

Study on the Innovation Competency Model of Students with Mechanical Major

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Abstract. To improve students' innovation ability need to consider their innovation competency, on the basis of existing research results, and the students' innovation competency is defined, through the investigation on the students of mechanical major, the students' innovative competence dimensions determined, and the students' innovation competency model established. Then the mechanism to promote the innovation competency is discussed, which includes the learning motivation, learning basis, learning environment, learning system four aspects, and specific suggestions to improve students' innovation competency are obtained. This study can provide reference for the research of students' innovation competency and the cultivation of students' innovative ability.

1. Introduction

The cultivation of innovation ability is an important part of the talent training with mechanical major, the effective training programs and measures of innovation ability are actively being explored in both at home and abroad [1-4]. If taking into account the innovation ability of students, a multiplier effect can be achieved. Competency is a direct impact on individual conditions and behavioral characteristics of people's work performance, and innovation competency can influence the individual conditions and behavioral characteristics of students with innovation, innovation competency has an important reference value for describing students' creative potential and promotion way. Since McClelland put forward the definition of competency in 1973, the research of competency (model) has been raised in the world. Such as Boyatzis used the competency model for the management of human resources, Raven has introduced competency to all kinds of work field, the competency model was introduced to university innovative talents of key disciplines by Wang Yi [5]. Zhou Xia studied on the innovative talent competency model for empirical research [6]. Jiang et al introduced the competency model to teaching management [7], Li et al built the multi-dimensional competency model, and designed the training mode of innovative application talents of mechanical major [8]. But there are few researches on the innovation competency, this paper makes a research on the innovation competency model of mechanical major students.

2. The Innovation Competency Model of Students

The concept of competency is not strange, but the concept of students' innovative competency is not clear, the students' creative competency is defined as the embodiment of quality and ability about students understanding innovative knowledge, mastering innovative thinking, starting innovation ability. Learning from the existed competency model, innovative students should have the following core competencies.

1) Professional knowledge, the students with innovation ability can apply the professional knowledge to creatively analyze, judge and solve the problem in a certain extent. And can continues actively expand their professional knowledge through academic journals, conferences, courses, the network etc. The results of innovation and professional courses and practice can be more objective evaluation of their level of expertise.

2) Innovation ability, innovation students can have a greater advantage in the innovation concept, creative spirit, innovation method, learning ability, achieve relatively prominent results in the

innovation practice. First of all, innovative students must have unceasingly enterprising, novelty psychology and ideology, can take the initiative to discover new situation, analyze new situations and solve new problems. Secondly, innovative students should be able to doubt everything, and change them fearless. Thirdly, innovative students can flexibly apply various kinds of thinking methods on the basis of certain knowledge, experience and intelligence, and create new ideas. Finally, innovative students must insist on innovation and learning, extract for their useful information and knowledge from a large amount of information, and use knowledge to solve practical problems.

3) Personality ability, innovative students' personality tendency is important factor of competency, it potentially affects the gain and enhance the previous three kinds ability, related to competency personality including achievement orientation, initiative, careful, self-confidence and moral character and other factors, but also covers the collective adaptability.

Through the analysis of the core competency, the paper further investigates the structure of the students' innovation competency. A questionnaire consisting of 38 questions was set up to cover the influence of various factors on innovation competency. By sending paper questionnaire and fill out the online questionnaire issued a total of 300 questionnaires (250 from mechanical engineering students), 287 valid questionnaires (including school of mechanical engineering, 239 valid questionnaires). The results of the analysis are shown in Table 1.

