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LEARNING STYLE - THE CORE OF PERSONALIZED INSTRUCTION IN E-LEARNING

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Articolul prezintă o cercetare al cărei obiectiv îl constituie identificarea legăturii dintre stilurile de învățare ale studenților şi aşteptările lor față de mediul de învățare on-line şi definirea unei tipologii a profilurilor de învățare, rezultată din combinații speciale ale stilurile investigate. Aceste obiective ştiințifice sunt subordonate, în planul pragmatic, formulării unor recomandări pentru construirea scenariului de formare pentru remote laboratory. Ca instrumente, au fost folosite un chestionar pentru mediul de învățare electronic, un inventar pentru stilurile de învățare şi două teste psihologice vizând anxietatea şi raționamentul abstract, iar eşantionul a fost constituit din studenți aflați în anii I şi al II-lea, din domeniul electric şi al ştiinței calculatoarelor. Concluziile confirmă existența profilurilor de învățare şi a unor relații preferențiale între dimensiunile acestuia şi unele caracetristici ale mediului de învățare, a unor diferențe semnificative statistic introduse de vârstă şi gen. Cunoaşterea profilurilor de învățare şi a aşteptărilor studenților față de mediul on -line permite profesorului proiectarea şi implementarea unor scenarii a căror eficiență este mai ridicată, favorizează comunicarea între actori, măresc satisfacția studenților şi performanțele acestora în învățare.

I. Academic performance and learning styles

The advent of virtual learning environments has changed the roles of teachers and students at several levels. Comparing the two pedagogical approaches (the traditional one, teacher-centered, and the new one, learner-centered), Audet and Lepinay (1999) point to several changes in the teachers' role. From orators, they have become the students' companions, guiding their learning. From source of information, they have become organizers of the learning activity. From people who penalize learning by means of grades, they become facilitators of the students' autonomy [2]. Consequently, focus is given to learners, while the knowledge that teachers process no longer represents the starting point of the teaching process [11].

The focus on the learner excludes teaching addressed to the average individual, whose peculiarities correspond to a robot-portrait; it recommends and favors the adjustment of teaching to the learners' needs, preceded by the determination of their school profiles; thus, a personalization of learning is accomplished, as recommended one hundred years ago by E. Claparede [ap. 13]. Being given that, according to specialty literature, the level of individuals' skills

cannot entirely explain performance, specialists in education psychology have made a choice for the study of personality structures, where learning styles play an important part [14].

The learning style was developed from the superordinate concept of „style", thought of as a personal, repeated way to perform daily activities, globally characterizing an individual and being materialized in definite ways of acting, behaving, expressing oneself [10]. No matter if they regard teaching or learning, the styles have objective, stable bases, resulted from personality traits (temperament, sensitivity to the external environment, propensity to work by oneself or in a team), the peculiarities of the cognitive system (perceptive abilities, ways to treat information etc.) or from subjective elements triggered by one's experience: subjects that tended to be studied more, professional roles etc. [14].

Regarding learning styles, developed from cognitive styles with which they often identified [14], typologies have been drawn up which send to ways of naming and classifying individuals' behaviors according to preferences, as far as learning is concerned. Personal preferences are based on sensorial modalities (visual, auditory, kinesthetic etc.), the type of content (abstract vs. concrete), social relationships (independent-dependent on the teacher), the preference for emotion or cognition (impulsive-reflective) etc. The complexity of learning styles has led to the occurrence of several complementary perspectives, whose variety is almost disconcerting. In what follows, we will briefly present some well known typologies:

- Impulsivity - reflection proposed by Kagan [4], where reflection corresponds to the preference for slow, deliberate evaluation of hypotheses and impulsivity to quick reactions and answers regarding certain issues.
- Field dependence – independence, proposed by A. Witkin [14]; those belonging to the former category do not isolate the relevant information from the irrelevant one in solving problems, while the latter category prefers to select relevant information.
- Auditory – visual, proposed by A. de la Garanderie, categories which are differentiated according to the "habit" - originated in the learner's social environment – to evoke images of a certain kind: visual, auditory, tactile, kinesthetic; we can notice the visual, auditory, kinesthetic types etc. [5].
- Divergent – convergent, assimilator – accommodator, proposed by Kolb, types built on two dimensions: the source of knowledge and the way it is processed [9]; hence we have four types of learning styles: divergent learners, convergent learners, assimilator learners and accommodator learners.)
- Sharpening – leveling; people from the former category give emphasis to differences between objects, the latter prefer to evoke similar elements [10].

