Questionnaire analysis related to the lesson:

"Witelo's studies on rectilinear propagation of light"

by Justyna Chojnacka

The *Questionnaire* that was recommended to complete before and after conducted lesson has been prepared within the framework of international project HIPST. The questionnaire is divided into two parts. The first part consists of questions such as: what is science, what are the conditions of the scientific work, who is a scientist, whether the students are aware of the fact that the achievements of science are used in everyday life. Students respond to the individual questions using the Likert scale choosing from among five items: *No (strongly disagree), rather No (disagree), I don't know (neither agree nor disagree), rather Yes (agree), Yes (strongly agree).* The second part consists of 15 affirmative sentences each one describing two types of People. Students had to determine with which type they identify. They had two options to choose: the type of person who describes me either moderately or strongly. Students completed the Questionnaire twice: before and after the lesson.

The questionnaire has been carried out in the second class of higher secondary school (adolescents of 18 years) with mathematical - physics profile. In total, it was completed by 18 People, including 13 men and 5 women.

Below, I insert a chart with a brief commentary, illustrating how the attitude of students towards the science and scientists has changed after the lesson: "Studies of Witelo on the rectilinear propagation of light". The first than the second part of the questionnaire will be discussed.

Part one contains 22 statements divided into 3 subgroups: those concerning science, its universality, scientists and their conditions of work as well as our impact on discoveries made and research work. Students ticking the box determined consistency (or inconsistency) with the opinion stated in the sentence. The first subgroup consists of 11 sentences such as:
"In science, most of the questions have only one correct answer, Science helps us understand the world, In science the truth is always the same, Science is only for men/women".

Before the lesson on rectilinear propagation of light 10 out of 18 pupils stated that in science rather most of the questions have only one correct answer and only one person was strongly against. After the lesson the students view of this fact has not changed significantly (Fig.1).

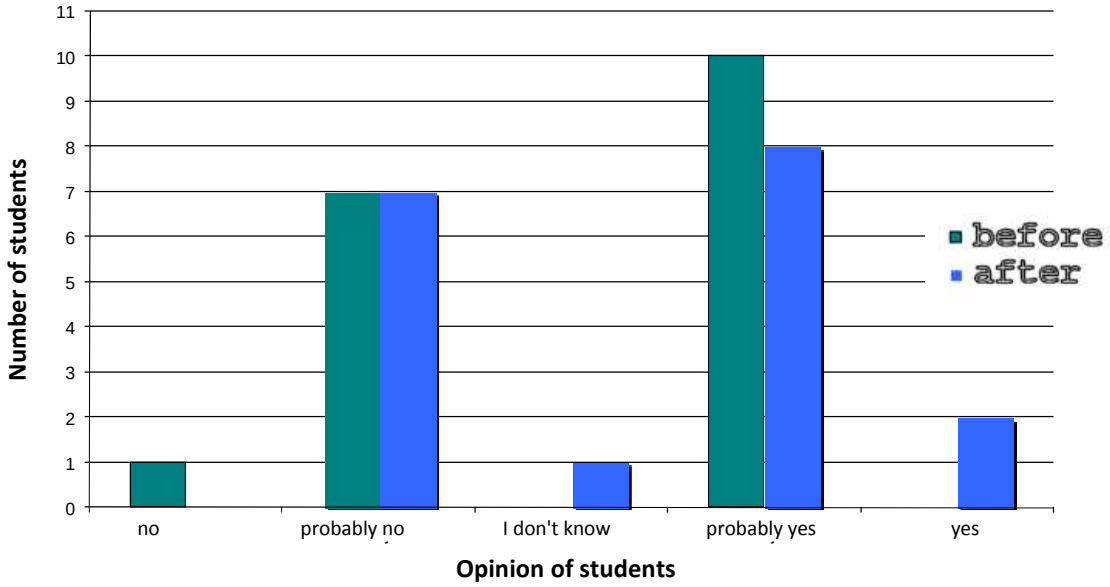


Fig.1. Trends presented by students concernig the statement: „In science, most of the questions have only one correct answer"

Almost every student (before the lesson 12 out of 18, after the lesson 11 out of 18) believes that the contents of the scientific books are true. There is one question remaining: are the students able to distinguish scientific books from popular- science and pseudo - science and the truth contained in which of them they consider to be unquestionable (Fig 2).

