Yazılım Sektöründe Kişilik Tiplerinin Bir Uzman Sistem Kullanılarak Belirlenmesi: Pilot Çalışma[1]

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Determination Of Personality Types in Software Industry by Using an Expert System: A Pilot Study

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DOI:10.33461/uybisbbd.1214494

Makale Bilgileri

Makale Türü: Araştırma Makalesi

Geliş Tarihi: 05.12.2022

Kabul Tarihi: 26.12.2022

Öz

Bir yazılım geliştirme projesi üzerinde çalışan grup üyelerinin kişilikleri, ekip üyelerinin rollerine uygun olmasına bağlı olarak, çalışma sonucunun başarısını etkiler. Bu nedenle, ekip üyelerinin yazılım projelerindeki rollerini kişilik farklılıklarına göre belirlemek önemlidir. Bu çalışma, yazılım projelerinde yazılım mühendislerinin uygun rollerini belirlemek ve yazılım sektöründeki yetenek yönetimi için, yenilikçi ve yaratıcı bir uzman sistem önermektedir. Önerilen sisteminin en belirgin yönü, teste girenler için kişilik analizi hissini uyandırmayan sorulardan oluşmasıdır. Sorular, yazılımcıların projelerindeki görev ve doğal davranışlarıyla alakalı olacak şekilde tasarlanmıştır. Yazılım mühendisleri genellikle psikometrik testlere inanmazlar ve bunları manipüle etmeye çalışırlar. Ek olarak, bu testlerdeki soru sayısı oldukça fazla olduğundan sıkılabilmektedirler. Önerilen test, Jung Tabanlı Yazılım Yetenek Yönetimi (JBSTM) ve Keirsey Mizaç Sıralayıcı testinin sonuçları ile karşılaştırılmıştır. Bu iki test, 20 yazılım sektörü çalışanına rastgele bir sıra ile tek bir oturumda uygulanmıştır. Testlerden sonra da bir karşılaştırma anketi doldurtulmuştur. E / I, T / F ve J / P'de JBSTM ve Keirsey testi arasında orta derecede bir korelasyon ortaya çıkmıştır. JBTSM ve Keirsey test sonuçları test tamamlanma süreleri açısından da karşılaştırılmıştır. Karşılaştırma anketinin sonuçları kullanılarak JBTSM ve Keirsey testi kolaylık, uygunluk, rahatlık ve kullanışlılık açısından da karşılaştırılmış ve JBTSM'in dört açıdan da Keirsey testine kıyasla daha yüksek puanlar aldığı görülmüştür.

Anahtar Kelimeler: *MBTI, Keirsey testi, kişilik testleri, yazılım mühendisleri, yetenek yönetimi.*

Article Info

Paper Type: Research Paper

Received: 05.12.2022

Accepted: 26.12.2022

Abstract

The personalities of the group members working on a software development project affect the success of the work result, depending on the suitability of the team members for their roles. Therefore, it is important to determine the roles of team members in software projects according to their personality differences. This study proposes an innovative and creative expert system for determining the appropriate roles of software engineers in software projects and talent management in the software industry. The most obvious aspect of the proposed system is that it consists of questions that do not evoke the feeling of personality analysis for those who take the test. The questions are designed to be relevant to the tasks and natural behaviors of the software engineers in their projects. Software engineers often do not believe in psychometric tests and try to manipulate them. Furthermore, the number of questions in these tests is quite large, so they can get bored. The proposed test was compared with the results of the Jung-Based Software Talent Management (JBSTM) and the Keirsey Temperament Sorter test. These two tests were applied to 20 software industry employees in a single session in a random order. A comparison questionnaire was completed after the tests. A moderate correlation between JBSTM and the Keirsey test appeared in E / I, T / F and J / P. The JBTSM and Keirsey test results were also compared in terms of test completion times. Using the results of the comparison questionnaire, the JBTSM and Keirsey test were also compared in terms of easiness, suitability, comfort and usefulness, and it was found that the JBTSM received higher scores compared to the Keirsey test in all four respects.

Keywords: *MBTI, Keirsey test, personality tests, software engineers, talent management.*

Atıf/ to Cite (APA): Kuruoglu, E., Ozen, Ç., Kamasak M., (2022). Determination Of Personality Types in Software Industry by Using an Expert System: A Pilot Study. International Journal of Management Information Systems and Computer Science, 6(2), 149-161

[1] This work is related with an ongoing doctorate thesis that is titled as "Developing an Expert System for Talent Management in the Software Industry"

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1. INTRODUCTION

Various personality tests are adopted throughout the software development industry in order to hire the right person for the right position or enabling that person to pursue the correct career path after recruitment. Yet, software engineers typically have high technical and analytic intelligence, and they do not believe in these tests. Hence, they might manipulate the results in a way that they do not reflect the truth. They may even choose the necessary answers that will enable them to have valid results that will help them get the desired results. As there is no invalidity or contradictoriness in the results report, an unexperienced person might not see the manipulation and may interpret the results incorrectly. Besides, as the number of questions in almost all the psychometric tests are too many, software engineers find it boring to answer all of them.

