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RHIZOMATIC LEARNING IN ARCHITECTURAL EDUCATION: AN EMPIRICAL RESEARCH (1)

MİMARİ EĞİTİMDE RİZOMATİK ÖĞRENME: DENEYSEL BİR ARAŞTIRMA

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Öz: Amaç: Modern mimarlık eğitim sürecinde, mimarlık öğrencilerinin, dış uyaranlar nedeniyle oluşan akademik strese karşı gösterdikleri tepkiler arasında bir köprü oluşturan pozisyonu; bu çalışmada incelenmiştir. Araştırmanın amacı, mimarlık öğrencilerinin göstermiş oldukları yeni öğrenme eğilimlerini dikkate alarak, rizomatik öğrenme yöntemi ile benzerliklerinin tartışılmasıdır. **Yöntem:** Çalışmada, araştırmacıların görev yaptıkları bir vakıf üniversitesinin mimarlık bölümü öğrencilerinin (CAD-tabanlı tasarım, proje yönetimi, yapım teknolojisi derslerini alan öğrenciler) 99 çevrimiçi anket verisi SPSS yazılımı kullanılarak değerlendirilmiştir. **Bulgular:** Dersten başarısız olma nedenlerinin özellikle; dersin öğretim elemanına (%38.4), ders diline (%47.5), derste el çizimi yapmaya (%45.5), CAD araçlarını kullanmaya (%48.5) bağlı olmadığı görülmüştür. Bununla birlikte, mimarlık öğrencileri derste başarılı olmak için YouTube (%5.1), Google Videoları (%23.2), WhatsApp ile iletişim (%13.1), kütüphane kullanımı (%11.1), kitap satın alma (%5.1), kitap indirme (%14.1), CAD projesi indirme (10.1), arkadaşlardan CAD projesi isteme (%6.1) gibi sanal veya fiziksel ortamda daima çözüm arayışında oldukları analiz edilmiştir. **Sonuç:** Mimarlık öğrencilerinin akademik stres yaşadıklarında, dijital ve sosyal ağlar sayesinde, anlık, isteğe bağlı, bağlantılı bir öğrenme yöntemi olan rhizomatik öğrenme yöntemi uyguladıklarına işaret etmektedir.

Anahtar Kelimeler: CAD Tabanlı Tasarım, Mimarlık Eğitimi, Öğrenme Yöntemleri, Proje Yönetimi, Rizomatik Öğrenme, Yapım Teknolojisi

Abstract: Aim: Considering the learning process in modern architectural education, the position of architecture students as a bridge between external stimuli and reactions to academic stress is examined. The aim of the research is, to discuss the similarities between the students' new learning tendencies and the rhizomatic learning method. **Method:** In the study, 99 online survey data (the participating students who take CAD-based design, project management, and construction technology courses) was evaluated by using SPSS software. **Results:** Initially, the findings show that failing the course was not related to; the lecturer (38.4%), language (47.5%), hand drawing (45.5%), and CAD tools (48.5%). Besides, on virtual/physical environment as YouTube (5.1%), Google (23.2%); WhatsApp (13.1%), library (11.1%), book purchase (5.1%), book download (14.1%), CAD project download (10.1), asking for a CAD project (6.1%) architecture students are always searching for solutions. **Conclusion:** The architecture students who experience academic stress; develop instant, optional, connected learning through digital and social networks; which points to the application of the rhizomatic learning method.

Keywords: Architectural Education, Building Technology, CAD Based Design, Learning Methods, Project Management, Rhizomatic Learning

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INTRODUCTION

The learning theories are commonly based on different scientific disciplines such as psychology, linguistics, cybernetics, design, philosophy, education, organization, and social anthropology (Millwood, 2013[1], Sezer et.al, 2016: 165-183). Understanding the mechanism of learning is one of the research topics of classical psychology which has contributed also to today's new learning theories. On that account, teaching methods in architecture faculties at present moment are progressed by understanding whereby architecture students learn.

All the while of an academic term, the accompanying obligations may cause academic stress, which sometimes arises with the anxiety of success that reveals in the emotions and behaviors of the student. In this context, the academic stress experienced by architecture students; may be evaluated depending on many variables as external stimuli that include the lecturer, the language of the course, the adaptation of the student to the digital world, and her/his gender. As well, the education model accepted in faculties of architecture includes compulsory, elective, theoretical, and applied courses within the scope of architectural curricula. Because of an architecture student who aims to be successful in the course, adaptation to the atmosphere that includes the use of digital tools, the internet, computer, and software is obligatory to accomplish their student work.

In the digital age, the field of architecture has become a discipline that frequently uses the internet for online education, meeting platforms, and research-based student studies (Bayne and Rose, 2014[2]; Cormier, 2008: 1-9; Liyanagunawardena, et. al, 2013, p:2-227) In comparison the teaching in classical architecture education; methods, tools, course material and lecturer of the course are also renewed by keeping up with the digital age so that creates a digital external world which so-called stimuli for architecture students. Hence, the digital transformation in the education system is a shift (Korur and Dulgeroglu, 2013, pp:11-25) for those architectural students who want to learn new knowledge, and are more connected to the digital world and its services such as social networks, social media alternatives that it provides.