Even though the typologies are most often built mono-dimensionally or bi-dimensionally, using couples that seem to be mutually exclusive (dependent-

independent, competitive-collaborative), interferences can be noticed between them. In an attempt to overcome the fragmentarism introduced by several typologies, J.P. Astolfi [ap. 6]) proposes a learner's profile resulted from several dimensions. The multidimensional approach guarantees a greater relevance for the diagnosis and for grouping students and, consequently, a higher efficiency of teaching and learning.

The studies show individual learning style would influence students' perception of the learning environment, interaction, responsive ability and achievement [7, 8]. Regarding the relationship between students' learning style and instruction, research has showed that students' achievement increases if instruction meets their learning style. Learning styles can affect students' emotions, the ways they perceive and retrieve information, and finally their learning outcome and reaction towards instruction [12, 16]. Other researchers have found out that students with different academic achievement perform different learning styles and have different expectations from the teachers [ap. 8]. Students also increase their active learning strategies, that is, they know how to integrate previous knowledge with new knowledge; Students' satisfaction and attitude outcomes were significantly different for format: students in the small group were more satisfied, while those using the individual learning situation were more strongly agreed that they controlled the pace and sequence of their own instruction [3].

II. Research design

The general objective of the research is to identify connections between students' learning styles and their expectations regarding the on-line learning environment, as well as to define a typology of learning profiles, as resulted from special combinations of the researched styles. These scientific objectives are pragmatically subordinate to the formulation of certain recommendations for building the learning scenario for the remote laboratory.

The general hypothesis of the research postulates the existence of certain connections between learning styles and students' expectations regarding the virtual learning environment. The following subordinate hypotheses were derived:

H1. Learning styles are evolutionary; they vary according to students' age, the students in advanced years of study exhibiting a stronger orientation towards independence regarding the teacher and the context, reflection and production.

H 2. Learning styles vary according to the respondents' gender, girls tending to be more dependent on the teacher and on the socio-affective context, but more rational and, implicitly, less impulsive.

H 3. Subjects with independent styles prefer individual learning; their need for guidance is lesser, choosing methods that suppose exploration,

cognitive risks and more complex evaluation forms.

H 4. It is possible to define a typology of learning profiles, resulted from special combinations of the dimensions researched.

The following tools were used in the research:

- a multidimensional inventory, to determine learning styles, drawn up by the authors through adapting a model taken from G. De Vecchi (1992); examples of items can be found in *table 1*;
- a questionnaire focused on the learning environment, with close answers, also original, focused on peculiarities of the learning environment in the remote laboratory ; examples of items can be found in *table 2*;
- classic psychological tests (STAI-Y for anxiety and B53 for intelligence).

Category	Items	Examples
Visual - auditory (A. de La Garanderie)	1-5	*When studying a lesson* *a.* You can better remember what you saw, what was written, the pictures presented; *b.* You can better remember what you heard, (the person's words, intonation, voice).
Field dependence – independence (B.H. Witkin)	6-10	*When performing a laboratory experiment,* *a*. you feel somehow lost, you need clear instructions, a guide; *b*. you prefer to be free, to have initiatives, to make your way by yourself.
Dependence - independence regarding the psycho-affective context	11-14	*a.* You have the tendency to reject or to accept everything just the way the others do. *b.* the idea you reject or accept also depends on the person it comes from.
Production - consumption (J. L. Gauzieu)	15-19	*When accomplishing a task* ***a*.** You tend to invest all your energy, irrespective of the stakes. ***b*.** You tend to defend yourself, sparing your energy.
Reflection - impulsivity (J. Kagan)	20-23	*When you have to answer a question* *a.* you give a quick answer, even if you may be wrong. ***b*.** you regret the others have just verbalized what you also had in mind but did not dare to say.
Sharpening - levelling (D. Ausubel)	24-27	*In a discussion*, *a.* you are more interested in differences, you like to underline contradictions. *b.* you are satisfied when you find what you have thought yourself, because you feel protected.

