COGNITION AND METACOGNITION IN SELF-REGULATED LEARNING. A POSITIVE LEARNING PATTERNS ANALYSIS

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Abstract

The present paper aims to investigate cognitive and metacognitive strategies in relation to learning patterns in students in higher education. The article proposes the analysis of the learning patterns of students in regular universities. The research was based on a qualitative strategy. Photovoice and interpretative phenomenological analysis were blended to support the process of data collection and analysis. The research results indicate the presence of four learning patterns, following the model of Vermunt with slight nuances. A discussion of the learning patterns, cognitive and metacognitive strategies is provided. Differences among learning contexts and persons were revealed. The article concludes by recommending teaching strategies to regulate negative learning patterns and proposes further research subjects.

Key words*: academic learning, cognitive processing, higher education, metacognitive regulation, self-regulated learning*

Introduction

There is a clear need to research and understand how learning takes place in academic environments. As Zimmerman and Schunk argue (as cited in Cassidy, 2011, p. 989) the 'fascination with self-understanding and self-regulation has seen a recent shift in focus to learning and academic achievement processes'. Martínez-Fernández and Vermunt (2015) underline a scientific commitment regarding motivational, cognitive, metacognitive and contextual aspects of learning in order to develop, improve and foster students' learning strategies in a specific educational context and domain. Considerable research efforts were invested over

the last two decades to depict student learning. Metacognition represents probably the most actively investigated process in the last decade. Stimulating metacognitive reflection brings learners closer to their mental processes occurring while learning takes place. Research studies on metacognition demonstrate that metacognitive reflection improves learning in terms of efficiency, time, the capacity of understanding and expressing oral messages, memory and attention qualities, social cognition and self- management. There is currently widespread interest in fostering 'independent learning' (IL) among students in academic sets (Porumb, 2002). While there is a clear interest and commitment in promoting IL, there is no clear understanding of what this might consist and how IL can be specifically addressed through instructional strategies.

Recent research emphasizes the need to develop and improve self-regulated academic learning (SRAL) in students, based on metacognitive strategies. The long-term goal to achieve is an independent autonomous learner, capacitated in deep learning, regulation, and meaning creation.

In this article, the author is interested in exploring the experiences of learning of students in higher education from a person-oriented perspective in order to identify and describe cognitive and metacognitive strategies as components of the learning patterns.

Student learning is a vast and complex domain where considerable research efforts were invested over the last two decades. Branches of research interests appeared: cognitive processing of information, learning styles, learning attitudes, metacognition, learning conceptions, approaches to learning, learning motivation. Furthermore, Vanthournout et al. (2014) discuss about 'research traditions' in learning studies. However, up until now, not that much attention has been devoted to research learning patterns and the subjectivity of learning experience in South-Eastern Europe.

This paper follows the Students' Approaches to Learning tradition (SAL) (Lonka et al., 2004). SAL is grounded on phenomenological studies, focusing on students' perceptions on how they engage in different learning activities and tasks. There are qualitative differences in students' approaches leading to differences in learning outcomes. Due to the conceptual proliferation in the field of learning, a multitude of models can be discerned within the SAL tradition (Vanthournout et al., 2014).

The learning pattern model oriented the research in this paper. This model was originally developed by Vermunt in the early 1990s (Vermunt, 1996), and refined latter (see Vermunt and Vermetten 2005 for a more expansive discussion). The gain of the learning pattern model is to provide a more comprehensive view of learning by bringing together four different learning components (Gibels, Richardson, Donche, & Vermunt, 2014): cognitive processing strategies,

regulation strategies, conceptions of learning, and orientations to learning. According to the model's authors [10], processing strategies refer to thinking strategies used to perform a specific learning task. The regulatory component of learning is defined in relation to secondary order thinking strategies, namely planning, monitoring, and evaluation of learning (Veenman, 2011). All regulation strategies are based on metacognitive knowledge. Learning conceptions refer to the students' perceptions and beliefs about what learning, meanwhile students' orientation to learning can be conceived as their personal goals, intentions, motives, attitudes, expectations, concerns and doubts with regard to their studies (Vanthournout, Donche, Gijbels, & Van Petegem, 2014).