Social networks, which have entered our lives by virtue of the internet, enable us to use social media for obtaining information, communicating, and sharing data regardless of time and place. Considering the definition of a network, ''a group or system of intercon-

1 https://blog.richardmillwood.net/2013/05/10/learning-theory/

2 https://www.advance-he.ac.uk/knowledge-hub/pedagogy-massive-open-online-course-mooc-uk-view

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nected people or things'' is defined, and a social network is known as ''social interactions and personal relationships''.[3] In the light of this definition, when students use the concept of the social network to be successful in the course, they establish connections for learning, acquiring, and sharing information. Furthermore, architecture students, who use these opportunities provided by the digital world, also create a network among themselves as an extra-curricular communication and collaboration for their learning progress.

Initially, the cognition of new information, and gaining more knowledge is explained in the literature under the title of the learning methods based on classical psychology concerning cognitivism, constructivism, and connectivism. More, these subjects may also be in a digital transformation today. Regarding that learning concept in architectural faculties, the students may show a tendency to find their learning methods in a face-to-face classroom environment or a digital community. Before all else, connectivism has been tried to be explained with the metaphor of a "rhizome", which implies the branching and growth of a plant's root under the ground following its genetic code, starting from the idea of establishing a connection (Deleuze et.al, 1987:1-629). Similarly, in rhizomatic learning, the keywords as connecting, networking, and coming together for learning are used (Cormier, 2008: 1-9).

3 https://www.techtarget.com/whatis/definition/social-networking

AIM

The concept of rhizome as a metaphor has started to take place in the literature in the last 10 years as a new learning method. A rhizome is considered as the gathering on a physical or virtual platform of students by an unpredictable spread and growth for the same purpose. As the idea of a plant root expands and grows underground; the corresponding metaphor is transferred to the discipline of education by analogy, likewise the spread of the network formed by students using today's digital learning tools and platforms.

The social network established by architecture students constitutes the theoretical basis of this study, as it evokes the concepts of connectivism and rhizomatic learning. Hence, this study it is aimed to explore the existence of rhizomatic learning in architectural obligatory courses such as CAD-based design, project management, and building technology education.

SCOPE

This research covers the CAD-based design, project management, and construction technology courses because these three courses are obligatory and applied-based lessons in

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architectural curricula and the authors had been teaching these courses at the mentioned foundation university in Turkey. The findings were progressed by the observations of the researchers made on architecture students of the course and turned into statistical research.

These courses, which are within the scope of the study, include the use of CAD software, a product of digital technology, project management calculation, time scheduling program, and other 3D architectural modeling programs. Since group work is also obligatory during the course, the most important tool that enables students to communicate is social networking platforms. Moreover, explaining the transformation of orientation to digital platforms and social media as a result of reasons related to psychological response as an instinct with the concept of connectivism and rhizomatic learning.

METHOD of the RESEARCH

Due to its nature, this study begins by presenting insights about learning theories based on the fundamentals of classical psychology; besides, it focuses on rhizomatic learning to understand its position in the digital learning environment. Moreover, this study was carried out with 99 students studying at the faculty of architecture of a foundation university through an online questionnaire-based survey. The survey design has four different parts basically which its first part covers the personal information of the students such as age, gender, and academic year (either 2nd-grade or 3rd-grade students), and the responses of the students were collected by asking 'Yes/ No Questions. The second part of the survey consisted of a 5-point Likert-type scale that measures the information about students' views about CAD-based design, project management, building technology courses, and digital platforms. In the ongoing, the third part of the survey evaluates the emotions of students as a response to their academic stress during an academic term. The final part of the survey includes questions about using the internet and social network platforms for student connection and collaboration. In consideration of the whole research design, in the final section, the hypotheses were tested using the SPSS program, and the discussion related to the findings of the study was presented. Finally, further research ideas were mentioned to conclude the research.

LIMITATIONS of the RESEARCH

There are some limitations of the study. The first limitation is the three compulsory applied (time-limited submission-based) courses are selected from the architecture curriculum since these lessons may play a role to increase the academic stress of the students. Thus, only 99 architecture students' performance was observed during an academic semester,

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because these students are in one-to-one connection with lecturers.

RESEARCH PROBLEM

The key questions motivating our research are as follows:

RQ1: Whether there is a relationship between students' tendency to follow new learning methods in terms of the fact that having difficulties in architectural education or failing the course?

RQ2: Whether there is a difference in the behaviors shown by students in architectural education in terms of gender?

RQ3: Whether there is a tendency in the behaviors shown by students in architectural education in terms of rhizomatic learning?

RESEARCH SUBPROBLEMS

Evaluating the stress factors experienced by students in courses such as CAD-based design, project management, and building technology, which are analyzed within the scope of this study on architectural education, is one of the sub-problem of this study.

In the time of the digital age, social platforms and online information resources, essentially; YouTube, Google Videos, Whatsapp, downloading new books, downloading CAD projects or asking a question to a friend, and meeting on social networks were also included in the survey questions as the other sub-problems of this study.

In addition, on the online survey; the students were asked whether their type of responses as a reaction in case of failing the course might be related to the lecturer of the course, the language of the course. Finally, the connection between all these variables and gender difference as another sub-problem was tested by referring to the hypotheses.

