Students` Attitudes towards Computer: Statistical Types and their Relationship with Computer Literacy

Diana Saparniene
Siauliai University, Lithuania

Gediminas Merkys
Kaunas University of Technology, Lithuania

Gintaras Saparnis
Siauliai University, Lithuania

ABSTRACT. The results of the diagnostic analysis on students' computer literacy are presented in the article. The study involves students from Lithuanian universities and colleges (N=1004). Based on the study results attempts are made to identify and define the existing statistical types of students in connection with their attitudes towards a computer (emotional – motivational relationship with a computer) as well as to disclose some link with the factual computer literacy.

INTRODUCTION

As today's society is becoming more and more dependent on new technology, increasing attention is given to ***computer literacy***, which in the current information age is no less significant as was reading, writing and calculus in the 19^{th}-20^{th} centuries (Anderson, 1983). Like reading, which is sometimes rightly called by socialisation scholars ″the socialisation of socialisation″ or secondary socialisation, computer literacy becomes an essential precondition for successful socialisation and professional career. For this reason education, being an important factor in society development, plays an essential role in addressing the issue of literacy and in particular computer literacy.

Not accidentally computer literacy is increasingly widely addressed in research around the world as well as in Lithuania (M.Hayden, 1999; D.Johnson, M.Eisenberg, 1991; S.McMillan, 1996; A.Mitra, 1998; J.Oderkirk, 1996; R.Petrauskas, 1998; D.Saparniene, 2002, et al.). The analysis of the scientific literature has proved that the impact of psychological factors on computer literacy level has not been sufficiently studied. The impact of psychosocial factors on the 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), A.Brogos (2005), et al. However, despite some significant research contributions in the area, so far little attention has been given to *the impact of non-cognitive personality's traits on the computer literacy and its level*, so far little attention has been aimed at answering the question "*Does different attitudes towards computers lead to different levels of computer literacy*".

It is universally known that achievements of the academic work depend upon many sociopsychological and socioeducational factors. Besides the cognitive factors (*intellect, general knowledge, attention, etc.*), which are traditionally associated with academic achievements, in this perspective it is essential to analyze non-cognitive personality's traits (*emotions, motivation, interest*, etc.) and their place in the context of computer literacy.

Attitude is an inner psychic state influencing behaviour. Therefore, we can understand an inner state from actions and words. For instance, we may presume that a person actively avoiding a computer has a negative attitude towards it. Attitude is not an inborn, instinct phenomenon; it mainly depends upon person's experience

and its impact in a new situation. Consequently, attitudes are formed in the process of experience and their change is possible due to the internal and external factors.

Obviously the quality of computer literacy is closely related to one of the major attitude's components – *motivation*. If a student is absolutely motiveless to work with computer, the learning result will not be optimal. A motivated computer user, even under unfavourable conditions, willingly works with computer. In everyday conception the level of motivation usually is measured by such notions as "*time devoted to the work with computer*" or "*the degree of efforts*". Motivation approaches the pupil towards the object and increases his/her efforts in relation to the object (Keller, 1999). It is an inner process, the explanation of which demanded a lot of efforts from the scientists for many years (Schunk, 1991). Today the researchers are interested in how inner motivation affects achievements and behaviour of work with computer. Inner motivation is related to personality's dispositions: demands, interests, wishes, etc. In this way it helps to reveal pupil's inner interests (Astleitner, Keller, 1995; Keller, 1999). Inner motivation involves repetition of action which stimulates positive emotions. All mentioned types of inner motivation suit to define personality's satisfaction, enjoyment obtained by a successful computer usage.

