

# COMPARATIVE KNOWLEDGE AS A MOTIVATIONAL FACTOR AMONG MILLENNIALS

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**Abstract** - This paper describes a study that was conducted among undergraduate students in their third and last year required for BSc degree in Software Engineering. The study's main purpose was to explore and measure students' possible motivational increase due to elevated knowledge regarding their peers' performance. The study that is derived from Maslow's motivational theory used an ICT (Information and Communication Technology) tool that provided comparative information regarding students' achievements. The Software Engineering course consists of four assignments and after each assignment the tool calculated the class average as well as each student's achievements. The comparative information was available through the course site. Each student could enter his/her ID number and receive a two graphs figure. One graph represented the average class grades for the assignments already submitted and the second graph represented his/her assignments' grades. For reinforcing learning and preventing results sharing, all course assignments were uniquely individualized. This means that each student received a different assignment. This mechanism was made possible by using another self-developed ICT tool. Using this self-comparative assessment, each student could judge his/her relative performance as compared to the class average. As part of the study, 49 Software Engineering students were randomly divided into two groups. Students in one group (the comparative group) were able to access the ICT tool while the students in the second group (the standard or control group), did not. The study revealed that the grades of the four assignments in the test group gradually increased while on the control group the average grades remained very close. For the first assignment the average grade for the two groups was identical. In the second assignment there was one point of difference and the test group's average grade was higher. The difference between the groups increased further and in the fourth assignment the average grade of the test group was higher by 5 points compared to the control

group. Furthermore, while the course average grade of the control group was similar to the grades in previous years, the course average grade in the test group was higher by 3 points. Students' reflection supported these findings as some students expressed their views regarding the importance of their relative performance. The paper concludes with a discussion on the results and future follow-up directions.

**Key Words:** Individualized assignments, Elevating learning responsibility, Improving learners' motivation

## 1. INTRODUCTION

This paper describes an experimental study aimed at increasing the motivation of students learning towards their Software Engineering degree. 49 students in their third and last year participated in the study that was conducted as part of the Software Engineering course. The course's grading scheme is based on 4 home assignments and an exam. All assignments were uniquely individualized due to the lecturer previous good experience with this tactic. When using personal and unique assignments [27] each student receives a different assignment so sharing or "borrowing" the solution or parts of the solution is impossible. This tactic has a positive impact on the students' learning habits [26, 27] and it provides an accurate assessment to the students' understanding. This study however, moves one additional step forward by trying to increase the students' motivation even further. The idea used in this study is based on Maslow's motivational theory. As part of this study a special ICT (Information and Communication Technology) based tool was developed. The tool displayed personal and comparative information for each one of the students. The information shown was a brief analysis of the student's relative performance as compared to the class average. By using the tool, each student could assess his/her performance relative to the other students. The study revealed that the comparative method had a positive effect on the learning habits as was demonstrated by the students' grades. The paper starts by briefly addressing some of the motivational theories, defines the special traits of the current students' generation and describes the experiment that was performed as part of the study. The

last chapter is dedicated to a discussion related to the results obtained and thoughts about possible next stages.

## 2. LITERATURE REVIEW

The term motivation and how it can be increased has been addressed by many scholars since the early days of psychology. Motivation stems from the word motion and it is used to define motives for a specific behavior. As such the motivation theories were developed in order to explain human behavior and how it can be increased or tunneled to the required direction. Over the years there were many attempts to explain the motivational drives, attempts that stemmed and represented the researchers' different views. Maslow's Hierarchy of Needs [16] defined motivation as a set of five hierarchal internal needs. Hierarchy in this sense means that only after one lower need is fulfilled the person is ready to proceed to the next level. Nevertheless according to the Hierarchy of Needs theory every person is capable and possesses the need to move to the next level of the hierarchy up to the self-actualization which is the highest level. The Self Determination theory suggested by [6] is rooted in the belief that each human being possesses a need to develop and materialize his/her potential. This theory is based on three fundamental needs: (1) autonomy that suggests that the human being needs to feel that the behavior was not imposed on him or her; (2) competence represents a human need that he or she is capable to achieve goals even difficult ones; (3) relatedness is the need to love and be loved or being part of the community. The Self Efficacy theory that originated from a social cognitive theory by [1, 23] represents the belief that one has the ability to achieve the goal and complete the task at hand. A similar theory (Nicholls' Achievement Goal theory [18]) is based on the assumption that every individual has a need to demonstrate his/her ability to succeed and show his/her competence.

