Students’ Learning Strategies: Statistical Types and their relationship with Computer Literacy

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Introduction

As modern society is becoming more oriented to advanced technologies, a new type of literacy - computer literacy – is being more widely discussed. Like reading, which by socialisation scholars is sometimes rightly called the socialisation of socialisation or secondary socialisation, computer literacy has become an essential precondition for a person's successful socialisation and his/her professional career. For this reason education, as an important factor for society development, has begun to play an essential role, particularly in addressing the issue of literacy and computer literacy in particular.

Not surprisingly, the issue of computer literacy is increasingly widely addressed in research works around the world as well as in Lithuania (Hayden, 1999; Johnson, Eisenberg, 1991; McMillan, 1996; Mitra, 1998; Oderkirk, 1996; Petrauskas, 1998; Šaparnienė, 2002, Šaparnienė *et al*., 2002). Analysis of the scientific literature has proved that the impact of cognitive and non-cognitive personality traits on computer literacy levels has not been sufficiently studied. The impact of personality traits on computer literacy and its level was researched by M. Igbaria, A. Chakrabarti (1990), A. Harrison, R.K.Jr. Rainer, (1996), G. A. Marcoulides, Y. Stocker, L. D. Marcoulides (2004), *et al*. At an international level and especially in Lithuania there is a shortage of research on computer literacy analyzing *whether a person's preference for one or another learning strategy can influence the development of his/her computer literacy. The question of whether searching for statistical types of the investigated persons results in the demonstration of different computer literacy levels and other important factors still remains unanswered*.

A number of factors influence a person’s academic achievement and his/her occupational success. Work with new technologies requires new, different abilities as compared to work with the old ones. The fact is that these new abilities are more “cognitive”. In order to satisfy his/her need to communicate, work and learn, a person has to perceive their surroundings, be attentive to certain moments and elements of activities, think and express him/herself. This means that a person’s activities are impossible without cognitive processes. The latter are developed through activities or expressed by special types of activities.

Understanding of a person’s cognitive abilities is necessary for his/her effective education and development. Despite the fact that the link between a person's computer literacy and his/her cognitive features is evident, the issue has so far not been widely studied.

Although the success of human activities is determined by a number of variables, an important position in the hierarchy of learning success is occupied by a person's *learning strategies*. D.M.Smith and D.A.Colb (1996) state that a person's learning strategy defines how he/she behaves in various everyday situations; he/she learns more effectively, easily, and comfortably when his/her learning needs are generated by his/her learning experience. In other words, a learning strategy outlines the way a person learns. For example, R. Dunn (1986) defines learning strategy as a way of perceiving and preserving information and abilities. Many authors (Gregorc, 1979; Davidson *et al*., 1992) emphasize that learning strategy is an obvious observed behaviour, which reveals how a person gains, processes and collects information.

Basically the presented definitions state that *learning strategy is linked with the way a person processes and perceives information in learning situations*. Moreover, scientists agree that learning ways and habits are a conditionally permanent construct, invariable in various learning situations and contents. However, in the course of time, learning strategies may change with changes in experience.

Research on computer usage confirms that learning strategies contribute to success. For example, R.P.Bostrom and others (1990) ascertain that while learning to work with a computer, students of a convergent learning style (Colb's taxonomy) achieve better results than students of other learning styles. G.V.Davidson and others (1992) also maintain that students who have certain learning strategies perform better than others.

Literature surveys (foreign and Lithuanian) have clearly shown a shortage of research in which the relation between computer literacy and a person's cognitive abilities is examined. One of the reasons for this could be the narrowness of the investigated theories.

The aim of this article is to identify and describe existing students' statistical types by their learning strategies and to show the connection with factual computer literacy. The paper deals with the scientific problem related to the hypothetical assumption about the impact of a person's cognitive trait - learning strategies - on the peculiarities of computer literacy in the system of higher education.

Research methodology and characteristics of empirical basis

The *empirical-experimental part* of the present study is based on a series of diagnostic studies of 1004 surveyed students. They represented 4 universities and 5 high schools and colleges in Lithuania. 84.7% of the sample were university students, 15.3% – students from high schools and colleges. The major part of the sample, 73.1% (N=733) were students from management and economics study programmes. The remaining respondents (22.9%, N=271) included students from other areas: education, philology, informatics, physics, mathematics, technical, agricultural and health sciences. The study was based on voluntary participation and anonymity.

Study instruments. A test (theoretical and practical) on computer literacy (CL) and 2 anonymous closed type questionnaires “Student and computer” and “Student and studies”, consisting of a series of questions on computer literacy and studies, were designed (Šaparnienė, 2002). The study instruments (tests) designed by other researchers were used to study the respondents’ attention, to rate their general intelligence and their knowledge of terminology, and to measure their verbal and non-verbal intelligence.

The presented paper analyses the most significant empirical research findings, which identify students’ statistical types by their learning strategies and the relationship with computer literacy. For this purpose the respondents’ answers to the questions on learning strategies (questionnaire “Student and studies”) and the results of the test on computer literacy are analysed.

Psychometric validity of the diagnostic study variables identified and discussed in the article.