Considering all these observations, we believe a novel test is required specifically for software engineers. This test should have questions that are related to the tasks in software projects.

With this approach, participating software engineers would respond naturally as they do not feel like they are taking a personality test and the most accurate, realistic and beneficial results can be obtained.

2. BACKGROUND

For the determination of personality types within software engineering field, there have been many studies conducted. Methods that are used widely can be listed as; Myers-Briggs Type Indicator (MBTI), Keirsey Temperament SorTer test (Keirsey test) (based on MBTI), Five Factor Model (FFM), NEO Personality Inventory – Revised (NEO PI-R) (based on FFM) etc. In the following subsection, these tests are compared. Next, Jung's 16 personality types which both MBTI and Keirsey tests are based are explained.

2.1 Comparison of MBTI, Keirsey Test, FFM and NEO PI-R

(White, 1984) and (Cruz et al., 2015) argues that MBTI is widely used within software engineering studies. In software projects, heterogeneous team members are more productive and efficient in unstructured tasks, while homogeneous team members working together in structured jobs provide the optimum (White, 1984). (Cruz et al., 2015) systematically reviewed 90 articles that empirically explored personalities in software engineering. These articles were selected from among 19,000 articles published between 1970 and 2010. 72% of these studies were published after 2002. Based on these 90 articles, we concluded that the most used test to investigate personality traits in software engineering is the MBTI.

According to (Kaluzniacky, 2004), in studies where MBTI is employed, it was shown that emotional intelligence is important. Besides, (Cruz, 2015) pointed out that there are specific situations that FFM is employed. (McCrae, 1992) and (Feldt et al., 2010) studied traits such as Openness (O), Consciousness (C), Expressiveness (E), Appropriateness (A) and Neuroticism (N) in FFM applications. Yet, specifically within the software engineering industry, research of traits such as Neuroticism (irritability, anxiety, bad temper or disappointment) have disturbed the participants. Due to this, many software companies refrain from using FFM-focused personality inventories. Besides, in Turkey, some of the human resources experts from several software engineering companies have reported that the participants have been unwilling to answer NEO PI-R since it has several questions regarding private issues.

(Kosti et al., 2014) provided the compared results between MBTI-based personality inventories and FFM. (Rutherfoord, 2001) applied Keirsey test on computer engineering students to provide good project teams that have been selected based on the results. According to these results, ESTJ type groups generate a lot of ideas and they are following a traditional path. Contrary to this, ISTJ type are very quiet and behave on their own. When groups consisted of a wide variety of types, they were successful in having the ability to listen and discuss and thus find what was "best" for the group.

Therefore, in software engineering, heterogeneous groups were good at solving problems and generating more innovative and productive ideas. On the other hand, in homogeneous groups where everyone is of the same type, strengths and weaknesses can be distorted because there is no counterbalance to meet them.

(Capretz and Ahmed , 2010a) and (Capretz and Ahmed , 2010b) have published the connections between the software engineering job descriptions and both MBTI and Keirsey test results. In this publication, the authors mentioned the difficulty of researching personality types associated with software engineering since these studies usually include theoretical research on psychological type connections between human-oriented disciplines and software engineering. In this work, the authors contributed towards linking software engineering concepts and the psychology of software developers. The authors investigated the mapping of human roles and MBTI personality types at different stages of the software engineering lifecycle. For this, they first determined the roles in software engineering under five groups as system analyst, software designer, programmer, tester and maintainer. The authors then defined the job descriptions for these five software engineering roles across 12 soft skills. Then a map that matches them with MBTI personality types was proposed. In this manner, a map that presents soft skills needed for the job descriptions of these five roles in software projects was formed. Therefore, a link between soft skills and the MBTI's personality types (E/I, S/N, T/F, and J/N) was created with this map. Next, which role in software engineering would match which personality type of MBTI was deduced. As a result of this effort, they concluded that the best systems analysts would be E-F, the best designers would be N-T, the best programmers would be I-S-T, the best testers would be S-J, and the best maintainers would be S-P.

(Capretz et al., 2015) applied MBTI to 100 Cuban software engineers. According to these results, ESTJ type was the most common MBTI personality type (25%). It was followed by ESTP (15%) and ISTJ (10%) types. The least common personality types were INFJ and INFP types with 1%. ISFP, ENTP and ESFJ types constituted 2% of the total study participants. In this study, participants were also asked which software development roles they preferred. As a result, system analyst, system designer and programmer were the most preferred roles, while tester and maintenance roles emerged as less preferred roles

MBTI and Keirsey are widely used in the software engineering industry for recruitment, careers and talent management. Because MBTI and Keirsey results give very accurate results in matching employees with the right roles and positions. It is also widely and reliably used to identify promising "high potential" employees for the organization and to create talent pools (Cruz et al., 2015), (White, 1984).

