DISCOVERING PERSONALITY TYPES AND DIVERSITY BASED ON SOFTWARE TEAM ROLES

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ABSTRACT. Human aspects in software engineering play key role in composing effective team members. However, to date there is no general consensus on the effective personality types and diversity based on team roles. Thus, this paper aims to discover relationships between personality types and diversity based on two software team roles – team leader and programmer. A rule-based approach by using rough set technique was used to discover patterns of the data selected. The results revealed that extrovert personality type is dominant for both software team roles for effective team. The results of this study provide useful rules for decision makers to understand and get insight into selecting effective team members that lead to producing high quality software.

Keywords: software team composition, personality types, diversity, team roles, rule-based

INTRODUCTION

Software engineering (SE) is often perceived as technical activity. However, there is growing evidence that the success of software project depends on humanistic aspects (Dingsoyr & Dyba, 2012; Martínez, Licea, Rodríguez-Díaz, & Castro, 2010). One of the humanistic aspects that may impact the quality of software project is the composition of personality types and behaviour among the team members (Acuña, Gómez, & Juristo, 2009; Cunha & Greathead, 2007; Koroutchev, Acuña, & Gómez, 2013; Mazni, Sharifah Lailee, & Naimah, 2011). A number of studies have been done in the past on team composition and personality types in software engineering, but the issue pertinent to a suitable personality type composition for effective teamwork is still being questioned (da Silva et al., 2013; Dingsoyr & Dyba, 2012).

Software team diversity is one of the significant elements in determining team effectiveness (Peslak, 2006; Woehr, Arciniega, & Poling, 2013). Diversity may refer to diversification of demographic, knowledge, skills, or personality types amongst team members. In this study, diversity defined as the differences of personality types among members in a team. Currently, there is no general consensus on the advantages of having diversification amongst team members towards developing high quality software. This is because team dynamism plays a key role in software team composition.

To date, most of techniques to analyze patterns of personality types in software engineering are based on statistical and qualitative analysis (Acuña et al., 2009; Bradley &Hebert, 1997; Koroutchev et al., 2013). There is lack of research on applying rule-based technique in order to understand patterns existed in the data selected. Rule-based approach

offers significant advantages because the rules generated are easy to understand and can be easily interpreted. This is because rules generated imply rules decision in human understandable forms. Therefore, this study aims to investigate the relationships of personality types, diversity, and software team roles by using a rule-based approach.

RELATED WORKS

In software engineering, the Myers-Briggs Type Indicator (MBTI) personality type is a widely used and accepted amongst researchers in SE domains (Bradley & Hebert, 1997; Cunha & Greathead, 2007; Karn & Cowling, 2006; Karn, Syed-Abdullah, Cowling, & Holcombe, 2007; Mazni, 2012). The MBTI consists of 16 personality types that combine 4 pairs of personality type's dimensions, which are:

i. Introvert (I) – Extrovert (E)
ii. Sensing (S) – Intuitive (N)
iii. Thinking (T) – Feeling (F)
iv. Judging (J) – Perceiving (P)

Mazni and Sharifah-Lailee (2010) indicated that certain personality types, namely extrovert (E), sensing (S), feeling (F) and judging (J), affect the software project success the most, whereby the last type inevitably affects project success, as most software team members are judging types. Another study by Martinez et al. (2010) proposed a RAMSET a Role Assignment Methodology for Software Engineering Teams, in which a personality of team member was defined with team roles. In the study, the researcher focused students to know their expertise in the particular area of programming languages and databases. MBTI personality test was used to gain the personality of an individual student. The research revealed the fact that Extrovert (E)'s and Sensing (S)'s can be suitable for analyst and designer, and Introvert (I)'s for programmer/developer. Moreover, the researcher recommended that ISTP personality type is suitable for programmer, ENTJ for designer, and ESTJ for analyst and tester.

In order to mitigate risks of assigning ineffective personality types of team members, Capretz and Ahmed (2010) has proposed a conceptual model of the effective personality types team members. The authors suggested a suitable personality types according to software team roles. For example, programmers must have Introvert (I) personality types, whereas system analyst must have Extrovert (E) personality in order to compose effective team members. They also suggested that software designer should be with intuitive (N) and thinking (T) personality types. Moreover, programmer must have IST personality types to be effective members. Lastly, sensing (S) and judging (J) personality types can benefit the tester role. Nevertheless, this model is non-empirical which is difficult to test its effectiveness.

