
The process of teaching mathematics carries huge difficulties in understanding certain definitions, theorems or facts, which usually are written in adequate symbols. Proper understanding of information included in mathematical notation as well as logical structure of the notation itself is a basic rule of acquirement of mathematical knowledge. Wrong insight into the logical structure of mathematical sentences may be the cause of students failure during their learning and it can provide wrong impression on the studying case.

The article introduces the sketch of the idea of the research about students’ understanding of the logical structure of mathematical problems and the way of using that structure in the process of correction false mathematical statements. Presented tests allow to distinguish preferences of the particular student – factual or logical aspects of mathematical truth. Places, where students make a correction in every sentence, tell us a lot about their choices – if they are interested only in factual meaning of the complex mathematical sentence or if they are also interested in logical structure of that sentence. Some results of the research and analysis of those results, as well as the main goal and short characterization of the research itself are presented in the following article.

Keywords: didactics of mathematics, sentencial logic, reading of mathematical text

When we learn mathematics we constantly start off different mathematical activities – the specific intellectual operations, and only undertaking those kinds of activities allows us to understand, what mathematics really is. For that reason, good navigation into direction of that activity seems to be very important. That navigation can be provided by, for example, aiming ourselves with rational instructions and solving well chosen mathematical problems. Teacher’s assistance is essential here, his role is to guide his students through various roads, setting down their goals. He should not keep their hands and show them the correct road, but quite the opposite, he should sometimes let them make mistakes, just to see the cause of their fails and not allow to do similar mistakes again. The teacher’s goal should be constant developing students’ creative attitude, which lets them not only to get the upper reaches of mathematical creativeness, but also it makes it possible to get rational thinking in other disciplines, not apparently connected with mathematics.

We can consider operation character of mathematical language as a natural consequence of the mathematical activity and then, finding optimum of the linguistic precision becomes a general aim and a goal itself. Language of the mathematics is built of specific symbols, proper terminology and common language,
so working out optimal forms of elementary mathematical language and looking for the most effective methods of exploring students’ language (Krygowska, 1977). Teachers should be aware that coming from the language of concrete things to the language of symbols, from words to signs, makes a basic difficulty for their pupils (Krygowska, 2003). More difficulties the mentioned author sees also in ambiguity of symbols and psychological problems of bringing together automatic and conscious applying of symbols. The ability of using common language students have had since their early childhood and they are still improving it in the process of permanent education. Language of mathematics is very artificial for a student and, besides it partially derives from every-day language and it is strictly connected with natural communication, it is deprived of both emotions and feelings (Kania, 2015).

In literature we can find two different conceptions of teaching elements of logic, especially in reference to propositional calculus. The first conception is based on introducing elements of logic in two separate stages. Initially, students need to be shown the implicit regularity in mathematical reasoning, not officially, but purposefully. The other stage is based on formal course of mathematical logic to accomplish some synthesis and generalize previous experiences and intuitions. The second conception stands for unofficial forming of proper linguistic habits and rules of logical thinking during the whole mathematical education. It needs to be systematic and consistent and a teacher has to be aware that using proper mathematical language, operative applying of adequate symbols is a basic rule in getting mathematical knowledge. Achieving that goal does not depend on chosen conception of teaching elements of logic and both ways we are able to accomplish all our purposes.

A decree of the National Minister of Education from May 30th 2014 about general education in various types of schools (as well as previous versions from August 27th 2012 and December 23rd 2008) does not include any elements of mathematical logic as obligatory in school syllabus. We can accept then, that current school education stands for the second conception that was mentioned before – for unofficial or even occasional introduction to adequate symbols of propositional calculus and proper understanding of any mathematical text. Students’ logical education should be based on “common sense” and so the “logic of common sense” should determine boundaries, which passing would turn out to have fatal consequences as well as it could just do more harm than good. For example, if we have to admit (in formal ways) the following sentence is true:

*If 2 + 2 equals 5, then spinach grows on trees,*

We know inside, that it is some kind of “logical backroads”, thereby common sense backroads (Szurek, 2006). We should remember though, that in many situations the natural students’ intuitions about some logical objects are completely different from their real meaning and functioning in mathematics. Besides, as research show (Nowecki 1978, Klakla et.al. 1992, Kania 2013) there is no automatic transfer of the students’ logical knowledge from situations they know, every-day situations that are close to them, to students’ mathematical thinking or even any abstract reasoning. Other research (Klakla, Nawrocki 1999, Kania 2012) pay attention to the fact, that some difficulties and errors in understanding of logical claims and theories could be the reason of failure in mathematical studies.