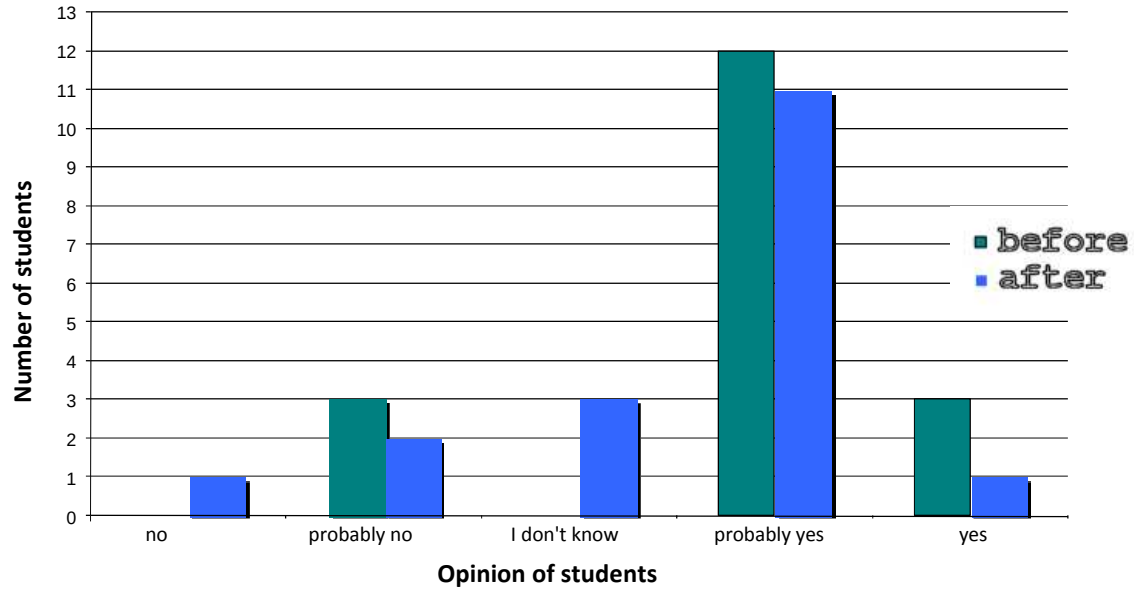


Fig.2. Trends presented by students concerning statemen: „If you read something in the scientific book – that is true for sure.

Students are aware that science allows us to understand the world and makes our lives easier and more comfortable. 16/18 students find science explaining the processes occurring on Earth and in the Universe (Fig 3,4).

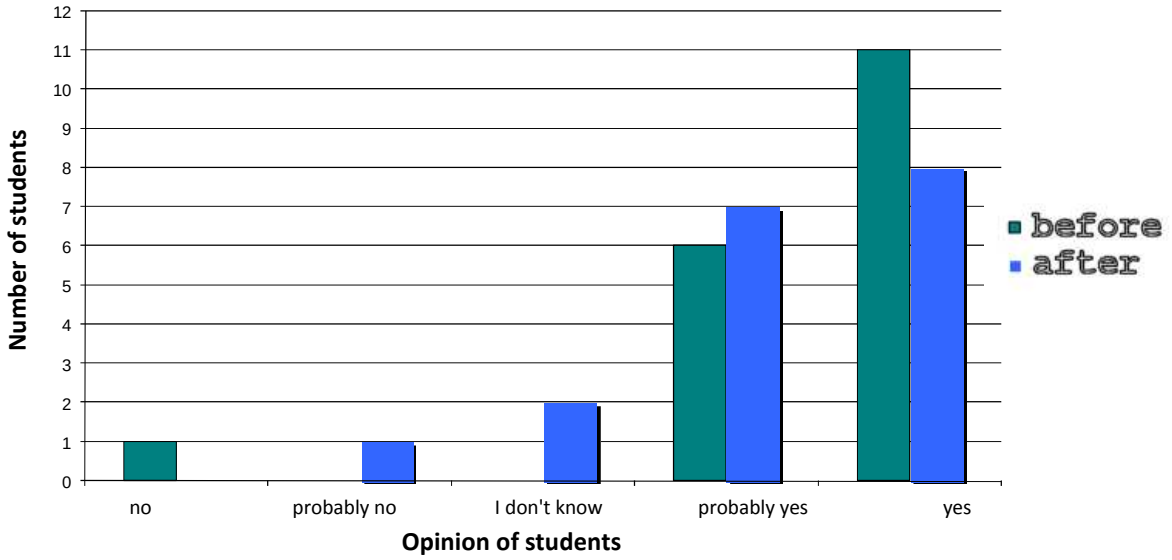


Fig.3. Trends presented by students concerning the statemen:: Science helps us to understand the world"