Tab. 1 Fragment from the multidimensional inventory for determining the learning profile

The multidimensional inventory of learning styles is comprised of 27 yes-no questions, organized according to six dimensions: visual - auditory, field dependence - field independence, dependence – independence regarding the psycho-affective context, production - consumption, impulsivity – reflection, sharpening- leveling (*Table 1*). The characteristics mentioned are placed on an axis and a continuum can be found in between the poles, so that a subject is placed closer to one or another of the poles, according to his/ her score and the mean of the scores for the tested population.

The learning environment questionnaire (LEQ) has 17 multiple-choice close questions, organized on dimensions: group work (4, 6, 12, and 15), organization of the content to be learned and preferred learning methods (5, 7, 8, 11, 14, and 16), evaluation (13, 17), perception of the advantages and disadvantages in computer-mediated communication (9, 10). The factual data were collected in the items 1-3 and they focused on age, gender, school level. Two examples are presented in *Table 2.*

1. *Which of the following best suits your learning habits*? (*Please select only one!*)
a. starting from the first chapter and progressively going through the next chapters
b. reading only the chapter that I want to learn and leave the others for later
c. trying to understand the end of a chapter, the examples and questions, never reading the rest
d. looking for keywords (by using the search engine of the site or the index of a book) and then studying the results.

2. *Select the frequency of the following behaviors in your case*:

When learning in a group:	never	seldom	often	always
There are several ideas that can help me.				
I do not dare to defend my ideas.				
I am able to learn from others.				
I am disturbed by my colleagues.				
I dislike that some colleagues work too little.				
I just dislike the presence of my colleagues				

Tab. 2 Examples of items (LEQ)

The two instruments were applied on a sample of 176 respondents (139 boys and 37 girls); 60.4 % of the boys and 51.4 % of the girls are under 20 years of age, while 39.6 % of the boys and 48.6 % of the girls are over 20. They are all students in the Faculty of Electrical Engineering and Computers, University Transylvania of Braşov. The data were processed by means of SPSS.

III. Findings

The analysis of the correlation coefficients between the six dimensions of the inventory for determining the profile of the learning style indicates the lack of any connection between the dimensions „preferred sensorial modalities" and „field dependence - field independence" and the other four (*Table 3*).

Dimensions of the learning profile	Correlations	Dimensions of learning styles					
		1	2	3	4	5	6
1 Visual - auditory	No correlations						
2. Field dependence - independence	No correlations						
3. Dependence – independence regarding the psycho-affective context	Pearson	-	-	-	-	-	-.255**
	p						.001
4. Production – consumption	Pearson	-	-	-	-	.228**	.273**
	p					.003	.000
5. Impulsivity – reflection	Pearson	-	-	-	.228**	-	.189*
	p				.003		.016
6. Sharpening-leveling	Pearson	-	-	-.255**	.273**	.189*	-
	p			.001	.000	.016	-

Tab. 3 Correlation coefficients in learning styles

Nevertheless, correlations can be found between other dimensions of the learning styles, which allow profiles to be outlined. The more independent students are of the psycho-affective context (i.e. they are more sensitive to information than to the way information is conveyed, they have school results that do not vary from one teacher to another); the more sharpening they are, in other words, they tend to underline what is different in objects which are similar. They are active learners, invest a lot of energy in their work, have numerous personal projects (productive), are impulsive, react quickly to problems, and are quick to suggest an answer which can be sometimes wrong, inhibit analytical, deliberate reflection. The opposite profile can be characterized by affective dependence (sensitivity regarding relationships, better use of one's personal qualities in a favorable climate, with academic performance varying according to the teacher), learning through observation, tendency to join others' ideas, proposals (consumers), reflection, inhibiting impulsive reactions and quick answers, leveling different features of the objects and tendency to confuse them, exaggerating similar elements. The result confirms the 4th hypothesis.