All mentioned research became the inspiration to create my PhD thesis (Kania 2015). A starting point was the question whether pupils (secondary school) and students (university) are able to notice the logical structure of mathematical statements and use it properly
during the mathematical text reading. To understand mathematics deeply and completely, there are two abilities necessary – both the capability of correct verification of factual aspects in mathematical text we read and appropriate understanding of logical aspects of the relations between them. Trying to find an answer whether the two categories of abilities are equally important in the process of teaching and learning mathematics and what possible factors decide whether one of them is more significant, became a foundation to construct and perform series of various tests. Constructed tests were created to examine if the students prefer most likely to use only their own mathematical knowledge or they also consider the logical structure of a complex mathematical statement during evaluation if given statement is true or false.

To verify hypothesis included in my PhD thesis, there were 2538 various tests taken by 616 different pupils and students. I am going to quote some conclusions from PhD thesis, which I would like to expand and partially modify in the following article:

1. Students’ logical preferences are getting smaller when the time of learning elements of logic is getting longer.

2. Students’ choices in the process of correction false mathematical statements depend on the logical structure of mathematical statements (if it is conjunction, alternative, implication or equivalence).

3. The notation of given statement (symbolic or verbal) and mutual relations between simple sentences in a complex mathematical statement have the influence on the kind of students’ preferences in the process of correction false mathematical statements.

4. When students do not know whether considered sentence is true or false, they make more mistakes.

In further part of the following paper I would only concentrate on a test, which results were not completely satisfying and research on that test are currently continued. Results and observations born after performing some new research are partially presented in the following article.

CONSTRUCTION AND ANALYSIS OF THE TEST

Solving constructed tests consisted in making such a correction in false mathematical statement, that changed logical value of given statement into true. The place where the correction was made in a statement qualified students’ preferences – logical or factual. Students were given the same test three times (in three different versions) – first, they could choose a place where they make a correction all by themselves (it was named spontaneous choice). The second version of the test limited places to choose, there were four selected spots and students (and pupils) had to pick one of them and make a correction there (partially limited choice). Choosing two of the selected spots qualified students’ preferences as logical, the other two – as factual. The third version of the test gave only two options to choose – picking one of the addressed students’ preferences as logical and the other one – as factual. I present all three versions of the test below:

Test W₁
There are **eight false mathematical statements** below. Correct each statement (with the **minimal number of corrections necessary**) to change its logical value from false to true. You can make a correction in any place (places) in a sentence.

1. \( W(x) = x^3 - x^2 - 4x + 4 \) is a 2 degree polynomial and after its distribution into factors it forms as \( W(x) = (x-1)(x-2)(x+2) \)
2. The area of the expression $W(x) = \frac{x - 2}{x + 3}$ is $R \setminus \{2\}$ or x-intercept of that expression (zero of the expression) is $-3$.

3. If the number 1 is a root of polynomial $W(x) = x^3 - 6x + 2x + 2$, then we have $W(0) = 1$.

4. The set of x-intercepts of the expression $W(x) = \frac{(x^2 - 1)(x^2 - 4)}{(x - 1)(x + 2)}$ is $\{-2, -1, 1, 2\}$ if and only if the area of that expression is $R \setminus \{-2, 1\}$.

5. The triangle with edges 3, 4, 5 is right - angled and a diagonal of a rectangle with edges 3, 5 equals 4.

6. The diagonal of a square with edge 2 equals $2\sqrt{3}$ or the area of a square with edge 2 equals $2\sqrt{3}$.

7. If the height of an equilateral triangle with edge 6 equals $3\sqrt{3}$, then the area of that triangle is written by a formula $P = 6 \cdot 3\sqrt{3}$.

8. Diagonals of a rhombus do not intersect at right angle if and only if the area of a rhombus is written by a formula $P = \frac{fe}{2}$, where $e, f$ – length of diagonals.

Test $W_2$

There are eight false mathematical statements below. Correct each statement (with the minimal number of corrections necessary) to change its logical value from false to true. You can make a correction only in selected place (places) in a sentence.

1. $W(x) = x^3 - x^2 - 4x + 4$ is a 2 degree polynomial and after its distribution into factors it forms as $W(x) = (x - 1)(x - 2)(x + 2)$.