RESEARCH HYPOTHESES

Based on the research problems, there are two assumptions on which this study is based:

1. In architectural education, the fact that students fail when they have difficulties with the lecturer, the language of the course, hand drawing, and the CAD tools used affects their behaviors (It aims to test the existence of a new learning method such as rhizomatic learning).

2. It is related to whether there is a difference in the behavior of students in architectural education (It aims to test the tendency for a new learning method such as rhizomatic learning) in terms of gender.

THEORETICAL FRAMEWORK

Since the 1800s, many learning theories have been presented in different disciplines such as psychology, linguistics, cybernetics, design, philosophy, education, organization,

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and social anthropology (Holland and Guattari, 2013:1-190). Learning theories were commonly named with learning, and teaching methods regarding human cognition and behaviors (Ertmer and Newby, 2013:43-71; Calguner, 2021:31-79). According to the research questions, behaviorism, cognitivism, constructivism, and connectivism were closer to our research design in logic.

Cognitivism: Cognitivism is a theory of learning that focuses on the progress that is mixed in learning, then on observed behavior. Compared to behaviorism, cognition does not depend on any visible representation of learning but focuses more on the internal progression and relationship that occurs during learning. In the 1920s, Jean Piaget played a major role in the development of the theory, and later cognitive change became perceptible in American psychology by the 1950s (Piaget, 1973: 1-154; Saettler, 1990: 1-599).

The focus of cognitive thinking is respect for the human mind during learning (Harasim, 2012: 1-213; Schunk, 2012:1-571). The human mind is considered more of a black box and is a processor as a computer for cognition. Uncovering the contents of the black box by modeling the mental structures of the human mind was important for cognition, but for behaviorists, it was just a black box. Because of cognition, human behavior can only be understood by looking inside the box and is considered a central computer to process information (Harasim, 2012: 1-213).

Constructivism: As a learning theory, constructivism is based on learners' own experiences, which are linked to the efforts of their understanding and knowledge in the learning process. As another learning theory, it was first talked about as a reformist theory in learning in the USA and Europe in the 1970s. Jean Piaget (1973:1-154) emphasized cognitive constructivism, on the one hand, emphasizing that each individual has different biological stages in his life for the construction of knowledge. Lev Semyonovich Vygotsky (Heather et al., 2003: p.21), on the other hand, drew attention to social constructivism and social communication in active knowledge construction rather than personal context. In constructivist thinking, learning is a group activity involving the lecturer and the learner to construct knowledge and understanding. However, the basic idea of constructivism is based on the construction of knowledge through communication between society and the environment, the result of this communication is never complete (Harasim, 2012: 1-213).

Connectivism: Connectivism was introduced as a new theory in the digital age, with a recent preliminary work introduced by Siemens (2005: 3-11) and Downes (2012).[4]

4 https://blog.richardmillwood.net/2013/05/10/learning-theory/

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"Learning the Networking Way" (Siemens, 2005: 3-11) and "Introduction to Connective Knowledge" (Downes, 2012[4]) were the first studies on the topic of juveniles to receive great attention. You are considered to be the way that makes it possible to combine for greater production inferences, later. Digital age magazine, the networked lecturer is also popular for students, convenient environment including photo travel, social networking sites, Twitters, wikis, blogs, video conferencing, social book reading, exercises, lectures, education, and digital resources presents. family and community, colleagues. Therefore, connectivity forces us to associate to be informed. Being connected to learning triggers learning related to the connective, which will pass through kindergarten to learn (Kop and Hill, 2008: 1-13). In the information network, digitally sharing and assessing connectivity is key. From this point of view, Siemens (2005: 3-11) describes it as "improving in the scope of ideas" (Kop and Hill, 2008: 1-13). Siemens (2005: 3-11) also "A community is about engaging in interaction, sharing, dialogue, and cooperation". Connectivism, one of the learning methods described above and explaining learning in classical psychology, has been evaluated in connection with rhizomatic learning, which is the main subject of the research.

The reason connectisivm is chosen most related to our study is that in their article titled; ''Rhizomatic learning and connectivism #rhizo14'' and Hamon (2013)[5] ''Why Rhizomatic Learning? Pt. 3#etmooc'', they pointed out that connectivist learning theory and rhizomatic learning have a relationship in terms of making connections. In the next chapter, the definition of rhizomatic learning is given.

Rhizome Concept and Rhizomatic Learning for Architectural Education

In botanical science, a rhizome is defined as the underground root of the plant, as a term (Millwood, 2013)[1]. Yet, the rhizomatic concept in literature is also related to learning discipline, and the "rhizome" term was used in place of the word "rhizomatic", concerning research for multiple in the interest of theory. On the other hand, in rhizomatic learning, the learning concept focuses on knowledge, learner, and relation with the entire environment around. The knowledge, that the learner does not know before is welcomed with advanced questions about the subject. Asking questions constantly concerning learning more about the composing knowledge that engaged the world.

Thus, the creation of knowledge, the expectation of learners about learning support, the role of the lecturer, and the curriculum are related subjects and can be altered with the

5 http://www.downes.ca/files/books/Connective_Knowledge-19May2012.pdf

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idea of independent learning environments (Cormier, 2008: 1-9). However, the rhizome is also introduced as a logical concept in the study '' Capitalism and Schizophrenia by Deleuze and Guattari (Deleuze et al, 1987:1-629).

