



ELSEVIER



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

Procedia - Social and Behavioral Sciences 215 (2015) 98 – 101

Procedia  
Social and Behavioral Sciences

International Conference for International Education and Cross-cultural Communication.  
Problems and Solutions (IECC-2015), 09-11 June 2015, Tomsk Polytechnic University,  
Tomsk, Russia

## The Role of Research Work in the Training of Master Students Studying at Technical University

Alexandra V. Ruchina<sup>a</sup>, Marina V. Kuimova<sup>a\*</sup>, Denis A. Polyushko<sup>a</sup>, Arkadii E. Sentsov<sup>b</sup>,  
Zhang Xue Jin<sup>c</sup>

<sup>a</sup>Tomsk Polytechnic University, 30, Lenin ave., Tomsk, 634050, Russia

<sup>b</sup>Tomsk State University, 36, Lenin ave., Tomsk, 634050, Russia

<sup>c</sup>Dalian University of Technology, No.2 Linggong Road, Ganjingzi District, Dalian City, Liaoning Province, 116024, P.R.C.

---

### Abstract

Contemporary society needs initiative and independent specialists capable of improving their professional skills continually. These specialists are notable for high sensibility, curiosity, readiness for rapid updating of knowledge and a wide range of skills. Thus, the main purpose of higher education is the development of new educational content ensuring relevance and competitiveness of graduates in the labor market. In this article, the authors investigate the research work of technical university students studying at Master's programs in the context of innovative changes in modern education. Research work is the process of shaping the future specialist by individual cognitive activities aimed at obtaining new knowledge, solving theoretical and practical problems, self-education and self-realization. The authors prove that research work is one of the mechanisms for the integration of higher professional education into a modern innovative society.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of IECC 2015.

**Keywords:** higher education; research work; master students' research activity; scientific research environment of the university; professional competences.

---

---

\* Corresponding author. Tel.: +8-3822 42-12-74.

E-mail address: [kuimova@tpu.ru](mailto:kuimova@tpu.ru)

## 1. Introduction

At present, the issue of enhancing the quality of higher education, and master's training in particular, is an urgent one. This is due to the change of the demands of modern innovative society for highly qualified specialists "who can independently take responsible decisions in situations of choice, predicting their possible consequences, and are able to work both independently and in teams. These graduates are characterized by mobility, dynamism, constructiveness and have a strong sense of responsibility for the fate of the country" (Kushnir, 2004).

The materials of the Bologna seminars (Slovenia 2004, Bergen 2005 and others) underline that higher education must become more competitive. Acquired knowledge quickly becomes obsolete, and this contradiction can be overcome with a flexible educational system. At each level of university training, it is necessary to develop the students' creative thinking and research skills, without which it is difficult to continue education and become in-demand specialists. In this regard, a modern graduate must possess not only the necessary amount of basic and specialized knowledge, but also certain creative skills for solving practical problems, be able to adapt quickly to changing conditions and constantly improve his skills.

The purpose of this study is to analyze and assess the experience of master's students involved in research work. The participants of the study were 52 master's students of the Institute of Non-Destructive Testing, National Research Tomsk Polytechnic University. The study employed the following **methods**: literature review, survey and data analysis.

## 2. Analysis of research work of master's students

As an innovative and dynamic character of modern education, change in the general orientation of educational activities has sharpened the basic contradiction in the content of the research work. The tradition to learn the rules that ensure a high level of subject knowledge and the need to resolve constantly occurring situations of diverse difficulty and uncertainty require research competence. This means that the course of the master's training is changing, assuming new approaches, methods and technologies. The performance of research work helps to understand the field and scope of professional activities and is an initial step in research design. Research design involves the creation of the environment that helps students to form a deliberate attitude toward their studies, scientific work and future profession. Research work:

- motivates interest in science;
- develops cognitive needs;
- expands theoretical and practical knowledge;
- deepens the desire to get acquainted with the problems of the field of study (Asmolov, 2008).

The main objective of master's programs in technical universities is to deepen specialization in a particular professional direction. Education in the master's degree is an important step in becoming a professional researcher, a step leading a young scientist to the dissertation research. The student engaged in scientific work is responsible for himself. The research topic, time period for doing the work, and importantly whether the work is done at all depend only on him. Spending his personal time on research, the student develops such important skills and abilities as:

- critical thinking;
- creative thinking;
- reasoning abilities;
- ability to consider different points of view, explain and defend his point of view.

That is why scientific research is of high importance for the students enrolled in the master's program. To develop students' research work there is a need to:

- introduce and develop different forms of research activity;
- create conditions that motivate students' participation in university research work and outside Alma Mater;
- elaborate student scientific societies and conferences (Almendra, 2012; Di Carlo, Barsics, & Moitroux, 2003; Jokinen, Rajamäki, Karppinen, Tarkkanen, & Tiainen, 2015; Pechenkin & Serper, 2014).

Modern universities work diligently to strengthen the quality of education, promote learning, foster an exciting

intellectual environment and offer rewarding conditions and flexible strategies contributing to research activities aimed to enhance:

- the development of analytical, critical thinking, problem-solving and decision-making skills;
- acquisition and development of autonomous skills;
- development of science communication and public speaking skills;
- abilities to independently learn new knowledge and methods;
- writing skills (Lino & Duarte, 2011; Shawcross & Ridgman, 2012).