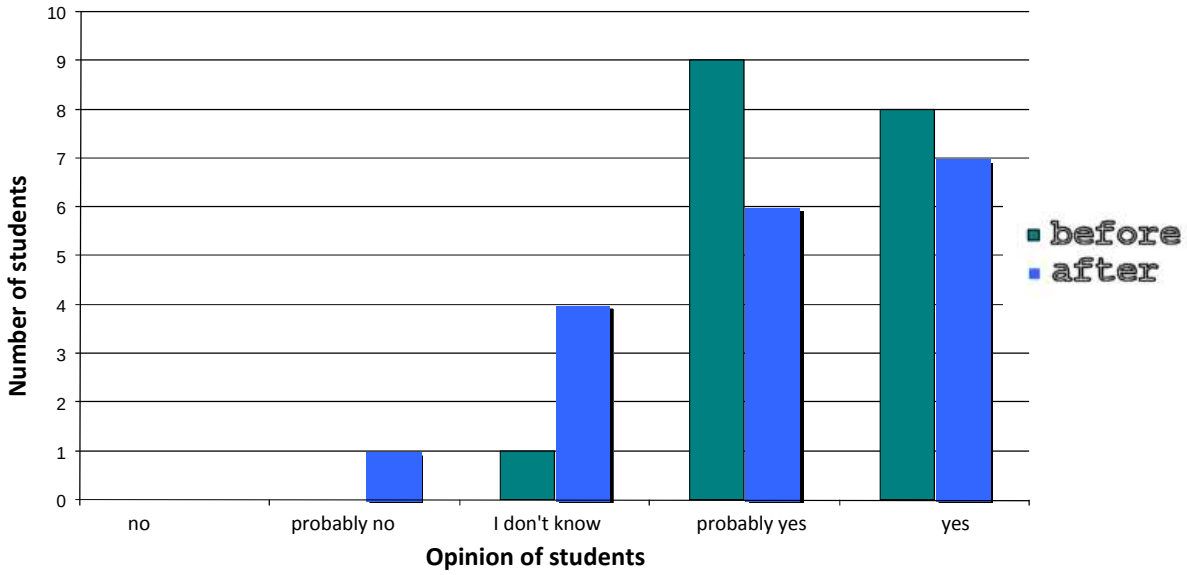


Fig 4. Trends presented by students concerning the statemen:„ Science helps make our life happier and much more comfortable".

Enjoying is the fact that students do not identify science with only one gender e.g. they assume that a good scientist might be both a man and a woman. Nevertheless, it can be seen that a more specific answer on this issue was granted before the lesson. Results of the questionnaire conducted after the lesson on Witelo are more scattered in other answers, although still indicate equality between men and women. It is probably due to the fact that it was the boys that showed greater brilliance, creativity and curiosity than girls. (Fig 5,6).

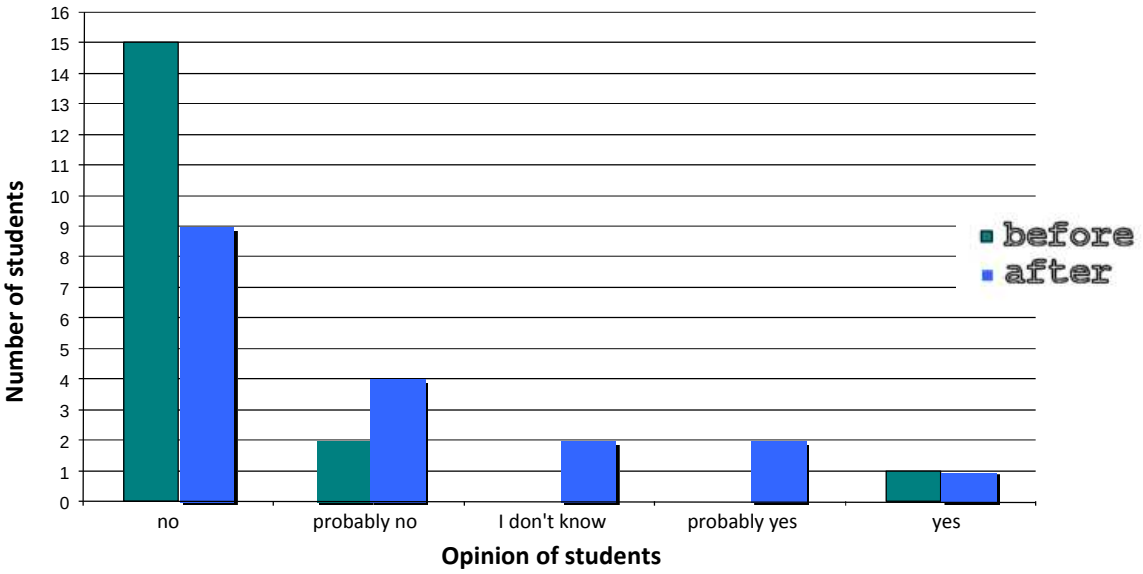


Fig.5. Trends presented by students concerning the statement: „Science is only for man”