It is a difficult task to determine what factors inspired motivation and demotivation, whether the circumstances were internal or external, steady or changeable, controlled or uncontrolled. Trying to avoid computer demotivation the researchers (Pancer, George, Gebotys, 1992; Hancock, 1995) suggest: 1) work with computer must be related with present or further pupil's demands. These demands can be fulfilled considering pupil's aims, clearly stating the use, adjusting degree of difficulty, etc.; 2) work with computer has to stimulate self-confidence, confidence in success what promote efforts and further successful, motivated work; 3) work with computer must give self satisfaction and preserve constant motivation. Students, meeting their expectations, have to realize the received use as fair, neutral, and permanent.

There exists an obvious relationship between *emotions* and *motivation*. For instance, students that have personal problems in their life may not have a motive to study computer subjects well, or performing various tasks they may have attention problems. Otherwise, students' positive feelings (enthusiasm, pleasure, satisfaction, etc.) help to do difficult tasks and achieve good academic results.

The analysis of the scientific literature has proved that the impact of besides the analysed non-cognitive personality traits on computer literacy level has not been sufficiently studied. No research has been aimed at answering the question whether significant *identification of statistical types in the student's population is based on differences in computer literacy and other important variables*. Mainly this article deals with the ***scientific problem*** related to the hypothetical presumption on the impact of non-cognitive personality traits - attitudes - on the peculiarities of computer literacy in the *system of higher education.*

The article deals with the study of students' computer literacy one of the **aims** being – to identify and define the existing statistical types of students in connection with their attitudes towards a computer (*emotional – motivational relationship with a computer*) as well as to disclose some link with the factual computer literacy using multidimensional statistical methods.

RESEARCH METHODOLOGY AND CHARACTERISTICS OF EMPIRICAL BASIS

The **empirical-experimental part** of the present study is based on the series of diagnostic studies with the total number of 1004 surveyed students. They represented 4 Lithuanian universities and 5 high schools and colleges. 84.7% of the sample were university students, 15.3% - students from high schools and colleges. The major portion of the sample – 73.1% (N=733) consisted of students from management and economics study programmes. The rest of the 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", which comprised of a series of questions on computer literacy and studies, were designed (Saparniene, 2002). Study instruments (tests) designed by other researchers and practiced in research studies to study the respondents' attention, to rate their general intelligence and their knowledge of terminology and to measure their verbal and non-verbal intelligence were used.

The presented article analyses the most significant empirical research findings, which demonstrate identification of students' statistical types by attitudes towards computers and their relationship with computer literacy. For this reason the respondents' answers to the questions on emotional – motivational relationship with a computer (questionnaire *"Student and computer")* and the results of the *test on computer literacy* are being analysed.

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

1) ***Computer literacy test***. Using the method of expert analysis a two-part computer literacy test was designed. 19 theoretical questions with the aim to assess the respondents' general knowledge of computers were included into the first part of the test. The second part of the test was composed of 24 practical tasks to assess the respondents' competence to use the applied software practically. For every step in the test percentage frequency was calculated and the parameters for central tendencies were selected: average, standard error and standard deviation (Table 1). Standard reliability rates to measure computer literacy are presented in Table 2. The rates presented in the table evidence that the scale constructed to measure computer literacy is fairly reliable (Bortz, 1993; Anastasi, Urbina, 2001; Merkys, 1999).

Table 1. **Parameters of the Computer Literacy Test Scale**

	Scale average	Standard error	Standard deviation
Theoretical part of the test	9.7 (maximum 19)	0.26	3.4
Practical part of the test	25.4 (maximum 48)	0.69	9.4

Table 2. **Reliability 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) ***Scale of emotional-motivational relationship with a computer***. The statements of the scale indicating emotional-motivational relationship with a computer were selected intuitively, by means of qualitative analysis and later were verified empirically. Factor analysis was used to validate the psychometric applicability of the stimulus material on the initial emotional-motivational scale and to construct sub-scales. By this method 5 factors (sub-scales) were singled out and named: "*Computer as a hobby and an object of admiration"*, "*Computer as a source of fatigue, stress and dissatisfaction", "Indifference to a computer", "Dissociation from computer enthusiasts and fanatics"* and "*Computer as a factor of improvement and education"*.