The research of Vermunt (Vermunt J. , 2005) revealed four major learning patterns, prototypically named as: undirected style, reproduction-directed style, meaning-directed style, and application directed style. The present article proposes a research where the four patterns of learning are explored from an interpretative phenomenological point of view, focusing on factors that influence the adoption of a surface or deep approach.

The aim of this research was to explore subjective learning experiences of students in higher education and to identify features of learning patterns according to Vermunt's model. The author hypothesised that learning patterns may vary over time, contexts, and persons. Meaning-oriented and application-oriented strategies appear to be influenced by the perception of content relevance and utility. Teachers act not just like 'regulatory persons' but may have an active role in the process of translation from a surface approach to deep learning.

In the subsequent sections of the article, the paper presents the methodological aspects of the research and discusses the results of the study.

Methods

Participants

The study was conducted on undergraduate students form three Romanian universities, covering a wide range of domains (engineering, economics, and socio-humanities). The students were sampled based on a purposive sampling procedure. The author was interested in sampling a heterogeneous group of students in order to assess the variation of cognitive and metacognitive strategies between different academic profiles of studies. Both the conventional and unconventional means (social media, posters, flyers and e-mail campaigns) were used to promote the project and invite students to apply. Eighty-seven students applied for the project. Preliminary interviews were organized to evaluate willingness and capacity of students to engage into the

research project. Forty-nine students were selected after the initial interview. Table 1 synthetises the participants' demographics and presents retention rates. Thirty-seven subjects (19 female subjects and 18 males) were fully involved until the end of the research project.

The participation was based on volunteering; each subject could decide to withdraw from the project at any time.

Table 1. *Participants' demographics*

Age range	Gender	Retention rate
19 – 23	51.35% females	70.37%
$M_{age} = 21.7\ years$	48.65% males	81.81%

All the thirty-seven students actively contributed to the research on cognitive and metacognitive strategies associated with learning.

Measures

As argued in previous sections, a person-oriented framework was preferred to conduct the research. Thus, photovoice (PVM) and experience-sampling methodologies (ESM) were coupled to accomplish the participatory goal of the research.

Due to the complexity of the learning phenomenon, the PVM method was considered appropriate to give access to learning experiences in different settings. In photovoice methodologies, the participants are provided with disposable cameras and document life experiences by taking photographs. Despite its accuracy in gathering data (Graziano, 2004), photovoice has not been widely harnessed in education and learning research. In its traditional use, PVM was applied to under acknowledged research. Simmonds et al. (2015) argue that PVM enables subjects to document real life experiences and supports reflection.

According to the theoretical perspective outlined above, the subjects in this particular research were invited to take photographs to describe the way they learn and understand learning.

To sample experiences, an experience-sampling methodology was applied. Zirkel, Garcia, and Murphy (2015) argue that ESM "examine individual' experiences and behavior in context" (p. 7). Moreover, the essential feature of ESM is that the participants' feelings, thoughts or actions can be measured repeatedly at the moment they happen in real life.

To sample experiences to be captured into pictures, two sampling approaches were blended, namely random and event-based sampling (see Bolger & Laurenceau, 2013 for a more detailed discussion). In doing so, the researcher was responsible for random sampling and the subjects applied event-based selection. In the first case, for instance, the researcher sent text messages to all participants to assign them the task to take photos of learning experiences occuring in a specific day. In addition, the participants decided by themselves other relevant events and experiences to be captured (e.g. preparing for an exam, group learning). Both PVM and ESM contribute in a significant way to giving acces to imediacy and proximity of learning experiences, otherwise diffcult to assess by an outsider researcher.

In the subsequent sections, the procedures of data collection and analysis will be described.

Data collection procedures

After the preliminary interviews, the students benefited from a training session to discuss scientific, procedural, and ethical aspects. Initial group meetings were dedicated to negotiate a prompt to guide the selection of learning experiences to be documented by students during the data collection process. The prompt agreed by both the researcher and the participants stated as follows: "Take photographs of objects, persons, and situations that you consider most representative for the way you learn and you understand what learning is".

