

LEARNING PATTERNS AND SELF-REGULATION IN HIGHER EDUCATION: A ROMANIAN STUDY

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Abstract: *The article aims to highlight the psychometric properties of Vermunt's (1994) Inventory of Learning Styles (ILS). A Romanian higher education sample was used in order to determine the psychometric properties of ILS. We also aimed to analyse relationships between learning patterns and academic performances. The results showed that the reliability of most ILS scales is satisfactory. The factorial structure of the ILS determined through exploratory factor analysis showed a partial superposition with the original model. The best represented factor was active meaning-directed learning pattern, including mainly the learning processing and the regulation strategies. Considering the cultural differences and the high degree of similarity between the factor structure obtained in this research and that presented in other researches we can conclude that the Romanian version of the Inventory Learning Styles is a valid and reliable instrument.*

Keywords: *learning; learning orientations; learning patterns; mental models of learning; processing strategies;*

1. Introduction

The management of learning within and across learning contexts is a widely researched topic in the educational psychology including concepts which sometimes tend to overlap such as styles, approaches to learning, or patterns of learning. As Evans and Vermunt (2013) stated, some of the overarching questions facing the styles, approaches, and patterns research domain are examined in relation to three main issues: dimensionality (research evidencing on the multi-dimensional models and on the inclusion of self-regulation), measurement (various contributions focusing mostly on appropriate methodologies to explore differences at the individual level), and contextuality and changeability (researchers debating the relative stability versus variability of dimensions in student learning).

In the past, the majority of student learning research focussed on cognitive processing strategies and motivation while little was known about the relations among regulation activities and the way students used these strategies (Vermunt & Vermetten, 2004). Recent research tried to integrate learning components, metacognitive aspects of learning, cognitive processing strategies and study motivation focusing on their interrelationships (Entwistle & McCune, 2004; Vermunt & Vermetten, 2004). Representations of these models are the model of self-regulated learning elaborated by Pintrich and his collaborators (Pintrich, 2004) and the model of Vermunt (Vermunt & Vermetten, 2004). At the beginning, these patterns of behavioral, belief, and motivational components were labelled learning styles (Vermunt, 1996). However, the term learning style has a broader meaning, considered by some of the researchers unchangeable, innate and deeply rooted in personality, therefore the term was changed to a more neutral term, learning patterns (Endedijk & Vermunt, 2013).

The instrument which operationalise the model of learning patterns is the Inventory of Learning Styles (ILS) (Vermunt, 1994). Although the ILS uses the concept of learning style, it measures mostly patterns of learning. The instrument includes four components of learning in higher education: processing strategies, regulation strategies, mental models of learning and

learning orientations. Based on the combination of this four components, several patterns of learning can be identified: meaning-directed, reproduction-directed, application-directed and undirected learning. Although the ILS has been widely used in the international literature, it is relatively new in the Romanian literature.

The ILS was developed within the context of higher education and distinguishes three levels of learning processes: the executive level (including the processing strategies), the control level (including the regulation strategies) and the conceptual level (focusing on the learning orientations) (Van der Veken, Valcke, Muijtjens, Maeseneer, & Derese, 2008). Its origin is in a qualitative research conducted by Vermunt and van Rijswijk (1988) who distinguished between the processing activities that students and the regulation activities. The interviewees' responses were used to construct items of the ILS. A more detailed analysis of the interview led to the identification of different mental models of learning and learning orientations (Vermunt, 1998). The model of Vermunt is a constructive model of learning also called the "onion" model of learning styles; the model explaining that the choice of processing and regulation strategies is influenced by the learning context - the first or second layer, instructional preference and information-processing style; learning orientations and conceptions or mental models of learning are relatively stable, they are personal characteristics, belonging to the innermost layer – the cognitive personality style (Richardson, 2011).