2.2 Jung's Personality Types

Myers-Briggs personality types (Myers, 2010) and the personality types that are used in Keirsey test (Keirsey and Bates, 1984) were created upon (Jung, 1921) personality types. According to (Yilmaz et al., 2017) MBTI and Keirsey test can be used both in education and in business life as a determiner of personality traits. JBTSM, the test which is explained in terms of its design, application and results within the framework of this article, was also founded upon Jung's personality types.

Jung's two main classifications for personality types are Introversion **(I)** and Extraversion **(E)** types (Fordham, 2011). By adding Thinking **(T)**, Feeling **(F)**, Sensing **(S)**, INtuition **(N),** Jung defines eight types of Introversion and Extraversion types.

1) Thinking **(T)** - Introversion **(I)**: This way of thinking focuses on subjective ideas.
2) Thinking **(T)** - Extraversion (**E**): This way of thinking focuses on the physical and outside world.

3) Feeling **(F)** - Introversion **(I)**: Feelings are kept inside and feelings are not usually exposed.
4) Feeling **(F)**- Extraversion (**E**): Feelings are affected by the outside world and are also exposed.
5) Sensing **(S)** - Introversion **(I)**: Reactions are based on the internal subjectivity.
6) Sensing **(S)** - Extraversion (**E**): Progresses on perceptible experiences and does not get stuck on anything for long.
7) INtuition **(N)** - Introversion **(I)**: Knowledge is based on intuitionism.
8) INtuition **(N)** - Extraversion (**E**): Connections are established with the outer world through intuitions.

Finally, with the addition of Judging **(J)** and Perceiving **(P)** to these eight types, a total of 16 different personalities have been generated (see Table 1).

Extraversion (E) - Introversion (I): Introversion types (I) gain their energy from within themselves and they are mostly self-motivating. Extraversion (E) types, on the other hand, gather their energy externally and thrive in a group environment. They are the ones to initiate a conversation in a public atmosphere.
Sensing (S) – Intuition (N): INtuition (N) types prefer abstract concepts and innovative thinking. They prefer solving new problems and refrain from tasks that do not provide added value. Sensing (S) types, on the other hand, prefer knowledge through experience and have an eye for details. They solve problems through experiencing.
Thinking (T) - Feeling (F): Thinking **(**T**)** types mostly behave objectively and rationally when making a decision and try to be impartial. Feeling (F) types, on the other hands, prefer social and subjective evaluations and decide in accordance with their feelings. They also create strong personal connections.
Judging (J) - Perceiving (P): Judging (J) types prefer being planned, organized and systematic. Perceiving (P) types, on the other hand, do not like planning and are flexible. They are not bothered by disorganized environments and might leave their jobs to the very last minute.

Table 1**.** Personality types of MBTI and Keirsey test

ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

(Baron,1988) mentioned that these 16 different personalities and characters are specialized in different fields of competence, have interests in different jobs and they are successful in relevant jobs to their personality type. Furthermore, (Keirsey and Bates, 1984) provide an emphasis on important details regarding the process of choosing a job in the business life.

(Bush and Schkade,1985), mention that there is an abundance of use of MBTI or Keirsey test within the industry of software engineering. In addition to this, they argued that ISTJ type of personality is the most prevalent one to this industry. (Turley and Bieman, 1995) also observed that I and T factors are the most common ones among software engineers. (Gorla and Lam, 2004) concluded that people with S and J factors are more inclined to programming work and project team duties. As stated by (Ahmed et al. , 2012), ESTJ types are more effective in software projects due to their extraversion characteristic, so that they can be defined as important and distinctive figure in these projects. Specifically in projects that are custom-made for a client, with their highly-developed social skills, ESTJ types are commonly sought after. (Martinez et al., 2010) stated that according to

MBTI, NT types tend to be more creative than ST types. NT types see the possibility beyond the reality, seek patterns and make connections between them. They have more capability on determining principles through data. NT types can provide a theoretical framework and, by going beyond the details, they make new principles visible. Research and development of software systems by using latest technologies is more interesting for ST types. On the other hand, (Martinez et al., 2010) also points out that many NF and SF types are happy to work with clients directly as engineers focusing on less technical parts and parts that need more human interaction. Furthermore, (Martinez et al., 2010) states that projects are more successful when different behavioral competencies as well as technical competencies of system analysts, designers, programmers, testers and maintainers involved in software lifecycle stages are taken into account. (Capretz and Ahmed, 2010) also discuss that the studies focusing on which personality type is more suitable for what kind of software development effort have a great importance. As there is a need for client interaction, people with high E factors are able to empathize with the client. Despite their high technical knowledge, if there is a lack of E factor, many software engineers might fail at being a system analyst. E and F types are able to connect and empathize with clients much better than I and T types. F types make the client feel better while T types might be unable to feel the needs of a client. Due to this, ENFJ, ENFP and ESFJ types are generally chosen for customer interface sides of a project.