In order to contextualize the pictures, the participants were invited to write short narratives about them. In addition, narratives represented a mean to stimulate reflection on learning. To upload pictures and write narratives the participants used the on-line data collection platform Survey Gizmo®.

To gain more insights about the subjective reflection of learning, the author invited the participants to answer questions about their emotional state associated with each of the pictures below: 'How do you feel about the experience in this picture?'; 'How strongly do you feel [that emotion]'. The questions were addressed via the online platform where the participants uploaded pictures and wrote narratives. The measure of emotions was supported by incorporating faces in the scale to access the feelings of participants more sensitively (see Figure 1).

Figure 1. *Questions to support the evaluation of the emotional state of participants. Source of the faces' images: FaceTrace®)*

The use of images to measure emotions can be deployed not just once, but multiple times for each picture providing an emotional narrative of learning. For this study, the assessment of the emotional states made a relevant contribution to the evaluation of learning patterns over disciplines, types of learning tasks, and teaching styles.

Data analysis

From the above description, it is clear that the research had a strong participatory note. By applying PVM, the research subjects became co-researchers. Therefore, participatory research was an option for the data analysis process.

The photos previously collected were the object of a phenomenologically interpretative analysis during individual interviews. An interview protocol was designed based on the preliminary analysis of pictures. During interviews, the participants were exposed to all the collected pictures. Each participant selected a number of ten pictures according to the personal relevance criterion. Based on the SHOWeD technique (Wang & Burris, 1994; Wang, 1999), widely associated with PVM, the participants answered trigger questions to ignite the discussion on learning patterns:

'What do you see in this picture?', 'What do you think is really happening into the mind of the student in the picture?', 'What does this picture tell about the way these students learn?', 'Can you describe this type of learning?', and 'Do you think there is something to improve learning in such a situation?'

The questions above stimulate deep reflection on learning actions and processes. The interviews were recorded and transcribed. To analyse the interviews' transcripts, IPA was applied. The first step in applying IPA consisted in reading and re-reading narratives and transcripts of interviews. Relevant quotes were selected and noted during the second stage. Descriptive, interrogative, and reflective comments were associated to each quote. The quotes have been synthesized and expressed through a single item. Polarization (Smith, Paul, & Larkin, 2009) was applied to group items into super-ordinate themes or clusters representing cognitive processes, metacognitive strategies, conceptions of learning, and learning orientations (see Table 2). In addition, the table presents examples of representative pictures for those specific quotes.

Table 2. *Sample of matrix of cluster and emergent themes*

Clusters	Emergent themes	Quotes	Exploratory and conceptual comments
Cognitive processes	Passive processing of information Reading and re-reading processing 'The coloured marker' strategy	S: 'In this picture, I am doing my homework for Philosophy. Copy – paste is the only thing I am doing. Nobody cares about these disciplines. They are useful to gain some more credit points' (P-009-F; P-122-M). S: 'For me it is important to read the entire material. Then, I try to retrieve different parts or aspects. If am not able, I will read it again' (P-027-F; P-063-M). S: 'These are my papers ready to be learnt. They are cool, aren't they?'(P-028-F; P-032-F).	Tendency to minimize the importance of learning in certain disciplines. Does this attitude support cheating behaviours? This reading strategy is applied even for STEM disciplines. Students spend time to colour and underline course notes (the picture shows a masterpiece of the course material).