Rather high correlations of the ratings of the statements and the extracted factors were obtained. The fluctuation limits of the correlation coefficient meaning $0.41 \leq r \leq 0.79$ were obtained. Factor descriptive variation ranges from 16% to 8% (the total explained variation is 53.1%). *Kaiser-Meyer-Olkin* (KMO) coefficient, which is comparatively high in this scale (0.92), explains the extent the matrix is applicable for factor analysis. Inner consistency of single factors, expressed by *Cronbach alpha* coefficient, ranges from 0.59 to 0.83. Moreover, all 5 factors are quite homogeneous. Inner consistency of the combined scale is rather high (0.69). Thus, the scale parameters presented on the whole meet the methodological norm of construct reliability and factor validity.

Attention should be drawn to meaningful classification of categories within a factor. It is evident that factor 1 and factor 5 reflect positive attitudes toward a computer, factor 2 and factor 4 – negative attitudes toward a computer and factor 3 – indifference to the computer dimension. Thus, the factors contain variables representing fairly homogeneous dimensions.

The subscale "*Computer as a hobby and an object of admiration"* (15.9% variation) comprises sentences reflecting attitudes of computer fanatics. This factor includes such statements as "My most important hobby is computer", "Living without a computer for me is the same as living without air", "If anybody deprived me of the possibility to use a computer, my life would become humdrum" etc., which clearly show that factor 1 represents great emotional-motivational satisfaction from the work with a computer. Thus the work with a computer, computer competence are compared to success in life, life experience.

The subscales "*Computer as a source of fatigue, stress and dissatisfaction"* (11.5% variation) and *"Dissociation from computer enthusiasts and fanatics"* (8.1% variation) involve statements reflecting negative attitudes toward computer. Here emotional dissatisfaction is revealed by such statements as "If I were able, I would "run away" from the computer, but the situation is such that I must start studying this subject", "While working with a computer I constantly feel trouble, get irritated", "Computer and me are two opposites", "Computer causes me continual stresses" etc. Meanwhile the statements "I feel bored in the company of the delighted by computers" and "I find computer fanatics strange" illustrate dissociation from the delighted by computers.

"Indifference to the computer" factor (10% variation) consists of the statements representing absolute indifference towards computers by the respondents. The statements falling into this subscale are as follows: "I am indifferent enough to the computer", "I can do without a computer in my life", " A computer for me is just a tool to perform my work".

All the statements of subscale 5 "*Computer as a factor of improvement and education"* (8 % variation) display a positive attitude toward computer technologies and deep perception of its influence on the success in life.

RESEARCH RESULTS

The study indicates that one of the factors which has influence on the quality in computer literacy is **emotional-motivational** relationship of the surveyed with a computer. The study data revealed that students having formed a positive contact with a computer usually demonstrate higher computer literacy level, whereas persons expressing a negative attitude are of lower computer literacy level.

Firstly, in order to divide the respondents into groups by their emotional – motivational relationship with a computer cluster analysis was made. As the number of the surveyed and of the objects to be classified was considerably big, k-means (k-number of clusters) cluster analysis was chosen. The structure of the clusters was reflected by breaks. The surveyed were typologised by 5 scales of their emotional-motivational relationship with a computer. Statistical evaluations were suggested: „Surely YES", „almost yes", „do not know"; „almost no"; „surely NO". The most informative and liable for interpretation by dynamics is the respondents' (N=1004) division into 3 clusters. Graphically it is presented in Figure 1.

46.5% of the surveyed were included into group 1; 33.5% - into group 2; 20.1% - into group 3. There were relatively more women in cluster 1 (N_{Male} – 39.6%, N_{Female} – 49.4%) and cluster 3 (N_{Male} – 15.8%, N_{Female} – 21.9%) and men dominated in cluster 2 (N_{Male} – 44.7%, N_{Female} – 28.7%).