Besides, rhizome metaphors as a concept; works extensively in the sense of rapid development, reproduction, and expansion and are as essential as a metaphor conditioned by the internet. In this regard, rhizomatic learning is understood as the social learning opportunity of the internet collaboration with this while creating information (Millwood, 2013)[6]; Yousef et al, 2015: 69-93). For example, the spreading and proliferation of information on the internet in the digital age and the spreading and reproduction logic of the information on the internet in the digital age is for its information. As far as we know, the internet is one of the rapid platforms that "concepts" and people may easily get together, however, we do not have any information about its "mechanism of growth". "the rhizome pertains to a map that must be produced, constructed, a map that is always detachable, connectable, reversible, modifiable, and has multiple entryways and exits and its lines of flight"[7] (Deleuze and Guattari, 1987: 1-55). So, the rhizome metaphor possesses fast growth inside (Buchanan, 2007)[8]. As well, a rhizome is like a living organism that may regrow the lost part when it is cut. Nevertheless, it was raptured that will result in the regeneration of every piece which grows along the lines.[9] According to Deleuze and Guattari, these lines were called "lines of flight", the regeneration process and its outcomes are also related to the principle of multiplicity since the rhizome is accepted as a live organism, it has a "genetic code" (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629; Mackness et al, 2016: 78-91; Yousef et al, 2015: 69-93). It was also stated that "a rhizomatic plant has no center and no defined boundary; rather, it is made up of several semi-independent nodes, each of which is capable of growing and spreading on its own, bounded only by the limits of its habitat" (Cormier, 2008: 1-9; Downes, 2012; Liyanagunawardena, et al, (2013): 2-227).

6 http://www.downes.ca/files/books/Connective_Knowledge-19May2012.pdf

7 https://blog.richardmillwood.net/2013/05/10/learning-theory/

8 http://ids1-2215.blogspot.com/2013/02/why-rhizomatic-learning-pt-3-etmooc.html

9 http://www.australianhumanitiesreview.org/archive/Issue-December-2007/Buchanan.html

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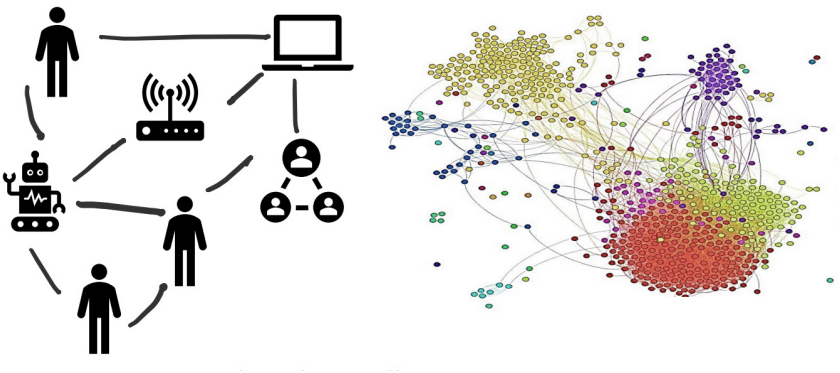

Figure 1. The Network Conception of Learning (Bralias, 2021)[6]

When rhizome is accepted as a metaphor, it has helped define the principles explaining teaching and teaching issues. Deleuze and Guattari (are the skills of a rhizome, these skills; connection, multitude, heterogeneity, cartography, decalcoma, and a pronounced break, which are related to teaching and learning (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629; Millwood, 2013)[10]. First, rhizomatic learning is defined with principles that formerly ‘’connection’’ is essential between learners. While it is not in a controlled way, it happens for each learner as a growing, unclear, personal map (Cormier, 2008: 1-9). Second, “multiplicity” is another norm of rhizomatic thinking. A rhizome with multiple connections point to point reveals multiplicity, so it can not be considered a “unity”. For all that, unity is rather be taught with a certain hierarchical order.

When unity and multiplicity terms are compared while defining a rhizome. One can say that unity is related to “a certain hierarchy, several singular identities”. More, in the design studios, we have an academic term that starts with a “clear beginning” that continues with a “middle and clear conclusion” (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629).

This is a teaching strategy, a pedagogical structure that does not like a rhizome but is closer to a tree-like structure regarding geometrical and hierarchical features. A multiplicity environment contains diversity in “size, shape, length, color, and other external characteristics” but on the other hand has similarities in their “genetic constitution”. So, multiplicity, unity, and also uniformity are different terms[11] (Deleuze et al, 1986: 1-55; Deleuze et al, 1987:1-629; Mackness et.al, 2016: 78-91; Mackness et al, 2016: 78-91). As the

10 https://blog.richardmillwood.net/2013/05/10/learning-theory/

11 https://doi.org/10.35542/osf.io/n4xhs

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third skill of a rhizome,[12] "heterogeneity" as a second principle is linked with connection, it is defined as "any point in a rhizome that can be connected to any other thing" (Deleuze et al, 1986: 1-55; Deleuze et al, 1987:1-629; Mackness et al, 2016: 78-91).

