65\%$) were college educated, while the remaining 21 subjects (35%) reported having a high school education. Among the respondents, 49 (81.7%) said they do not play computer games, while in the remaining 11 cases (18.3%), when asked about playing computer games, participants answered in the affirmative.

Description of the tool

The study used the Generalized Self-Efficacy Scale (GSES) to measure the level of self-efficacy before and after the intervention in the study group and the control group twice (as a pretest and posttest). The authors of the Generalized Self-Efficacy Scale are: Ralf Schwarzer, Michael Jerusalem, Zygfryd Juczyński. The Polish version was translated in accordance with the principles developed for cross-cultural research (WHOQOL - Translation Methodology), based on the 1993 English version. The fact that all 10 questions are positively worded was an aid to the accuracy of the translation.

The GSES has a category A test, that is, one that can be used by people who have a degree in psychology or are graduates in other social science fields. The nature of the test is single-factor, comparing only one trait during the test (Eleri, 1987). It consists of 10 statements comprising a single factor. There are four possible answers to each question: no, rather no, rather yes, yes. Points are assigned to each answer. The answer "no" is the lowest scoring answer, which is assigned 1 point, the answer "rather no" - 2 points, the answer "yes" - 3 points. The biggest number of points is given for the answer "yes" - 4 points. The sum of all points gives information about the value of self-efficacy. This is a range from 10-40 points. The higher the number of points, the higher the value of self-efficacy. The GSES is designed only for the study of adults. There is no restriction on its use only for healthy people. Illness is not an exclusion criterion. It can be used for individual or group surveys. The total survey time is 3 minutes.

The questionnaire measures the strength of an individual's overall belief in the effective ability to cope with difficult situations and obstacles (Schwarzer 1993). The internal consistency of the GSES scale was estimated from a survey of 174 individuals aged 20-55 (Juczyński, 2012). The Cronbach's alpha coefficient was 0.85. The reliability of the scale, assessed by the test-posttest method (after five weeks), was 0.78. In standardization studies, the adjusted correlation coefficients of individual statements were found to be high, ranging from 0.47 to 0.63. Statistically significant correlations were found between the GSES scale and internal locus of health control (MHLC), optimistic attitude (measured by the LOT-R Life Orientation Test) and self-esteem (measured by the Rosenberg Self-Esteem Scale, RSES). Similar to the original version, the scale has a unified structure, confirmed by the results of factor analysis (Juczyński, 2012).

The tests used in the study were purchased from the Psychological Testing Laboratory of the Polish Psychological Association, which holds the copyright to the Polish version of the tool. A set of 120 paper-based tests was purchased, 60 for the study group and 60 for the control group.

2.2. Research Plan and Organization

The research matrix consisted of each participant completing twice a research questionnaire based on the Generalized Self-Efficacy Scale (GSES). In addition to the standard 10 questions of the above test, participants were asked to provide: gender, age, educational status and the answer to the question: do they play computer games? Tests were administered to both groups: test and control.

As for the selection of people for the program, it was made from among 150 clients of Lion Group according to the criterion of people's declaration of working as a manager. Such a declaration of working as a manager was made by 90 people. From these, 60 people were drawn and invited to participate in the study, 30 people for the study group and 30 people for the control group. This was done on a randomized selection basis, by drawing the contract numbers of specific clients.

All distributed questionnaire sheets, both in the study and control groups, were returned. All participants were informed that the survey would be repeated 30 days after the first survey.

In the case of the study group, it was subjected to a psychological intervention aimed at changing participants' health behavior by attending an online presentation of the Superbetter method and 4 individual meetings on formulating a goal and pursuing it using this method. Persuasive communication was used during the intervention to change the group's behavior in the area of strengthening their sense of self-efficacy. In the case of the control group - its participants were told that they were being asked, as part of their participation in the program, to complete tests related to self-efficacy twice. They were not promised to take part in training or individual classes in the Superbetter method.

