

# Impact of Learning Styles on Student's Creativity: Insights from India

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Received	Reviewed	Revised	Published
11.09.2023	14.10.2023	24.10.2023	31.10.2023

<https://doi.org/10.61275/ISVSej-2023-10-10-10>

## Abstract

Learning and creativity are the focus of all educational institutions including architecture schools. Various researchers have analyzed the individual differences and preferences of the students' learning processes. These preferences have been collectively termed as 'Learning Styles'.

Styles are not related to abilities, but relate to preferences. Though individual differences have been widely discussed in the field of general education, their role in the field of architectural design is relatively less explored. This paper reviews these differences in learning styles of architecture student's vis-a-vis their relations with creativity. It employed Kolbe's Learning Style (LSI 3) and Baqer Mehdi's Nonverbal Test of Creative Thinking. In applying them, creativity tests on students were compared with the teacher's scores on the same parameters. The tests were done on 33 girl students of third semester design studio in the architecture department of IGDTUW, Delhi, India.

Results show that accommodators scored the highest in both creativity tests. However, the individual creativity scores given by the teachers did not match the scores of Baqer Mehdi's Nonverbal Test of Creative Thinking. However, the average scores of all learning styles from both evaluations were significantly correlated. A single factor anova showed significant differences in scores of all learning styles.

**Keywords:** Learning Styles, Creativity, Kolbe's learning Style, Baqer Mehdi's Non-Verbal Test of Creativity.

## Introduction

Learning happens throughout a person's life, which begins at birth and continues till the end of the life cycle of a person. According to Kalantari and Tahan, (2016), it has always been taken into account that a student's learning style is one of the aspects that contributes to learning and academic achievement. Styles are not related to a set of abilities, but are rather, a matter of preferences. A basic understanding of how learning takes place is essential for teachers and students. Various researchers have worked to review the individual differences and preferences in the learning process. These preferences in which people prefer to gain new knowledge have been collectively termed as 'Learning Styles'

Creativity is an original cognitive ability and thinking process. Within the gamut of education, creativity is considered a significant characteristic of cognitive development and has been identified as the highest cognitive process in Bloom's Taxonomy. It is known that knowledge of individual learning preferences equips teachers in designing suitable teaching strategies and for students and helps them to reflect on their own learning and expand their learning horizons.

Though individual differences have been widely discussed in the field of education, their role in the field of architecture design creativity is relatively less explored. Therefore, the aim of this study is to examine the various learning preferences of individuals in the design studio and how each learning preference affects students' creativity. Its objectives are as follows.

1. To review the styles of learning of architecture students.
2. To assess the creativity of different style learners in the design studio.
3. To explore the relation of student's learning styles and creativity.

While striving to achieve these objectives, this research poses the following question.

How are the learning styles and creativity of students in design studio related?

## **Theoretical Basis**

### **Experiential learning theory**

Kolb (1984) Claims in his Experiential Learning Theory that information can be learned by grasping and modifying experience. This experiential model defines learning as “the process whereby knowledge is created through the transformation of experience” (Kolb, 1984). It regards reflection as a fundamental learning characteristic that allows one to receive and internalize information. The Experiential Learning Theory views information acquisition as a dynamic cycle comprised of four modes of learning: experiencing, reflecting, thinking, and acting recursively. Concrete experience is followed by observation and reflection, which is then followed by the formation of abstract notions and generalizations, and finally by active experimentation, which leads to the development of new experiences, according to this cycle. Depending on their preferred method of knowledge construction, learners in experiential learning refer to different stages of this cycle. Kolb (1984) mentions learning is a holistic set of processes that are continuous, with a lesser emphasis on outcomes. Learning style is the “generalized differences in learning orientation based on the degree to which people emphasize the four modes of the learning process” (Kolb, 1984).