People working on the design side have a perspective that is holistic and wide, which enables them to see all the components of a system. They are creative and innovative. They think abstractly, and by having a conceptual look and modeling, they bring abstract definitions to uncertainties. Hence, people with N factor are great designers. They conduct various tasks such as prototyping, developing processing functions and definition of inputs and outputs. As the first phase of the design phase requires team discussions and client interaction, designers might require similar abilities with the analysts. That is why (Capretz and Ahmed, 2010a) claim that people with these duties require a T factor in order to think and find the best logical solution. Programmers convert the designed version into a program. By processing a programming language in detail, they turn a designed version into a working one. That is the reason programmers have the ability to pay attention to details, logical and analytical competence. Due to this, (Capretz and Ahmed, 2010a) determined that programmers with a T factor are better than the others. Besides, they also concluded that F type people might have difficulties meeting the expectations in programming due to the fact that they are emotional, not logical. S type people pay attention to details and I types might stay long hours in front of a computer without feeling the need to socialize. Hence (Capretz and Ahmed, 2010a) concluded that ISTJ and ISTP types are better programmers.

Testers mainly find software problems. While unit tests are generally conducted by the programmers who run the code for the first time, functionality and feature tests, interface tests, integration and systems tests and validation tests which confirm that the software is working as a whole are run by testers. Test strategies and steps are planned and methodical. Hence, while J types are better at testing with their planned and orderly approach, S types are better in applications. (Capretz and Ahmed, 2010a) also concluded that in order to provide ease of access for the client in interface tests and for “user-friendly interfaces", E and F types are more suitable, while I types are more suitable for working with databases or complicated tests. Generally, for user interface and user functionality, ESFJ types are much more suitable, while ISFJ types are better in detailed system tests. In addition to this, as system analysts are mainly ESFJ types, it is only natural that they create the test scenarios. While ISTJ types are better with more complex tests that require more analytical thinking, they find the role of a “programmer” more suitable for their jobs and personalities. Just like the role of maintenance, the role of documentation also requires patience, attention and putting similar and iterative topics on paper time and again. F types are generally preferred here in order to understand the user needs. I types with their strong written communication skills, are more successful in documentation. As N factor improves the imagination, design and visual presentation skills, INFJ and INFP types are generally more successful in documenting jobs. Generally, software engineers do not think that this is an appropriate job for their skillset, for a person who graduated as a software engineer

who has an interest in editorship and writing, this role might be perfectly suitable. As they can manage the main components of the software project management lifecycle, scope, time and cost, with their extrovert qualities, ESTJ types show strong operational management qualities with their knowledge of teamwork and their ability to keep the team together with their strong communication skills, hence they are the best suitable type for the role of managing a software project. While projects including research, projects that include the latest developments and innovations mainly fall into the interest areas of N type, people who take the role of protecting and developing software systems are mainly S types with their practical, realistic and observant qualities. Generally, S types prefer having a job that has been proven to be successful before. Yet, on the contrary, an N type person generally prefers to conduct a business in a way that has never been tried and tested before since they enjoy working in a field that has never been tried and developed and requires a high level of innovative thinking and creativity. Hence, N types are generally bored with the optimizations and small corrections that are required in the software maintenance side, due to their preference of new projects. S types, however, prefer jobs that require the use of established knowledge instead of developing new ideas. Also, they are great observers and have a tendency to focus on the details. P types are mostly calm, they enjoy searching for the possibilities and take their time deciding, yet J types are mostly determined and impatient. Hence, for maintenance projects that require patience, sometimes monotony and recurring "patching", P types are more suitable. Because they are more open to changes in adaptations and they are more sympathetic towards the constant flow of changes asked by the client. Problem-solving ability and the applied approach of SP types are two good qualities of the maintenance projects, as these people enjoy solving practical and defined problems. So, ESTP types provide great maintenance software engineers. Furthermore, (Omar et al.,2015) mentions a similar study conducted in Malaysia and in that study, INTJ, ENTJ and ISTJ types were the most prevalent ones while no ENFP types were encountered.