### 2.1 Generational Differences

Generational research first appeared in scientific papers over half a century ago and was originally attributed to [17] who analyzed the impact of generational experience on people. In the last six decades since then, the generational cohort has been developed further and is used to define a group of people who were born within the same time period. Such a group experiences similar events that shape its attitude and traits [11]. [24] analyzed similarities and differences between generations spanning over 550 years. According to their findings one cycle of history spans about 80 years and is divided into four generational cohorts. The last three generations in the twentieth century are:

The Baby Boomers, who were born between 1946 and 1964. The term was used to define the "boom" in birth rate in the post Second World War era. This generation was affected by events such as the Vietnam War, the human rights movements, rock and roll, the arrival of

television and the economic prosperity. This generation is considered idealistic, optimistic and highly competitive. Compared to previous generation, more Baby Boomers pursued higher education and were willing to relocate for a better career or education [14, 22].

Generation X who were born between 1964 and 1980, were affected by new media channels beyond TV including games, VCR, FAX machines and the personal computer. This generation saw the fall of the Berlin Wall and end of the Cold War. Generation X sometimes called the lost generation was the first "latchkey" generation in which the children were exposed to daycares and an increasing rate of divorce. People in this generation are considered skeptical and independent, relying on their individual abilities rather than institutional help. In the US this generation has the lowest voting participation rate which represents their skepticism about the system [22].

Generation Y (also referred to as Gen Y, Millennial, or The Digital Generation), were born between 1981 and 2000. People belonging to this generation were influenced by the rapid expansion of technology and media, and unprecedented immigration growth [22]. The Millennials are the most technological savvy generational group, feeling confident and natural in using a variety of technologies. Generation Y people use the Internet extensively for finding solutions to their problems and expect to be in touch constantly with friends and peers using SMS, instant messaging, chat, and social networks. If consistent with their referent research, they depend on their social network to answer problems. They even tend to prefer Internet networking over the telephone based voice communication [19].

### 2.2 Generational college students

The vast majority of current college students are Millennials [10, 20 and 25], characterized by the digital technology that surrounds them. As stated by [5] "as long as they [have] been alive, the world has been a connected place, and more than any preceding generation, they have seized on the potential of networked media". Millennials, who are innovative in using technology, seek instant gratification, and value education, but, at times, are (too) confident and unaware of their own lack or skills required for success [13]. Millennials represent a special challenge for the traditional learning system. Students of the 21st century have taught themselves how to network and find the relevant solutions via their networks. They are capable of responding rapidly to multiple stimuli initiated by the changing digital surrounding and expect the learning environment to provide the same challenging and interesting experiences. As [21] suggests, before they leave college, the average Generation Y student (in order of magnitude) has spent approximately:

"over 10,000 hours playing videogames, [has sent and received] over 200,000 emails and instant messages ... [has spent] over 10,000 hours talking on digital cell phones; over 20,000 hours watching TV (a high

percentage fast speed MTV) ... And, maybe, at the very most, 5,000 hours of book reading".

There is no surprise that these students are looking for 24/7 study environments to accommodate their learning preferences, instead of using the library [9]. For Millennials, life is an ongoing interactive experience with many activities occurring simultaneously. This multitasking behavior, characterized by fast switching from one activity to the other, dominates these students' attention span. Living in a fast-moving world (fast food, Internet banking, online shopping), Millennials have zero tolerance for delays [8] and expect the information, responses or resources to be available immediately, when and where needed [3]. Many Generation Y students balance their life studies and social life with full- or part-time work [15].