2. The area of the expression $W(x) = \frac{x - 2}{x + 3}$ is $R \setminus \{2\}$ or x-intercept of that expression (zero of the expression) is $-3$.

3. If the number 1 is a root of polynomial $W(x) = x^3 - 6x + 2x + 2$, then we have $W(0) = 1$.

4. The set of x-intercepts of the expression $W(x) = \frac{(x^2 - 1)(x^2 - 4)}{(x - 1)(x + 2)}$ is $\{-2, -1, 1, 2\}$ if and only if the area of that expression is $R \setminus \{-2, 1\}$.

5. The triangle with edges 3, 4, 5 is right - angled and a diagonal of a rectangle with edges 3, 5 equals 4.

6. The diagonal of a square with edge 2 equals $2\sqrt{3}$ or the area of a square with edge 2 equals $2\sqrt{3}$.

7. If the height of an equilateral triangle with edge 6 equals $3\sqrt{3}$, then the area of that triangle is written by a formula $P = 6 \cdot 3\sqrt{3}$.

8. Diagonals of a rhombus do not intersect at right angle if and only if the area of a rhombus is written by a formula $P = \frac{fe}{2}$, where $e, f$ – length of diagonals.

Test $W_3$

There are eight false mathematical statements below. Correct each statement (with the minimal number of corrections necessary) to change its logical value from false to true. You can make a correction only in selected place (places) in a sentence.

1. $W(x) = x^3 - x^2 - 4x + 4$ is a 2 degree polynomial and after its distribution into factors it forms as $W(x) = (x - 1)(x - 2)(x + 2)$.
2. The area of the expression \( W(x) = \frac{x-2}{x+3} \) is \( R \setminus \{2\} \) or x-intercept of that expression (zero of the expression) is \(-3\).

3. If the number 1 is a root of polynomial \( W(x) = x^3 - 6x + 2x + 2 \), then we have \( W(0) = 1 \).

4. The set of x-intercepts of the expression \( W(x) = \frac{(x^2 - 1)(x^2 - 4)}{(x-1)(x+2)} \) is \( \{-2, -1, 1, 2\} \) if and only if the area of that expression is \( R \setminus \{-2, 1\} \).

5. The triangle with edges 3, 4, 5 is right-angled and a diagonal of a rectangle with edges 3, 5 equals 4.

6. The diagonal of a square with Edge 2 equals \( 2\sqrt{3} \) or the area of a square with edge 2 equals \( 2\sqrt{3} \).

7. If the height of an equilateral triangle with edge 6 equals \( 3\sqrt{3} \), then the area of that triangle is written by a formula \( P = 6 \cdot 3\sqrt{3} \).

8. Diagonals of a rhombus do not intersect at right angle if and only if the area of a rhombus is written by a formula \( P = \frac{fe}{2} \), where \( e, f \) – length of diagonals.

Pupils and students, which solved presented test were asked to solve many other tests before the mentioned one and each of those tests was of the same kind, despite each one focused on different aspects of understanding mathematical truth and each one illustrated various assumptions and goals. Knowledge of the subject being testes, more specifically – knowledge of the form and character of the test (three versions of choice) could determine students’ objectivity and their preferences would probably be different if they did not solve any similar tests before. They knew they would be given next version of the test after another and they knew exactly that there would be places marked to be chosen. Observations that were made after performing research at the time show, that marking some places, giving students a specific choice activates another thinking about the problem. They start looking at the statement differently, they start analyzing it from totally other angle. They also start wondering how to make a correction in each of indicated place and finally they choose a place, where in their opinion a correction would be the most interesting. When students and pupils were given presented Test W in first version of choice, they knew they would receive another versions of the test, so during solving the spontaneous choice version (the first one) they analyzed many possibilities and they were looking for “the most interesting” choice for themselves. It could determine their real preferences – with reference to preferences described and classified in that specific research, there are not any general and normalized preferences that distinguishing was a part of some taxonomy.

Logical structure of Test W is different than in other tests discussed and analyzed in my PhD thesis. The main difference is the fact, that symbolic notation of logical conjunctions were substituted by their verbal analogues. The construction of the statements in the test creates a factually consistent sentences, that means a specific conjunction joins sentences that are strictly connected on basis of content. The instruction of the test was also changed towards other tests – students have to make a minimal number of corrections here, not exactly one correction as it was instructed in another tests. In each statement there is still possible to make exactly one correction that changes logical value of given statement to true, but not telling that directly may give students some kind of freedom and it does not impose looking for exactly one way to solve a problem.
The main task of Test W is to verify if students even notice and consider a logical structure of the statement written without any symbolic notation of logical conjunctions. Test W checks if the lack of that symbolic notation causes focusing only on factual contents of the statement without noticing the logical built or even a structure of a statement – if it is a conjunction, alternative, implication or equivalence.