Clusters	Emergent themes	Quotes	Exploratory and conceptual comments
Metacognitive strategies	Survival learning Bulldozer strategy Lack of self-regulation Lack of planning and monitoring External regulation	S: 'That is why we have colleagues. It is easier to figure out what happened in other groups, taking into account we will not need to know anything about this, the teachers do not vary so much the subjects in exams' (P-011-M; P-021-M; P-037-M). S: 'In this picture I was feeling really, really lost. There was a lot of study material but I had no clue from where to start or what is important for the teacher to know. I did not pass the exam' (P-013-F; P-015-F).	There are no planning, monitoring or evaluation stages related to the task solving process. External regulation based on the fellows' experiences. The role of the teacher as a regulatory element is secondary. Student is overwhelmed (the presence of a double really). The lack of external regulation (when needed) transforms learning into an exhausting process.
Conceptions of learning	Learning is not useful and pleasant Learning is to memorize texts Learning is to describe something	S: 'I do not know why I went to this faculty. I thought we will do some practical things, but it is too much theory' (P-101-M; P-098-M). S: 'One has to memorize formulas and textbooks. My specialization is in management. I never heard of a manager having to apply multinomial regression' (P-001-F; P-005-F). S: 'I do not know if I am on the right way. I thought we will do some practical things in here but there is nothing but lots of full blackboards and written papers to memorize' (P-134-M; P-056-M).	Reappearing perceptions of the unbalance between theory and practice in academic curriculum. Students question the relevance of what they learn. Do these perceptions affect conceptions of learning? Possible narrowing of representations associated with learning (e.g. learning is memorization and retrieval). Possible misunderstanding of the curriculum design and the relations between academic disciplines and the final qualification
Orientations to learning	Ambivalence Lack of motivation Confusion	S: 'In this picture I wrote down this quote (*Exams are my life*) because I was trying to convince myself that what matters is to pass the exams and get my certificate' (P-043-M; P-083-F)	Certificate and test oriented; Do the students see their academic route as a trampoline to their professional life? Does this perception affect the pleasure of learning?

Note: For instance, P-134-M and other similar codes represent a picture code considered representative for that quote. 'P' represents the initial letter of the word 'picture', 043 is the number of picture and 'F' or 'M' represents the student's gender.

The results of the participatory and non-participatory analysis are described and discussed in the subsequent sections.

Results

The results of this research are consistent with previous studies conducted based on Vermunt's learning patterns model (Martínez-Fernández & Vermunt, 2015; Vermunt & Vermetten, 2004; Vermunt, 2005; Vanthournout et al., 2014). Therefore, four learning patterns were revealed, prototipycally named undirected learning, reproduction-oriented, meaning (MD) and application-oriented (AO) patterns. According to Gibels et al. (2014), the first two are negative learning patterns, while the last two are considered positive. In the following, positive learning patters will be discussed. All the students were characterized by a dominant learning pattern and showed features of other patterns.

Meaning-directed learning pattern

Students in this cluster enjoy learning and getting actively involved. MD students are interested and vivid when learning, finding an intrinsic interest. In addition to reading and re-reading strategies, these subjects apply deep processing techniques in most of the learning situations. They do not dissociate deep or surface learning according to the status of the discipline (core or optional) but seek for subjects they are interested in.

> S: 'I am like a … tree when I learn, with many pages open in my browser. I usually feel the need to search for more and I like it (smile)'.

They usually process information by using schemas or conceptual maps in order to establish relations between new and already acquired knowledge. The experience of learning is an enjoyable one because MD students try to find the personal and real life relevance of the material.

This learning pattern is based on internal regulation. The planning, monitoring, and evaluation phase are put in place by students themselves (Figure 2).
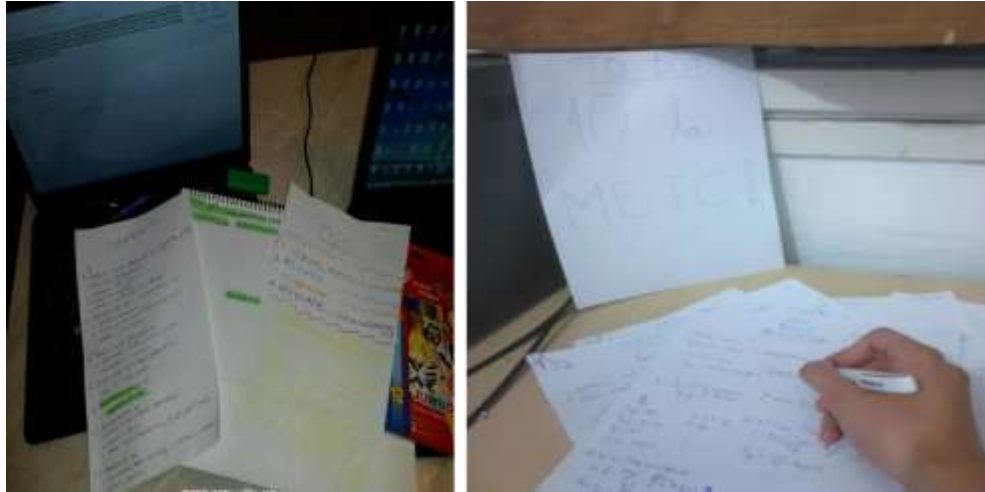
Figure 2. *Metacognitive planning strategies: to-do lists and goals to accomplish*