3. METHODOLOGY

3.1 Participants

20 software developers (system analysts, programmers, testers, and team leaders) who have an advanced level of English and work in the software department of a technology firm were participated in the study. There were 16 male and four female participants with a mean age of 30.5 years. The participants' work experience in software industry was 8.5 years on average. Before conducting the study, they were informed that their responses will not affect their career lives, will not be shared with the officials in the company, and will only be used as statistical data in the article without specifying the company and the subject name. The participants are also informed about other details and they are free to leave anytime. Their consent is taken in a written form.

3.2 Materials

3.2.1 Proposed Test

Proposed test consists of 20 questions with two answer choices (see Appendix). These questions aregenerated by considering project management steps of software engineering processes, agile software development methodology, people's activities, tasks, roles, behaviors and attitudes within each step of a software project. Permission was taken from Istanbul Technical University Ethics Committee (ITU_INAREK) for the whole study and proposed questionnaire.

3.2.2 Keirsey Test

Keirsey test was discussed in detail in the previous section (see Background section).

3.2.3 Comparison Questionnaire

Comparison questionnaire was developed with four questions to compare proposed questionnaire and the Keirsey test in terms of easiness, suitability, comfort (in terms of privacy) and usefulness with ten-point scales (1 is "Not at all likely", 10 is "Extremely likely") (see Appendix).

3.3 Procedure

Firstly, the participants were informed about the study. Next, proposed and Keirset tests were conducted in random order finally comparison questionnaire was applied. Test completion time of each participant has been measured for the first two questionnaires.

3.4 Data Preparation and Analysis - Jung Based Software Talent Management (JBSTM) Expert System

Jung Based Software Talent Management (JBSTM) is an expert system for effective talent management in software industry. The system identifies each participant's personality type by using proposed questionnaire based on Jung's 16 personality types. The 20 questions were developed by creating five questions for each of the following four group pairs; E/I, S/N, T/F and J/P. The ultimate goal of this system is to determine people's most suitable roles in a software project by taking their psychological type into consideration.

As shown in the following figure (see Figure 1), JBSTM has three inputs; proposed questionnaire, Keirsey test and the comparison questionnaire. The expert system has four processes; conducting tests and questionnaire that are inputs of the system, checking validity and reliability, determining people's psychological types, and matching determined psychological type with a role in a software project. The system produces three outputs; JBSTM expert system report and results of the Keirsey test and the comparison questionnaire.

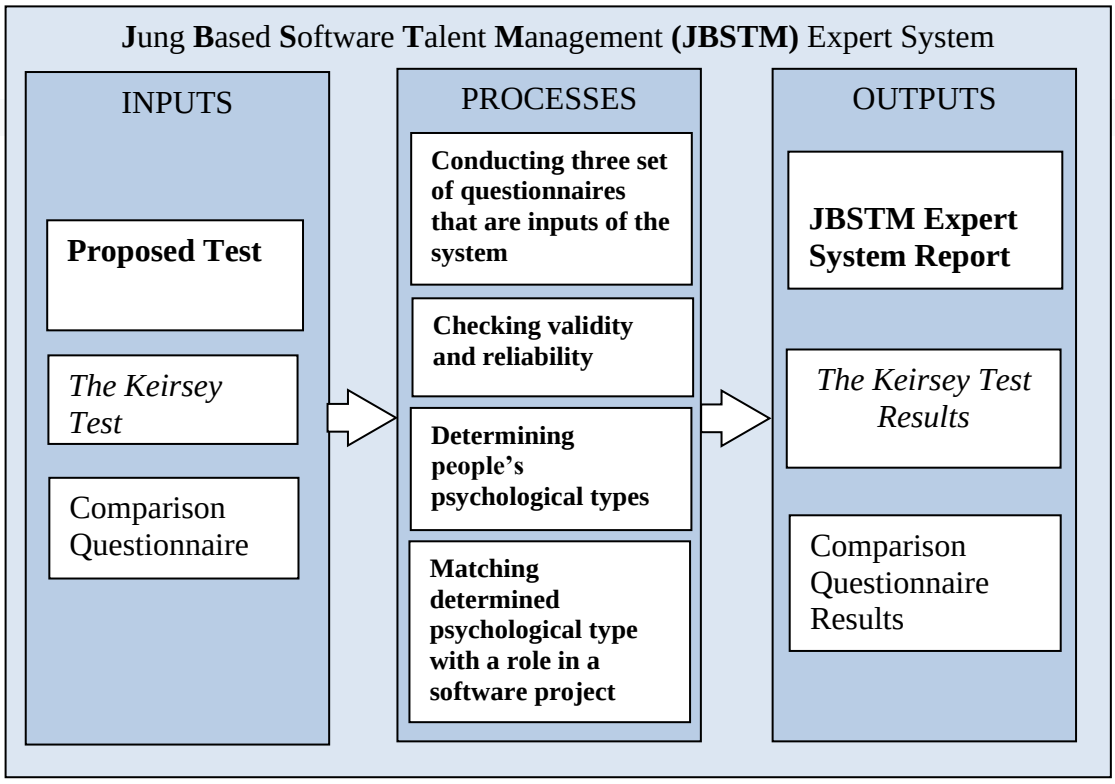

Figure 1. Jung Based Software Talent Management (JBSTM) Expert System for Talent Management in Software Industry

To investigate the validity and reliability of the system, the system uses compliance validity (Alpar, 2018:502) that is comparing the results of the referenced test with the results of the proposed test. Therefore, the system checks the outputs of the Keirsey test and the JBSTM by taking (Alpar, 2018) Pearson Correlation Coefficient (R) values into consideration (see Table 2).