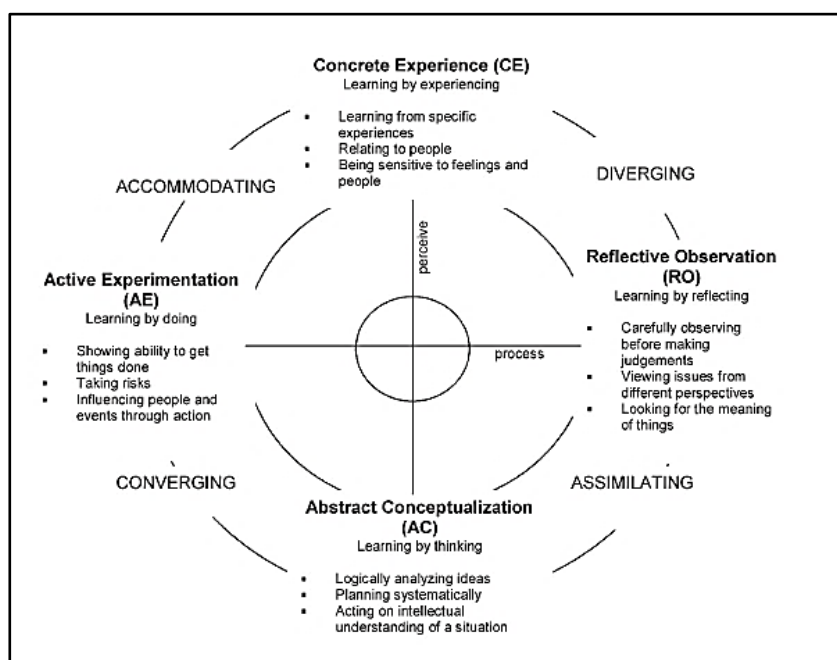
### **Learning styles**

Educationists believe that recognizing the way in which students learn is one among many factors with which their learning process and environment can be improved and learning be enhanced. Learning style is an element of the wider concept of personality (Hawk, 2007). A learning style is basically the way in which a person receives information. It should not be confused with learning ability. A person's preferred method of learning in any learning setting is determined by that person's learning style. Learning can be characterized as an individualized internal process, and learning styles can be characterized as the manner in which people assimilate new information (Demirbas and Demirkan, 2003). Various examinations demonstrate that the learner's performance will be improved if the teaching material is aligned to the learning style of the learner.

### **Kolb's learning Style Inventory**

The Learning Style Inventory based on the experiential learning theory suggests a four-process cycle of learning that begins with Concrete Experience (CE), followed by Reflective Observation (RO), moving next to Abstract Conceptualization (AC), and lastly going to Active Experimentation (AE), (Kolb, 1984). Learning can begin at any point of the cycle depending

on the students. Individual learning styles result from a combination of two adjacent mode preferences in the experiential learning cycle leading to four basic learning styles: Diverger (CE and RO), Assimilator (RO and AC), Converger (AC and AE), and Accommodator (AE and CE), (Hawk, 2007). According to Willcoxson and Prosser, (1996), the four learning modes of Kolb's Experiential Learning Theory constitute two bipolar learning dimensions: concrete/abstract (the perceiving axis, Fig. 1) and active/reflective (the processing axis).



**Fig. 1:** Characteristics of different learning styles  
Source: Demirbas and Demirkan, 2003

In this way Kolb suggested four forms of Learning Styles:

- **Diverging:** This style is a combination of learning through experiencing and through observation; is imaginative, views situations from different perspectives; learns from observation rather than action; is people centric and emotionally sensitive.
- **Assimilating:** This style is a combination of learning by reflecting and thinking. They prefer a logical approach to problems, are individual centric, require clear explanations, and prefer theories, systematic planning and take their time to intellectually understand situations.
- **Converging:** This style is a combination of learning by thinking and doing. They are good problem solvers and have preference for technical tasks. They are individual centric and like to experiment.
- **Accommodating:** This style blends learning by doing and experiencing. They are action oriented, risk takers, prefer hands on tasks, and rely on their gut instinct rather than analysis. They are people centric and attracted to challenges.

### The Learning Style Inventory

Kolb proposed identifying an individual learner's style by analyzing her/his position on each of the bipolar dimensions using a test called the learning styles inventory (LSI). In LSI, there are 12 open-ended questions with four possible alternative replies. In each question, respondents are asked to rank-order four sentence endings in the order that best indicates their learning preference in any learning context. Four scores are calculated after answering all 12 questions using the test key in Fig 5.

These scores are classified into four learning cycle modes: CE, RO, AC, and AE. In the following stage, two composite scores are calculated by subtracting CE from AC and RO from AE scores. These combined scores represent the learner's position on the two bipolar scales.