Other skills of a rhizome are defined as "cartography and decalcomania". They are two close principles that they both defined with the relation with a map. Deleuze and Guattari compare and explain a map and a rhizome resemblance, "'Unlike the graphic arts, drawing or photography, unlike tracings, the rhizome pertains to a map that must be produced, a map that is always detachable, connectable, reversible, modifiable, and has multiple entryways and exits and its lines of flight''. So, a map is mentioned as a rhizome here, because a map has different points, connections such as a terrain without "a particular beginning or end" (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629; Mackness et al, 2016: 78-91).

In this regard, a design studio or applied lessons of architectural education may be reconsidered from the point of rhizomatic thinking and learning. As ideation, the skills of a rhizome have an intersection with the architectural students' behavior. In-studio environment or on digital platforms, students "ceaselessly" start-up connections, student groups are thought to increase creativity (multiplicity) or some of the students may prefer working individually. Besides, students move and motive in the studio or digital environment, and their network connections trigger the creation of an unseen unique map (cartography, decalcomania) or homogeneous environments of architectural education (heterogeneity). However, at the end of the term, all these connections may be lost after the lessons, and students may connect and groove the network again (a signifying rupture) when it is needed (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629; Liyanagunawardena, et al, 2013, p:2-227). In the next section, the field research and the findings will be explained.

FINDINGS

In our study, we defined features such as properties of architectural education, difficulties experienced by students, new learning methods (as the learning theory of the digital age, learning methods in terms of the connectivism approach, which is an approach that explains learning on networks) using SPSS (Statistical Package for The Social Sciences) package program. Moreover, we searched for properties, ie relationships between variables, and tested other hypotheses suggested within the scope of the research.

12 http://www.downes.ca/files/books/Connective_Knowledge-19May2012.pdf

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Descriptive Statistical Results

The minimum and maximum values, mean value, standard deviation, and variance of the student age, which is an interval scaled variable, were analyzed from the data obtained within the scope of the study.

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Age	99	19	31	22,76	2,246	5,043
Valid N (listwise)	99					

As seen in Table 1, it was observed that the age of the students varied between 19 and 31 years, the mean age was 22, there was a 2-year deviation from the mean value, and therefore the variance was 5.

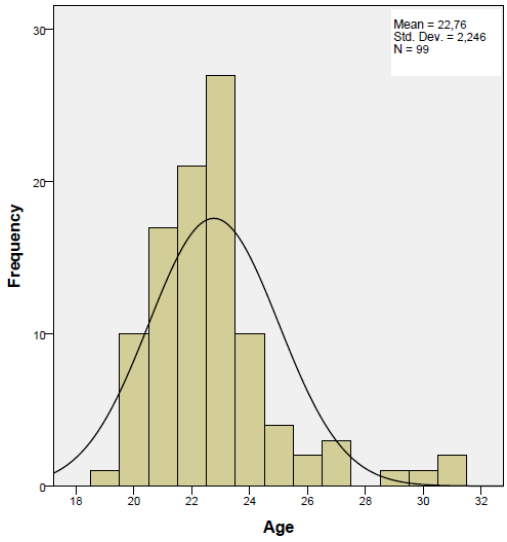

Figure 2. Descriptive Statistics

As a result of the histogram taken out of the sample group (Figure 2) and the One-Sample Kolmogorov-Smirnov test (Table 2), the sample was found to show a normal distribution.

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Table 2. One-Sample Kolmogorov-Smirnov Test

		Age
N		99
Normal Parameters[b]	Mean	22,76
	Std. Deviation	2,246
Most Extreme Differences	Absolute	,225
	Positive	,225
	Negative	-,106
Test Statistic		,225
Asymp. Sig. (2-tailed)		,000[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

Gender: According to the number of surveys; 59.6% of the architecture students were female and 41.4% of them were male students. Departing from the sample, it can be said that 58.6% of the students in architectural education were female and 41.4% were male students. Gender difference is tested in this research because "there is no ideal speaker-listener but there is a homogeneous linguistic community" (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629) that idea of rhizomatic learning indicates the gender factor.

Failure of students: The values for the frequency distributions obtained for architectural students regarding the fact that they fail the course by having difficulties with the lecturer, the language of the course (English), hand drawing, and CAD tools were shown in Table 3. Here, it is seen that when students have difficulties in these matters, 'never failed' was the most frequent option, and 'sometimes failed' was the second. This shows that the students do not mainly consider the difficulties with the lecturer, language (English), hand drawing, and CAD tools as a reason for failure.