Research showed that the ILS is an efficient instrument integrating both motivational and cognitive elements, with applicability in different educational settings (Vermunt, 1998). The ILS dimensions could be linked to innovative instructional approaches (Van der Veken et al., 2008), to personality traits (Vermetten, Lodewijks, & Vermun, 2001), to students perceptions of their academic environment and to their conceptions of learning and their conceptions of themselves as learners (Richardson, 2011). The ILS allows to differentiate between excellent and average students (López, Cerveró, Rodríguez, Félix, & Esteban, 2013) and its dimensions were associated with the academic performances (Boyle, Duffy, & Dunleavy, 2003; Lopez et al., 2013). The present research will present an overview of the ILS psychometric properties after its translation in Romanian.

2. Method

2.1. Aims

The main aim of the paper was to determine the psychometric properties of the Romanian version of ILS. Reliability, construct and predictive validity were estimated. We also aimed to analyse the relationships between learning patterns and academic performances.

2.2. Sample

The sample included 400 first year university students from three universities in Romania, Transilvania University, University of Pitesti and University of Bucharest. The sample included only Psychology and Education sciences students from the three universities mentioned above, 46 boys and 354 girls, with a mean age of 20 years ($SD = 3.2$) The questionnaires were administered in a paper-pencil format during the courses, the participation being voluntary and unpaid.

2.3. Instruments

The Inventory of Learning Styles (ILS) (Vermunt, 1994) consists of 120 items grouped into four dimensions: Processing strategies (Deep processing, Stepwise processing, Concrete processing), Regulation strategies (Self-regulation, External regulation and Lack of regulation), Learning orientations (Personally interested, Certificate oriented, Self-test oriented, Vocation oriented, Ambivalent) and Conceptions of learning (Construction of knowledge, Intake of knowledge, Use of knowledge, Stimulating education and Cooperative learning). Overall, the ILS comprises 20 subscales with good psychometric which will be presented below.

Academic performances were also measured by the grade point average at the end of the first academic year.

3. Results

3.1. Reliability of the ILS

Cronbach's Alpha coefficients for all the subscales ranged between .65 and .89 (Table 1). Although some values are rather low, there are similar to those reported for the original version of the instrument.

Table 1. Cronbach's Alpha coefficients for the ILS

Subscales	No of items	α for the Romanian version *	α for the original version **
I. Processing strategies	27		
Deep processing	11	.85	
1a. Relating and structuring	7	.82	.83
1b. Critical processing	4	.71	.72
Stepwise processing	11	.79	
2a. Memorizing and rehearsing	5	.76	.79
2b. Analysing	6	.73	.63
Concrete processing	5	.70	
3. Concrete processing	5	.70	.71
II. Self-regulation strategies	28		
Self-regulation	11	.81	
4a. Learning process and outcomes	7	.76	.73
4b. Learning contents	4	.69	.73
External regulation	11	.76	
5a. Learning process	6	.66	.48
5b. Learning outcomes	5	.67	.65
Lack of regulation	6	.65	
6. Lack of regulation	6	.65	.72
III. Learning orientations	25		
7. Personally interested	5	.65	.57
8. Certificate oriented	5	.74	.76
9. Self-test oriented	5	.70	.84
10. Vocation oriented	5	.71	.69

Subscales	No of items	α for the Romanian version *	α for the original version **
11. Ambivalent	5	.77	.82
IV. Conceptions of learning	40		
12. Construction of knowledge	9	.75	.78
13. Intake of knowledge	9	.75	.77
14. Use of knowledge	6	.78	.70
15. Stimulating education	8	.85	.88
16. Cooperative learning	8	.89	.89

Note: * $N = 400$; ** Vermunt (1998)

The test-retest reliability was also computed, the inventory being administered and data collected on two occasions approximately two-month apart. For all the subscales, and especially for those measuring learning strategies, the correlation coefficients were strong and statistically significant ($p < .001$) demonstrating the long-term stability of the responses (Table 2). The lowest stability was obtained for the Conceptions of learning, a possible explanation being the changes of individuals' beliefs as a consequence of their learning processes.