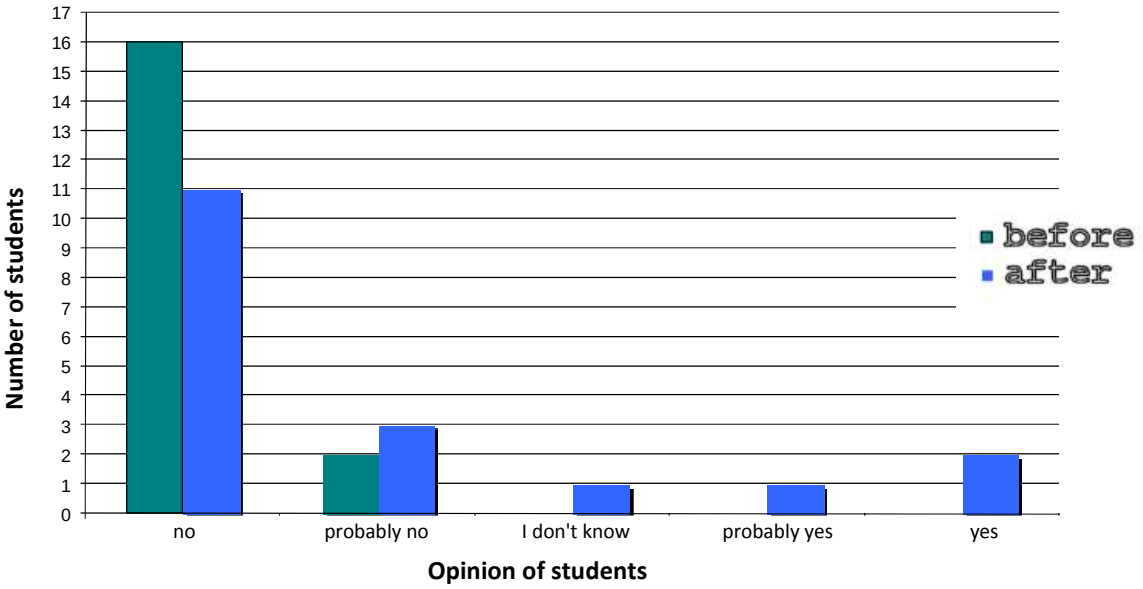


Fig.6. Trends presented buy students concerning the statement: „Science is only foe woman”.

Surprisingly , according to 11/18 students science is not only for gifted people. After participating in individual scientific work the number dropped to 4/18. (Fig 7)

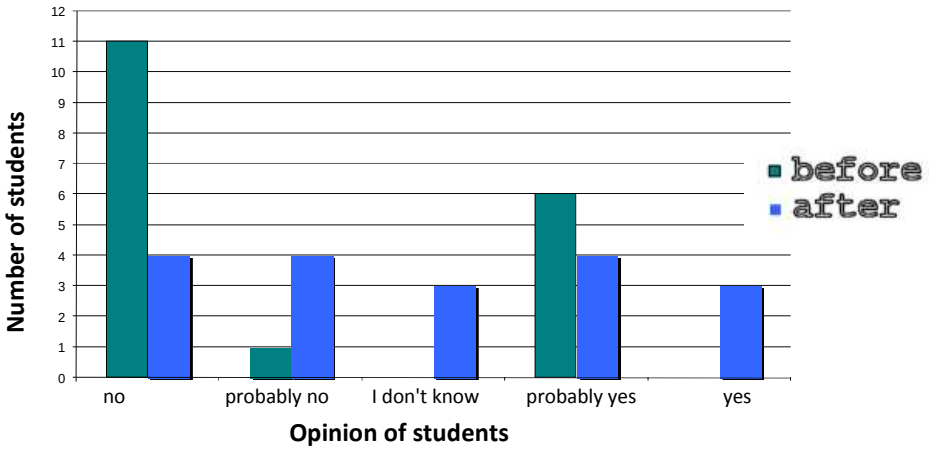


Fig.7. Trends presented by students concerning the statement: „Science is only for gifted students"

Sentences in second subgroup are connected to scientists, their work circumstances and applied research methods.

Students show a rather poor knowledge of scientists lives. They do not realize that national policy, the economy, financial situation as well as place of residence, etc. have great influence on their development. That explains a great number of answers – neither agree nor disagree.

After presenting the situation in medieval (superstitious) Europe, a strong impact of the Church on the science and scientists, and how Witelo's views on many issues differed from generally accepted, the pupils realized that the way we live and how we live influence the way we reason (Fig 8,.9).

Students generally assume that scientists conducting research use different scientific methods and conduct research using different methods so they can explain one thing in a variety of ways. (Fig 10,11)

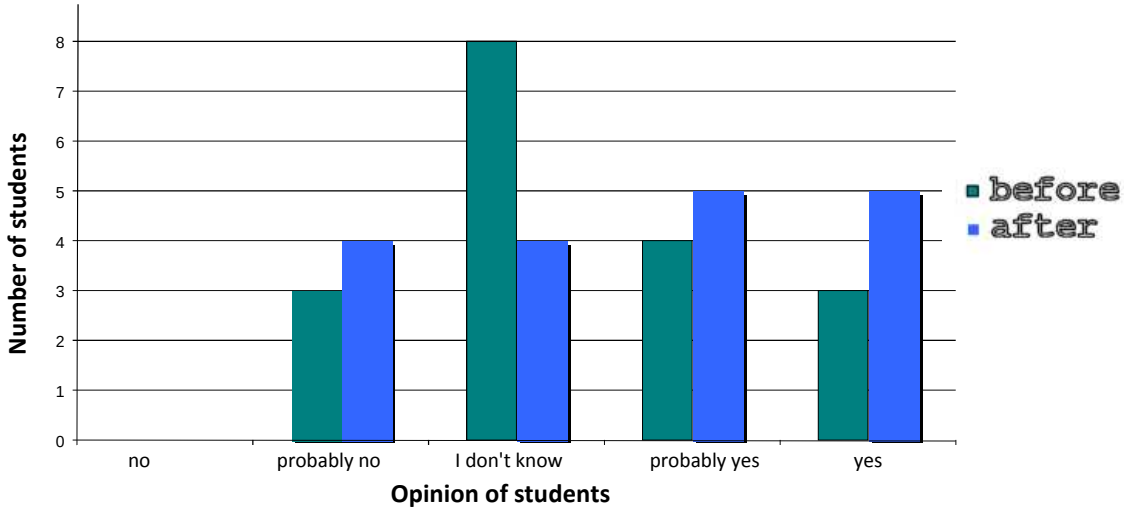


Fig.8. Trends presented by students concerning the statement: „Scientists are influenced by the conditions of their life: economy, religion, art".