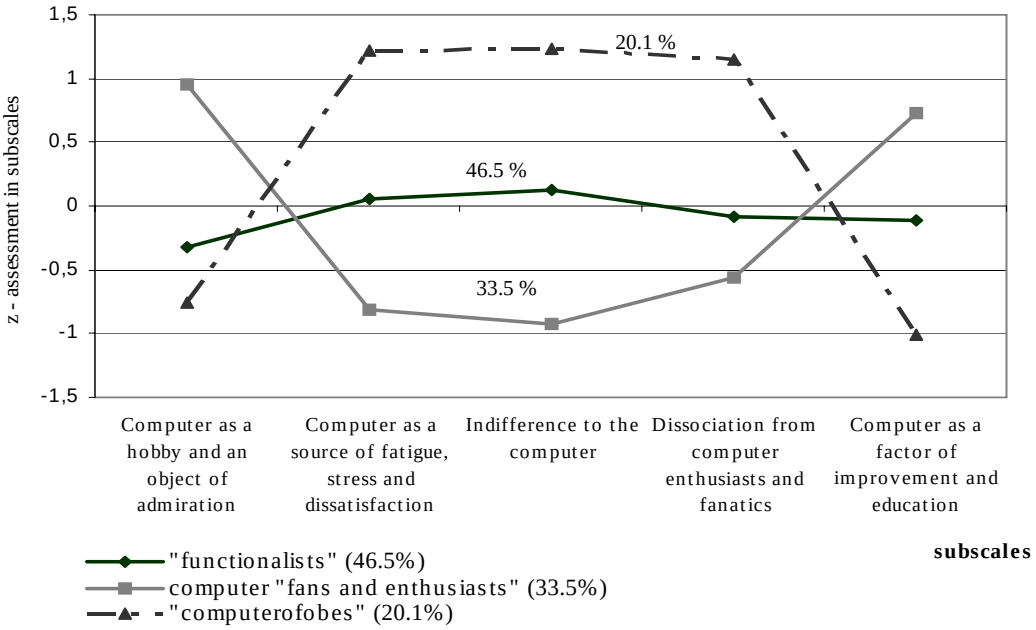

Figure 1. Typology of students' by their attitudes towards a computer (a three - cluster model) (N=917)

Cluster 1. The surveyed of this group may be considered as taking up a ***neutral, functional position*** in relation with a computer. Figuratively speaking their opinion about a computer may be compared to a person's attitude towards any piece of equipment, e.g., a vacuum cleaner: neither one finds it an object of particular affection and admiration nor demonstrates any fear of using it, it simply serves as an instrument to perform certain functions. The representatives of this type comprise a relatively most numerous statistical group (46.5%), i.e. almost a half of the surveyed. Such a utilitarian, functional attitude of the representatives of this group suggests to refer to them as ***"functionalists***". It is possible to put forward the hypothesis that the structure of the statistical types under discussion would be slightly different within school age students. It is believed that a relative number of "fans and enthusiasts" would increase at the expense of "functionalists".

Cluster 2. ***Computer "fans and enthusiasts"*** considering a computer as a hobby, an object of admiration. They express their emotions by the following statements: "Life without a computer for me is the same as living without air", "If anybody deprived me of the possibility to use a computer, my life would become humdrum". The respondents of this group find a computer as the means of improvement and education. The graphic expression demonstrates that this cluster includes the surveyed representing only entirely positive attitudes towards a computer. It maybe assumed that the formation of such an attitude was affected by the fact that cluster 2 included a relatively greater number of males (compared to females) in terms of percentage.

Cluster 3. Entirely ***negative attitudes*** towards a computer. It includes students considering a computer as a source of weariness, stress, dissatisfaction, displaying absolute indifference to a computer and experiencing a kind of discomfort in the company of computer enthusiasts. The representatives of this group do not regard a computer as an essential factor for their improvement and education. They convey emotional-motivational dissatisfaction with a computer. This statistical type may be addressed as "***computerphobes***".