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Table 3. Descriptive Statistics Related to the Reasons for Failing the Course

	Never	Occasionally	Sometimes	Mostly	Always	No idea
Failing the course by having difficulty with the lecturer	38,4	18,2	28,3	7,1	5,1	3
Failing the course by having difficulty with the language (English)	47,5	15,2	25,3	7,1	2	3
Failing the course by having difficulty with hand drawing	45,5	20,2	22,2	7,1	2	3
Failing the course by having difficulty with CAD tools	48,5	11,1	30,3	7,1	2	1

Student behaviors: When we look at the frequency distributions obtained regarding the behaviors (new learning methods) shown by the students in architectural education when they need more information; in terms of searching in Youtube and Google videos, it was seen in Table 4 that the students' search frequency was as 'sometimes', 'mostly', 'always', and 'occasionally', respectively. Only 5.1% of students do not search on Youtube and Google videos. Also, as seen in Table 4, in terms of the behavior of asking for help from their friends in the Whatsapp application, students asked for help from their friends with the following frequency, respectively: 'sometimes', 'occasionally', 'never', 'mostly', and 'always'. Another important point is that in terms of going to a library behavior, students' frequency to go to a library is as follows, respectively: 'sometimes', 'occasionally', 'never', 'mostly', and 'always'.

In terms of the behavior of buying new books, students show the following behaviors, from the highest frequency to the least, respectively: 'never', 'sometimes', 'occasionally', 'mostly', and 'always'. Only 5.1% of the students buy new books when they need more information in the courses. More, the behavior of downloading new books, students show the following behaviors, from the highest frequency to the least, respectively: 'sometimes', 'occasionally' and 'never' (in the same rates), and 'mostly' and 'always' (in the same rates). In the behavior of downloading CAD projects, students show the following behaviors, from the highest frequency to the least, respectively: 'sometimes', 'occasionally', 'mostly', and 'never'. Only 10.1% of the students always download CAD projects. Lastly, the behavior of asking their friends about their CAD projects, students show the following behaviors, from the highest frequency to the least, respectively: 'sometimes',

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'never', 'occasionally', and 'mostly, and 'always'.

Table 4. Descriptive Statistics Related to Student Behaviours About New Learning Methods

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	Never	Occasionally	Sometimes	Mostly	Always	No idea
Searching in YouTube Videos	16,2	27,3	24,2	22,2	5,1	5,1
Searching in Google Videos	9,1	10,1	29,3	27,3	23,2	1
Asking for help from friends on WhatsApp	17,2	26,3	28,3	15,2	13,1	0
Going to a library	19,2	24,2	30,3	13,1	11,1	2
Buying new books	34,3	20,2	26,3	12,1	5,1	2
Downloading new books	18,2	18,2	31,3	14,1	14,1	4
Downloading CAD projects	15,2	21,2	36,4	16,2	10,1	1
Asking friends about their CAD projects	28,3	25,3	29,3	9,1	6,1	2

Rhizomatic learning: The rhizomatic learning effect, which expresses that the internet offers a social learning opportunity, was stated with descriptive statistics obtained from the thoughts of students about architectural education in an internet-free period.

As seen in Figure 3, it was seen that 35.4% of the students will have difficulty finding educational sources, while 14.1% of them will be unable to use CAD tools, 9.1% of them will have difficulty asking for help, 9.1% of them will be unable to complete the education by hand drawing techniques, and 7.1% of them will be unable to complete tasks on time. Besides, it was observed that the students evaluate a few thoughts on this issue together, with small frequency values.

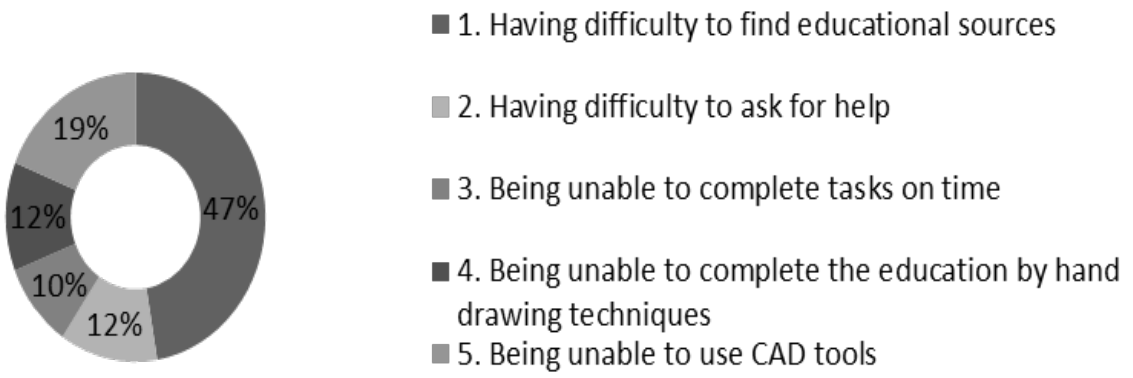

Figure 3. Descriptive Statistics Related to Architectural Education in an Internet-Free Period

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These values make definitions regarding architectural education and student characteristics in Turkey.

Statistical Analysis Used in the Research

The analyzes used in the research will enable the search for relationships between new learning methods and student characteristics in terms of connectivism which is an approach that explains learning on networks as the learning theory of the digital age in architectural education and in terms of rhizomatic learning that states that the internet offers a social learning opportunity.

The hypothesis, statistically, is an assumption put forward about a population from which a sample group is selected. Hypothesis testing consists of a decision rule for accepting or rejecting a hypothesis and the rule is generally established based on statistical measures of a sample group (or groups) randomly chosen from the population.