Factual content of the presented test makes an elementary issues of school mathematics and an assessment of the logical value of statements should not cause any difficulties.

To illustrate possibilities of making the logical or factual corrections, let consider following statement (Statement number 2 of presented test):

\[
\text{The area of the expression } W(x) = \frac{x - 2}{x + 3} \text{ is } R \setminus \{2\} \text{ or } x-\text{intercept of that expression (zero of the expression) is } -3.
\]

A logical kind of correction would be a contradiction of a false sentence, that means to strike off the word is and write is not in first or second constituent sentence of given alternative (it would be named a 2nd type logical correction). A logical kind of correction would also be a proper changing of logical conjunction, in this case a word or to if and only if (equivalence), or separable conjunction If..., then... (implication). Those types of corrections would be named a 3rd type logical correction. Moreover, in statements written as implications or equivalences there is possible to make a logical correction that changes logical value of true sentence into false – changing implications to "\(1 \Rightarrow 0\)" or equivalence "\(0 \Rightarrow 0\)" or "\(0 \iff 1\)" to "\(0 \iff 1\)". Types of corrections mentioned above would be named a 1st type logical correction.

Any other corrections would be classified as factual type corrections. For example, the area in presented sentence could be written correctly as \(R \setminus \{-3\}\) or x – intercept could be appointed right as 2.

The general results of Test W

In my PhD thesis I formulated a hypothesis that students and pupils (there were 55 students and 60 pupils tested) can notice a logical structure of the statement even when its logical structure is not strictly underlined adequate symbol of conjunction. Specifically marking a spot that indicates there is a possibility to make a correction in given statement causes waking up interiorized “logical kit”, even if it was interiorized long time ago. Students and pupils were able to make a proper logical correction. The general results of Test W are presented in the table below:

<table>
<thead>
<tr>
<th>Research group</th>
<th>Version of choice</th>
<th>Factual</th>
<th>Logical</th>
<th>Mistake</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>pupils</td>
<td>spontaneous</td>
<td>39%</td>
<td>38%</td>
<td>17%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>partially limited</td>
<td>43%</td>
<td>41%</td>
<td>13%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>limited</td>
<td>29%</td>
<td>57%</td>
<td>13%</td>
<td>1%</td>
</tr>
<tr>
<td>students</td>
<td>spontaneous</td>
<td>56%</td>
<td>42%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>partially limited</td>
<td>51%</td>
<td>45%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>limited</td>
<td>46%</td>
<td>54%</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>
It is worth to notice that a number of logical and factual preferences is almost the same for high-school pupils in the version of spontaneous choice. Students also choose logical type corrections very often in a first version of the test. The analysis of the results compounded the feeling that high-level number of logical choices was probably the consequence of the knowledge from similar tests students and pupils solved before. Hence the idea of performing that particular test (Test W) on a group of pupils and students that have never solved any tests like that before.

The research was conducted on a group of 42 pupils from high school in Sławków (Liceum Ogólnokształcące w Sławkowie), where I work as a math teacher. Pupils attended to two different classes, 22 pupils from 2nd class and 20 pupils from 3rd class. Some of them in both classes were learning mathematics on advanced level and some of them only on basic level. Research was also performed on a group of 18 students of Mathematics in the Institute of Mathematics in University of Silesia, where I work as research associate and academic teacher. I met chosen groups of and students regularly on classes, there were 13 students of the 1st year of 2nd degree studies (master degree) and 5 students of the 2nd year of 2nd degree studies (master degree). They were all studying mathematics to become math teachers (teaching specialties).