2.3. Description of the Intervention Carried Out

The intervention was planned and carried out in accordance with current CONSORT principles and in accordance with ethical principles. The author of the study obtained permission from the head of the research team working on the Superbetter method to use this method for the purpose of studying its effect on self-efficacy. The participants did not receive any material benefit from their participation. The initiator and implementer of this intervention was the author of this paper, who is a certified business coach and an enthusiast of the Superbetter method. She also

uses it herself. The intervention was carried out in a group version as a joint online training conducted by the author of this paper for all 30 people in the study group, and in an individual version. In the case of the individual intervention, it had the convention of 4 individual online meetings (for everyone) scheduled within 30 days of each participant writing a pretest.

The activities undertaken as part of the intervention to influence the behavior of the group were as follows:

- a persuasive online presentation to all 30 people in the study group using materials about the Superbetter method;
- during the presentation, elements of analysis and questions about the materials showed at the presentation was used to arouse the involvement of the participants. The presentation lasted 45 minutes;
- sending personalized messages to the participants of the study group with the results of the pretest and an invitation to work together in individual mode;

Persuasive training sessions, conducted in one-on-one mode, during which a goal was formulated in their managerial work. These meetings also discussed the possibilities and stages of achieving participants' own goals in managerial work based on the Superbetter. Participants defined their individual goal for managerial work during the first of the four meetings. Each of the next three meetings referred to the established goal and determined its current status on the way to achieving it. The meetings identified allies (including internal allies in the form of predispositions and talents) and enemies (including internal enemies in the form of weaknesses and limitations) that they might encounter in pursuit of their goal. Communication and organization of meetings with the participants was done via messenger. The meeting schedule was set at the first meeting and was mostly, except for two people who have shift work, based on fixed dates on a weekly schedule.

In between meetings, participants performed one task they had set, which would take them to the next stage. During our online meetings, which lasted from 30-120 minutes, depending on the need, we discussed the reality of performing the task, which ally helped the most? Which enemy was the most difficult to defeat?

An important aspect was to visualize the achievement of the goal and the awareness that it was achievable. These goals were set individually with each manager:

- 10 people (33%) chose a goal related to improving communication with the team they manage;
- 8 people (27%) chose a goal related to improving the efficiency of organizing their work time during the day;
- 5 people (17%) chose to work on consistent behavior in terms of accounting for work on tasks delegated to the team;
- 4 people (13%) decided to work on building their image as a leader;
- 2 people (7%) set a goal of improving the team atmosphere;
- 1 (3%) person indicated as a goal the need to organize procedures.

The inspiration of the new method and the joy it generated during its application caused all participants to regret the information that it was the end of the study.

3. Analysis of Own Research Results

Analyses were carried out using the JASP program. Using this program, analysis of basic descriptive statistics was performed, as well as comparative analyses between measurements and groups. The level of statistical significance in this chapter was considered $p < 0.05$. Results significant at the level of $0.05 < p < 0.1$ were considered significant at the level of statistical trend. The Shapiro-Wilk (S-W) test was used to examine the level of normal distribution. Results that were twice or more deviated from the standard were considered outliers.

The following Table 1 provides descriptions of the results obtained by those completing the GSES questionnaire.

Table 1. Descriptive statistics for GSES scale scores in pre- and post-test

Descriptive statistics	Pre-test experimental	Post-test control	Pre-test experimental	Post-test control
Number	30	30	30	30
Mean	32.933	31.733	35.500	30.500
Median	35.000	33.000	39.500	30.500
Standard Deviation	8.068	6.968	6.801	6.867
MAD	5.000	3.500	0.500	4.500
Skewness	-0.997	-0.675	-1.479	-0.598

Descriptive statistics	Pre-test experimental	Post-test control	Pre-test experimental	Post-test control
Kurtosis	-0.269	-0.497	0.752	-0.277
Shapiro-Wilk test	0.803	0.892	0.690	0.923
P-value of the Shapiro-Wilk test	< .001	0.005	< .001	0.033
Minimum	16.000	17.000	20.000	15.000
Maximum	40.000	40.000	40.000	40.000