### 3. THE STUDY

The current study was initiated in order to try and cope better with the Millennials different traits that affect their learning habits. As observed by many researchers, Millennials are competitive and sometimes obsessed with their grades however it is not directly linked to their learning [12]. In most cases these are self-centered individuals who have a positive attitude but poor learning habits [2]. Their high ambition to succeed combined with their advanced technology understanding and the era of "share everything" leads them sometimes to cheat on their assignments [4, 12, and 26]. Taking into consideration all these factors, the study that was conducted as an experiment raised a simple research question. Will it be possible to use the "Share everything" phenomenon for enhancing class competition and thus increasing students' motivation?

The main idea behind the current study stems from the various motivational theories. The fourth level in Maslow's hierarchy is Self Esteem which represents the human need for appreciation and respect. Since in most cases the three lower levels in the hierarchy (Physiological needs, Safety and Belonging) have been fulfilled, Self-Esteem plays a dominant role in motivating students. So for increasing motivation as part of this experiment, the information that enabled each student to compare his/her performance to the class average was made available. The intention was that students with a lower than average grades will be motivated to spend more time so in the next assignment they will achieve a higher grade. This behavior is in line with the Self Determination theory that claims that each student possesses the need to develop further and achieve his/her potential [6]. Thus the comparison information provides an objective measure regarding the student's achievements and hopefully will serve as an additional motivational booster. The study is consistent with the Self Efficacy theory as well. By providing the comparison information, combined with the Self Efficacy theory that advocates the student's ability to complete the task [23], it is assumed that the student will be positively engaged in

the next assignment which in turn translates into higher motivation. Providing the students' comparative information creates a more competitive environment in which each student can demonstrate his/her ability to succeed by demonstrating his/her competence. This matches Nicholl's Achievement Goal theory [18] which list the goal achieving needs as a motivational factor.

The study was performed as part of the "Software Engineering" course. This is a third year mandatory course that provides understanding about software development methodologies and tools. Most students regard it as an important subject with significant direct bond to their future vocation. The course's structure is based on lectures, 4 tri-weekly assignments and a final exam. Being aware to the students traits (as observed by many researchers) all assignments were uniquely individualized. This means that each student received an assignment which is different from the assignments his/her peers received. This was done in order to minimize the possibility of sharing some or all of the assignments' answers. The personal and unique assignments tactic [27] has been used in previous studies and was found to be effective especially for the current students' generation. Although most of the current students are Millennials who value education and possess a strong need to succeed, they are also involved in many additional activities, such as work and social life [15]. These activities sometimes interfere with the learning process and then Millennials revert their common practice for obtaining help, and use their various communication channels (WhatsApp, Facebook, Text messaging, etc.). The personal and unique assignments tactic prevents all these, since the required help does not exist.

### 3.1 Methodology

For sharing the comparative information between the students a small ICT based tool was developed. The tool that included the assignments' grades was available through the course web site. Each student could enter his/her ID number and get a visual graph of his/her grades compared to the class average. As the course proceeded more data was accumulated providing each student with more relevant information on his/her relative performance. When the tool was used after the first assignment, only the first grade was displayed, however when using the tool after the fourth assignment the graph provided the information that relates to all four assignments (Chart 1 and Chart 2).