Preferences of tested pupils and students are forming as follows:

The first impression after studying a table above is about growing number of logical types corrections in next versions of choice. Hence we can deduce (also taking into account results presented in Table 1), that marking a spot where students and pupils can make a logical type correction, induced them to change their preferences. The conclusion above was also confirmed by individual conversations I had with chosen students and pupils after the research. Pupils claimed that after receiving a test in first version of choice and after discussing the instructions, they had no idea what the following research was about and how to start solving it. Despite teacher’s assurance that there is no one good way to solve given test but it actually is just the opposite, there are many ways to go in each statement, many pupils tried to find the only place, where making a correction would be evaluated positively, they even wondered *which place they should choose to have a correct answer*. Pupils are not used to the fact that during solving some kind of mathematical problems there is no better or worse solutions and they should trust their own knowledge, instincts or intuitions and make a correction wherever they want. They also admitted (especially pupils from 3rd class) that the instruction was completely new to them, they have never solved similar tests and it caused some kind of insecurity and a fear of making a mistake. It raised my anxiety that realization of the general education basis is focused entirely on solving

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**Table 2** General types of corrections made by pupils and students that have never solved similar tests before

<table>
<thead>
<tr>
<th>Research group</th>
<th>Version of choice</th>
<th>Factual</th>
<th>Logicl</th>
<th>Mistake</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>pupils</td>
<td>spontaneous</td>
<td>66%</td>
<td>10%</td>
<td>18%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>partially limited</td>
<td>60%</td>
<td>30%</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>limited</td>
<td>52%</td>
<td>40%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>students</td>
<td>spontaneous</td>
<td>82%</td>
<td>17%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>partially limited</td>
<td>64%</td>
<td>34%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>limited</td>
<td>40%</td>
<td>58%</td>
<td>2%</td>
<td>0%</td>
</tr>
</tbody>
</table>
standard problems, problems we can solve by schematic methods. Moreover, aspirations for the best results on matura exam (high – school certificate) could extinguish those activities in pupils, that develop abstract thinking the most and shape their creative attitude. Using the expression “standard problems” I mean solving mathematical problems mechanically using certain methods and very often the most important goal for teachers is to develop an ability to solve a problem with a right method without taking all meaningful steps in a way of finding a solution. Teachers forget that each step in a way of finding solution is necessary in mathematical development of particular pupil and it crates his mathematical personality. The digression above is just a suggestion to look deeper in a correlation between realization of general education basis and realization of established purposes of education, but the digression has no connection to issues discussed in the following paper.

Individual conversations also indicate that information about falseness of all sentences in the test partially suggested, or in some way even commanded to look for mistakes in all statements, thereby to focus only on factual meaning of constituent, simple sentences in the statement. At last marked places made a reflection raised in pupils’ minds about other possibilities. Especially, chats with learners showed that underlining a word *is* was the most controversial and it caused they started to notice logical structure of the whole statement. Many times during solving Test W in the partially limited choice and limited choice versions pupils paid attention to the fact that they could not change a word *is* to *is not* if they were not completely sure if it actually *is* or *is not*, thus if considered simple sentence is false to change its logical value to true. The opposite case, changing logical value of the true simple sentence to false, were not considered by pupils at the moment despite it would be possible in every implication and equivalence in the test without verifying logical value of constituent sentences of the implication or equivalence. Learners did not care for logical structure of the statement, they were interested only in its factual meaning. Deeper analysis of the statement, very often controlled and navigated by a teacher, made pupils look on particular statement as a conjunction, alternative, implication or equivalence of two simple sentences and use their logical built. Students did not need that kind of guidance from teacher, by looking at marked spots where it was possible to do a logical type correction, they were able to realize that sometimes it is enough to consider only logical structure of the statement to make a good correction, without even thinking about factual meaning of particular sentences. The 2nd degree students of Mathematics are better prepared to abstract reasoning though, so the observation above is just its natural consequence.

It is worth to notice that in pupils’ case, in a test of spontaneous choice there were many wrong corrections, 18% of all answers included a mistake. The cause of appearing mistakes was sometimes the lack of factual, mathematical knowledge and a correction someone made did not change logical value of a simple sentence, it remained false. Sometimes pupils made mistakes when they tried to do a 3rd type logical correction, so they changed a connective for the wrong one and in that case false statement after changing its connective also remained false. However the most often mistakes consisted in making more than one correction in a statement, mainly two. Errors appeared mostly in a statement written as alternatives, pupils made corrections in both simple sentences changing an alternative formed on alternative formed. It is probably the consequence of not noticing and not considering the whole logical built of a complex statement as I wrote before, and noticing and considering only the factual
meaning of simple sentences of the statement. Both simple sentences of a false alternative are false, so in pupil’s opinion the minimal number of corrections that changes logical value of the statement is two. In the second version of Test W (partially limited choice) number of wrong correction was getting smaller already, we can even say that errors happened occasionally, only 4% of all answers were wrong and mistakes were caused by lack of an elementary mathematical knowledge. Pointing a few places where pupils could make a correction was some kind of a guidance to them and it caused a gain of their self-assurance. A pupil feel more secure when he knows where he can, or even where he should make a change.