S: 'This is a to-do list I settle before starting learning. Usually, before starting to learn, I make a list of questions to answer when I finish. During learning, I put more questions on the list'.

In daily learning experiences, meaning-oriented students organize and structure content into coherent structures, but they are not committed to underline or colour as reproduction-oriented students do (see Figure 3). In addition, they actively use the metacognitive knowledge on strategies and, in doing so, various approaches across teachers, courses, and contexts are possible. Students in this segment also prefer collaborative regulation.

Figure 3. *Meaning-oriented (left) versus reproduction-oriented students' behaviours in content structuring*

Teachers, fellows, and different scholars may sustain a deep approach to learning and cultivate the personal interest in a specific subject matter. Sequential learning is also supported by using external resources, as pictured in Figure 4 (e.g. talks, discussions, movies, and websites).

For students in this category, learning means the construction of knowledge by interacting with others: teachers, colleagues or scholars. They do not focus only on outcomes but enjoy the process. This proves a personal interest in academic and professional career.

Figure 4. *Finding external resources to support deep learning*

Application-oriented (AO) learning pattern

Students driven by this pattern believe learning is a vital component of their personal development. They are very selective and focused on specific subjects they consider practically relevant. AO students bring their personal experience when learning or solving tasks and sometimes do not prefer to confront it with scientific literature. One of the most frequent cognitive strategy relies on establishing relations between concepts and reality. Further, this strategy is known as the *conversion strategy*. Many of the AO students' are interested to transfer and 'test' what they learn in their immediate reality. They are interested to concretize and bring their own experience in learning. Therefore, they do not enjoy theoretical learning tasks and perform better in applicative ones.

> S: At the very beginning, I was wondering why I have to learn Mathematics at
> this faculty. Then I met a great teacher and she let me explore what one can
> do with applied mathematics. I was fascinated. It was as I was acting in
> 'Numbers'.

In relation to the conversion strategy, they spend time and are interested in depicting the events they lived according to a certain theory (see Figure 5). This behaviour occurs across various fields of study.
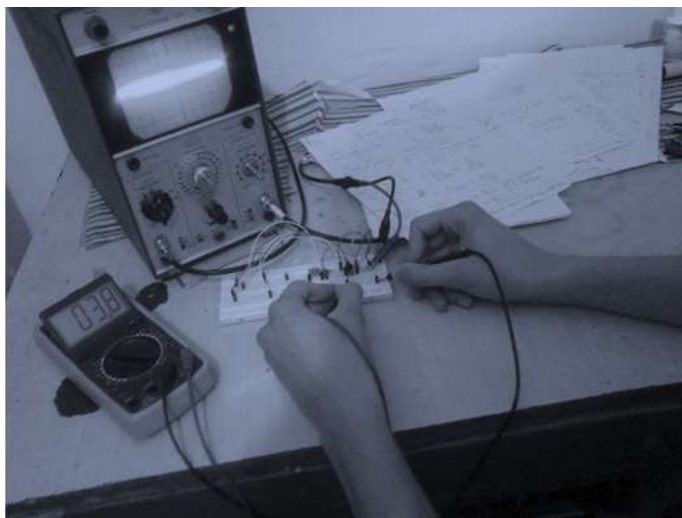

