

Humanistic Approach to Teaching the Course in Mathematics

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Abstract – The aim of the present research is to attain understanding about topical issues of pedagogy of the 21st century: humanization of the teaching process, the main principles of humanization of school, possibilities to apply humanization of school in teaching math at high schools and universities, working out the recommendations that would improve math teaching process. The object of the study is learners from two different educational institutions: Ozolnieki Secondary School, Jelgava District, and 1st year students of Riga Technical University (students originally come from various secondary educational institutions and places in Latvia). As the result of research certain conclusions concerning creation of new educational environment for math studies have been drawn.

Keywords – humanization of the study process, humanistic approach to teaching mathematics

I. INTRODUCTION

In Latvia there is a certain disparity between employer demand for qualified employees and the resources of the educational system. The ability to quickly improve the qualification or re-qualify is required in the labor market. Currently, the economy is getting reoriented from the production of goods to the provision of services. Studies attest that in Latvia

- Workforce expenses are gradually increasing, and the number of economically active people in the workforce is decreasing.
- Currently individual spheres face lack of workforce (building, trade, health care). In future, this problem can affect wider economic segments.
- According to the forecasts of the Bank of Latvia, by the year 2015 200,000 economically active citizens will gradually leave the country, thus further decreasing workforce supply in Latvia.

The lack of qualified workforce is an urgent problem in the world. The only way to ensure prosperity and competitiveness of the workforce in the labor market is to create new study programs with wider specialization opportunities and with more elective study courses supplementing basic professional courses. Therefore, nowadays great emphasis must be put on the development of lifelong education programs. That is why it is important to humanize the study process, it means to approach educational content and its acquisition process using the principles of humanistic recognitions, taking into consideration the interests and abilities of the student. It foresees [1]:

- development of human values;
- self-confidence, self-values, self-reflections and at the same time increased awareness of the needs of the others;

- educational process centered on students, actively involving students into problem solving activities.

Humanization of education is a hot topic both in Latvia and in other post-Soviet countries. These countries have experienced transition to democracy and market economy. The changes of socially political principles of life have determined new demands set forth to education, which should focus on the child as an individual.

II. THE ATTITUDE OF THE STUDENTS TOWARDS MATHEMATICS

Learning of mathematics at school is a long, continuous process that starts in grade 1 and continues in higher educational institutions. The motivation of learning math changes during the learning process. When working with students at the university, lecturers have to take into consideration that students have developed different levels of knowledge and different attitude towards mathematics during their studies at the secondary school. The aim of the present study is to follow students' experiences in the acquisition of mathematics and to find out the causes of the change in their motivation to learn.

The object of the study is the learners from two different educational institutions: Ozolnieku Secondary School, Jelgava District, and 1st year students of Riga Technical University (RTU students originally come from various educational institutions and places in Latvia).

Summarizing the answers about the biographies of the learners of mathematics, namely, seventeen 10th-grade students and twelve 12th-grade students of Ozolnieku Secondary School, as well as 86 1st year students of the Faculty of Civil Engineering of Riga Technical University, the following results about the learners' attitude towards the subject of mathematics have been obtained (see Table I):

TABLE I
LIKE OR DISLIKE FOR MATHEMATICS

| | RTU | School |
|------------|-----|--------|
| Like | 28% | 26% |
| Dislike | 17% | 12% |
| Cannot say | 55% | 62% |

III. MOTIVATION OF STUDENT IN DIFFERENT AGE GROUPS

Diverse attitude towards mathematics must be taken into consideration when working with the learners, and if

necessary an attempt to change it should be undertaken to reach good results. Examining the change of attitude towards mathematics at the primary school, it can be noticed that a teacher's personality and their level of proficiency appear to be the main affecting factors. Students like mathematics if the teacher explains everything and promotes the willingness to learn and search, to comprehend the interrelations between figures and numbers, if the students do not get bored during the lesson and feel good.

Almost all students in grades 1–4 have a positive attitude towards mathematics, except the cases when the teacher raises the voice to the students. Difficulties and the change of attitude usually occur in grades 7–9, when the motivation to study decreases, and students have to solve more complicated tasks, which require greater intellectual effort. Psychological peculiarities of this age group should also be taken into consideration. They should be treated with greater tolerance and thoughtfulness; the teachers should demonstrate the ability to raise interest in all students. One of the respondents writes: „I like math if I understand the material”. If a student makes calculations and does not understand the cause of mistakes, they discontinue their effort, and protest and indifference towards the subject appear [2].

The number of students in the class was also mentioned as a barrier to the acquisition of mathematics. If there are too many students in the class, students find it difficult to concentrate on work, and the teacher does not have an opportunity to approach every student and explain incomprehensible topics.