1) *Computer literacy test*. Using the method of expert analysis, a two-part computer literacy test was designed. With the aim of assessing the respondents’ general knowledge of computers, 19 theoretical questions were included in the first part of the test. The second part of the test was composed of 24 practical tasks, to assess the respondents’ competence using the applied software in practice. For every step in the test percentage frequency was calculated and the parameters for main tendencies were selected: average, standard error and standard deviation (Table 1). With the aim of measuring computer literacy, standard validity rates are presented in Table 2. The rates presented in the table are evidence that the scale constructed to measure computer literacy is valid (Bortz, 1993; Anastasi, Urbina, 2001).

Table 1. Parameters of the computer literacy test scale

	Scale average	Standard error	Standard deviation
Theoretical part of the test	9,7 (max 19)	0,26	3,4
Practical part of the test	25,4 (max 48)	0,69	9,4

Table 2. Validity indices of the computer literacy test scale

	Cronbach coefficient	*Gutman Split - half* coefficient	*Spearman Brown* coefficient
Theoretical part of the test	0,73	0,72	0,72
Practical part of the test	0,90	0,84	0,85

2) *Test on learning strategies (or learning ways and habits)*. The test consists of 81 statements, which reveal various learning aspects and learning factors, starting from

special logic and psychological learning techniques and tactics and concluding with the management of learning time, learning ergonomics, etc. The psychometric validity of the scale was evaluated by factorial analysis using the method of Principal Components and VARIMAX rotation. 19 factors were extracted during primary factorial analysis; secondary factorial analysis multiplexed the statements to the model of 6 factors (which explains 55.7% of dispersion of the variables). Factorial analysis (especially secondary factorial analysis) presented a rather significant link between the majority of statements and the factors; their inside grouping is theoretically significant. It should be noted that a rather high correlation of the statements' estimation with extracted factors was obtained. This is evidenced by the limits of the meaning variation of the correlation coefficient ($0.52 \leq r \leq 0.88$). The descriptive power (dispersion) of the factors ranges from 15.8% to 10.7%. Kaiser-Meyer-Olkin (KMO) coefficient, which in this case is 0.80, shows to what extent the matrix is valid for the factorial analysis. Inner consistence of the factors, evaluated by Cronbach alpha coefficient, remains above the limit of 0.5, therefore, all five factors are homogeneous enough.

The first factor, explaining 15.8% of the dispersion of all the variables, combined the statements on *structured, methodological activities*: intended planning of learning time, learning the exactly marked amount of material, planning the succession of the learning material, usage of schemes, marks, summaries, etc.

The second factor, explaining 15% of the dispersion, combined the statements on *reflectivity*: attempts to relate new material, conceptions and theories with the old ones and experience, comparison of various theories and conceptions, search for alternatives, critical evaluation of the studied material, etc.

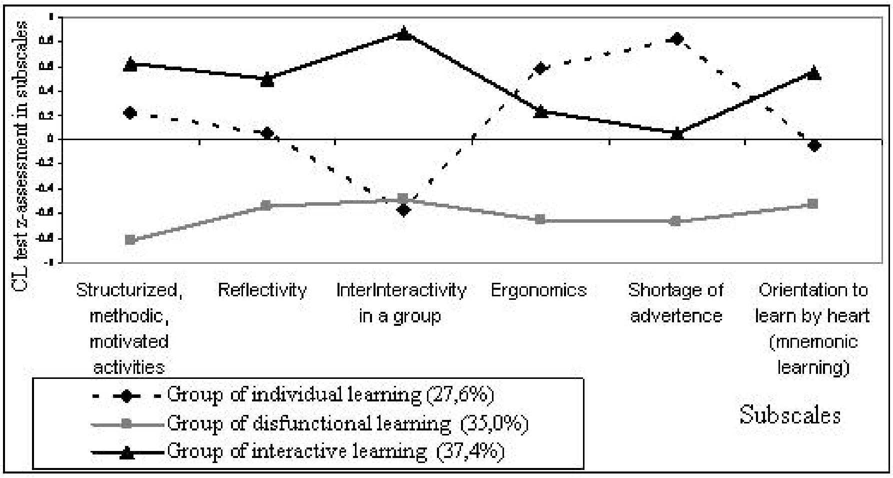
The third factor combined the statements on *interactive learning in a group* (dispersion – 13.4%), the fourth factor – *learning ergonomics* (dispersion – 10.7%).

In the secondary factorial analysis the factors *shortage of advertence* and orientation to learn by heart (*mnemonic learning*) formed individual cases.

Research results

In order to divide the respondents into groups by their learning strategies, statistic analysis of the respondents was carried out. For classification Cluster Analysis was used. Since the number of the surveyed students and the classified objects is quite large, k – Means (k – number of clusters) cluster analysis was chosen. The determined cluster structure is shown in the graphs below.

Typologization of the surveyed students by their learning strategies was significant. The classification was made using six subscales of the analyzed scale, obtained through secondary factorial analysis. The format of the scale answers is four-staged and includes the following variants of answers: "especially rarely", "rarely", "often", "very often". According to the dynamics the respondents (N=774) were attributed to three clusters, in what appeared to be the most informative and best interpretable way. Graphic expression is presented in Figure 1.