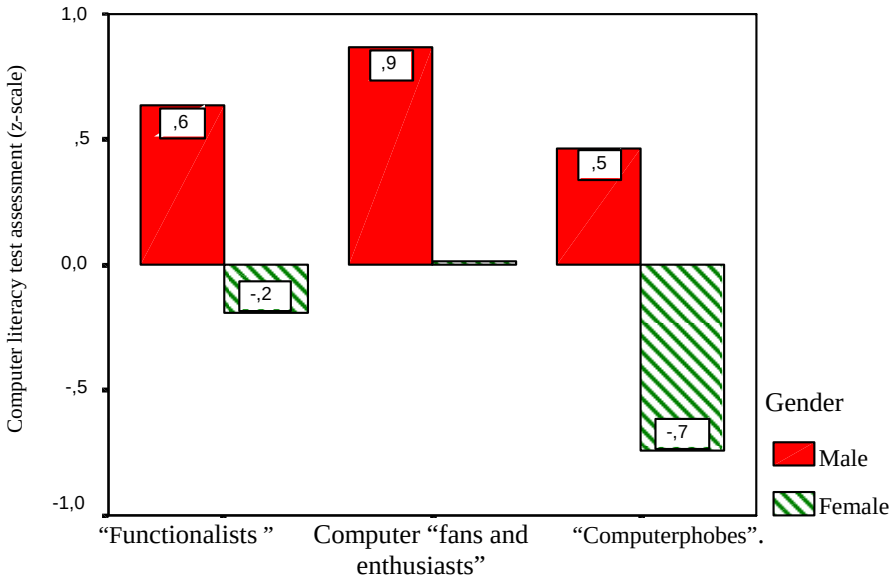

Figure 2. Ratings of computer literacy test by emotional-motivational relationship with computer and gender specificity

In the course of the study a statistical correlation between the emotional – motivational relationship clusters and computer literacy level has been tested. To be more exact, we have elucidated if it is possible to state that students having formed a positive attitude towards a computer usually demonstrate higher computer literacy level, whereas persons expressing a negative attitude are of lower computer literacy level. For the data analysis it has been worth studying how the gender aspect is intervening into the statistical interaction of the two variables discussed above. The graphic analysis (Figure 2) evidently reveals that the best results were achieved by the respondents from group 2 (both male or female) or computer „fanatics“, and the worst ones – by the respondents from group 3, possessing an entirely negative attitude towards a computer. It also demonstrates that there are statistically significant differences between male and female attitudes in groups 1 and 2 (cluster 1 – $t = 4.1$, $p<0.001$; cluster 2 – $t = 3.2$, $p<0.001$), in group 3 – $t = 2.1$, $p = 0.05$. The latter group includes a small number of male respondents having done the computer literacy test. Figure 2 witnesses gender effect being stunningly strong and unacceptable both socially and educationally.

CONCLUSIONS

The study indicates that students’ computer literacy is relatively strongly affected by the ***emotional-motivational relationship with a computer***. The study data has revealed that students having formed a positive contact with a computer (both male and female) usually demonstrate higher computer literacy level, whereas persons expressing a negative attitude are of lower computer literacy level.

The study data showed that the idea of using cluster analysis to identify statistical types in the student population based on differences in computer literacy and other important variables has been fully justified. The actually existing student types have been identified and described by their *emotional-motivational relationship with a computer*. It would be important to describe such ‘pure’ (in terms of the above characteristics) statistical

groups by qualitative terms and to identify their percentage in general population, as this information could and should be used for optimising and increasing efficiency of the computer literacy development process. In that case the choice of the existing and/or development of the ***new educational strategies and methods of computer literacy development*** would be based on targeting not some abstract, "faceless" student, but very concrete and actually existing types of students.

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