It was mentioned before when the research groups were introduced, that pupils participating in solving Test W attended two different classes (2nd class or 3rd class). I would analyze results of the test with distinguishing on particular classes. It should be added that pupils from 2nd grade had a lesson dedicated to propositional calculus and they were reminded of the logical connections and its logical value. It was intended operation to recall and wake up some dormant logical issues. It was intentional for them to know and remember those elements of propositional calculus, that in an implicit kind of way could help them to interpret Test W they were solving afterwards and it could point their attention to logical structure of the statements. Let’s see how the results of pupils being tested formed with distinguishing on particular classes. I limit myself only to introducing results in the version of spontaneous choice, because results in two other versions of the test are in accordance with general results.

Based on received effects we can confirm the hypothesis that

Students’ logical preferences are getting smaller when the time of learning elements of logic is getting longer.

<table>
<thead>
<tr>
<th>Research group pupils</th>
<th>Class</th>
<th>Factual</th>
<th>Logical</th>
<th>Mistake</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>54%</td>
<td>18%</td>
<td>20%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>78%</td>
<td>6%</td>
<td>12%</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>

The pupil that was taught elements of mathematical logic recently is able to notice logical structure of the statement more often than a pupil that lessons about propositional calculus attended long time ago. It was probably a consequence of the fact, that every knowledge we possessed at the moment, if it was not used it would be forgotten or it would became a dead tool in “a great construction of mathematical knowledge”.

**SUMMARY**

Teachers’ duty should be constant referring to logical structure of the statement, making sure that pupils use proper logical connectives and when they do not, teachers’ obligation is to correct their mistakes. Average pupils are not fluent in any elements of mathematical logic, especially in using propositional calculus and they show many inadequacies during their mathematical education. It is teachers’ duty to equip pupils with very important ability on the road of their mathematical development – any teacher should create a solid logical base for his students that lets them read and understand mathematical text.

It is necessary to remember though that a teacher’s language during a lesson, as well as academic teacher’s language during any lecture, should be adjusted to intellectual level of its receivers, it should consider their pre-dispositions, a level of their mathematical sophistication and even a level of their interest
The sketch of the idea of the research of understanding and using the logical structure of the mathematical statement.

of the subject. Math’s teacher, we can assume educated mathematician, very often treats mathematical language very natural, freely but conscious and he loose himself in belief that his students understand his language as well as he does. Unfortunately, his unambiguous words could be interpreted completely different than he thinks. Students are not aware of the power and range of the notions and terms their teacher uses in every statement he says, they do not notice any cognitive connections of the absorbing knowledge and teacher’s words. The words they hear are usually left without any argumentative analysis. It is one of the reason of communication’s disorder on the mathematic lesson but also a basis of mentioned communication’s disorders could be a negligence in students’ logical education.

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ZARYS KONCEPCJI
BADANIA ROZUMIENIA I WYKORZYSTYWANIA
STRUKTURY LOGICZNEJ MATEMATYCZNEJ WYPOWIEDZI

STRESZCZENIEI

Proces nauczania matematyki niesie za sobą wiele trudności związanych z rozumieniem pewnych pojęć, twierdzeń i faktów najczęściej zapisanych przy użyciu odpowiedniej symboliki. Poprawne rozumienie zawartych w zapisie matematycznym informacji jak i logicznej struktury samego zapisu ma zasadnicze znaczenie na drodze matematycznego rozwoju. Błędne pojmowanie logicznej struktury zdania matematycznego może być przyczyną niepoważnych w trakcie nauki i może prowadzić do mylnego spojrzenia na omawiane zagadnienia.
Artykuł przedstawia zarys pewnej koncepcji badania rozumienia struktury logicznej matematycznej wypowiedzi i sposób uwzględniania jej w procesie korekty fałszywych stwierdzeń matematycznych. Skonstruowane testy pozwalają wyodrębnić preferencje uczniów i studentów – merytoryczne bądź logiczne podejście do problemu. Miejsce dokonania korekty przez badanego w danym zdaniu świadczy o jego wyborach – czy interesuje go tylko merytoryczna treść składowych zdań prostych, czy bierze on pod uwagę również strukturę logiczną całego zdania złożonego.

Słowa kluczowe: dydaktyka matematyki, logika matematyczna, rachunek zdań, lektura tekstu matematycznego