DIFFERENT LEARNING STYLES BASED ON KOLB'S LEARNING STYLES MODEL AND EXPERIENTIAL LEARNING THEORY	
Hand's-On	ACCOMODATING
Gut Instinct rather than Analysis	
Target achieving	
Attracted to challenges	
People Centring	
Action & Initiative	DIVERGING
Different Perspectives	
Emotional Sensitivity	
Strong in Arts	
Imagination in Solving Problems	
Good in Idea Generation	ASSIMILATING
People centric	
Concise, logical approach	
Ideas and concepts important	
Individual Centric	
Require good clear explanation	CONVERGING
Prefer theories than Practical Approaches	
Need time to think through	
Preference to Technical tasks	
Good in Problem Solving	
Like Experimentation	CONVERGING
Specialists and technology abilities	
Practical uses for ideas	
Individual Centric	

**Fig. 2:** Characteristics of different learning styles  
Source: Author

## Creativity

Creativity as a general term in different disciplines has several overlapping meanings including imagination, innovation, inspiration, originality, novelty, inventiveness, uniqueness (Kaufman and Sternberg, 2019). Creativity definition in the literature varies between the novelty of the idea, the value of usefulness, and problem-solving. Sternberg et al, (2005) emphasize that creativity has a different meaning to different people and does not attempt to define creativity, instead stating that “the term creativity is used to reflect a psychological view of creativity on a personal level”. To understand the whole concept of creativity, (Rhodes, 1961) has defined 4 strands and measures of creativity, of which are referred to as 4 P's: Person, Process, Product, and Press.

Creativity is acknowledged in the architecture design pedagogy as an essential component of the design process (Onsman, 2016). According to Herwindo et al, (2023) making something new is a crucial component of creativity. Individuals' sensitivity and a divergent, and unusual style of thinking in general comprise the basis for developing an architectural creative output with original value.

## Assessing Creativity

There is very little on the recording and assessing of creativity in architecture in the literature, although in the field of psychometrics, creativity tests were historically used, for example those developed by Torrance, (Torrance, 1966) (Torrance, 1974). Torrance described four components by which individual creativity could be assessed:

- **Fluency:** the ability to generate a large number of ideas,
- **Flexibility:** the ability to generate a large variety of ideas,
- **Elaboration:** the ability to develop, or execute out an idea
- **Originality:** the ability to generate ideas that are unusual or uncommon.

## Review of Literature

Individual factors contribute to the creativity of people and has been the focus of many researches (Hosseini et al, 2019; Suh and Cho, 2018; Saadet and Sadeghi, 2005; Yazici, 2017; ). Individual factors are considered as the integral components of creativity of people in most viewpoints and have been emphasized by researchers. Of the most important individual-level variables effective in creativity, one can refer to capability, personality features, cognition style, intelligence, and challengeable personality of people. In continuation, several examples of the researches performed in the area of learning styles and creativity are pointed out. Hsu (1999) reported Divergers to be the most imaginative of all the learner types. Research performed by O'Hara and Sternberg (2001) reports the effect of creativity training of 110 students on their performance to prove that the effect of creativity training is dependent on the personality and cognition of students. Pasha (2008) studied and compared the effect of three methods of fostering creativity on the enhancement of creativity in students. The results show that regardless of the teaching method, creativity teaching helped the growth and fostering of creativity in students. Bhat (2019) shows that there is a meaningful relation between the learning style and problem solving of high school students. Out of 559 students on whom the test was conducted, those having assimilating and diverging learning styles possessed better reasoning and problem-solving ability skills. Eishani et al. (2014) investigated the link between learning styles and creativity. The study sample consisted of 354 students (164 boys and 190 girls). The findings revealed a substantial link between learning styles and creativity. Garg (2015) studied the impact of Learning and Thinking Styles on Creativity in 600 High School Students of Jabalpur, India. The findings demonstrate that learning and thinking styles have a major impact on creativity.

Looking at the research on learning styles in the field of architecture and design education, according to Kolb (1981), there are variances in learning styles within fields, and the main style among architects is Accommodator. In contrast, Demirbas and Demirkan (2003), Kvan and Jia (2005) & Yazici and Yazici (2011) found that Accommodators were in the minority among architecture students, with the bulk of participants being Assimilators and Convergents. They discovered extremely similar values for Assimilators and Convergents and hence reported both learning styles.