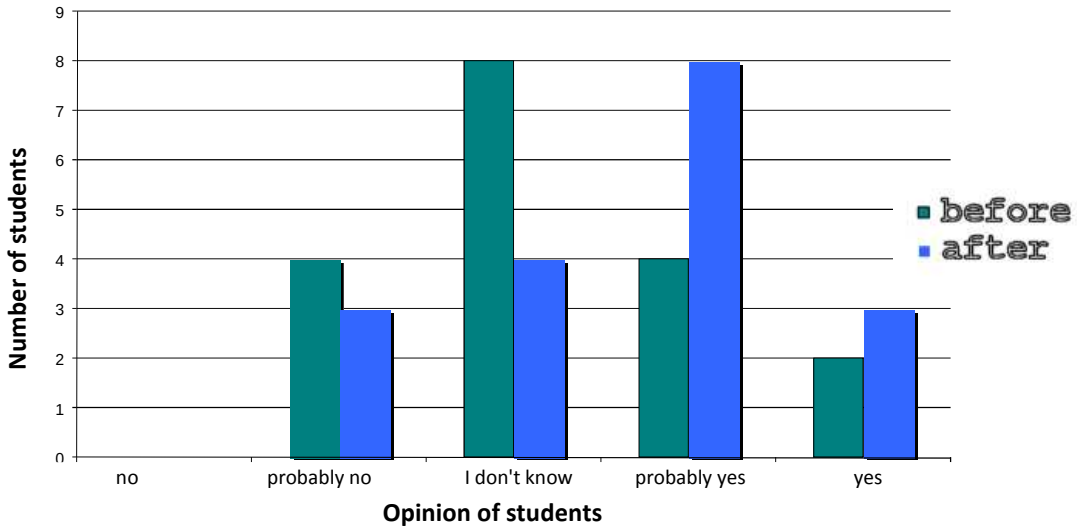


Fig.9. Trends presented by students concerning the statement:„ Scientists are influenced by the ways they live. For example through their families, financial situation, place of living".