Table 2**.** R values and definitions (Alpar, 2018)

R values	Definition
0.00-0.19	No correlation
0.20-0.39	Low degree
0.40-0.69	Moderate degree
0.70-0.89	High degree
0.90-1.00	Perfect

4. RESULTS AND DISCUSSION

The Keirsey test and JBSTM in E/I, T/F and J/P revealed a moderate degree correlation based on (Alpar, 2018) R value classification (R = 0.42 for E/I dimension, R = 0.51 for T/F dimension, R = 0.47 for J/P dimension). Only for the S/N dimension's R is low (R = 0.1).

JBTSM and Keirsey test results were compared in terms of test completion times. On average, 20 participants responded JBSTM in seven minutes while they replied Keirsey test in 16 minutes. This result indicates that the time participants spent answering the Keirsey test was almost twice the time they spent answering the JBTSM.

JBTSM and Keirsey test results were also compared in terms of easiness, suitability, comfort and usefulness (see Table 3). JBTSM acquired higher scores compared to Keirsey test in all four aspects.

Table 3**.** Comparison Questionnaire Results

	JBSTM Score	Keirsey Score
Easiness	157	132
Suitability	171	154
Comfort	183	167
Usefulness	165	129

The results showed that the participants found JBTSM easier and more convenient. Furthermore, participants stated that they feel more comfortable while they were answering JBTSM. Besides, they think that JBTSM is much more useful for the software industry than the Keirsey test.

This work is based on the observations and experiences which were derived from the software engineering industry. Questions in the test are based on the project processes, business manners and behaviors in software engineering and these questions were directed to the participants in the pilot scheme.

Based on Jung, which is widely used for the validity of the test, when looking at its correlation with Keirsey test, validity correlation was obtained in E/I, T/F and J/P types. Intentionally, or unintentionally, the crisis period at the time of the test and the participants' concerns about their careers caused N weighted markings in the test. It was also concluded from the feedbacks given by the participants that they had anxiety that would affect their career life and that they marked the way they wanted to be seen, not as they were. The post-application feedbacks of the participants also support this view. Therefore, it would be better to improve the questions in a way that the subjects will not be able to feel if they are S or N.

It is also found that the time participants spent answering the Keirsey test was almost twice the time they spent answering the JBTSM. This result can be considered as a validation for our claim. Since psychometric tests contain plenty of questions and they require very long time to provide responses, software engineers do not prefer these tests.

The study results showed that the participants found JBTSM easier and more convenient. Furthermore, participants stated that they feel more comfortable while they were answering JBTSM. Besides, they think that JBTSM is much more useful for the software industry than the Keirsey test. These are promising and significant results that reinforce the purpose of the development of JBTSM.

On the other hand, in practice, some difficulties have occurred within the companies which the pilot scheme is already performed or intended to be performed. The companies are not enthusiastic to take part in this practice on the ground of the law on the protection of personal data, as they have encountered such cases that the subjects brought a suit against the companies following their participation. In one of the companies that the survey was conducted, since another survey which was going to be applied to the employees was rejected by the company because of the law, our practice has also drawn negative reaction from some employees. The study was requested to be done remotely from a company by using electronic devices. However, such a method is not compatible with our pilot scheme rules. In another company, when a voluntary invite for the participation was sent to the employees, they were not eager to attend the practice, since they had some worries about accessibility of the results, specifically by the HR department, and the management. It can be inferred that the resistance against the voluntary study derives from the employees' career concerns and trust issues with their companies.

5. CONCLUSION

Most of the software engineers feel disturbed by the psychologically-based personality tests. Also as previously mentioned, these disadvantages are not present in an innovative and creative approach, yet, on the contrary, by considering whether it is possible to maintain a positive approach and trust by the software engineers, a method has been developed that is naturally adaptive to the environment of the software engineering projects and questions were prepared in this manner.

Most of the software engineers who are working in the software industry have very strong analytical thinking skills. Therefore, it is observed that they can manipulate the personality tests to provide the most common and desired results. Because, they believe that the psychometric tests are not aimed at what they do in their own business world. Moreover, they claim that the tests are providing false results and these tests may affect their careers in a negative way. Also, as there are plenty of questions in psychometric tests, they find them rather boring.