In the domain of architecture education, Jia (2004) tested the relationship of architecture student's learning styles to their design studio performance. She reports that there is a considerable relationship between students' learning styles and their design studio performance. Her study suggested that a learning style test administered early in the design studio, as well as teacher knowledge of the need to accommodate varied learning styles, could inform modifications in studio programmes. Demirkan and Demirbas (2010) found that academic performance and learning preferences of students were significantly correlated. According to Demirkan and Demirbas, design students' learning styles were more concentrated in assimilating and converging groups than accommodating and diverging groups. Also, the design studio scores of Convergents were significantly higher than those of Divergers. He found that though Accommodators scored higher in initial design stages, the improvement in Assimilators' performance in different design stages was significantly higher than the other three types of learners. The role of students' learning styles in design problem solving was

studied by Casakin (2010) who reports that in constrained design conditions, Accommodators and Convergents performed better than Divergers and Assimilators who performed better in an unconstrained environment.

Suh and Cho (2018) investigated the domain-specific association between individuals' cognitive styles and improvements in creative performance in Interior Design students. They emphasize the importance of Individual variations in creative performance within distinct instructional styles to be considered in design education, particularly at the starting level. According to Suh and Cho (2018), applying a matching instructional method to beginning design students will be more effective and will help students gain confidence in their creative performance.

The above review finds that although a lot of work has been done in the field of learning styles in relation to academic performance, little or no research has been done to identify the role of learning styles with a focus on creativity of architecture students, particularly in the Indian context.

### **Research methodology**

The study sample consisted of 33 girl students (comprising one section) of the third semester design studio in the architecture department of Indira Gandhi Technical University of Women, (IGDTUW, Delhi, India), where the first author was teaching as a Visiting faculty. Third semester students were chosen because at this level, their design thinking and creativity skills are still in their formative stages and not much influenced by formal architecture education.

### **Tools used**

1. Kolb's Learning Style Inventory Questionnaire to identify individual learning styles.
2. Mehdi's Test of Creative Thinking for assessment of student's creativity.

The learning styles of students were identified using the Kolb's Learning Style Inventory Questionnaire and assessment of student's creativity was done using Mehdi's Test of Creative Thinking (Non-Verbal) on parameters of originality and elaboration. A parallel assessment of the student's design projects on the same parameters of originality and elaboration was done by three design studio teachers having a minimum of ten years of experience. The average of the three teacher's scores was calculated. The results from both creativity tests were then correlated.

### **Mehdi's Nonverbal Test of Creative Thinking**

Mehdi's Nonverbal Test of Creative Thinking (Mehdi, 1985), was adopted for this research as it is more suitable for the present context of research on architecture students. This test has been made on the basis of the Torrance Test of Creative Thinking (Torrance, 1966) which assesses creativity on the parameters of originality, fluency, flexibility and elaboration (Torrance, 1974).

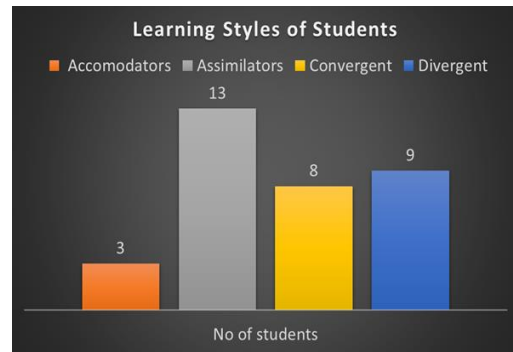
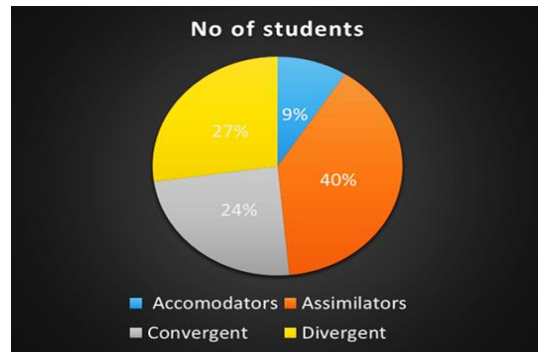
Torrance Test of Creative Thinking (TTCT) is a comprehensive set of tests designed to assess creative ability, with a focus on divergent thinking. It is based on Guilford's divergent thinking creativity theory (Guilford, 1986). This is a paper-and-pencil test that can be taken by individuals of any age or skill level. Since tests are culture specific, an Indian version of the test was provided by Mehdi (1985). Mehdi's nonverbal test scores on originality and elaboration.

