Role of Cognitive Processes in the Implementation of Research Activity by Students

Larisa A. Darinskaya*, Sergey I. Rozum

Department of Psychology, Saint Petersburg State University, 6 Makarova emb., 203, Saint Petersburg, 199034, Russia

Abstract

The purpose of this study was to recognize various characteristics of students’ and tutors’ cognitive sphere in terms of research activity (RA) efficiency. Significant differences in flexibility and logic thinking between researchers with various levels of professional aptitude were traced. Students with high level of research potential (RP) showed a marked ability for situational analysis, knowledge implementation and consolidation, flexibility thinking and analytical style of thinking. Students with low level of RP demonstrated rigid thinking and limited capacity for abstraction. Relevant connections between RP components and certain characteristics of cognitive sphere were discovered.

Keywords: Student; Research potential (RP); Research activity (RA); Cognitive component of research potential; Questionnaire “Scientific research potential” (“SRP”).
1. Introduction

This study was conducted within a larger project on students RP run by the Department of Psychology and Education in Personal and Professional Development of St-Petersburg State University. RP is considered as subjective psychological qualities multi-dimensional all-level system that secures capacity for efficient and result-oriented work in achieving research goals (N.V. Bordovskaya et al., 2012). According to the adopted concept RP was divided into three main structural-functional components: conative, cognitive and performing (S.I. Rozum, 2012). Thorough RA analysis established the most vital personal cognitive qualities for carrying it out effectively: the ability to effectively operate with concepts, unique style of thinking, divergent facilities (creativity, verbal thinking), flexibility thinking, well-developed capacity for reflection (A.N. Poddyakov, 2006; N.N. Pachina et al., 2008). RA result is qualified as objectively or subjectively new information acquiring (A.V. Leontovich, 2003) or as a “breakthrough” in knowledge based on the previous data and human experience (E.R. Vazhnova, 2010).

V.D. Druzhinin (2007), M.A. Kholodnaya (2002) et al., point out four major intellectual aspects corresponding to four types of intellectual qualities or capacities:

- Convergent facilities
- Divergent facilities (creativity)
- Educability
- Cognitive styles

Each intellectual facility is considered to be intellectual characteristic deriving from individual mental experience content and structure particularities (V.N. Druzhinin, 2007; M.A. Kholodnaya, 2002). Our study concentrated on some of the researchers’ cognitive particularities that are part of the intellectual qualities listed above (learning capacity excluded). We sought to identify the cognitive patterns of researchers with different levels of professional aptitude and the cognitive patterns of students with different RP levels measured using an original questionnaire SRP.

2. Research description and methods

Research methods and procedure. Sample group consisted of 79 bachelor’s students from the Economics faculty, 40 master’s students from the History and Psychology faculties, 40 lecturers and tutors at St-Petersburg State University, 94 master’s students from the Institute of Childhood of the Russian State Pedagogical University named after A.I. Hertzen.

Blank versions of the following methods were used:

1. SRP (Scientific Research Potential) method created by the Department of Psychology and Education in Personal and Professional Development, assessing scientific RP level. This method allows general RP level measuring by adding up demonstrated intensity of conative, cognitive and performing component scores.

2. Intelligence structure test (TSI) by R. Armthauer, subtests 1-4 used convergent facilities and conceptual system assessing.

3. The questionnaire “Thinking Styles” by A.F. Harrison and R.M. Bramson (adapted by A.Alekseev, L.Gromova) for cognitive style assessing.

4. The test of verbal creativeness (RAT) by S. Mednic (version for adults, adapted by A. Voronin) for divergent facilities assessing.

5. A. Luchin’s test for flexibility/rigid thinking assessing (Psychological Workshop edited by L. Porkhacheva, K. Jus, 2009)


SPSS-20 was used for data processing.
3. Results

Master’s students sample group correlation analysis results show that the general RP level positively cross-links with theoretical abilities according to TSI, the analytical style of thinking, and negatively cross-links with the flexibility thinking. RP conative component positively cross-links with intellectual capacities according to TSI and the analytical style of thinking. RP cognitive component positively cross-links with the analytical style of thinking and the second TSI subtest. RP performing component positively cross-links with the analytical style of thinking, verbal intellect, theoretical abilities, the fourth TSI subtest and practical abilities. Significant relations throughout (p<0.05).