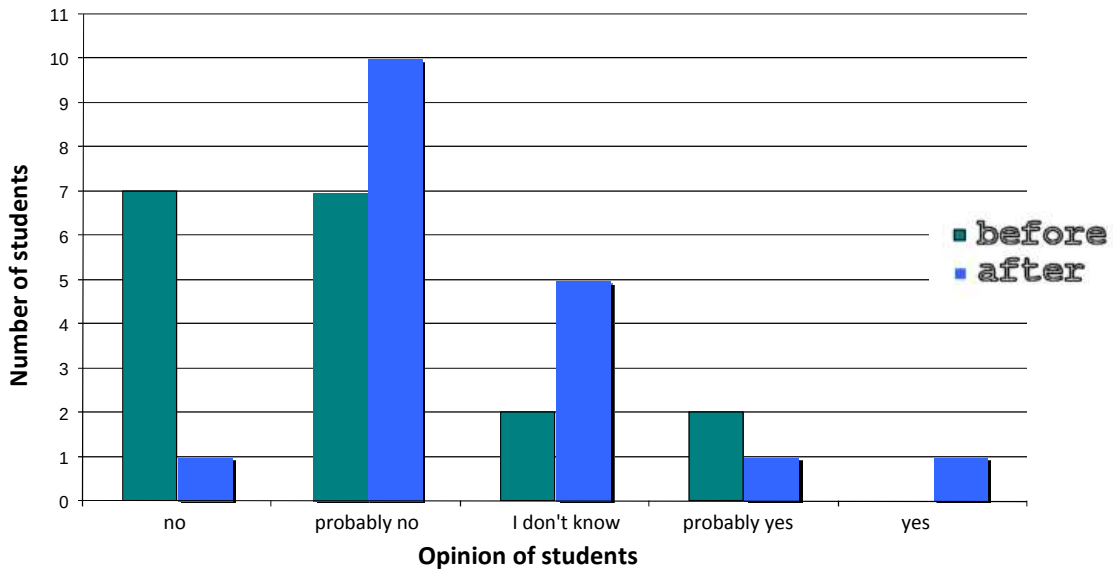
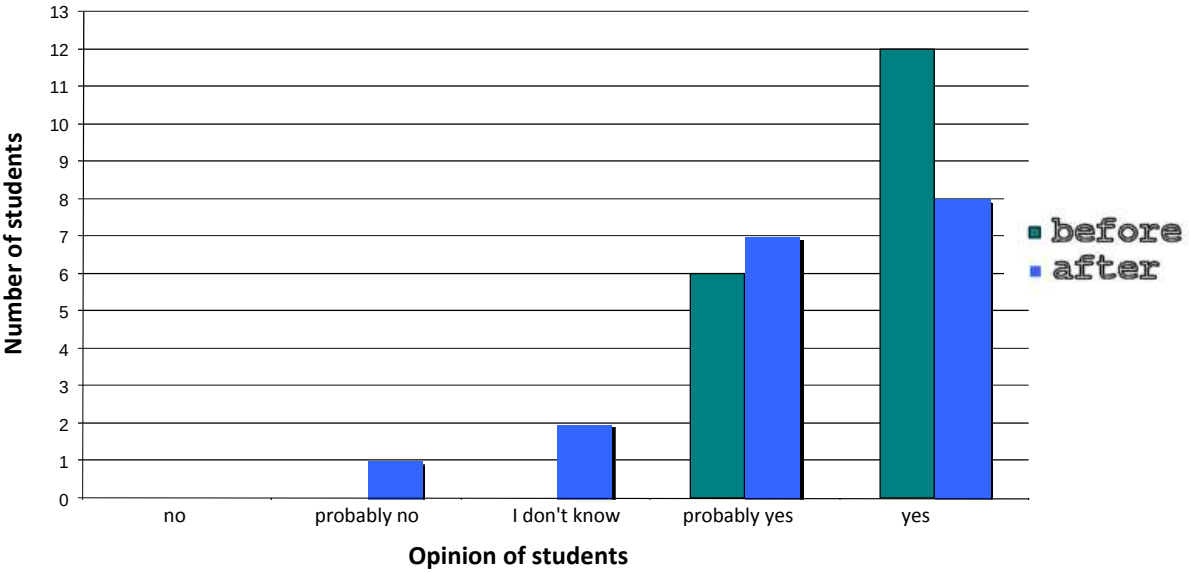
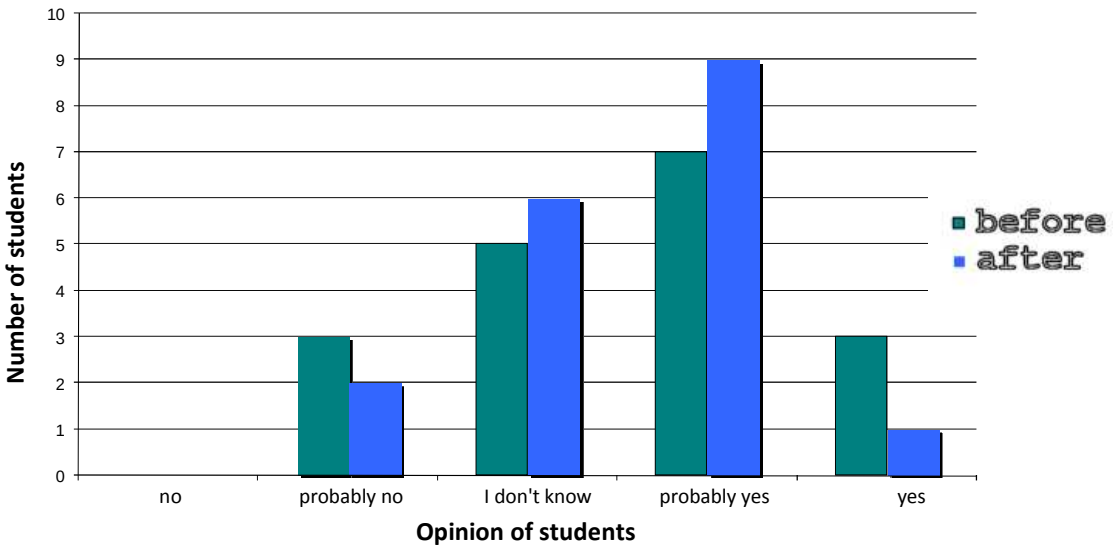


Fig.10. Trends presented by students concerning the statement: „ All scientists conducting research use the same scientific method".

