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Teaching statistics to the blind psychology student

Nauczanie statystyki niewidomego studenta kierunku psychologia

Abstract: The objective of this article is to share the experience of teaching statistics to a blind student at Institute of Psychology, The John Paul II Catholic University of Lublin. It discusses three conditions that have to be met in order to be successful. These conditions are: an individual approach toward the student, adaptation of didactic materials and availability of special software which enables the blind student to access the statistical package called SPSS. Solutions developed by us can be used both in teaching students of psychology and students of other faculties who are blind. The limitation in the generalization of applications is related to the fact that that it was a case study and that in the population of blind people there may be individual differences in mathematical abilities and logical thinking.
Keywords: psychology, statistics, individual classes, tactile graphics, computer software

Streszczenie: Celem artykułu jest podzielenie się doświadczeniami z nauczania statystyk niewidomej studentki Instytutu Psychologii Katolickiego Uniwersytetu Lubelskiego Jana Pawła II. Omówiono trzy warunki, które należy spełnić, aby odnieść sukces dydaktyczny. Warunki te to: indywidualne nauczanie ucznia, adaptacja materiałów dydaktycznych i dostępność specjalnego oprogramowania, które umożliwia studentowi, który nie widzi, dostęp do pakietu statystycznego o nazwie SPSS. Wypracowane przez nas rozwiązania mogą być wykorzystane zarówno w nauczaniu studentów psychologii, jak i studentów innych kierunków, którzy mają niepełnosprawność wzroku. Ograniczenie w uogólnianiu wniosków wiąże się z faktem, że było to studium przypadku i że w populacji osób niewidomych mogą występować indywidualne różnice w zdolnościach matematycznych i logicznego myślenia.
Słowa kluczowe: psychologia, statystyka, zajęcia indywidualne, grafika dotykowa, oprogramowanie komputerowe

For a great majority of students mastering statistics is quite a challenging task or even a very serious problem. In order to study statistics effectively students have to not only master a huge variety of methodological assumptions but they also need to understand many mathematical formulas, graphs of the function, and abstract notions. Is it possible, under these circumstanc-

es, to teach statistics to blind students who can not see tables, charts or mathematical formulas?

Considering the experience gained by professors and students in the Psychology Department at The John Paul II Catholic University of Lublin, one may come to the conclusion that despite many technical difficulties, it is possible to be successful at teaching statistics to students who are blind. This goal has been also achieved by students and professors at other universities in the world [Baker, Haak, 2004; Gibson, Darron, 1999, pp. 130-131; Meehan, Hoffert, Hoffert, 1993, pp. 242-244]. Yet, according to our experience, in order to teach statistics to a student with visual impairment three conditions have to be met: an individual approach toward a student, adaptation of didactic materials, and availability of special software thanks to which a blind student is able to use the statistical package called SPSS. The first condition was met because the blind student had an individual class on statistics. The second and third conditions were met due to cooperation with The Center for Adaptations of Educational Materials for the Blind at John Paul II Catholic University of Lublin.

Individual classes

Initially, the blind student (the second author of this article) took part in regular classes as a member of a group. Unfortunately, studying in a group with sighted people appeared to be ineffective for the student. During classes the theoretical background of statistical tests was covered as well as elements of methodology, which were discussed in detail during lectures. Students were also taught how to use the statistical package SPSS 14.0 PL for Windows that allows one to analyze data and how the results of this analysis should be interpreted.

The person running the course (the first author of this article) put much effort into explaining new and complicated concepts but for technical reasons, the blind student had great difficulty grasping them in the time allotted. As a result, the student was not able to keep up with the rest of the group. Therefore it was decided that the blind student should have an individual course.

The individual course took much longer than the regular one but was much more effective. The most significant advantage of this arrangement was that the person running the course had an opportunity to readjust all necessary equipment, the pace of the course, and strategies for teaching to the needs of the student. Due to the fact that it was the first time the teacher was running the course on statistics for a blind student, they both had to work out

innovative methods which allowed the blind student to complete the course successfully. For instance, all complex mathematical formulas were verbalized. Another example of an innovative solution was the use of Wikki Stix, a rubber mat and German film – which enabled the student and teacher to draw or construct crosstabs, graphs and charts.

Adaptation of didactic materials

All chapters of the textbooks on statistics and methodology were adapted by The Center for Adaptations of Educational Materials for the Blind at John Paul II Catholic University of Lublin. The student received them in an electronic version and was able to read those chapters with the help of a Braille notetaker called the Braille Lite M20 (the equipment borrowed for the student by The Center for Adaptations of Educational Materials for the Blind).

The Center also adapted all charts, diagrams, tables and mathematical formulas that occur frequently in textbooks on statistics. These graphics are often essential to understand notions included in the textbook. Naturally, it is not enough to convert them into tactile form. Every element of a graph has to be modified so it becomes clear for the blind person.

Mathematical Formulas and Tables

All complex mathematical formulas were presented in braille and were converted into sequential verbal descriptions. Thanks to such detailed explanation, the student was less likely to misinterpret mathematical formulas. At the same time she gained greater understanding of statistical concepts.

