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## **An analysis of typical learning styles of primary school pupils using the VARK questionnaire**

### **Introduction**

The purpose of this article is to analyse the typical learning styles of upper primary school pupils with the use of the VARK questionnaire. The data obtained were analysed with a generalized cluster analysis. This method is suitable for processing pedagogical research results when the data are identified at a nominal measurement level. In fact, a classical cluster analysis assumes metric data.

### **1. Description of the research**

A classical method of questionnaires, i.e., in combination with various questionnaires e.g. LSI, ILS [Mareš 1998] or VARK (Visual Aural Read/Write, Kin-aesthetic), is most frequently used to identify learning styles. In this research, which was further processed using a generalized cluster analysis, the learning styles of primary school pupils were examined using the VARK questionnaire [Turek 2005].

The basic research question was: Will certain typical groups of pupils who prefer a similar learning style or styles occur when analysing the answers of pupils from the VARK questionnaire? Will these analysed groups correspond to four basic learning styles? The research was conducted with upper primary school pupils in two chosen schools within the Olomouc Region [Rešková 2013]. The total number of respondents was 271. A more detailed breakdown of the research sample is shown in Table 1.

### **2. Research methods employed and research findings**

The data obtained from the VARK questionnaire were evaluated by classical methods [Turek 2005], and each pupil was evaluated for his/her prevailing learning style. The answers to individual questions, assessed as a total sum from all pupils, were subsequently analysed with a generalized cluster analysis [Chráska jun. 2008; Hendl 2004]. This analysis was conducted using the STATISTICA 10 CZ statistical package.

In the first phase – see Table 2, the optimum number of clusters, which amounted to two clusters, was analysed with the STATISTICA 10 CZ statistical package. Differences in individual answers in the VARK questionnaire as well as in other variables of interest (gender, age, year, location of school) for pupils in both clusters were calculated – see Table 3. This table shows the prevailing answers to individual questions of pupils in both identified clusters, along with their frequency. From the sum of preferred learning styles V, A, R and K in individual questions of the VARK questionnaire, we can then summarize the characteristics of individual identified clusters of pupils.

**Table 1**

**The research sample structure (g = girls, b = boys)**

| Classes 6, 7, 8, 9 were in a rural school, other classes were in an urban school. |       |        |        |        |        |        |        |            |
|---|-------|--------|--------|--------|--------|--------|--------|------------|
| Gender  | Class | Age 11 | Age 12 | Age 13 | Age 14 | Age 15 | Age 16 | Row Totals |
| g   | 6     | 1      | 1      | 0      | 0      | 0      | 0      | 2          |
| g   | 7     | 0      | 6      | 3      | 0      | 0      | 0      | 9          |
| g   | 8     | 0      | 0      | 6      | 5      | 0      | 0      | 11         |
| g   | 9     | 0      | 0      | 0      | 4      | 1      | 0      | 5          |
| g   | 6a    | 8      | 2      | 1      | 0      | 0      | 0      | 11         |
| g   | 6b    | 4      | 6      | 0      | 0      | 0      | 0      | 10         |
| g   | 6c    | 7      | 1      | 0      | 0      | 0      | 0      | 8          |
| g   | 7a    | 0      | 13     | 6      | 0      | 0      | 0      | 19         |
| g   | 7b    | 0      | 4      | 2      | 1      | 0      | 0      | 7          |
| g   | 8a    | 0      | 0      | 11     | 2      | 0      | 0      | 13         |
| g   | 8b    | 0      | 0      | 3      | 8      | 0      | 0      | 11         |
| g   | 8c    | 0      | 0      | 2      | 3      | 0      | 0      | 5          |
| g   | 9a    | 0      | 0      | 0      | 4      | 3      | 1      | 8          |
| g   | 9b    | 0      | 0      | 0      | 9      | 3      | 0      | 12         |
| g   | 9c    | 0      | 0      | 0      | 4      | 6      | 0      | 10         |
| Total   |       | 20     | 33     | 34     | 40     | 13     | 1      | 141        |
| b   | 6     | 4      | 2      | 2      | 0      | 0      | 0      | 8          |
| b   | 7     | 0      | 4      | 3      | 0      | 0      | 0      | 7          |
| b   | 8     | 0      | 0      | 2      | 3      | 1      | 0      | 6          |
| b   | 9     | 0      | 0      | 0      | 4      | 6      | 0      | 10         |
| b   | 6a    | 3      | 7      | 0      | 0      | 0      | 0      | 10         |
| b   | 6b    | 3      | 7      | 0      | 0      | 0      | 0      | 10         |
| b   | 6c    | 2      | 7      | 0      | 0      | 0      | 0      | 9          |
| b   | 7a    | 0      | 4      | 4      | 0      | 0      | 0      | 8          |
| b   | 7b    | 0      | 10     | 5      | 0      | 0      | 0      | 15         |
| b   | 8a    | 0      | 0      | 3      | 2      | 0      | 0      | 5          |
| b   | 8b    | 0      | 0      | 1      | 4      | 0      | 0      | 5          |
| b   | 8c    | 0      | 0      | 4      | 6      | 0      | 0      | 10         |
| b   | 9a    | 0      | 0      | 0      | 4      | 6      | 0      | 10         |
| b   | 9b    | 0      | 0      | 0      | 5      | 1      | 0      | 6          |
| b   | 9c    | 0      | 0      | 0      | 3      | 8      | 0      | 11         |
| Total   |       | 12     | 41     | 24     | 31     | 22     | 0      | 130        |
| Column Total  |       | 32     | 74     | 58     | 71     | 35     | 1      | 271        |