Table 2. Pearson correlation coefficients between test-retest scores

Subscales	r Test - Retest
1a. Relating and structuring	.66
1b. Critical processing	.55
2a. Memorizing and rehearsing	.68
2b. Analysing	.61
3. Concrete processing	.58
4a. Learning process and outcomes	.57
4b. Learning contents	.66
5a. Learning process	.65
5b. Learning outcomes	.59
6. Lack of regulation	.45
7. Personally interested	.70
8. Certificate oriented	.80
9. Self-test oriented	.69
10. Vocation oriented	.36
11. Ambivalent	.54
12. Construction of knowledge	.71
13. Intake of knowledge	.57
14. Use of knowledge	.54
15. Stimulating education	.65
16. Cooperative learning	.72

Note: $N = 175$

3.2. Construct validity of the ILS

The exploratory factor analysis on the 120 items highlighted a solution with 16-20 factors, explaining 50% of the total variance. The Kaiser-Meyer-Olkin (KMO=.87) coefficient showed that the sample was adequate to the exploratory analysis, the Bartlett sphericity test being also statistically significant ($p < .001$). However, due to the differences between the original version of ILS and the Romanian version (some items had loadings in

several factors) and the small sample size, we decided to test a four-factor solution, using the Varimax rotation, on the 16 scales of the original ILS. The four-factor solution explains 61.24 of the total variance: factor I (23.7%), factor II (13.54%), factor III (13.42%) and factor IV (10.53%) (Table 3).

Table 3. Exploratory factor analysis for the ILS

ILS scales	Factorial loadings				Communalities
	F1	F2	F3	F4	
Processing strategies					
Memorizing and rehearsing		.725			.624
Relating and structuring	.788				.734
Critical processing	.734				.654
Analysing	.700	.425			.690
Concrete processing	.696		.348		.615
Self-regulation strategies					
Learning process and outcomes	.796				.701
Learning contents	.728				.545
External regulation of process	.513	.631			.663
External regulation of outcomes	.649	.439			.627
Lack of regulation				.622	.463
Conceptions of learning					
Intake of knowledge			.443	.336	.665
Use of knowledge			.722		.611
Construction of knowledge	.520		.581		.668
Cooperative learning				.682	.481
Stimulating education			.498	.588	.610
Learning orientations					
Certificate oriented		.707			.640
Self-test oriented		.550	.379		.507
Vocation oriented		.327	.693		.684
Personally interested			.586		.440
Ambivalent	-			.658	.629
	.385				
Eigenvalues	4.74	2.70	2.68	2.10	
% of variance	23.7	13.54	13.42	10.53	

The first factor is highly saturated in scales referring to the Processing strategies and Regulation strategies, the results being similar to those reported by other researchers (Law & Meyer, 2010; Vermunt & Vermetten, 2004; Ajisuksmo & Vermunt, 1999). According to Ajisuksmo and Vermunt (1999) this factor was labelled *Active meaning-directed learning pattern*. The second factor has mixt interesting structure, but approximatively similar to the structure of one of the factors reported by Ajisuksmo and Vermunt (1999) and Law and

Meyer (2010). The factor consists in scale such as External regulation, Certificate oriented learning, or Memorizing and rehearsing strategies. This factor was labelled by Vermunt (1998) *Reproductive-directed learning pattern*. The third factor covers most of the scales related to Conceptions of learning (Construction of knowledge Intake of knowledge Use of knowledge) and two scales related to learning orientations (Self-test oriented and Vocation oriented). There is no saturation in any of the processing or regulation scales, which is why the factor was labelled *Passive idealistic learning pattern* (Ajisuksmo & Vermunt, 1999). The fourth factor has high loadings in scales measuring Lake of regulation, Ambivalent orientation of learning, Cooperative learning and Stimulating education. This factor is also similar to the factor labelled by Ajisuksmo and Vermunt (1999) *Undirected learning pattern*.

The exploratory factor analysis confirmed partially the initial structure of the instrument. The best represented factor is the Active meaning-directed learning pattern. However, the results should be interpreted cautiously because of the high homogeneity of the participants, all of them being psychology and education sciences students.