The analysis used to test the hypotheses put forward within the scope of the research is correlation analysis, which is one of the parametric tests that are selected depending on the type of variables, the dependency/independence of the groups, and the number of groups, aiming to reveal or generalize about the main population characteristics, and the Mann-Whitney test, which is one of the nonparametric tests that do not rely on any assumptions about the distribution of the population and can be used safely when nothing is known about the population.

The Hypothesis Put Forward Within the Scope of the Research and Their Findings

In the scope of the research, the hypotheses put forward intend to look for relationships between new learning methods and student characteristics in terms of connectivism, an approach that explains learning on networks as the learning theory of the digital age in architectural education, and rhizomatic learning, which expresses that the internet offers a social learning opportunity, are as follows:

Hypothesis 1: In architectural education, the fact that students fail when they have difficulties with the lecturer, the language of the course, hand drawing, and the CAD tools used affects their behaviors (new learning methods). In this case, the null hypothesis and the alternative hypothesis would be as follows:

Ho: In architectural education, there is no relationship between the fact that students fail when they have difficulties and the application of new methods (behaviors).

H1: In architectural education, there is a relationship between the fact that students fail when they have difficulties and the application of new methods (behaviors).

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downloading CAD projects (b7) (+ 0.266 **), and asking friends for their CAD projects (b8) (+ 0.439**) (which are among the new learning methods) implies that there is a relationship between these concepts and that these behaviors will increase as the difficulties with the CAD tools used to increase.

Table 5. Hypothesis 1, Correlation Analysis

	f1: having difficulty with the lecturer	f2: having difficulty with the language of the course (English)	f3: having difficulty with hand drawing	f4: having difficulty with CAD tools
b1: Youtube videos	+ 0.096	- 0.140	+ 0.030	- 0.137
b2: Searching in Google videos	+ 0.085	- 0.069	+ 0.107	- 0.061
b3: Whatsapp	- 0.024	- 0.025	+ 0.030	+ 0.109
b4: Going to a library	+ 0.124	+ 0.239 *	+ 0.175	+ 0.326 **
b5: Buying new books	+ 0.051	+ 0.359 **	+ 0.258 *	+ 0.387 **
b6: Downloading new books	+ 0.118	+ 0.139	+ 0.141	+ 0.151
b7: Downloading CAD projects	+ 0.117	+ 0.215 *	+ 0.191	+ 0.266 **
b8: Asking their friends for their CAD projects	+ 0.047	+ 0.281 **	+ 0.213 *	+ 0.439 **

The significance level of the correlation coefficient:

* p £ 0.05
** p £ 0.01
*** p £ 0.001

Following these results, for Hypothesis 1, the Ho hypothesis was rejected and the H1 hypothesis was accepted; and it was decided that in architectural education, there is a relationship between the fact that the students fail when they have difficulties and the application of new methods (behaviors).

Hypothesis 2: It is related to whether there is a difference in the behavior of students in architectural education (new learning methods) in terms of gender. In this case, the null hypothesis and alternative hypothesis are as follows:

Ho: In architectural education, there is no difference between the female and male students in terms of the behaviors they show (new learning methods).

H1: In architectural education, there is a difference between the female and male students in terms of the behaviors they show

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(new learning methods). The Mann-Whitney test, which is a nonparametric test and can be used safely when nothing is known about the population, was chosen as the test technique.

As can be seen from the Mann-Whitney test shown in Table 6 conducted to determine whether there is a difference in the behavior of students [new learning methods; searching in Youtube videos (b1), searching in Google videos (b2), asking for help from their friends in Whatsapp (b3), going to a library (b4), buying new books (b5), downloading new books (b6), downloading CAD projects (b7), asking their friends for their CAD projects (b8)] in architectural education in terms of gender; since the differences in terms of searching video in Youtube (b1) (z: 1,590), searching video in Google videos (b2) (z: 0,781), asking for help from their friends in Whatsapp (b3) (z: 0,638), going to a library (b4) (z: 0,053), buying new books (b5) (z: 1,071), downloading new books (b6) (z: 0,397), downloading CAD projects (b7) (z: 0,462), and asking their friends for their CAD projects (b8) (z: 1,286) were less than the limit value of 0.05, these differences were not statistically significant.

Table 6. Hypothesis 2, the Mann-Whitney Test

	Gender	Z	Mean value
b1: Youtube videos	Female	- 1.590	40.47
	Male		49.00
b2: Searching in Google videos	Female	- 0.781	42.27
	Male		46.44
b3: Whatsapp	Female	- 0.638	45.41
	Male		42.00
b4: Going to a library	Female	- 0.053	43.88
	Male		44.17
b5: Buying new books	Female	- 1.071	46.35
	Male		40.67
b6: Downloading new books	Female	- 0.397	43.12
	Male		45.25
b7: Downloading CAD projects	Female	- 0.462	45.02
	Male		42.56
b8: Asking their friends for their CAD projects	Female	- 1.286	46.82
	Male		40.00

Critical values for two-way testing:

± 1.96 for α: 0.05
± 2.58 for α: 0.01
± 3.50 for α: 0.001

This finding shows that there is no difference between male and female students in terms of

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their behavior when they need more information in the courses (new learning methods; searching in Youtube videos, searching in Google videos, asking for help from their friends on Whatsapp, going to a library, buying new books, downloading new books, downloading CAD projects, asking their friends for their CAD projects). Under these results, for Hypothesis 2, the H1 hypothesis was rejected and the H0 hypothesis was accepted, and it was decided that there was no difference between male and female students in architectural education in terms of behaviors they show (new learning methods).