If the lessons are interesting, the teacher is smiling and well-disposed, mistakes are explained tolerantly, students gain satisfaction and joy during the time spent for learning mathematics, and that creates a positive motivation for the acquisition of mathematics. A lot of students admit that their emotional attitude towards mathematics as well as their academic achievements change when the attitude towards the teacher of mathematics changes, and when they develop trust in him or her.

If secondary school students blame teachers mainly for the difficulties in the acquisition of mathematics, students from Riga Technical University blame themselves for not having made enough effort to acquire the material of the secondary school. Students spend more time to solve one task (100–120 min), whereas secondary school pupils spend ~10–60 min.

As a motivation to learn mathematics, secondary school students mention that it will be useful at university, as well as it helps to do different calculations at work. It may be maintained that they are aware of the practical use of mathematics in real life.

Summarizing the results of the questionnaire, it may be observed that a teacher's personality plays a major role in the process of learning of mathematics. A pedagogue should not discourage the existing curiosity in the children during the first school years, should promote interest and joy of cognition throughout the years in primary school, secondary school and also university years. The teacher must establish

emotional contact and rapport with the students, must ensure that there is willingness to achieve the result and correct the mistakes, must respect each student as an individual with their own abilities and psychological peculiarities. These aspects must be taken into consideration when planning the work methods and tasks [3]. Students inquire whether it is possible to get back the money invested in education. That is why the career choice must be carefully considered. Students are interested in not just getting a diploma, but also in obtaining quality education. So the level of absenteeism at the lectures and cheating at the tests and exams are decreasing. Students and tertiary education institutions enter consumer – service provider relationships. Students demand education of high quality, that is why universities must ensure it to be able to compete.

Students from Ozolnieki Secondary School as a motivation to acquire mathematics mention also the fact that the knowledge of it will be useful at university, and also during career it is easier to do different sums, it means, they understand and feel the practical use of mathematics in life.

Orientation towards the success or failure (the type of motivation) was only characteristic for several students, that is why the gained results are not representative. One fact has been attested: there is no direct correlation between the success of the acquisition of mathematics and the type of motivation. It is possible that the link could not be established because the Reans Test is about motivation or a special occasion – motivation to acquire mathematics.

Multiple or 7 types of intelligence were determined among 27 students (see Table ii). Howard Gardner's Test is aimed at identifying the following types of intelligence:

Designation:

- G1 – Linguistic intelligence;
- G2 – Logical-mathematical intelligence;
- G3 – Visual-spatial intelligence;
- G4 – Musical intelligence;
- G5 – Interpersonal intelligence;
- G6 – Intrapersonal intelligence;
- G7 – Bodily-kinesthetic intelligence.

TABLE II

DOMINANT TYPE OF MULTIPLE INTELLIGENCE

| | Type of intelligence | Number |
|-----|-----------------------------|--------|
| G-1 | Linguistic | 4 |
| G-2 | Logical-mathematical | 2 |
| G-3 | Visual-spatial | 5 |
| G-4 | Musical | 0 |
| G-5 | Interpersonal communication | 4 |
| G-6 | Intrapersonal | 9 |
| G-7 | Bodily-kinesthetic | 3 |

The test was undertaken by 27 respondents. The most frequently detected dominant type of intelligence is intrapersonal (9 respondents). It is interesting to note that

none of 27 respondents demonstrated dominant musical intelligence.

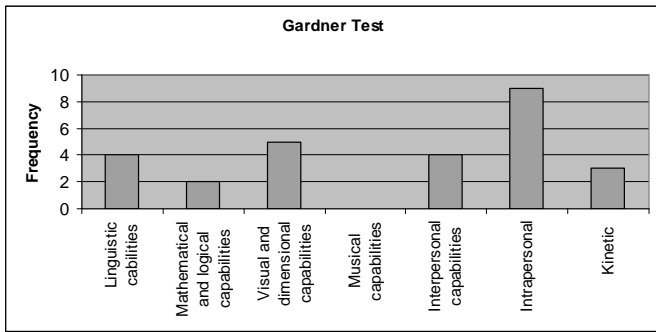


Fig. 1. Gardner Test

Amthauer's Test to measure general intellectual abilities was used on a much greater scale, it was given to 84 students (see Tables 5-10).

R. Amthauer's Test results:

Designation:

I total – The first part of the test measuring Verbal Intelligence;

II total – The second part of the test measuring Numerical Intelligence;

III total – The third part of the test measuring Figural Intelligence;

Total – Total results (I, II and III together).

The closest correlation is noticeable between parts I and II of Amthauer's Test (that is, between Numerical and Figural Intelligence), correlation ratio is 0.663. Weak positive correlation is observed between parts I and III of the test.

