# How to Classify Personalities of Team Members on Project-Based Learning

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## ABSTRACT
Recently, PBL (Project-Based Learning) is sometimes applied to software engineering education. When PBL is applied, software development teams are made. For the teams, influence of the personality of each member is not negligible. The personality will affect performance of the team and it may also influence the effect of education. So, we focus the personality and discuss how to measure and classify it.

## Categories and Subject Descriptors
D.2.9 [**Software Engineering**]: Management – *Programming teams*, K.6.1 [**Computing Milieux**]: Project and People Management – *Staffing*

## General Terms
Management, Measurement, Performance, Human Factors.

## Keywords
Personality, Team construction, Classification.

## 1. INTRODUCTION
Recently, PBL (Project-Based Learning) get much attention on software engineering education, especially in Japan. On PBL, students solve some problems by themselves, instead of classroom lecture. When PBL is applied to software engineering education, software development team is sometimes made, and students make software on the team. The activity is similar to the work in software development companies.

In software development companies, most software is developed by a team which consists of a project manager, system engineers, programmers, and so on. To develop software, they perform their work and communicate with each other. Hence, human side of the members is considered to affect activities of software development. Members may have adequacy of a role. For example, a person would be adequate for programmer, although he/she is not adequate for project manager. That could affect the efficiency of the development, if their role is inadequate for them. Also, if the distribution of characteristics of team members is biased, that may decrease the efficiency of communication between them. For instance, if all team members have introverted personality, it would affect communication between them, and it may decrease the efficiency of software development.

We think that likewise, on PBL of software engineering education, the influence of the human side of each member is not negligible for the teams. The personality would affect performance of the team and it may also influence the effect of education. So, we focus on the human side of software development team members, especially personality of them.

First, we surveyed researches which addressed personality of members in a software development team. We focus on not only a software developer but also a software development team. So, we mainly picked up researches which treated relationships between personality of members and the performance of a team. Next, based on the existing researches, we discussed the drawbacks of them, and what is needed to analyze the relationships between personality of members.

## 2. RESEARCH OF PERSONALITY IN SOFTWARE DEVELOPMENT
Some researches indicate that there is the relationship between performance of a software development team and personality of the members [1][2][4][5][7][9]. For example, Gorla et al. [4] conducted a survey about the personality, the role in a team, the performance of their team for 92 software developers. To evaluate the performance, they used six indices such as quality and efficiency. The indices were rated on a five-point scale. The personality was measured using MBTI (Myers-Briggs Type Indicator) [6]. MBTI classifies personality into 16 categories, based on answers to several tens of questionnaire items. Their result suggests that there are some personalities which adequate for a role, and the adequate roles enhance the performance of the team. For example, when a system analyst is thinking type personality, team performance is high.

Acuña et al. [1] analyzed influence of personality of team member to project results such as software quality. They analyzed dataset which was collected from 35 teams which consist of 105 students. The software was developed applying agile software process. Based on the analysis results of the dataset, they showed extraversion of team members positively affects software quality. To identify the personality of a team member, they used NEO-FFI, which is based on the five-factor model. The five-factor model does not classify personality according to type, but evaluates personality based on degree of five factors (neuroticism,

extraversion, openness, agreeableness, and conscientiousness). The NEO-FFI measures the factors based on answers to several tens of questionnaire items.

Licorish et al. [5] surveyed the existing researches, and based on that, they indicated the importance of personality of team member on software development. Also, they proposed a prototype tool which supports the selection of team members for agile software development. Using the tool, a project manager checks information of each member such as personality, and set roles of members. To classify the personality, the tool uses Belbin Team Roles [3]. The Belbin shows there are 8 roles when a team succeeds, and explains strong points and weak points of the roles. The role is settled on the answers to several tens of questionnaire items. It confirmed that there are the relationships between the roles and the personalities [7]. So, the Belbin Team Roles is regarded as classification of the personality.

MBTI and the five-factor model are used widely to analyze the influence of personality on software development. For instance, Salleh et at. [8] showed 12 existing researches which analyze the influence of personality on the pair programming. On them, five researches used MBTI, and three researches used the five-factor model. The Belbin Team Roles is often used to analyze the influence of personality to a development team.

## 3. NECESSITY OF A NEW CLASSIFICATION METHOD

The existing researches suggest that the personality of team members is not negligible on software development. Hence, it is better to utilize information about the personality of team members when building a software team. However, to utilize it, the existing methods (i.e., MBTI, the five-factor model, and the Belbin Team Roles) are insufficient on the following points:

1. The classifications of the existing methods do not specialize in the software engineering field.
2. To classify the personality, data should be collected using a questionnaire.

Although the existing methods can to apply not only software engineering field but also other fields, the granularity is not appropriate, considering the application to software development analysis. If the granularity is more appropriate, we may get more useful findings when analyzing the personality of team members, and utilize them when building a software team.

Also, the existing methods do not assume that personality of team members is measured automatically, based on a dataset such as a software repository. They use a questionnaire to measure the personality. To measure it automatically, it is needed to reconsider the classification and measurement methods of the personality. If the personality of team members can be measured automatically, we can analyze the influence of personality to software development teams on PBL more easily.

If we can know the personality of students based on the classification, it is expected for us to get the following effects on PBL.

- Students can experience team software development, when the team is built with appropriate and inappropriate role. It will give chance to students to consider the appropriate role in software development.
- Teaches can control performance of a software development team on PBL to some extent, assigning appropriate roles to students, based on their personality. It would make easier to control goal of the education.

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