Our respondents are rather close in point of age, attending the 1st and 2nd years, which can explain why the means for the diagnosed dimensions are so

close. Statistically significant differences appear only for reflection-impulsivity (t=2.70 p=.008): students who are more reflective, slower in formulating answers belong to the 2nd year, 1st year students being more impulsive, partially confirming H1 (*Fig. 1*). A more heterogeneous sample in point of age may have provided more convincing results with a view to checking the hypothesis.

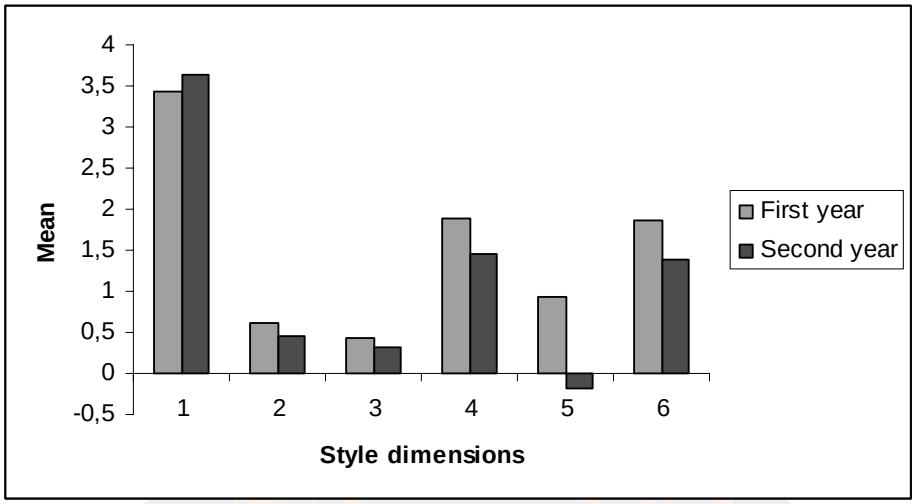

Fig. 1 Age-induced differences

As regards the variation of results according to gender, two differences were found which cannot be accidental: girls are more visual than boys (t=2.8 p=.006), boys are more impulsive, whereas girls are more reflective (t=1.76 p=.08), a fact that confirms hypothesis H 2. As far as affective dependence-independence is concerned, the results we obtained, without being certain, show the girls' tendency to be more independent and the boys' to be more dependent, contrary to our supposition (*Fig. 2*).