### **Findings and Discussion**

Kolb (1981) reports that there are differences in learning styles of different disciplines and that the dominant style in architecture professionals is Accommodator. On the contrary, the studies of Demirbas and Demirkan (2003), Kvan and Jia (2005) & Yazici and Yazici (2011)

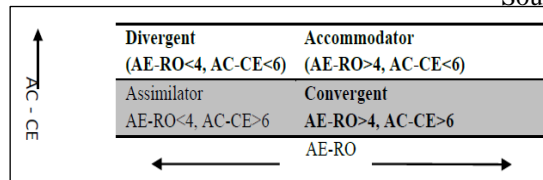
reported accommodators in the minority for architecture students, whereas the majority of their participants were Assimilators and Convergents. They found very close values for assimilators and convergers, therefore they reported both learning styles.

In this study, however, there is a huge difference between the two, Assimilators and Convergents i.e., 40% and 24% respectively. According to this study, the maximum number of students had the Assimilator style of learning, followed by Divergers and Convergents. Accommodators were found to be the least in number which is in contrast to the findings of Kolb (1981) who reported Accommodators as the dominant style of architecture professionals. The number of Active learners (Accommodators + Convergents), which is 33.33%, is also much less than Reflective learners (Assimilators + Divergers), which is 66.66%.



**Fig. 3:** Learning styles distribution of the Sample  
Source: Author

**Fig. 4:** Percentage of Active Learners (Accommodators +Convergents) vs. Reflective learners (Assimilators + Divergers)  
Source: Author



**Fig. 5:** Scoring Key  
Source: Kolb (2005)

Least number of Accommodators can be due to the fact that students have not been exposed much to learning by doing and learning by experience. The traditional model of education followed in schools in India is a traditional one, which sees children as empty vessels waiting to be filled with facts by the teachers. Teaching is primarily through lectures in which students play a passive role. Memorizing is emphasized. Even in the design studios, students are not encouraged to learn by doing or by experiencing. They learn mostly by memorizing other’s experiences. According to Joyce (2022) active learning can help students obtain better learning results.

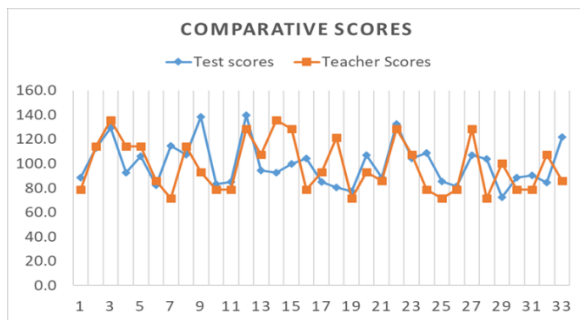
### Creativity Tests

The results of both creativity tests, using Baqer Mehdi’s test and the assessment given by teachers show maximum score for Accommodators, followed by Assimilators, Convergents and Divergers. Divergers scored much less than other learning styles. Previous studies by Jia (2004) show that Accommodators performed highest in the second year and Convergents performed highest in the third year. Demirbas and Demirkan (2010) found that though accommodators performed the highest in the initial stages, the progress of Assimilators was significantly higher than the others. According to Hsu (1999), Divergers are the most

imaginative of all the learner types. In contrast, this study shows that other learner types are more creative than Divergers.

Creativity evaluation was also done by three instructors with minimum ten years of experience in teaching as well as practice was done on the students' design assignments. The evaluation was done on a Likert scale of 1 to 5 with 1 being the lowest and 5 being the highest. The individual students' scores of Creativity Test (T1) and teachers' scores for creativity (T2) were compared (Fig.6). Correlation of T1 and T2 shows that these scores are not significantly correlated having a weak correlation of 0.3 (Fig.8). Some students who scored very high in Mehdi's Test scored very less in the teacher's evaluation. This reflects that the inherent creativity of not all the students is reflected in their design studio assignments. The kind of assignments being done in the studio might be suitable only to a certain type of learners in the studio. The mean scores of the four learner types from both evaluations were also compared (Fig.7). The average scores of the four learner types given by teachers and the test scores are significantly correlated (Fig.7).