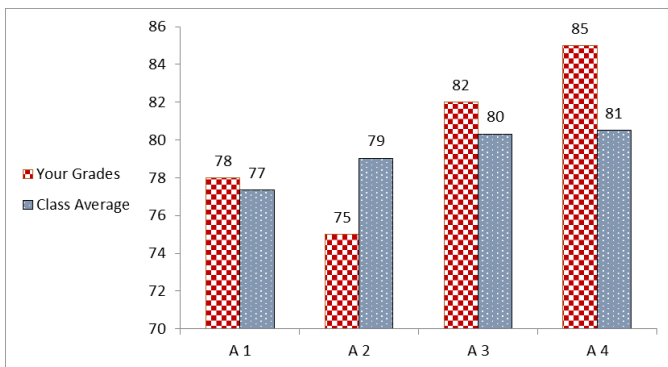


Chart -1: Assignments' grades comparative graph

Chart 1 depicts a real example (ID removed) of the grades obtained by a student on the four assignments compared to the class average. In this specific case on the first assignment the student's grade was one point above the class average, on the second assignment it was four points lower than the class average and on the last two assignments the student's grades were two and four points (respectively) above the average. Figure 2 is another example of the grades graph, and this time it is for another student. In this example the student's grades were always above the class average, with an exception of the grade for assignment 2 which is similar to the class average.

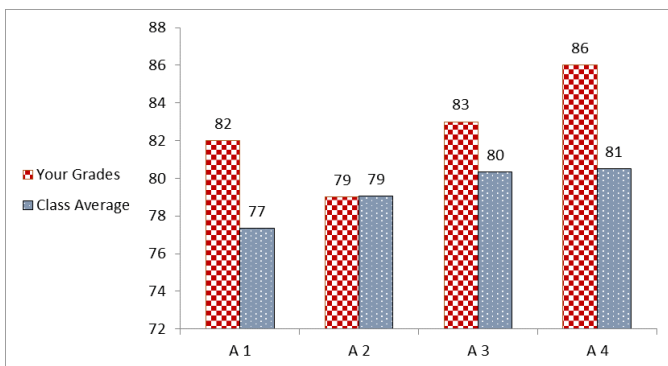


Chart -2: Another assignments' grades comparative graph

An additional feature of the tool was a zoom-in capability. Since the assignments were divided into several questions and in some cases each question was further divided into additional sub-questions, the tool provided the means to assess the performance on a sub-question basis. Contrary to the standard mode, in which the tool provided comparison on all available assignments, in the elaborated mode, the comparison was just for one assignment. Chart 3 depicts an example of assignment 2 which had four questions, each one divided into sub-questions. Question 1 had 3 sub questions (1.1, 1.2 and 1.3), question 2 had 5 sub-questions (2.1, 2.2, 2.3, 2.4 and 2.5) and so forth. The student could compare not just the overall assignment grade, but the grade of each of the sub-questions in the assignment. In this specific case, only on sub-questions 1.3, 3.2 and 4.2 the student's grades were above class

average, while on all other sub-question the grades were lower.

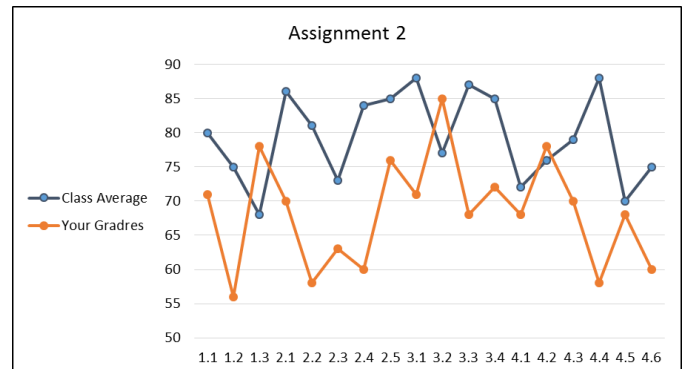


Chart -3: Detailed Assignments' grades comparative graph

The 49 student of the Software Engineering course were randomly divided into two groups. One group (the comparative group) was given access to the tool and was exposed to the class average grades, while the second group (the standard group) that acted as a control group did not get the tool. For preventing cases in which a control group student will use the tool provided to a peer in the comparative group, the control group's students' grades were omitted from the tool.

The methodology used for assessing the tool and its effectiveness regarding the research question was by measuring the trends of the class grades' averages as it changed over the course of the semester and especially check the differences between the two groups.

