Information and Software Technology 56 (2014) 973–990

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Personality, emotional intelligence and work preferences in software engineering: An empirical study

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ARTICLE INFO

Article history:
Received 1 September 2013
Received in revised form 7 March 2014
Accepted 13 March 2014
Available online 21 March 2014

Keywords:
Software engineering
Personality
Empirical study
Five Factor Model
Self-compassion
TEIQue

ABSTRACT

Context: There is an increasing awareness among Software Engineering (SE) researchers and practitioners that more focus is needed on understanding the engineers developing software. Previous studies show significant associations between the personalities of software engineers and their work preferences.
Objective: Various studies on personality in SE have found large, small or no effects and there is no consensus on the importance of psychometric measurements in SE. There is also a lack of studies employing other psychometric instruments or using larger datasets. We aim to evaluate our results in a larger sample, with software engineers in an earlier state of their career, using advanced statistics.
Method: An operational replication study where extensive psychometric data from 279 master level students have been collected in a SE program at a Swedish University. Personality data based on the Five-Factor Model, Trait Emotional Intelligence Questionnaire and Self-compassion have been collected. Statistical analysis investigated associations between psychometrics and work preferences and the results were compared to our previous findings from 47 SE professionals.
Results: Analysis confirms existence of two main clusters of software engineers; one with more "intense" personalities than the other. This corroborates our earlier results on SE professionals. The student data also show similar associations between personalities and work preferences. However, for other associations there are differences due to the different population of subjects. We also found connections between the emotional intelligence and work preferences, while no associations were found for self-compassion.
Conclusion: The associations can help managers to predict and adapt projects and tasks to available staff. The results also show that the Emotional Intelligence instrument can be predictive. The research methods and analytical tools we employ can detect subtle associations and reflect differences between different groups and populations and thus can be important tools for future research as well as industrial practice.

1. Introduction

There have been several calls to value and study human factors in SE [1–3] and in recent years there has also been an increase in empirical studies [4–7]. Even though technical and methodological innovation and improvement is essential to progress the developers themselves are often the same and their motivations, needs, characteristics and even idiosyncrasies must be understood to improve the socio-technical system as a whole. As a related example, Glass [2] stated that "*The most important factor in software work is not the tools and the techniques used by the programmers, but rather the quality of the programmers themselves*". Studies performed during the last decades have made personality one subject of this call for a larger focus on the individuals and their characteristics even though it was recognized already early in the development of the field [8,9].

However, the connections between factors like personality, job attitude and performance are not simple. This is likely the reason why some studies show clear links [6] while others show little or no effects [4] of personality of developers on their preferences and performance in the software development process. This does not come as a surprise if we take into account that personality is one of the most complex concepts in the social sciences and its conceptualization and analysis is one of the most challenging tasks

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http://dx.doi.org/10.1016/j.infsof.2014.03.004
0950-5849/

in psychology [10]. Even so, the prediction of performance on specific tasks [11], building effective teams [12] or peers in pair programming [13] and, more generally, the search for the most suitable person for a specific IT job [14] shows that personality-focused SE research is both an active area and has many practical applications.

Despite the research interest shown during the last decades on the importance of human factors in SE and particularly the personal characteristics of the humans involved in the SE processes, such factors have been largely disregarded or were not empirically studied [15–19]. When studies have considered the personality of developers empirically, they have primarily used dated models or metrics that have been criticized within psychology [20], in particular the Myers–Briggs Type Indicator (MBTI) [21–25]. In contrast, Feldt et al. [6] used the modern and more scientifically validated Five-Factor Model (FFM) and found significant associations between personality factors and the attitudes and preferences[1] of 47 industrial software developers. The more detailed and nuanced picture of personality offered by the Five-Factor Model allows statistical analysis that can help identify and quantify complex relations between individual, team and project factors in SE projects. Despite these advances, the knowledge linking individual characteristics of software engineers to their SE performance is in a nascent state; there is a general lack of large, empirical studies and there is a lack of information on weather personality effects are stable over the age and length of experience of the investigated subjects. The latter is important if we are to exploit a deeper knowledge in practical guidance on team formation and role and career decisions.