Another important finding is that 45% of the students scored below the class mean in Originality and Elaboration scores. This shows a lack of creativity training in the design studio.



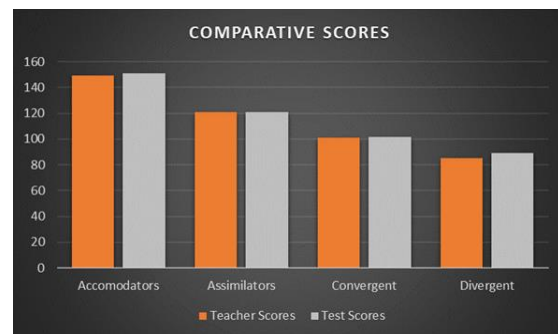
**Fig. 6:** Comparison of Individual Scores of Creativity Test & Teacher's Scores  
Source: Author

	Test scores	Teacher Scores
Test scores T1	1	
Teacher Scores T2	0.379859	1

**Fig. 8:** Correlation of Test Scores & Teacher's Scores. 0.37 signifies a weak correlation of T1&T2  
Source: Author

	Teacher Scores			Test Scores		
	Originality	Elaboration	Total	Originality	Elaboration	Total
Accommodators	78.1	76.4	154.5	79.3	76.8	156.1
Assimilators	60.6	60.5	121.1	61.8	59.2	121
Convergent	50.9	50.4	101.3	51.8	50.1	101.9
Divergent	43.4	44.9	88.3	43.5	45.6	89.1

**Fig. 7:** Comparative Originality, Elaboration and total Creativity Scores of Creativity Test & Teacher's Scores.  
Source: Author



**Fig. 9:** Comparative Creativity Scores of Creativity Test & Teacher's Scores  
Source: Author

### Relationship of Learning Styles and Creativity

A one-way analysis of variance was used to determine whether the learning styles of the students had any impact on mean scores of originality and elaboration obtained from Mehdi's Test (Fig.7), summary of which is given in Table1. With learning styles as the independent variable and creativity scores on originality and elaboration as the dependable



variable, (alpha value of .05) significant difference was obtained between mean scores of different learning styles. A significant difference in mean scores is shown with p-value .000117 ( $< .05$ ) and  $F > f$  crit value ( $167.48 > 6.59$ ) as shown in Table 2.

**Table 1:** Analysis of Variance Summary Table

SUMMARY				
Groups	Count	Sum	Average	Variance
Accommodators	2	156.1	78.05	3.125
Assimilators	2	121	60.5	3.38
Convergent	2	101.9	50.95	1.445
Divergent	2	89.1	44.55	2.205

**Table 2:** One way Analysis of Variance

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1275.614	3	425.2046	167.4858	0.000117	6.591382
Within Groups	10.155	4	2.53875			
Total	1285.769	7				

## Conclusion

The aim of this study was to investigate the learning styles of architecture students in India and their impact on their creative thinking. The learning style evaluation shows Accommodators in the minority in architecture students which is in line with studies of Demirbas and Demirkan (2003), Kvan and Jia (2005) & Yazici and Yazici (2011) and in contrast to the findings of Kolb (1981) who reported Accommodator as the preferred style of architecture professionals. The lower number of active learners shows the lack of exposure to the students in experiential and hands-on learning.

A single factor anova used to analyze the results shows a significant difference in the creativity scores of the four learner types, with Accommodators scoring the highest, followed by Assimilators, Convergents and Divergers scoring the lowest. This is in line with the findings of Jia (2004) who reported that Accommodators performed highest in the second year.

The disparity in teacher scores and creativity tests demonstrates that, while some students are inherently creative, they are unable to convey it in their design tasks. The findings also imply that the design brief and presentation criteria may disadvantage certain learning styles. Since learning styles have a definite impact on creativity, the unique differences among students, as well as the use of the Experiential Learning Theory, which is essentially a framework for understanding learning capacities, can contribute to the development of unique skills and abilities in a variety of design settings.

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