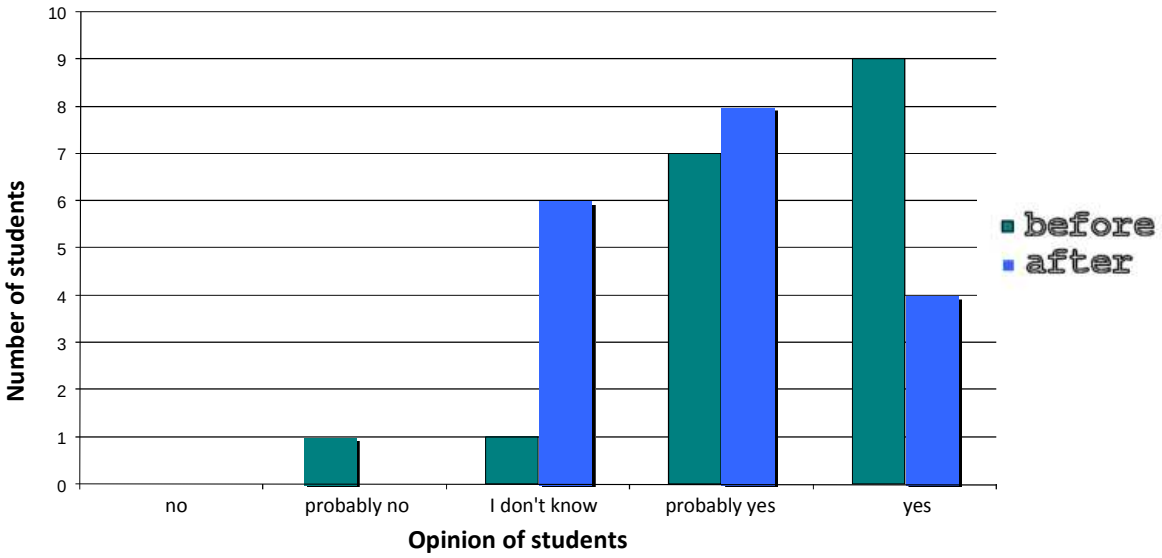


Rys.11. Trends presented by students concerning the statement:" Scientists conduct research using different methods".

Sentences from 18 to 22 indicate the degree of people's awareness that science or rather its achievements are used by us every day and that to a large extent we influence what the research are conducted on suggesting the need for a specific technique, technology, etc. (Fig. 12,13).



Rys.12. Trends presented by students concerning the statenent:„ The way scientists are conducting research is fluenced by needs of other People.



Rys.13. Trends presented by students concerning the statement:„ All of us are responsible for the way of using results of scientific research in the everyday life".

The second part of the Questionnaire consists of 15 statements describing two types of People. Students by ticking box determine the extent to which they identify with the types of People: moderately or strongly. Sentences describing particular types of People do not differ much from each other, they revolve around the same topic: Do students demonstrate the independence in discovering law of nature? Hence, my general summary of the second part of the questionnaire.

Students (adolescents of school age) like self –reliance when working on the lessons of natural science. 15/18 people pointed out that sentence concerning the independence of working on lesson described them perfectly. They demand teacher to engage only slightly by establishing the research topic. At the same time, students are willing to work as a team - 14/18 students announced after the lesson that this type of person described them. It is easier for them to discuss, call into question the observations made or draw conclusion in a group of their peers rather than discuss them with their teacher. For young people, for whom the natural science is not a favorite course, the ability to independently carry out simple "scientific" research is a big challenge and great fun. Lessons in which students make their own experiments are for most of them attractive. At the same time making an effort of experiments students realize how difficult it is sometimes to understand anything related to science.

The following charts (Fig.14,15,16) show the trends among the students described above.

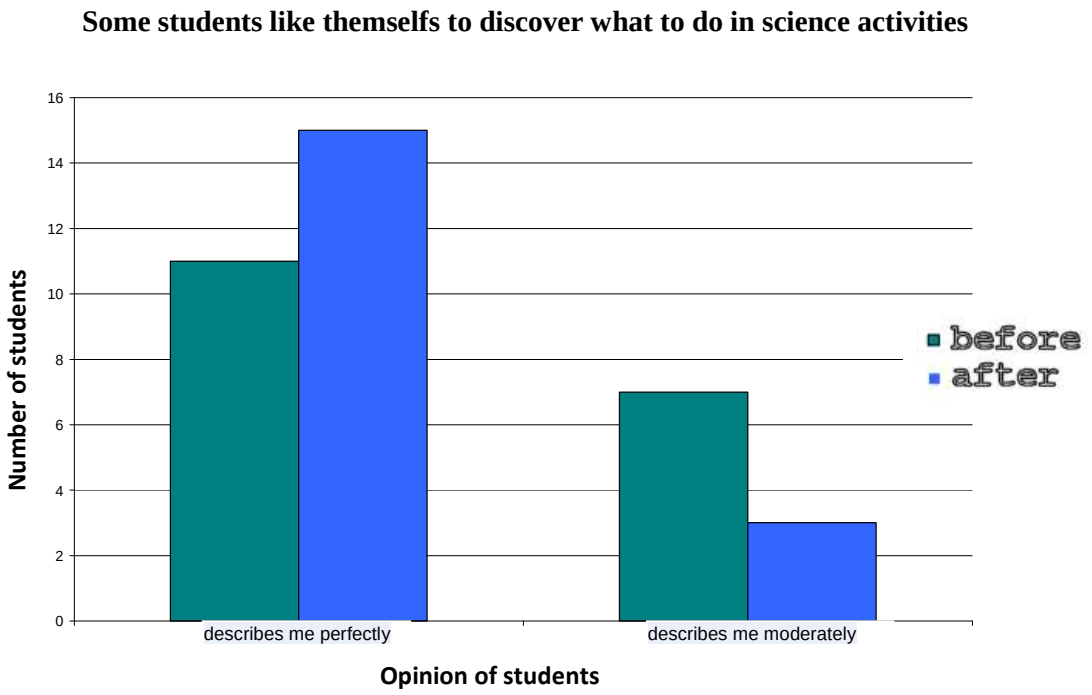


Fig. 14. Trends presented by students related to self-reliance work during the lessons