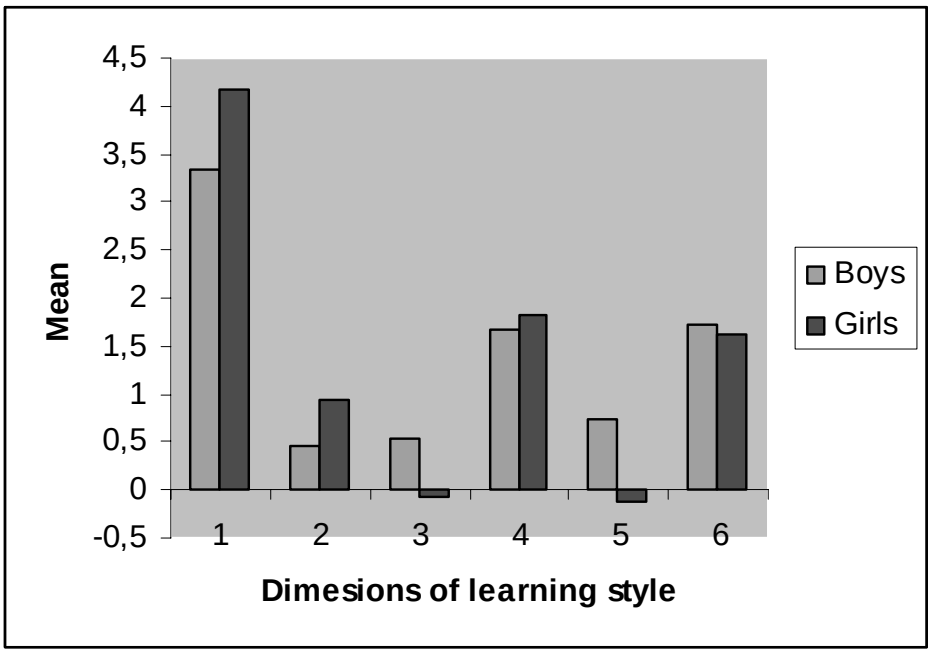

Fig. 2. Gender-induced differences in learning style

The relationships between learning styles and students' expectations regarding the virtual learning environment show that more visual students need additional information from the teacher when an experiment fails (r =.271, for p=.01), and, as assessment modality, they prefer to repeat the applications that were previously conducted by the teacher. For the time being, we cannot offer an explanation for this connection.

Students who are more field-dependent, with an overall perception and difficulties in isolating relevant elements, state that they feel a greater need to be helped by somebody else when learning something new (r =-.212, for p=.01) and tend not to skip laboratory classes (r =-.161, for p=0.05). They want to retake the experiments, but in traditional learning, there is not enough didactic time. As evaluation modality, they prefer to repeat the applications that were previously conducted by the teacher (r =-.157, for p=0.05).

Students who are dependent on the psycho-affective context exhibit a greater need for help when learning something new, often considering that the teacher does not give students enough learning time. Their behavior is similar to that of the students inclined towards production, who tend to invest all their energy in activities, having numerous personal plans and wanting to interact more frequently with the teacher when they learn.

The students with high impulsivity do not want the teacher to give them further explanations (r = -.177, for p=.05). Sharpeners, inclined to give emphasis to what is different in similar elements, are seldom willing to repeat until they understand and prefer to learn by themselves, not feeling the teacher's guidance as necessary. For the dimensions 5 and 6, there are direct correlations with anxiety: the more impulsive and sharpener students are, the higher their scores for anxiety (r=.203, respectively, r=197, for p=.01 and p=.05). Intelligence does not correlate with any of the dimensions of the inventory for the learning styles, confirming the fact that they are close to personality factors and not to attitudinal ones [8].

IV. Conclusions

The research we conducted aims at being part of the present tendency to overcome the differentiation of training by grouping learners according to the level of their knowledge, as expressed by grades, or according to their IQ level, in order to get closer to recent research which suggests grouping students according to their learning styles. Our findings demonstrate that it is possible to identify learning groups by using the proposed instruments, as there are peculiarities of learning preferences which are coherently organized, bringing about the appearance of learning profiles: a. independent, sharpener, active, productive, impulsive and b. context-dependent, consumer, reflective and leveler. The two profiles belong to opposite poles, but future research can refine the analysis, introducing additional profiles by considering intermediate profiles

in the continuum circumscribed by these extremes. Staring from the two multidimensional profiles and from the preferences for certain peculiarities of the virtual environment, there is the possibility to design laboratory activities or interpersonal relationships with the tutor or in the learning group, which would be more appropriate for ensuring progress.

Grouping students starting from their learning styles favors an authentic differentiation of teaching-learning and overcoming strongly selective approaches, which do not benefit certain personalities, negatively impinging on their performance. At the same time, it favors a better use of the resources, more efficient communication between teacher and students, a more complete use of the learners' competences and forming more proficient work-groups. Thus, the learning style can become the core around which the learning scenario is designed and developed. Attaining this goal requires the teacher (tutor or course-designer) to know students' learning profiles, but also his/ her own learning profile, in order to link them to the learning scenarios. The didactic norm recommends the development of less expressed learning modalities, in order not to isolate students within their learning styles and, at the same time, it forbids penalizing those students who do not respond in an efficient way to the style favored by the teacher (double constraint).

To the differentiations in point of learning styles, more or less acquired, we should also add differentiations introduced in the learning strategies, the operations and resources that students plan in order to attain their objectives in a particular learning situation. Even though there is a tendency to associate certain learning styles with higher academic performance, we no not plead for their being placed in a hierarchy, but for observing the two-fold constraint, which should enhance learners' satisfaction and performance [9] and which should be completed with appropriate deliberately chosen learning strategies.

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