Cognitive particularities differences in students with various RP levels were analyzed in the sample group divided into three subgroups according to the total score on RP (SRP method):

- Group 1 – low RP level – 273-315 points – 30.8% of master’s students
- Group 2 – average RP level – 316-356 points – 35.9% of master’s students
- Group 3 – high RP level – 357-403 points – 33.3% of the master’s students

Significant differences were assessed using Mann-Whitney U test through pairing each group results. All below differences are significant (p<0.05, p<0.001).

Significant differences according to TSI were revealed in the first subtest (problem specification analysis) between the subgroups with average and high RP levels, in the fourth subtest (level of abstract thinking) subgroups with low and high RP levels and subgroups with average and high RP levels (see Graph 1). The TSI first and fourth subtests results are therefore undergoing a nonlinear variation depending on the RP degree demonstrated by the master’s students. The best results were shown in the subgroup of students with high RP level.

![Graph 1. TSI subtests 1 (a) and 4 (b) indicators in master’s students groups with low, average and high RP levels](image)

Significant differences were obtained in the analytical style of thinking degrees in different subgroups, there were the lowest figures in the subgroup with low RP level, and the highest figures with high RP level. The subgroup with low RP level scored much higher than those with average and high RP levels in pragmatic style of thinking (see Graph 2).
An index of originality according to RAT appeared to be much higher in the subgroup with average RP level compared to low and high RP levels. An index of uniqueness according to the same test was much lower in the subgroup with low RP level than with average and high RP levels (see Graph 3).

Flexibility thinking assessment results according to A. Luchin’s test were much higher in the subgroup with high RP level than with low and average RP levels (see Graph 4).
We also attempted to qualify cognitive sphere differences between the study groups with various professional aptitude levels (bachelor’s students, master’s students, tutors) and obtained the following significant results (p<0.05).

Flexibility and logic thinking results among tutors are better than in two other groups (bachelors and masters). Tutors’ results were matched by the rest (see Graph 5). There were no significant differences in the original style of thinking between the groups.
4. Discussion

Research potential is an important prerequisite for the successful research activity. Cognitive component and its particular characteristics play the substantial role in the RP structure. However not all of them contribute equally to RP and relate differently to the other components, such as conative and performing.

Professional growth for example depends more on flexibility and logic thinking development, whereas original style of thinking appears to be personal cognitive quality not subject to enhancement through study or research. Given the RA character it would have seemed plausible for the high RP level to be greatly connected to the original style of thinking (according to the Mednic test). However our data does not bear this out. According to the same test uniqueness as a characteristic of thinking is more prevalent in people with a higher RP level. This fact merits a more careful analysis of “originality” and “uniqueness” in the Mednic test.

On the whole results obtained conform to the initial expectations based on academic literature analysis.

5. Summary and Conclusions

1. Cognitive patterns at various RA levels differ greatly. Bachelors have the lowest figures in flexibility and logic thinking; masters demonstrate average level of logic thinking and low level of flexibility thinking; university tutors have score high on flexibility and logic thinking.

2. People with high RP development level showed the following distinctive features of the cognitive sphere: remarkable capacity for situational analysis, knowledge implementation and consolidation, high flexibility scores and marked analytical style of thinking and steady resistance to pragmatic style of thinking. Simultaneously this group is characterized by average originality thinking and high uniqueness thinking as shown in RAT.

3. People with low RP development level showed the following distinctive features of the cognitive sphere: underdeveloped abstract thinking, average capacity for situational analysis, dominant pragmatic style of thinking, average original thinking, low uniqueness and flexibility thinking.

Obtained results complement published data on existent complex, non-linear cross links between various cognitive characteristics and effective RA.

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7. References


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