Master students' research work nurtures a passion for inquiry, new knowledge and experience, furthers the development of their intellectual potential, provides tools to face intellectual challenges with creativity and confidence, and gives opportunities to work towards a Ph.D. degree. There are two main types of research work:

*a) provided by the syllabus.* It includes:

- course work performed during the period of study at the university;
- research practice;
- graduate work.

This activity helps students acquire the skills of critical selection and analysis of the necessary information, develop creative and cognitive abilities, expand theoretical knowledge and provide in-depth study of the selected topics.

*b) beyond the syllabus.* It includes:

- problem subject and problem clubs;
- student laboratories;
- scientific and practical conferences;
- competitions on various levels.

This work contributes to the increase of personal and professional significance, favors confidence based on success and achievements. The experience of participation in extra-syllabus research work gives students the opportunity to discover their talents, feel proud of their achievements and get satisfaction from the results.

The research work is performed during:

- study (performances at seminar with scientific reports; participation in the discussion of reports, library-research papers, articles; preparation of written works of research character, etc);
- extracurricular activities (performances with scientific research papers at conferences, participation in conferences, clubs, etc.).

The list of forms of the research work in the semester for master's students varies depending on the specifics of the master's program. Universities establish a mandatory list of forms of research (including earning the credits for the research work in the semester) and the degree of participation in the research work. The organization of research work permanently requires special efforts from the management of universities and suggests the development of stimulation system for the engagement in the research.

Research work is a component of master's degree program specified by FSES (Federal State Education Standards) HVE (Higher Vocational Education). According to FSES HVE, research work is assigned to promote the following abilities:

- to generalize and critically assess the results received by domestic and foreign researchers; identify and formulate challenging scientific problems;
- to justify the relevance, theoretical and practical significance of the selected topics of the research;
- to conduct independent research following the developed program;
- to represent the results of the conducted research in the form of the research report or article.

Having conducted a survey among master's students of the Institute of Non-Destructive Testing, National Research Tomsk Polytechnic University, we found that they consider the participation in the following research activities as the most productive and fruitful:

- scientific research seminars and conferences;
- research projects offered by the department;
- individual research work of certain issues under the guidance of a supervisor from the teaching staff;
- competitions in different disciplines;

- scientific lectures delivered by recognized researchers;
- research projects funded by various sources (the state budget, contracts, grants, etc.);
- student's scientific organizations and events of different levels (faculty, city, regional, national, international);
- research work carried out by post graduate students.

### 3. Conclusion

Thus, the research work is an important component of master's students' training. It offers excellent opportunities for students to master their theoretical knowledge, develop potential and area of interest, and enjoy creative problem solving. Research work: fosters in-depth study in the area selected by students; develops the skills of information processing and interpretation of the experimental and empirical data; teaches to formulate and solve problems arising in the course of research work; helps to choose the necessary methods of the research; provides the readiness for professional self-improvement; develops innovative thinking, creativity and essential professional skills; promotes self-discipline and improves social and interpersonal skills.

### References

- Kushnir, A. (2004). Koncepcija modernizacii rossijskogo obrazovanija na period do 2010 goda. Moskva: TSGL, APK and PRO. *The concept of modernization of Russian education in the period up to 2010*. (Rus.)
- Asmolov, A. (2008). Obrazovanie kak cennostnoe polaganie: Dialog mezhdju pedagogikoj sotrudnichestva i kul'turno-istoricheskij psihologiej. *Narodnoe obrazovanie*, 5, 48–52. [*Education as value-positing: the dialogue between pedagogy cooperation and cultural-historical psychology*]. (Rus.)
- Almendra, R. (2012). Educating critical thinking in design research. *Proceedings of the 14th International Conference on Engineering and Product Design Education: Design Education for Future Wellbeing*, 717–722.
- Di Carlo, P., Barsics, J., & Moitroux, C. (2013). Contribution of research & development to student's motivation. *Proceedings of the 24th International Conference on European Association for Education in Electrical and Information Engineering*, 42–47.
- Jokinen, E., Rajamäki, J., Karppinen, K., Tarkkanen, L., & Tiainen, S. (2015). Learning within research, development and innovation projects: Case: The MACICO project. *Proceedings of 2014 International Conference on Interactive Collaborative Learning*, 877–883.
- Pechenkin, I.G. & Serper, N.A. (2014). Nauchno-obrazovatel'nye centry — jeffektivnaja forma integracii vysshej shkoly, nauki i proizvodstva. *Gornyi Zhurnal*, 7, 101–105. [*Research and education centers is an effective mode of the higher school, science and production integration*].
- Lino, F.J., & Duarte, T.P. (2011). Research skills enhancement in future mechanical engineers. 2011 IEEE Global Engineering Education Conference, 1088–1095.
- Shawcross, J.K., & Ridgman, T.W. (2012). Manufacturing excellent engineers: Skill development in a Masters programme. *Engineering Education*, vol. 7, issue 2, 38–50.