METHODOLOGY

In order to investigate the relationships amongst variables investigated; personality types, diversity and team roles, data from Mazni (2012) was chosen. The data was examined by using a rule-based approach. The rule based approach is based on rough set technique.

Rough sets technique was chosen because it could handle imprecise and uncertainty datasets. Moreover, data size assumptions and normality of data is not required in rough sets (Düntsch & Gediga, 2000; Hui, 2011; Pawlak, 1997). Rough set generates IF-THEN decision rules which pave a way for researchers to identify and understand different patterns in the collected data.

The data selected was examined using ROSETTA tool, a tool for analyzing data using rough set technique. In order to investigate patterns of data, several tasks are performed. The tasks are:

i. Reduct Generation Rules
This task was carried out to determine minimal attributes that show knowledge patterns in data.

ii. Rules Generation
This task was performed in order to obtain rules that shows patterns amongst the variables investigated- personality types, diversity and software team roles.

iii. Rules Filtering
The rules filtering task was carried to determine the most appearance variables in rules generated. The higher appearance of the variables demonstrated that the variable is the most significant variable to determine team effectiveness (Clark, 2009; Wong & Chung, 2007). Only rules that have effective decision were considered to be analyzed.

RESULTS OF RULES GENERATED

In this section, rules generated using ROSETTA tool will be presented based on the software team roles.

Team Leader Role

Initially, there are 22 rules were generated for team leader role. In order to understand relationships of patterns existed in the data, every pair of MBTI personality type indicator was observed based on decision (effective) rules. In this study, `Q (1)` refers to effective decision rules. After filtering the rules, only 9 rules are considered as effective decision rules.

Table 1. Decision Rules for Team Leader Role

Rule Number	Rules
1	`ie(2) AND sn(2) AND Diversity(2) => Q(1)`
2	`sn(2) AND tf(2) AND Diversity(3) => Q(0) OR Q(1)`
3	`sn(2) AND Diversity(6) => Q(1)`
4	`ie(2) AND Diversity(1) => Q(1)`
5	`ie(2) AND sn(2) AND tf(2) AND Diversity(5) => Q(1)`
6	`ie(1) AND sn(2) AND Diversity(4) => Q(1)`
7	`Diversity(7) => Q(1)`
8	`ie(1) AND tf(2) AND Diversity(4) => Q(1)`
9	`ie(2) AND sn(1) AND tf(1) AND Diversity(4) => Q(1)`

Based on Table 1, the first pair of MBTI, I-E (Introvert-Extrovert)) occurred 6 times (see rule number 1, 4, 5, 6, 7 and 8). In which the E, `(ie(2))` personality types appeared 4 times and I, `(ie(1))` types of personality appeared 2 times. Therefore, E personality type was observed more effective with appearance within 4 rules (66.7%) than I types of personality within 2 rules with 33.3%. The second pair of MBTI personality indicator, S-N (Sensing-Intuitive), was also observed from effective (decision) team leader's rules. This pair was also appeared 6 times in effective rules (see rule number 1, 2, 3, 5, 6 and 9), in which N `(sn(2))` got higher appearance within rules by appearing 5 times with 83.3%, whereas S `(sn(1))` personality types got lower appearance than N `(sn(2))` by obtaining 16.7%. Here N types of personality were shown as dominated personality types in the second pair.

In T-F (Thinking-Feeling) pair of MBTI personality indicator, the personality types were observed based on 9 effective rules as perceived in Table 1. It shows that the effective rules in which T-F pair appeared 4 times. The personality type F remained dominated on T by obtaining the 3 times appearance with 75%. The last pair of MBTI personality indicator J-P was not found in effective rules of team leader role in the data set. This is because majority of the team leader has J personality type.

The team personality diversity was also analyzed in team leader role based on the effective rules. It was seen that heterogeneous team leaders were effectively appeared than homogeneous. In this study, heterogeneous refers to team that have diversity more than 4. In results, the heterogeneous percentage was 66.7% by appearing 6 times in effective rules; whereas, homogeneous teams appeared 3 times with 33.3% in effective rules in the dataset.