**Table 2**

**The summary results from a generalized cluster analysis of the pupils' answers in the VARK questionnaire: summarizing the identification from the optimum number of clusters**

|                      |   |
|----------------------|---|
|                      | Summary for k-means clustering (VARK)<br>Number of clusters: 2<br>Total number of training cases: 271 |
| Algorithm            | k-Means   |
| Distance method      | Euclidean distances   |
| Initial centers      | Maximize initial distance   |
| MD casewise deletion | Yes   |
| Cross-validation     | 10 folds  |
| Testing sample       | 0   |
| Training cases       | 271   |
| Training error       | 2,929377  |
| Number of clusters   | 2   |

**Table 3**

**A generalized cluster analysis of answers to questions in the VARK questionnaire**

| Variable                      | Cluster 1 | Cluster 2 |
|-------------------------------|-----------|-----------|
| Question 1                    | A         | R         |
| Question 2                    | R         | R         |
| Question 3                    | R         | V         |
| Question 4                    | R         | R         |
| Question 5                    | K         | K         |
| Question 6                    | R         | R         |
| Question 7                    | K         | V         |
| Question 8                    | K         | A         |
| Question 9                    | K         | R         |
| Question 10                   | A         | A         |
| Question 11                   | A         | K         |
| Question 12                   | V         | V         |
| Question 13                   | K         | K         |
| Gender (g = girls, b = boys)  | g         | g         |
| Age                           | 12        | 11        |
| Year                          | 9         | 6         |
| Place of school: town/village | t         | t         |
| Number of cases               | 193       | 78        |
| Percentage (%)                | 71,22     | 28,78     |
| Number of V (Visual)          | 1         | 3         |
| Number of A (Aural)           | 3         | 2         |
| Number of R (Read/Write)      | 4         | 5         |
| Number of K (Kinaesthetic)    | 5         | 3         |
| Sum of V+A+R+K                | 13        | 13        |

In Table 3, the typical (prevailing) characteristics of both identified clusters (groups) are mentioned. To better specify the differences between clusters for other auxiliary variables (gender, age, year, location of school), additional details of both groups are mentioned in Tables 4–7.