CL – Computer Literacy

Figure 1. Typology of learning strategies. 3-cluster model (N = 774)

The first group consists of 27.6% surveyed students, the second – 35.0% and the third – 37.4% surveyed students. Table 2 illustrates percentage distribution in the clusters by gender. In the first and third clusters there are relatively more women, in the second cluster men evidently dominate.

Cluster 1. This cluster includes attentive students who are motivated to learn structurally and methodically. Reflectivity and mnemonic learning are characteristic for them; they need supportive and favourable learning conditions (suitable ergonomics). The surveyed students in this cluster are more likely to learn individually than interactively, i.e. individual learning is characteristic for them. This is conditionally *a group of individual (or functional) learners*.

Table 3. Percentage distribution of the surveyed students in the clusters by gender

	Gender		Total
	Male	Female	
Cluster 1	54	160	214
	23,9%	29,2%	27,6%
Cluster 2	118	153	271
	52,2%	27,9%	35,0%
Cluster 3	54	235	289
	23,9%	42,9%	37,4%
Total	226	548	774

Cluster 2. Specific learning attitudes and habits are not characteristic for this group. The surveyed students value some interactive work in a group, and sometimes reflective, mnemonic ways of learning are typical for them; however, they are not attentive or motivated to learn structurally and methodically. *Dysfunctional learning* is more characteristic for them. Table 2 illustrates that this group includes the highest percentage of male students. It could be that the mentioned features partially reflect a male stereotype.

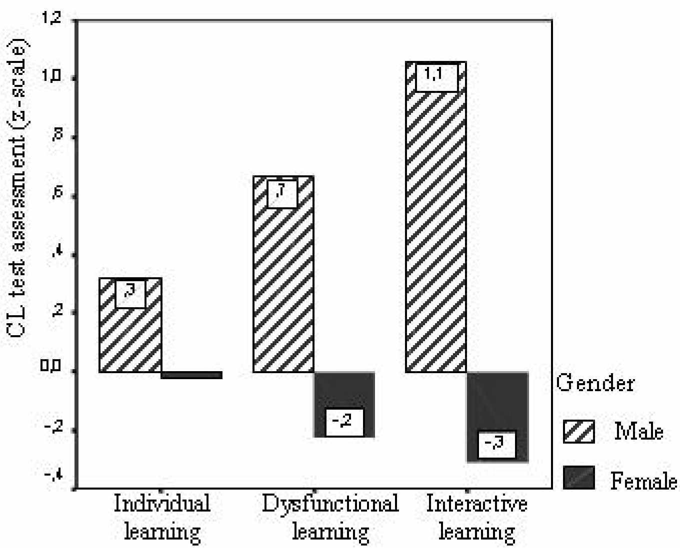


Figure 2. Assessment of the computer literacy (CL) test by learning strategies and gender of the surveyed students

Cluster 3. This is a functional group of leaders. *High interactivity in a group*, motivated, methodical, structured (although not always attentive activities) and sometimes mnemonic learning are characteristic for this group. Ergonomic conditions in the learning process are not important for them.

We aimed to disclose the statistic structure of the three variables – *gender, learning strategies and factual computer literacy*. Figure 2 reflects the graphic form of the structure. The graph of the three variables shows a very strong and specific effect of statistical interaction – the relation of the factual computer literacy and the clusters depending upon learning strategies. Figure 2 presents obvious gender effects: 1) computer literacy of female students is lower than that of male students in all clusters; 2) interactive learning is less characteristic for female students, who appear to prefer the other two learning strategies – dysfunctional and individual types of learning. As a consequence, *the highest computer literacy level of male students can be reasonably related to interactive learning in a group, of female students – to more individual learning*.

A person's interaction with a computer through the scheme "human – machine" is actually an interactive process. Practice has shown that it is much easier to master any unknown computer operation with the help of an experienced specialist who immediately demonstrates how and what to do, with the help of *interactive learning with educational media.* It appears that studying a voluminous manual on computers and learning from one's own mistakes and trials is usually less effective and attractive.

Conclusions

The research data has shown that the usage of a cluster analysis method, searching for statistical types of students' population by the variation of their learning strategies, has served its purpose. During the research the factually existing statistical types of students by their learning strategies were revealed; students oriented towards individual learning, dysfunctional learning and interactive learning were identified and described, and the relation with their factual computer literacy was also determined. *The highest level of computer literacy can reasonably be related to interactive learning* in a group.

Qualitative description of "pure" statistical groups, depending on the expression of features and the determination of these groups by percentage in the general population, is essential information with which the process of formation of computer literacy should be optimized and promoted. *While selecting the already existing and/or developing new educational computer literacy strategies and methods, and preparing textbooks and media, we should focus not on abstract "faceless" learners, but on very definite and truly existing types of learners*. In other words, the search technology for statistical types provides an opportunity to apply such classical and highly relevant didactical approaches as *learning differentiation and learning individualization* more effectively and efficiently.

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