In conclusion, JBTSM, which has been developed due to the manipulations of introverted and analytical software engineers who can get bored easily because of the question numbers in the psychometric tests, has provided considerably good results in terms of validity and reliability. Also, as expected, it has produced notably positive outcomes in terms of being easy, beneficial, and comfortable. Within this respect, it can be inferred that JBTSM is worth studying with a high motivation.

REFERENCES

Ahmed, F., Capretz, L. F., & Campbell, P. (2012). Evaluating the demand for soft skills in software development. It Professional, 14(1), 44-49.

Alpar, C. (2018). Spor Sağlık Ve Eğitim Bilimlerinden Örneklerle Uygulamalı İstatistik Ve Geçerlik Güvenirlik. 5.baskı, Detay Yayımcılık.

Baron, R. (1998). What type am I?: Discover who you really are. Penguin

Bush, C. M., & Schkade, L. L. (1985). In search of the perfect programmer. Datamation, 31(6), 128-132.

Capretz, L. F. (2012, February). Software development and personality traits. In Tenth International Conference on Computer Applications (pp. 1-8).

Capretz, L. F., & Ahmed, F. (2010). Making sense of software development and personality types. IT professional, 12(1), 6-13.

Capretz, L. F., Ahmed, F. (2010a). Making sense of software development and personality types. IT professional, 12(1), 6-13.

Capretz, L. F., Ahmed, F. (2010b). Why do we need personality diversity in software engineering?. ACM SIGSOFT Software Engineering Notes,35(2), 1-11.

Capretz, L. F., Varona, D., & Raza, A. (2015). Influence of personality types in software tasks choices. Computers in Human behavior, 52, 373-378.

Cruz, S., da Silva, F. Q., & Capretz, L. F. (2015). Forty years of research on personality in software engineering: A mapping study. Computers in Human Behavior, 46, 94-113.

Feldt, R., Angelis, L., Torkar, R., & Samuelsson, M. (2010). Links between the personalities, views and attitudes of software engineers. Information and Software Technology, 52(6), 611-624.

Fordham, F., & Yalçıner, A. (2001). Jung psikolojisinin ana hatları.Say.

Gorla, N., & Lam, Y. W. (2004). Who should work with whom? Building effective software project teams. Communications of the ACM, 47(6), 79-82.

Jung, C. G. (1921). 1971. Psychological types. Collected Works of CG Jung, 6.

Kaluzniacky, E. (2004). Managing psychological factors in information systems work: An orientation to emotional intelligence. IGI Global.

Keirsey, D., & Bates, M. M. (1984). Please understand me: Character & temperament types (p. 210). Del Mar, CA: Prometheus Nemesis Book Company.

Kosti, M. V., Feldt, R., & Angelis, L. (2014). Personality, emotional intelligence and work preferences in software engineering: An empirical study. Information and Software Technology, 56(8), 973-990.

Martínez, L. G., Licea, G., Rodríguez-Díaz, A., & Castro, J. R. (2010, June). Experiences in software engineering courses using psychometrics with RAMSET. In Proceedings of the fifteenth annual conference on Innovation and technology in computer science education (pp. 244-248).

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. Journal of personality, 60(2), 175-215.

Myers, I. B., & Myers, P. B. (2010). Gifts differing: Understanding personality type. Nicholas Brealey.

Omar, M., Katuk, N., Syed Abdullah, S. L., Hashim, N. L., & Romli, R. (2015). Assessing personality types preferences amongst software developers: a case of Malaysia. ARPN Journal of Engineering and Applied Sciences, 10(3), 1499-1504.

Rutherfoord, R. H. (2001). Using personality inventories to help form teams for software engineering class projects. ACM Sigcse Bulletin, 33(3), 73-76.

Turley, R. T., & Bieman, J. M. (1995). Competencies of exceptional and nonexceptional software engineers. Journal of Systems and Software, 28(1), 19-38.

White, K. B. (1984). A preliminary investigation of information systems team structures. Information & Management, 7(6), 331-335.

Yilmaz, M., O'Connor, R. V., Colomo-Palacios, R., & Clarke, P. (2017). An examination of personality traits and how they impact on software development teams. Information and Software Technology, 86, 101-122.