In the quest of a deeper understanding of the preferences of software engineers and how their personal characteristics can affect their professional decisions, this paper presents an operational, external replication study [26] of our previous study [6] in which we keep our measured constructs and the statistical analysis methods intact, while extending with additional psychometric instruments and using a different, larger set of subjects. The data we investigate is the responses to three different psychometric instruments by a total of 279 graduate students in a Master of Science program in Software Engineering at a Swedish University. The measurements were taken over 3 years (2010–2012) and involved students enrolled during a 5-year period (2008–2012). All of these subjects have at least bachelor degrees in Software Engineering or Computer Science and can thus be expected to be representative[2] to software engineers at a very early stage of their careers, i.e. fresh out of university. This is in contrast to our previous study that focused on industrial practitioners with a generally longer experience from software projects and industrial practice.

Additionally, to investigate if other psychometric instruments can be of use in understanding and characterizing software engineers, we broaden the study by including two additional psychometric instruments, the Self-compassion test [27] and the Trait Emotional Intelligence Questionnaire (TEIQue) [28]. There is a plethora of psychometric instruments to choose from, but we selected these two as they aim to represent psychological constructs that are different from personality and thus can add additional predictive power. Furthermore they have been quite recently introduced and investigated empirically. Emotional intelligence has also gotten a lot of attention in lay press through the work of Goleman [29] with claims that it is an important indicator of success in life and at the workplace. Both of the added psychometric instruments have been found to be associated to attributes such as creativity and social functioning, which is likely to be important in the often knowledge-intensive and team-based work life of modern software companies [30–32].

Overall, our goals are to evaluate our results and methods in a larger sample, using software engineers in an earlier state of their career. We employ advanced statistical methods in order to evaluate connections between questions and psychological constructs and to derive understandable, predictive models from one to the other. Our contributions are:

- results for the present set of subjects that are partially consistent with our previous results in [6], thus further strengthening them and the methods used,
- to show that one new (emotional intelligence) but not another (self-compassion) psychometric construct show associations to software development preferences,
- further statistical analysis of association between the software development preferences and
- a concrete example of an operational replication study in SE.

Overall, our results show that individual differences are reflected in different SE preferences and that the instruments and analytical methods proposed can detect such connections.

Section 2 of this paper provides the theoretical background on psychometrics and personality testing and present previous studies in SE and software development that have used such tests. Next, in Section 3, we describe the design of our empirical study, followed by the results and statistical analysis in Section 4. Section 5 involves the investigation of Trait Emotional Intelligence Questionnaire (TEIQue) and Self-compassion tools as supplementary psychometric tools in order to examine if similar outcomes can be derived. We discuss the results and try to answer to the research questions previously posted. Finally, we conclude with Section 6 summarizing the results and impact of our work.

2. Background

Various psychometric instruments and models have been used in previous studies for different purposes. In the following subsections we give a brief overview over these psychometric instruments and models and then summarize the related research in software engineering and software development.

2.1. Personality models, metrics and other psychometric instruments

Years of research and studies in the personality psychology field have led to one of many views, which concerns the description of personality by a set of traits, that is a set of factors or attributes that harbor information of how a person feels, thinks and behaves [33,34]. These traits, combined with other attitude aspects and empirical models can be used to, at least to some degree, predict how a person acts in certain circumstances.

Since 1930, different trait-based personality theories have been proposed, and then gained wider acceptance and interest in the 1970s. Meanwhile, a variety of practical tests to measure personality types have been proposed, such as the MBTI, the FFM, Self-compassion and TEIQue.

An important, first step was taken by Myers et al. [35] when they published in 1961 the initial MBTI psychometric questionnaire. The questionnaire and its traits were loosely based on Jung's theories, published in 1923 in "Psychological Types" [36], in an attempt to measure Jungian functions and attitudes. Jung studied the history of psychological typologies from the classical literature

[1] It is a fine line between an attitude and a preference and some of our questions are more clearly the former while some are about the latter; in the following we use the terms interchangeably.

[2] Some bias, of course, exist due to the bachelor level students all having decided to continue their studies towards a masters degree.