DISCUSSION

The field study was conducted to determine the characteristics of architectural education and to research new learning methods, difficulties experienced by students, and new learning methods in terms of the connectivism approach (an approach that explains learning on networks as the learning theory of the digital age) and rhizomatic learning (which expresses that the internet offers a social learning opportunity), etc. were defined, the hypotheses put forward within the scope of the study were tested and the results were discussed as follows:

Rhizomatic Learning in Architectural Education: The first of the hypotheses was about whether the fact that students fail when they have difficulty with the lecturer, with the language of the course, hand drawing, and CAD tools used affected their behaviors (new learning methods; searching in Youtube videos, searching in Google videos, asking for help from their friends in Whatsapp, going to a library, buying new books, downloading new books, downloading CAD projects, asking their friends for their CAD projects). As a result of the analysis, it was decided that there is a linear relationship between the fact that students fail in architectural education when they have difficulties and the application of new methods (behaviors). This situation also proves the existence of connectivism, an approach that explains learning on networks, and similar approaches in architectural education. According to Deleuze and Guattari (1986: 1-55; Deleuze et al, 1987:1-629), “a rhizome ceaselessly establishes connections between semiotic chains” in architectural education. This paper also emphasizes that students “ceaselessly” connect to the digital environment to make research, share and support their ideas on platforms such as WhatsApp or digital information sources such as YouTube and Google. Another rhizomatic sign of connectivist student behavior and student community is “multiplicity”. That “a multiplicity may comprise of elements of dissimilar size, shape, length, color, and other external characteristics, but are similar in their genetic constitution” (Deleuze and

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Guattari, 1985: 1-55; Deleuze et al, 1987:1-629). Architectural students are free to gather and combine the community when they have difficulty in lessons. They may work together or individually, and the community in the digital platform may increase or decrease in the number of students until they continue their sharing. So, the learning environment is not related to the "unity" of the group. Yet, it was emphasized "the mechanism of growth" (Buchanan, 2007)[1]. term related to the internet as a rapid platform where people easily gather together to have any information that the rhizome metaphor is growing fast inside.

In this way research outcomes similarly report that the rhizomatic learning effect, which expresses that the internet offers a social learning opportunity, was observed through the descriptive statistics obtained about the students' thoughts on architectural education in an internet-free period. A large percentage of the students stated that they would have difficulty finding educational sources.

Gender Difference in Rhizomatic Learning: The other one of the hypothesis was about whether there was a difference in the behavior of students (new learning methods) in architectural education in terms of gender. As a result of the analysis, it was decided that there was no difference between male and female students in terms of their behaviors (new learning methods; searching in Youtube videos, searching in Google videos, asking for help from their friends on Whatsapp, going to a library, buying new books, downloading new books, downloading CAD projects, asking their friends for their CAD projects) when they needed more information. When students have difficulties, they use new learning methods regardless of their gender. More, since "there is no ideal speaker-listener but there is a homogeneous linguistic community" (Deleuze et al,1986: 1-55; Deleuze et al, 1987:1-629) our findings also support this rhizomatic skill, that there is no difference across gender, students without any hierarchy equally have benefited from digital learning environments.

CONCLUSION

It is important to evaluate the reasons for failing the course in architecture faculties, the behavioral tendencies of students due to the academic stress they experience, and the potential of social networks offered by the digital age to acquire information and create new learning methods. Based on this idea, it can be said that connectivism, which explains the basic dynamics of learning, has evolved into rhizomatic learning, which is still experienced today but may not be defined in every learning process because it is not aware of.

1 http://www.australianhumanitiesreview.org/archive/Issue-December-2007/Buchanan.html

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In this development, the contribution of the digital age and the internet draws attention.

As the Rhizome metaphor predicts, learning-oriented architecture students, anywhere, develop their learning methods, find solutions to academic stress and work to be successful in the course, thanks to social networks and the internet. Understanding rhizomatic learning can also enable us to develop alternative teaching methods in terms of success in architectural program education.

RECOMMENDATIONS

This study is thought to be a descriptive study in terms of determining new learning methods, etc. in architectural education and it is expected to assist similar studies. In the continuation of this study, it is planned to look for relationships between new learning methods in architectural education and the features of courses such as courses where design-based CAD tools are used, project management, and construction technology, and to test other hypotheses to be put forward within the scope of the research.

It has been observed that the stress and similar behavioral reactions experienced by students in architectural education may cause the student to fail the course, as well as turn into the positive motivation described in this study. To understand students' interest in the lesson, learning methods, course material, and external influences can be evaluated, and new trends and learning methods can be researched through the eyes of students. Especially the virtual software offered by the digital age is also important in terms of its contributions to education and the convenience it provides to students. Rhizomatic learning refers to coming together and being involved to learn, regardless of age, gender, or physical environment. The online education experience experienced during the pandemic period falls within the working area of rhizomatic learning. In this sense, the benefits of online education and rhizomatic learning may be the subject of future studies for the design studio course and other architecture courses.

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