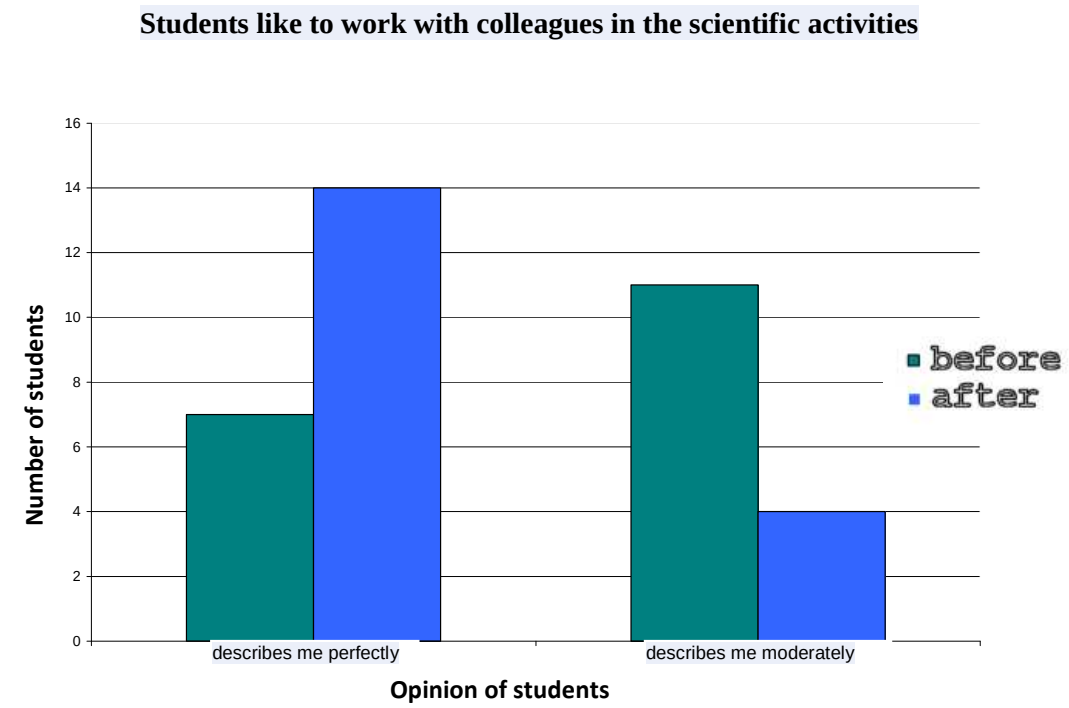


Fig.15. Trends presented by students related to working in team at science lessons.

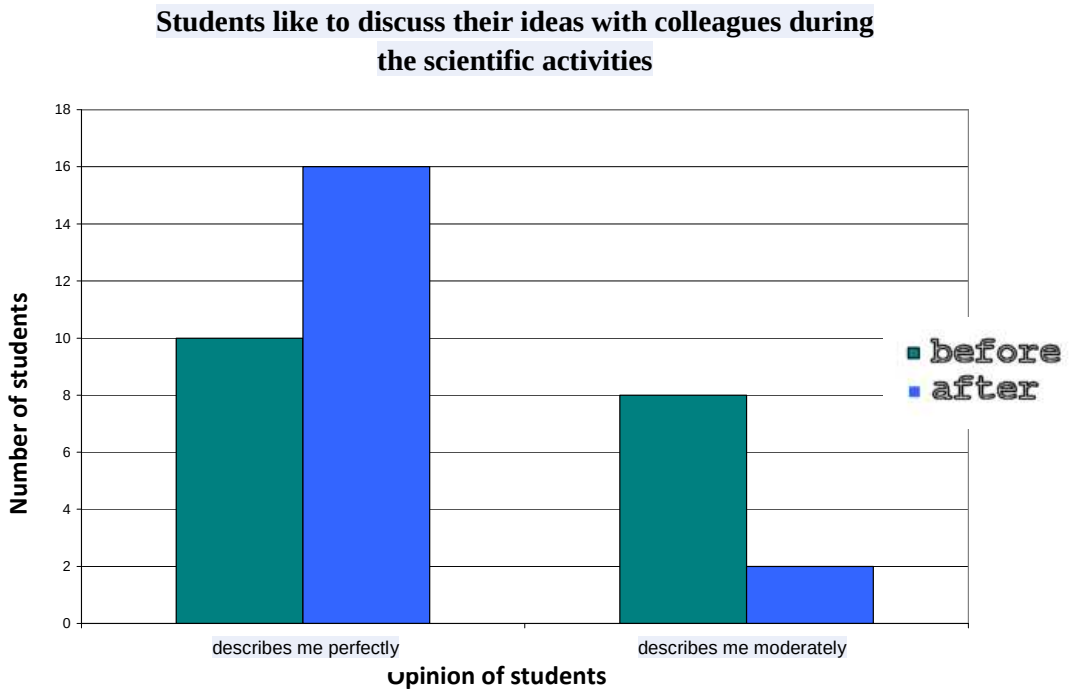


Fig.16. Trends presented by students related to discussion with colleagues at science lessons.