#### 4. RESULTS AND DISCUSSION

After collecting all the data about the assignment' grades it was discovered that the average grades in the control group fluctuations were three points, from an average of 77.4 for the first assignment to 80.5 for the fourth assignment. However the average grades in the comparative group increased by eight points, from an average of 77.5 for the first assignment to an average of 85.8 on the fourth (Chart 4).

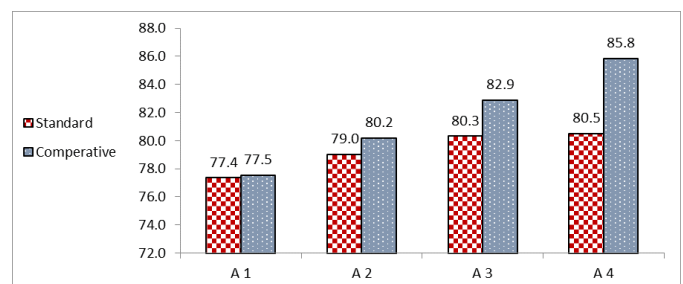


Chart -4: Assignments' grades

Chart 4 depicts the average grades of the four assignments in the Standard (control) group and in the comparative (under test) group. While the average grades of the first assignment in both groups were very close (77.4 in the

standard group compared to 77.5 in the comparative group), at the end of the semester this difference increased to five points. The results obtained are in line with previous findings regarding Millennials. As some researchers have observed, Millennials are competitive and the fact that the comparative group students had the opportunity to compare their performance to the class proved to be a motivational factor. This motivation is even strengthened by the use of the personal and individual assignments that assured that the grades obtained are the result of the students' own work with no parts that were borrowed from others [12]. These findings are in line with the various motivational theories and provide an additional layer of understanding regarding the motivational factors. Furthermore, regarding the research question, the results demonstrated that it is possible to tunnel some of the Millennials traits to increase their motivation. Another issue that was observed to be beneficial for enhancing motivation for Millennials is feedback [7]. The current study supports this finding. As part of the experiment the feedback was provided in two ways. Each assignment was checked and graded by the instructor that provided written feedback. In addition, due to the personal assignments tactic, each assignment was also assessed by another student. As part of the assessment, the students were required to reflect back on their assignment. The main issue to be addressed was if after assessing a peer's assignment the student would like to change his/her own assignment, based on the new knowledge obtained during the assessment. The dual assessment and feedback provided another need expressed by Millennials, the constant and immediate feedback [8].

This experiment supports other finding by many researchers that claim that special teaching methods are required for the Millennials [7]. The fact that they are multitasked and interested in a variety of subjects in parallel to their studies affects their performance. The unique assignments on one hand, that require full personal involvement and the comparative tool that fueled competition proved to be a successful tactic.

These results were clear even from the students' reflections about the course and its structure. Many students in the test group commented on the positive effects of the tool and the fact it provided them the most needed comparison on "How am I performing compared to my peers?" Some said that by using the tool, a more competitive but positive class environment as created. On the other hand, some students in the control group were complaining that the experiment was not fair for them. While their peers (in the test group) could enjoy the benefits of the tool it was not available for them. It should be noted, however, that there were some students who said that they were not interested in the tool and never used it. Following these reflections the course web site was analyzed in order to check the number of times the tool was used. It was found that 4 out of the 25 students in

the test group never used it. On the other hand there were students who used the tool more than 16 times. For privacy reasons the file cannot be saved on the local PC but even so, it is not clear why someone will want to use the tool so many times. May be some students know their peers ID number and wanted to check how they were doing on the assignment. Nevertheless, as can be understood, in every generation including among the Millennials, there exists some degree of diversity and not all students are alike. The fact that the majority of the students used the tool and found it beneficial is sufficient.

## 5. FUTURE STUDIES

This study is a part of a series of studies aimed at finding the proper and optimal tactics to teach the current generation of students. Although this experiment was successful and the suggested tactic proved beneficial, additional similar studies are needed to substantiate the results. One limitation that exists in the current study is the relatively small number of students who participated. A follow on study with additional students and using a different course is already being performed.

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