Table 1 Research hypothesis conclusion

Research hypothesis	Conclusion
H1: The innovation competency model of college students is composed of 4 dimensions: professional ability, innovation ability, collective adaptation ability, personality ability	Support
H2: Campus culture and social environment have a significant impact on innovation competence	Partly support
H3: Practical ability has a significant impact on college Students' innovation ability	Support
H4: Teamwork helps improve innovation competency	Support
H5: Innovative method to enhance the effectiveness of innovation	Partly support
H6: Training of innovative methods to help enhance the innovation ability of college students	Partly support

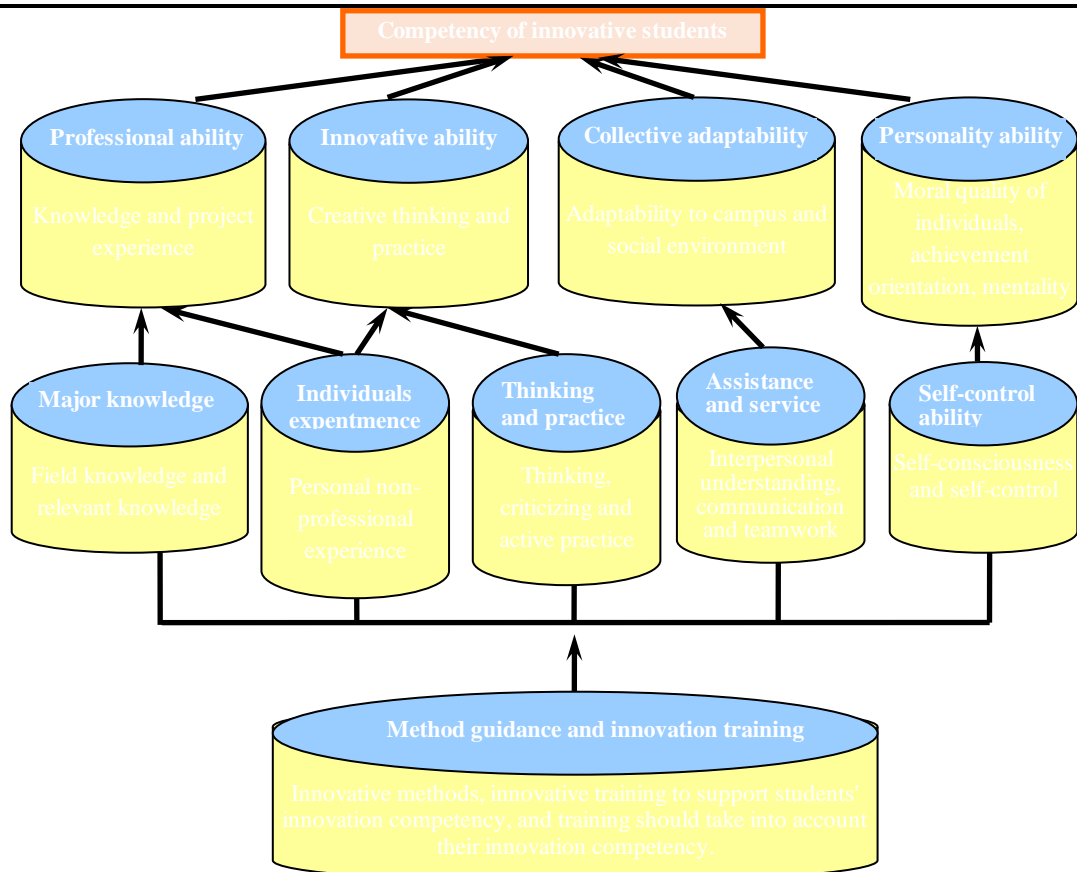


Fig. 1 The model of innovation competency

From Table 1, the findings support the core competence of students' innovative competency. According to the results of the survey, the innovation competency model of our students is established, and shown in Fig. 1.

From Fig. 1, the innovation competency is related to the professional ability, innovation ability, collective adaptability and individual ability. Professional competency includes master professional knowledge and personal experience, professional knowledge, including knowledge of the field and related fields, and accumulated knowledge in the project; personal experience is some relevant information supported non-professional experience in the growth process; collective adaptability refers to the ability of students to adapt to the campus and social environment, and they can communicate with others, can have the team cooperation and service consciousness to others, collective adaptability influences personality ability, and it is influenced personality ability too; personality ability includes various moral quality of individuals, achievement orientation, mentality; an important aspect of the personality ability is self-control, which is ability to resist the temptation of surrounding environment. At the same time the method guidance and innovation training, and innovation competency are acted each other, namely innovation method guide and innovation training methods are affected by innovation competency, and they can enhance innovation competency.