Note: MAD = median absolute deviation

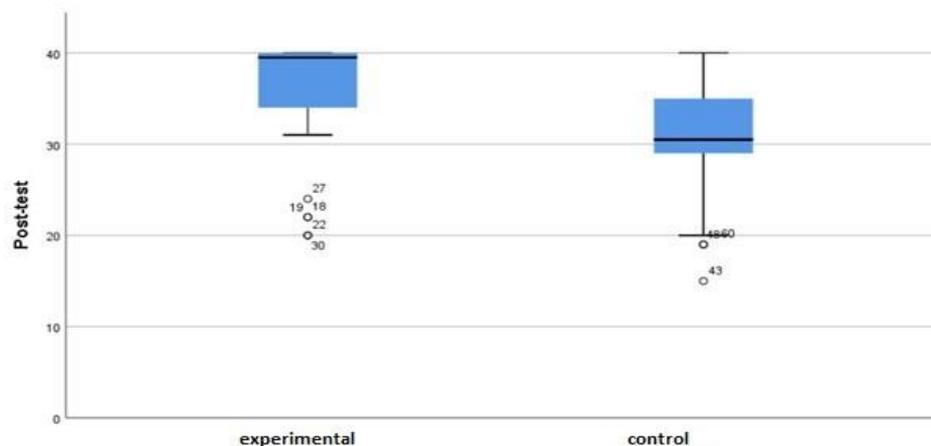
3.1. Preliminary Analyses

In the preliminary analysis, using the Mann-Whitney U test, it was shown that there were no statistically significant differences between the groups (experimental and control) in terms of the number of hours spent playing computer games per day ($W = 406.500$; $p = 0.51$).

The main purpose of the preliminary analysis is to select appropriate statistical methods by verifying the criteria for the use of tests based on the data obtained.

First, verification of the assumptions of analysis of variance (ANOVA) was undertaken to apply the analysis in a mixed model with within-group (measurement time) and between-group (control and experimental condition) factors. The results of the Shapiro-Wilk test, however, indicate statistically significant ($p < 0.05$) differences in data distributions relative to the normal distribution for all measurements (Table 1). In addition, in the post-intervention measure, there were cases deviated from the mean by more than two standard deviations - referred to as outliers (Figure 1). Due to the failure to meet the assumption of normality of the distribution and the outlier cases present, it was decided to use non-parametric tests as an alternative to methods based on normal distribution.

Figure 1. Box plot for post-test results with outlier observations marked



A comparison of baseline results between the groups (control and experimental) was planned to see if they were similar in terms of the level of sense of efficacy before the intervention. Subsequently, within-group comparisons were made between measurements to verify the main hypothesis. The standard procedure for studies with a repeated measure and a control group is to compare the differences formed from comparing the posttest with the pretest in the two groups, experimental and control (Brzeziński 1989). However, due to the negative correlation ($r = -0.299$; $p = 0.021$) between pretest and differential results, the comparison of differences was abandoned as a method to test the main hypothesis.

3.2. Main Analyses

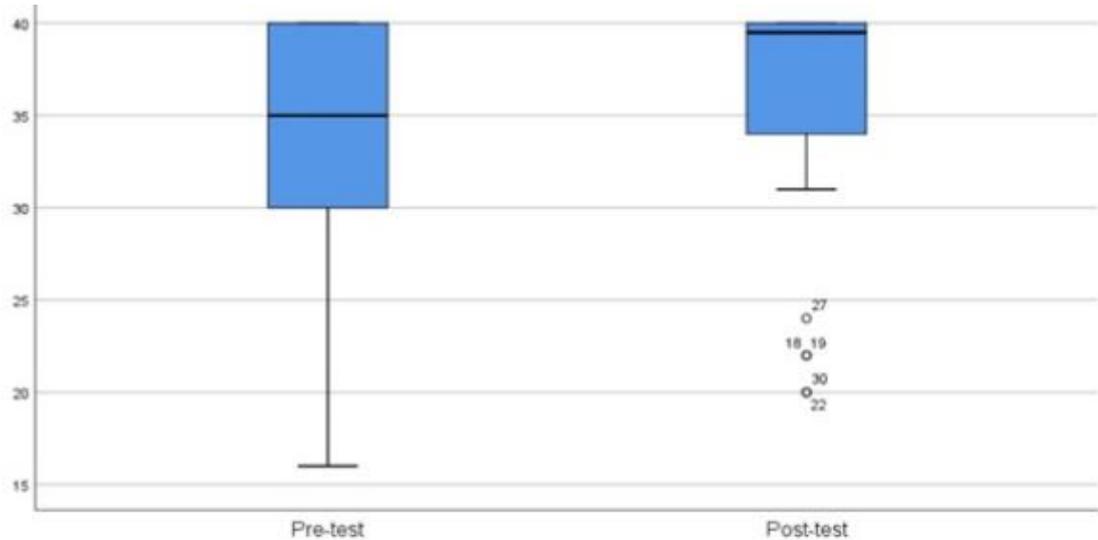
In order to compare the baseline levels of feelings of self-efficacy in the study groups, analyses were performed using the Mann-Whitney U test. The analysis showed that there were no statistically significant differences between the experimental group ($Md = 35$; $MAD = 5$) and the control group ($Md = 33$; $MAD = 3.5$) in the baseline measure of self-efficacy ($W = 522.000$; $p = 0.282$), which may indicate effective randomization in selecting participants into groups.