3.3. Predictive validity of the ILS

In order to estimate the predictive validity of the ILS we used the academic performances at the end of the first academic year (GPA's). The Pearson correlation coefficients obtained between the ILS scales and the GPA were statistically significant for the following scales: Relating and structuring ($r = .26, p = .001$), Deep processing ($r = .23, p = .003$), analysing ($r = .27, p = .001; p < .001$), Stepwise processing ($r = .30, p < .001$), Concrete processing ($r = .22, p = .003$), Self-regulation ($r = .23, p = .001$), External regulation ($r = .22, p < .001$), Personally oriented learning ($r = .11, p = .03$), Vocation oriented ($r = .30, p < .001$), Construction of knowledge ($r = .21, p = .017$), Use of knowledge ($r = .25, p < .001$). The highest predictive value was obtained for the self-regulation strategies and for the learning orientations (Tab. 4). The model including as predictors Self-regulation of learning process, External regulation, Construction of knowledge and Use of knowledge explains 30% of the variance of the academic performances, the model being statically significant $F(4, 324) = 13.01, p < .001$. The results highlighted that ILS is a valid instrument for measuring self-regulatory learning strategies and that using self-regulated learning strategies predicts academic performance.

Table 4. Predictive validity of the ILS – Multiple linear regression analysis

Predictors	<i>R</i>	ΔR^2	β	<i>B</i>	<i>SE b</i>	<i>t</i>
	.54	.30				
Self-regulation of the learning process			.15	2.23	1.7	1.31
External regulation			.34	3.37	0.09	3.74**
Construction of knowledge			-.25	-3.93	1.76	-2.22*
Use of knowledge			.36	7.92	2.05	3.85**

Note: * $p < .05$, ** $p < .01$, $N = 357$

4. Conclusions and discussion

The results of the current study confirmed previous studies on the ILS showing that four dimensions in student learning can be discerned: undirected, reproduction-directed, meaning-directed, and application-directed learning patterns (Vermunt & Vermetten, 2004). Considering the cultural differences and the high degree of similarity between the factor structure obtained in this research and that presented in other researches, we can conclude that the Romanian version of the Inventory Learning Styles is a valid and reliable instrument. The

results suggest that the ILS has reasonable psychometric properties after its translation into Romanian. The small number of male respondents and the high homogeneity of the sample could be considered limitations of the present study which has negative implications on the external validity of the learning patterns model. The learning patterns should be explored in more contexts and populations beyond the first years of higher education. Although there are many studies referring to the validity of the ILS on different populations (Vermunt, Bronkhorst, & Martínez-Fernández, 2014), the consistency and variability of learning patterns across cultures continues to be an interesting issue.

Our results showed that the factor scores accounted for a relatively small amount of variability in academic performance. ILS has a limited role in predicting academic outcome, the results being convergent with other studies (Boyle et al., 2003). Other studies showed that the learning styles were associated positively with academic success and the undirected learning style correlated negatively with academic success (Busato, Prins, Elshout, & Hamaker, 2000).

Future research should extend these findings, by estimating also the convergent validity of the instrument. The exploratory factor analysis should be followed by a confirmatory factor analysis for a more deep analysis of the structure of ILS. Therefore, the further exploration of the construct validity of the learning patterns model is needed. In addition, a deeper analysis of the associations between learning strategies, learning orientations or conceptions about learning could allow us to extend our understanding of effective learning patterns. The original assumption that the influence of students' mental models and learning orientations on their processing strategies was largely mediated by their use of different regulation strategies (Vermunt, 1998) could be also tested on a Romanian student sample.

Despite the limitations mentioned above, our study showed that the ILS could be used a diagnostic instrument for detecting learners with inappropriate views of and orientations to learning, who use inefficient learning strategies, all these aspects being predictors of maladjustment, underachievement or drop-out. The existence of different learning patterns offers the opportunity to find qualitative differences between them (Vermunt & Vermetten, 2004). Assessing the learning patterns of the students could provide a relevant view of the dominant student learning patterns and to linked them with other variables such as the teacher conceptions about learning and teaching, cognitive development of the student, previous performances, personality and achievement motivation etc.

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