APPENDIX

Proposed Test

1. Some software projects are time-independent research projects. These are not always expected to be finalized. Some projects are development projects where it is important to reach the target and finalize it on time. Which one would you like to work in?
   ◯ Research projects ◯ Development projects

2. When designing a product's database, it requires speculative thinking and considering many possibilities in the future, such as expanding the feature set and changing technology. Coding is the transformation of designed requirements into concrete functionality through coding. Based on these definitions, in which role would you like to work?
   ◯ Database design ◯ Coding

3. The Product Owner, who manages the needs of the customers by meeting with the customers frequently, and the Product Manager on the technical side of the project have equal authority and rights with the projects using Agile methodology. What role would you like to work in?
   ◯ Product owner ◯ Product manager

4. Which of the following describes your physical working environment in your workplace?
   ◯ I don't mind the disorder of my desk. I may appear disorderly to others, but in my mind, it has its own order.
   ◯ If my desk is messy and untidy, I can't focus. After getting it in order, I get to work.

5. Some software development projects are customer-specific and require frequent contact with the customer. Some are machine-based (M2M, robotics, etc.), customer-independent software development projects. Which project would you prefer to work on?
   ◯ Machine-based and customer-independent ◯ Customer-based

6. There are two open positions in the software project. In the job description of the first position, the design in which the components are constructed and associated is required, and in the job description of the second position, the coding of the designed structure is required. Which position do you prefer?
   ◯ Design ◯ Coding

7. You need to make a decision to end or continue a project in progress in the unit you manage. How do you take this decision?
   ◯ I decide by considering how the people involved in the project will be affected by the situation.
   ◯ I make decisions based on data, thinking realistically and logically.

8. Which of the following would suit you best when communicating with software project teams?
   ◯ I prefer e-mail or convey written information.
   ◯ I choose to convey information by speaking face to face.

9. Which of the following would you like to deal with during the design phase of a software development project?

◯ Database design that can meet the features and functions that can be added to the product in the future, and that requires fictional and relational thinking.

◯ Functional design in the process of converting current needs of customers or users into software.

10. In addition to the tasks, they perform themselves in software development projects, mentoring teams are formed for the future. Which team would you like to be on?
◯ Technical and professional orientation ◯ Project teams coordination

11. In which of the following tasks would you be more productive in a software project?
◯ Working on a single project with clear inputs and goals

◯ Working on a project where the goal can change according to new inputs

12. Assuming you have the same powers, fees, and rights, would you prefer to advance your career in technical positions (API design, setting coding standards, etc.) or administrative positions (sales, marketing, management, etc.)?
◯ I prefer to advance in technical positions

◯ I prefer to advance in administrative positions

13. It is important to analyze user behavior especially in mobile and web applications. Thus, it is ensured that effective and easy designs are made that users will like and prefer. What is your level of interest in these subjects?
◯ I am very interested, I would like to understand how users feel.

◯ I am not very much interested, I prefer to focus more on technical issues.

14. In customer-specific software development projects, firstly, by connecting with people in different positions on the customer side, their needs are analyzed. After the analysis, the focus is on coding independently of the customer. In which of these processes would you prefer to be involved?
◯ Requirements analysis ◯ Coding

15. The following two different software pools are created in a software company. Which one would you like to take part in?
◯ Pool of software developers focusing on design and modeling

◯ Pool of software developers focused on optimization and quality

16. There are two different types of projects in a software company:
A) Long-running, extensive but routine software projects, subject to specifications, where requirements and schedule do not change.
B) Dynamic projects where client's requirements and schedule can change.
Which project would you like to take part in?

◯ Projects subject to specification, with wide-ranging requirements and schedule unchanged

◯ Dynamic projects where client requirements and schedule can change

17. Which of the following best describes you?
◯ I have many different Software Development Project ideas and suggestions.

◯ I am more concerned with the implementation of software projects rather than generating ideas.

18. API (Application Programming Interface) developers often work alone or with a small team. Analyzing customer requirements requires working with different people on the customer side. Which one is suitable for you?
◯ Customer requirements analysis ◯ API development

19. Which of the following situations describes you in software development projects?
◯ I am happy when I deal with multiple projects at the same time or when I switch to new projects.
◯ I am happy when I work on a single project and complete my work.

20. Which of the following two tasks in the software project is suitable for you?
◯ By meeting with the customer, feeling the urgency of the features s/he needs and ensuring that the scope of the sprint is determined accordingly.
◯ To take part in the development of the scope and software decided at the sprint meeting.

COMPARISON QUESTIONNAIRE

Your comments about the inventory:
(A) with 20 questions
(B) with 70 questions
Can you rate the following expressions by giving values from 1 to 10?

Ease of making decisions when ticking choices (10: Very easy, 1: Not easy)
◯ A (…….) ◯B (…….)

Suitability of questions (10: Very suitable, 1: Not suitable)
◯ A (…….) ◯B (…….)

The extent to which the questions made you feel **comfortable** in terms of privacy (10: I felt very comfortable, 1: I did not feel comfortable)
◯ A (…….) ◯B (…….)

The degree of **usefulness** of the questions to the software industry career life: (10: Very useful: 1 Not useful)
◯ A (…….) ◯B (…….)