Next, the differences between the pretest and posttest within the study groups were analyzed to verify the main hypothesis that self-efficacy in the psych dietary process increased after the superbetter-based intervention. The Wilcoxon rank-sum sign test analysis showed that the results of the self-efficacy measure after the intervention ($Md = 39.5$; $MAD = 0.5$) were statistically significantly higher than the baseline results ($Md = 35$; $MAD = 5$) ($Z = -$

3.63; $p < 0.001$). It follows that the applied intervention increased the sense of efficacy in the experimental group, the differences occurring between pre- and posttest can be assessed as large ($r = 0.47$) (Rosenthal 1994).

On the contrary, in the control group, the baseline measure - pre-test (Md = 33; MAD = 3.5) was statistically significantly higher than the final measure - post-test (Md = 30.5; MAD = 4.5) in the Wilcoxon ranked signs test ($Z = -3.37$; $p < 0.001$). Differences between measurements were defined as large ($r = 0.44$).

Figure 2 Results of the GSES questionnaire for the experimental group



Conclusion

As a result of the study, it was confirmed that the application of the intervention on the basis of the Superbetter method resulted in an increase in self-efficacy among the managers subjected to it, and thus increased in them the chances of implementing changes undertaken by them.

The author of this article did not find any literature on the impact of gamification on the increase of self-efficacy, which would be in opposition to the conclusions presented in this study. Therefore, it can be assumed that this method can be effective in promoting change, and the entire research material (not only the results of the study) has a lot of potential for further research in the area of promoting self-efficacy.

Questions have arisen: To what extent would the intervention have an impact if one wanted to test the increase in self-efficacy over time? What impact does sense of efficacy have on the different categories of change undertaken by managers? How does sense of efficacy affect improvements in communication, efficiency or other categories assumed by managers?

An interesting issue is to investigate what could be the reason why in the control group the baseline measurement - pre-test was statistically significantly higher than the final measurement - post-test? Could this difference be due to dissatisfaction with the results achieved?

Finding answers to the above questions, may be helpful in further adaptation of the Superbetter method in the process of increasing self-efficacy among managers. Jane McGonigal, author of the Superbetter method, believes that games positively influence people's behavior. As she often mentions during her lectures and speeches, her dream is for a Nobel Prize to be won by a game developer. Perhaps this will happen precisely in the area of computer games' support of health change processes in humans. The Virtual Human Interaction Lab at Stanford University, being one of the most modern research laboratories in the world, is conducting a research project under the supervision of cognitive psychologist Professor Jeremy Bailenson, in which it has been proven through a variety of experiments, including those related to the sphere of gamification, that even a few minutes in a properly prepared virtual environment can affect willpower, empathy levels or self-efficacy (Bailenson, 2022).

All this makes it very realistic to conclude that the needs and challenges of the world in terms of the development of managers' competencies and, above all, by affecting their sense of self-efficacy in making changes in their management of teams, will find allies in gaming technology.

Conflict of Interest Statement

The author declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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