Programmer Role

For the programmer role, there are 17 rules were generated. After filtering the rules, only 7 rules are considered as effective decision rules.

Table 2. Decision Rules for Programmer Role

Rule Number	Rules
1	sn(1) AND tf(1) AND Diversity(2) => Q(0) OR Q(1)
2	ie(1) AND sn(1) AND Diversity(6) => Q(0) OR Q(1)
3	ie(2) AND tf(1) AND Diversity(1) => Q(0) OR Q(1)
4	tf(2) AND Diversity(1) => Q(1)
5	sn(2) AND tf(1) AND Diversity(4) => Q(1)
6	Diversity(7) => Q(1)
7	sn(2) AND tf(1) AND Diversity(2) => Q(1)

Based on MBTI personality indicator, the I-E pair was observed from effective decision rules generated by ROSETTA. The first pair of MBTI was shown only two times (rule number 2 and 3) in decision rules. Both personality types I (ie(1)) and E (ie(2)) appear one time in rules. Based on conditions supported, E obtained 57.1% and I got 42.9% in the first pair. The second pair of MBTI personality indicator, S-N (Sensing-Intuitive), was repeated 4 times in decision rules (rule number 1, 2, 5 and 7) in which both personality types S and N appeared equally 2 times. The T-F pair of MBTI appeared 5 times (rule number 1, 3, 4, 5, and 7) in the decision rules.

In T-F pair, the T personality types were observed as most frequent appearance in decision rules than F rules. In results, it was seen that T got 4 times appearance with 80% appearance. On the other hand, F only got 1 times appearance with 20%, T personality types could be categorized as effective as appeared 80% in the rules. It was observed that no rule was extracted from experiment for J-P pair of MBTI personality indicator. In descriptive analysis, it was observed that J remained dominated in the pair on P.

Team personality diversity was similarly observed as it was observed in team leader section. Based on rules generated by using rough sets technique, it was also obtained that homogeneous programmer were effectively appeared than heterogeneous. In results, the percentage of homogeneous teams was 57.1% by appearing 4 times in effective rules, whereas, heterogeneous teams appeared 3 times with 42.9% in effective rules.

DISCUSSION

Overall, 9 rules were obtained as effective rules for team leader role. Decision rules were then observed based on MBTI personality indicator, in which each pair was discussed separately. In the first pair, E remained dominated on I by obtaining 66.7%. N outperformed the S in the second pair of MBTI with obtaining 88.3%. In the third pair T-F, decision rules T outperformed the F with 75%. The last pair of MBTI, J-P, remained invisible in rules. Moreover, heterogeneous teams outperformed the homogenous by obtaining 66.7%.

For the programmer role, 7 rules are considered as effective decision rules. Based on MBTI personality indicator decision rules were then observed. Each pair was discussed separately, in the first pair, I and E found equally in rules but E got (57.1%) higher percentage based on conditions supporting compared to I. N and S in the second pair of MBTI were also appeared equally in rules. In the third pair T-F, T outperformed the F with 75%. The last pair of MBTI, J-P, is not visible in any decision rule. Finally, homogenous teams outperformed the heterogeneous with 57.1%.

The results show that E personality type is significant in determining team effectiveness for both team roles. A good leader and programmer need to actively communicate with the users in order to get clear requirements. This finding in line with previous study that demonstrated extrovert members give an impact towards the quality of software produced by a team (Acuña et al., 2009). In addition, T, thinking personality types are dominant for the programmers since it is naturally for a programmer to have the ability in making logical and objective decisions. These results are supported with other studies (Capretz & Ahmed, 2010; Peslak, 2006).

CONCLUSION AND RECOMMENDATIONS

This study revealed that there are significant relationships between personality types and diversity based on software team roles. The results demonstrated that extrovert personality types play a dominant role to induce a team to be effective team. In addition, this research also reveals that heterogeneous team leaders with diverse personality types in a team can be effective leaders; whereas programmers can work better in homogeneous software development team.

Knowledge patterns by the rules generated can assist decision makers to compose humanistic aspects that suited for the team members. This can promote better team performance that supports smart community initiative. The research focuses on small – medium software team composition, which comprises of 4-6 team members. Therefore, future research can use data collected from large scale software team size.

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