Since tables printed in Braille are extremely difficult to read, data presented in them was converted into text. In addition, it was presented in a more descriptive way than in the case of a regular table. For example, *z* tables were converted into the sequence of the *z* values. Each of the *z* values was followed by the value corresponding to the area under the normal curve. In the case of a positive value, it pointed to the area above the *z* value, and in the case of a negative value, the area beneath the *z* value. The student could easily find *z* value that she needed by means of a search option in her notetaker.

Graphics

The most important graphics included in textbooks such as frequency distributions or graphs of the function were accessible for the student in tactile form. Naturally, they had to be modified so they were easier to interpret [Edman, 1992, pp. 13-90; Hinton, 1996, pp. 1-145]. According to the rules of

adapting tactile graphics, all diagrams were simplified. Moreover, unnecessary details were removed from the diagrams so that only the most important elements remained. The most complex diagrams were divided into sections and presented separately. For instance, a chart presenting the concept of skewness [Ferguson, Takane, 2004, p. 51] was divided into three separate charts: negatively skewed, positively skewed and symmetrical distribution (see Figure 1). In addition to that modification, tactile charts and diagrams were presented to the student step by step and explained in great detail. Thanks to such modifications and verbal explanations, the student enhanced her understanding of the discussed concepts.

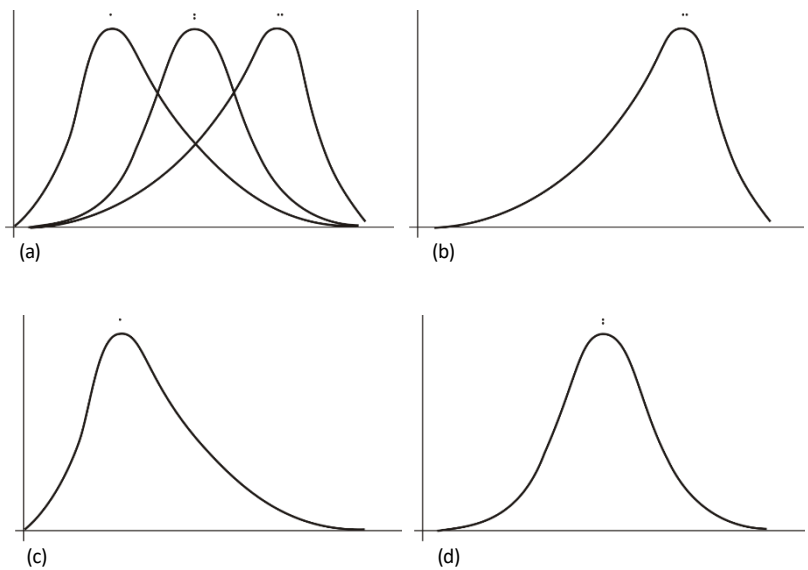

Figure 1. Concept of skewness. Original chart, presenting three different distributions (a) and modified charts divided into three separate diagrams: negatively skewed (b), positively skewed (c) and symmetrical distribution (d)

Moreover, the student was asked to construct a chart presenting the discussed concept in order to prove that she understood it. She performed this task with the help of Wikki Stix. Wikki Stix were also used to mark various points on diagrams (for example *z* value).

Adaptation of specialized software

The objective of the class was not only to teach the student theoretical assumptions but also to help her to gain practical skills. After completing this course every student, with the help of the statistical package, should be able to analyse data and interpret research results.

As the statistical package SPSS 14.0 PL for Windows is incompatible with the program called Window-Eyes (screen reader that allows blind people to use a PC), the student had to memorize the keyboard shortcuts in order to operate it. With the help of the screen reader, she could also read and navigate the menu, but this took much longer.

Moreover, a specialized software was created to enable the blind student to calculate, analyze and interpret data completely. The software named Bob Master was invented in cooperation with the third author of this article.

Bob Master allowed the blind student to access results of the calculations and analyses that were generated by SPSS 14.0 PL for Windows as very large and complicated tables. Thanks to Bob Master, and using keyboard shortcuts, the student could easily select any part of the table that she needed. Furthermore, Bob Master allows one to select specific columns of the table. Only two columns can be displayed at a time, which makes even the most complicated table legible and easy to interpret for a blind person.

The only inconvenience that have not been solved yet is entering the data into the statistical package. Initialy data has to be entered into Microsoft Excel software and then it has to be exported into SPSS.

Conclusions

Based on the experience that we have presented in this article, one may come to the conclusion that despite lack of vision, one can gain theoretical knowledge on statistics and methodology as well as practical skills allowing the analysis and interpretation of data. To achieve that goal a blind student has to be strongly motivated and the teacher has to be prepared to work individually with the student and to readjust teaching methods to the student's needs. Very important also is cooperation with the center responsible for adapting didactic materials for the blind student.

The person described in this article who successfully completed the course on statistics is a completely blind student in the Psychology Department. The person is adventitiously blind (she lost her vision at the age of fifteen). Since visual representations of abstract notions are extremely im-

portant for understanding statistics, it is hard to predict what difficulties a congenitally blind person may have with studying that subject. One may only guess that teaching statistics to a person who has no visual experience is even more difficult than to someone who could see in the past.

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