Figure 5. A student 'testing' the theory

These students are very demanding with their teachers asking for practical applications of knowledge. Depending on contexts and persons, they can adopt learning strategies that are specific to the meaning-oriented pattern. The relationship with teachers may influence the oscillation between survival learning strategies or meaning-oriented as well. The teacher is playing an active role to maintain and stimulate AO students' interest in exploring reality, even in the case of peripheral disciplines. These students are not 'theoretical persons' and cope well with small chunks of information. Sometimes they tend to stress less on information and go directly to applications.

> S: 'This is my favourite course. We have few to read … one or two pages per
> course. The teacher gives us the synthesis and focuses on applications'.

The teacher becomes a strong regulatory factor because he or she is responsible to design learning experiences to stimulate the conversion strategy. In the absence of this appropriate design, AO students may easily change to passive learners. In addition, disturbing factors may influence easily the learning state when the student considers that a specific activity does not meet his or her requirements. Regarding these students, the process of regulation is both internally and externally oriented. In some cases, the two sources of regulation may be conflictual.

S: 'In this picture I was angry because the teacher told me she had been expecting to give examples discussed in her book. However, I think my examples were also very good. In addition, they were tested. I hardly understand how the teachers' experiences are more valuable than those of students.

The main goal of learning is to use the knowledge they acquire. Not remaining at a theoretical level is the main expectation of these students based on their vocational-orientation (they are motivated to learn by a specific profession that they regard admiringly). As in the case of undirected students, the AO ones sometimes build an idealistic projection of the future.

Discussion

Implication of learning patterns for the teaching activity

As argued in the previous section, each of the students was characterized by a dominant learning pattern and showed features of other learning patterns. There may occur overlapping features and behaviours.

To design appropriate and relevant learning experiences, it is important to know and control the variables responsible for the shift between one learning and another. Therefore, as argued by Vermunt (2005) and collaborators (Vermunt & Vermetten, 2004; Vanthournout, Donche, Gijbels, & Van Petegem, 2014), learning patterns may vary across academic contexts, time and persons. Thus, *teachers, time* and *learning experiences* are key-variables in changing negative learning patterns and turning learning outcomes into positive ones. Teachers are extremely relevant regulatory persons. They are able to stimulate deep learning by using appropriate teaching strategies (Porumb, 2002; 2015). For instance, in the case of MD students, the teachers could propose progressive targets and guide learning through special strategies. In previous research (see Manasia & Pârvan, 2014), there were discussed strategies to improve metacognitive competence in both teachers and learners.

For meaning-oriented students, teachers could play an orienting role, especially for sequential learners. If the teacher provides the students with 'content milestones', this will be usefull to regulate time and avoid students to invest in a less significant chunk of information.

The AO students need to see the concrete and the real behind the theory. This specific need was cross-domain revealed. In this case, the teachers are expected to design flexible and challenging

learning experiences. The flexibility attribute is based on the AO students' need to bring into the classroom their own experiences and discuss them. Challenging learning is based on creating contexts where students apply and transfer the acquired knowledge. In other words, AO students call for authentic learning experiences (Ciolan & Ciolan, 2014) to construct rather than receive knowledge.

Participants' experiences in a PVM study

In this section, the participants' experiences are discussed in terms of the challenges and benefits they encountered during data collection and analysis processes. Opinions and reflections on the photovoice experience were the object of IPA. PVM was discussed with the participants in terms of relevance, satisfaction, and difficulties (
Table *3*). The main challenges can be conceptualized as context-related and person-related.