**Table 4**  
An analysis of the characteristics of identified clusters according to the pupils' gender

| Frequency table for categorical variable: Gender<br>Total number of training cases: 271 |           |           |       |
|---|-----------|-----------|-------|
|   | Cluster 1 | Cluster 2 | Total |
| g   | 102       | 39        | 141   |
| b   | 91        | 39        | 130   |

**Table 5**  
An analysis of the characteristics of identified clusters according to the pupils' age

| Frequency table for categorical variable: Age<br>Total number of training cases: 271 |           |           |       |
|--|-----------|-----------|-------|
|  | Cluster 1 | Cluster 2 | Total |
| 11   | 9         | 23        | 32    |
| 12   | 60        | 14        | 74    |
| 13   | 38        | 20        | 58    |
| 14   | 52        | 19        | 71    |
| 15   | 33        | 2         | 35    |
| 16   | 1         | 0         | 1     |

**Table 6**  
An analysis of the characteristics of identified clusters according to years of primary school attended

| Frequency table for categorical variable: Class<br>Total number of training cases: 271 |           |           |       |
|--|-----------|-----------|-------|
|  | Cluster 1 | Cluster 2 | Total |
| 6  | 36        | 32        | 68    |
| 7  | 48        | 17        | 65    |
| 8  | 43        | 23        | 66    |
| 9  | 66        | 6         | 72    |

**Table 7**  
An analysis of characteristics of identified clusters according to the location of the school

| Frequency table for categorical variable: Place of school<br>Total number of training cases: 271 |           |           |       |
|--|-----------|-----------|-------|
|  | Cluster 1 | Cluster 2 | Total |
| Town   | 158       | 55        | 213   |
| Village  | 35        | 23        | 58    |

## Conclusion

Based on the generalized cluster analysis of answers of upper primary school pupils using the VARK questionnaire, two typical clusters of pupils were identified.

**Cluster 1:** it is formed by approximately 71% of the pupils with learning style K prevailing (5x); styles R and A (4x) are also present. On the contrary, style V is used only on rare occasions (1x). In this cluster, girls (more specifically, the older ones from 9<sup>th</sup> grade) prevail, and this cluster includes more pupils from the city as compared to cluster 2.

**Cluster 2:** it is formed by approximately 29% of the pupils with learning style R prevailing (5x); they often use styles K and V (3x). Style A (2x) was the least frequent. In this cluster, girls and boys are equally represented and it includes mostly younger pupils from 6<sup>th</sup> grade.

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## Literatura

- Chráska M. (2008), *Uplatnění vícerozměrných statistických metod v pedagogickém výzkumu*. Olomouc: Votobia. ISBN 80-244-0897-X.
- Hendl J. (2004), *Přehled statistických metod zpracování dat*. Praha: Portál. ISBN 80-7178-820-1.
- Mareš J. (1998), *Styly učení žáků a studentů*. Praha: Portál. ISBN 80-7178-246-7.
- Meloun M., Militký J., Hill M. (2005), *Počítačová analýza vícerozměrných dat v příkladech*. Praha: Academia. ISBN 80-200-1335-0.
- Rešková M. (2013), *Styly učení žáků z hlediska smyslových preferencí [w:] DIDMATTECH 2013 Education technologies in the information and knowledge based society*. Tribun, s r.o., 2014. ISBN 978-963-334-8.
- Turek I. (2005), *Inovácie v didaktike*, 2. vyd. Bratislava: Metodicko-pedagogické centrum. ISBN 80-8052-230-8.

## Abstract

This article describes the results of research whose purpose was to identify typical learning styles of upper primary school pupils. The learning styles of pupils were determined using the VARK questionnaire. Two typical groups of

pupils that differed in preferences of individual learning styles were subsequently identified by using a generalized cluster analysis. The first group of pupils (71%) preferred learning style K. It was comprised mostly of older pupils and pupils from the city and it included more girls than boys. The second group of pupils (29%) preferred learning style R. It was comprised mostly of younger pupils, and girls and boys were equally represented.

**Key words:** learning style, primary school pupil, VARK questionnaire, generalized cluster analysis.