3. The Influence Factors of Students' Innovation Competency

Students' innovation competency in different periods, different campuses, and different groups will be different, which is related to the students' own quality, school environment and social environment.

Students' own quality. The students' own quality is the main and direct factor that affects the innovation competency, among them, the quality of the students is mainly four aspects: knowledge and skill, personality and behavior, intelligence quotient and EQ, motivation and need.

Campus environment. The campus environment affects the students' innovative competency, mainly by the campus culture, incentive factors, innovation conditions, etc. Incentive factors to encourage students' sense of innovation, give students the speak right and freedom of innovation. At the same time, the conditions of innovation must be built, such as the establishment of maker space, workshops, etc., to enable students to achieve innovation. Innovation of the campus culture will help to cultivate and improve students' ability to continuously innovate, such as respecting students, mobilize the enthusiasm of students, the development of students' potential as a management philosophy, students with the mutual trust and mutual encouragement, will help improve students' innovative competency.

Social environment. The strong consciousness of social innovation will help to improve students' innovative competency, such as good innovation policy, innovation atmosphere, customs, culture, morals, values, level of economic development, and innovative ways of application and promotion will affect students' innovation competency.

4. The Mechanism and Strategy of Improving Students' Innovative Competency

Innovation competency is not innate, most is result of the continuous learning and accumulation under various environment, and this study and accumulation directly affect the development and formation of innovation competency of students. Students through learning by the individual and organizational level to enrich their knowledge and skill, enhance their innovation competency.

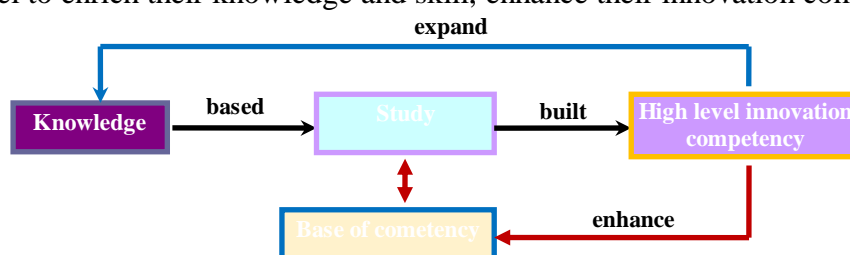


Fig. 2 The relationship among of knowledge, learning and innovation competency

To establish the relationship among of knowledge, learning and innovation competency, is shown in Fig. 2, the competency is the basis for mastering knowledge to innovate, is the result of learning knowledge, learning knowledge and competency interact each other; learning is the important means of the knowledge spreading, migration, development, and applying knowledge, knowledge can be transformed into internal quality with output benefits through the learning process. Competency basis is an important factor affecting learning, it not only affects the number of learning knowledge and skills, and affect the quality of the study, a proportional relationship between them.

From the above analysis, learning is an important means to improve the ability of innovation, through individual learning and collective learning to enhance the innovation competency. So we have established the following strategies to improve students' innovation competency.

A) To establish an effective incentive measures, to enable students to have a strong motivation to improve the competency, such as set up the innovation credit, innovation award and other measures; B) Simplified innovation method, reduce the requirements of students' innovation foundation. Simplifying the existing innovation method, such as the simplified TRIZ model, make the students easy to understand; C) The establishment of innovation laboratory and workshops, to facilitate students innovative learning and practice, to establish an innovation practice platform based on cooperation of university and enterprise, so that students can carry on innovative study and practice in the real engineering environment; D) The perfect innovation training system, ensure effective training of students' innovative thinking and innovative practices, is mainly aimed at the establishment of innovation professional training curriculum system and the professional practice system, teaching system and training methods.

5. Conclusions

The students' innovation competency is the foundation of creative education, this paper defines the students' innovation competency, and establishes students' innovation competency model through investigating our university students, which is related to the professional ability, innovation ability, collective adaptability and individual ability. And the evaluation system of innovation competency with 3 layer structure is built, and the mechanism of how to improve innovation competency is discussed, which promote strategy is given from learning motivation, learning basis, learning environment, learning system four aspects, includes some specific suggestions. These results can be provided references for the research of students' innovation competency.

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