Table 3. *Synthetic matrix of subjects' experiences in relation to PVM study participation*

Emergent themes	Summary of findings	Relevant quotes
Relevance	The participants positively evaluated the relevance of the method in relation to learning. We were interested to evaluate relevance in relation to any difficulties in understanding the prompts and make decisions about what to capture or not in the photographs. In addition, the participants mentioned they felt the projects and initial training activities helped them to understand themselves better.	S: 'At the beginning, I was a little bit confused. I thought it was strange to take photos of me during learning. However, after the training, it was clearer. It became even funny to take those pictures'.
Satisfaction	Most of the students expressed their fulfilment to participate in this project. The novelty of the project contributed to increase the satisfaction of subjects. In addition, there were students mentioning they felt important to be co-researchers and help to improve teaching practices.	S: 'In most of the cases, the teachers are not interested in what students think about courses and homework tasks. It feels good to know that a project like this will improve teaching and will help us learn better'.
Difficulties	Most of the difficulties were related to taking pictures during classrooms. Some of the teachers were reserved in allowing such a procedure. To mitigate the consequences, the students were advised to avoid taking pictures of teachers from frontal perspective.	S: 'There were teachers that did not allow taking pictures during classrooms and argued that we have to learn not to play at school'.

All the participants in the study said that they felt comfortable, relaxed, and happy when taking pictures of themselves and their colleagues.

> S: 'It was like a new reason to take a selfie or a groupie and we liked that.
> Who does not?!'

In the case of pictures taken during courses, the participants felt more tense because not all the teachers were open to taking pictures and manifested reluctance.

> S: 'Most of the teachers feel they are perfect and their courses as well. If you
> take a picture during that course it is like you want to defy them and it is
> really easy to get sanctioned'.

Seventeen of the students evaluated the teachers' attitude as a barrier into the data collection process. The students' reflections on this situation suggest a more complex framework, where the relationship teacher – student is a central element. The students adopting an undirected learning pattern argued that the relation with the teachers is another element to reinforce their opinion that learning is not useful and enjoyable at all.

Important considerations can refer to the meta-reflection on the students' experiences as co-researchers. Most of the participants argued that they gained many insights about themselves during IPA. The quotes that students expressed are mostly concentrated on the learning activities they put in place to accomplish their academic goals. In fact, the quotes bellow are twofold. In the first place, they demonstrate the presence of an elementary level of metacognitive competence and secondly argue that PVM had a clear contribution to a deeper understanding of cognitive processes taking place while learning occurs.

> S: 'It was interesting and intriguing to analyse myself while learning. I
> realized that sometimes I waste a lot of time searching for more and more
> information about a subject I am interested in. […] The effect is that I end up
> knowing a lot of information on that specific subject but not what the teacher
> wants'.

Conclusions

Changes in everyday life and the expansive use of various sources of information require re-thinking learning experiences and curriculum design. As Cassidy argues, the development of self-regulated learning skills in students is a priority for higher education (2011, p. 996).

The researched proposed in this paper aimed to explore learning experiences of college students based on a participatory research methodology. The model of the learning patterns oriented the theoretical framework. Photovoice, experience-sampling methodology, and interpretative phenomenological analysis were blended.

The research results are consistent with those of other researchers using the learning patterns model in the sense of the identification of the four learning patterns, namely: undirected, reproduction-oriented, meaning-oriented, and application-oriented. The paper focused on positive learning patterns. The research hypothesis has been confirmed. Therefore, the article states that learning patterns may vary across time, contexts, and persons. Students with meaning and application-oriented patterns apply deep learning strategies, but they need external regulation to improve metacognitive skills and learning outcomes. The redundancy of educational content is a recurrent issue of students. Largely, application-oriented students express the idea that contents are customized for teachers' needs and skills not for those of students. The effect is one of ambivalence, confusion and sadness.

Further research is recommended and needed. A first set of important suggestion for follow-up research is to theoretically and empirically substantiate the use of the photovoice method in education as both a research and pedagogical tool. The second recommendation is oriented towards the application of the *Inventory of Learning Styles* on Romanian students across various academic domains to identify dominant patterns and features. In addition, researching learning patterns of students preparing for a teaching career may be relevant to design initial and continuous training programs.

In conclusion, the model of learning patterns is a powerful theoretical framework to guide teaching activity and to understand learning in order to increase the enjoyment of learning and well-being in school.

Acknowledgements

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