TABLE III

SUMMARY OF AMTHAUER'S TEST

| Number of points gained | Frequencies (number) | | |
|-------------------------|-------------------------------|-----------------------------------|----------------------------------|
| | I part Verbal Intelligence | II part Numerical Intelligence | III part Figural Intelligence |
| 0 | 0 | 3 | 12 |
| 1 | 4 | 5 | 13 |
| 2 | 14 | 8 | 6 |
| 3 | 19 | 5 | 8 |
| 4 | 22 | 7 | 7 |
| 5 | 16 | 9 | 13 |
| 6 | 7 | 10 | 9 |
| 7 | 2 | 14 | 2 |
| 8 | 0 | 12 | 9 |
| 9 | 0 | 6 | 5 |
| 10 | 0 | 5 | 0 |
| Total | 84 | 84 | 84 |

TABLE IV

DESCRIPTIVE VALUES OF AMTHAUER'S TEST

| | I total | II total | III total | Total |
|------------------------|---------|----------|-----------|-------|
| Total number | 313 | 467 | 327 | 1107 |
| The arithmetic mean | 3.73 | 5.56 | 3.89 | 13,18 |
| Maud | 4 | 7 | 5 | 15 |
| Median | 4 | 6 | 4 | 14 |
| Standard deviation | 1.42 | 2.74 | 2.85 | 5,74 |
| Smallest value | 1 | 0 | 0 | 3 |
| Biggest value | 7 | 10 | 9 | 25 |
| Distribution range | 6 | 10 | 9 | 22 |
| Number of the observed | 84 | 84 | 84 | 84 |

TABLE V

CORRELATION BETWEEN THE THREE PARTS OF AMTHAUER'S TEST

| | I part | II part | III part |
|-----------|--------|---------|----------|
| I Total | 1 | | |
| II Total | 0.36 | 1 | |
| III Total | 0.30 | 0.66 | 1 |

The closest correlation is observed between parts I and II of Amthauer's Test (that is, between Numerical and Figural Intelligence), correlation ratio is 0.663. Weak positive correlation is observed between parts I and III of the test.

TABLE VI

COMPARISON OF RESULTS AFTER AVERAGE QUANTITIES

| | parts I and II | parts I and III | parts II and III |
|----------------|----------------|-----------------|------------------|
| 1 and 0 | 18% | 21% | 14% |
| 0 and 1 | 18% | 19% | 12% |
| 1 and 1 | 38% | 35% | 42% |
| 0 and 0 | 54% | 25% | 32% |

1 - the number of answered questions above the average level in the corresponding part of the test,

0 - the number of answered questions below the average level in the corresponding part of the test.

From the table it can be observed that the number of respondents whose answers were above the average level in Part I of Amthauer's Test, but below the average level in part II is equal to 18%. The number of respondents whose answers in two parts of the test (I and II) are above the corresponding part of the test is 38%. The number of respondents whose answers in two parts of the test (I and II) are below the corresponding level of the test is 54%.

Similar conclusions can be made about parts I and III, and about parts II and III.

TABLE VII
TABLE OF FREQUENCIES OF TOTAL AMTHAUER'S TEST RESULTS

| Number of points received | Frequency | Relative frequency |
|---------------------------|-----------|--------------------|
| 3 - 5 | 10 | 12% |
| 6 - 8 | 12 | 14% |
| 9 - 11 | 9 | 11% |
| 12 - 14 | 14 | 17% |
| 15 - 17 | 19 | 23% |
| 18 - 20 | 12 | 14% |
| 21 - 23 | 8 | 10% |

TABLE VIII
DESCRIPTIVE QUANTITIES OF THE AMTHAUER'S TEST RESULTS

| Geometrical imagination abilities | |
|-----------------------------------|------|
| The arithmetic mean | 5.6 |
| Median | 6 |
| Maud | 8 |
| Standard deviation | 2.3 |
| Skewed | -0.3 |
| Distribution range | 8 |
| Smallest value | 1 |
| Biggest value | 9 |
| Total sum | 257 |
| Number of measurements | 46 |

TABLE IX
CORRELATION COEFFICIENT OF PART THREE OF AMTHAUER'S TEST AND RESULTS OF GEOMETRICAL IMAGINATION ABILITIES TEST

| Correlation | | |
|-------------|-----------|---------|
| | III Total | G Total |
| III Total | 1 | |
| G Total | 0.59 | 1 |

Relatively close positive correlation is observed, when the number of correct answers increases in one test, it increases also in the second one.

It was interesting to compare the results of the same students obtained in Amthauer's Test and in the „geometrical” part of the test of mathematical intelligence (see Table 9).

IV. CONCLUSIONS

Working with adults, a pedagogue must be ready both to change the interaction roles and to use a variety of teaching methods.

Study materials that are appropriate to the adult skills and psychological readiness are necessary for a qualitative study process.

Teachers and lecturers must adopt a humanistic approach to teaching mathematics by introducing interactive teaching methods and developing study tools for students' individual work.

To ensure the continuity in the learning process of mathematics, cooperation between secondary school teachers and university lecturers must be encouraged. It may be promoted by sharing experience, looking for new working methods and developing new study materials at joint meetings.

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