

First Domino Tile in the Social Innovation Process: Idea Creation of University Students

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Abstract--Interrelations between creativity, innovativeness and entrepreneurial skills of individuals have long been discussed in the literature. Due to the challenges regarding their measurement, most studies focused on the intentions rather than the outcomes. The idea generation that requires creativity is the first stage of social innovation. The young population's creative potentials in participating social innovation practices deserve a special attention as they play a critical role in the innovativeness and entrepreneurship of societies. This study aims to explore the factors that determine the creative intentions of university students that are important in generating social innovation projects. A structured survey based on the literature was conducted among 600 management and engineering students from 3 universities from the different percentiles of the Entrepreneurial and Innovative University Index for 2012 of the Turkish Ministry of Science, Industry and Technology. The survey included questions on the demographic characteristics, environmental factors, motivators, university/institutional context, perceptions and creative thinking attitudes. By conducting reliability and factor analysis, accuracy and validity of data is tested and the impact factors were identified. Findings reveal that visionary attitude, curiosity, exploration and learning, attitude for own creativity, self-esteem, perception about the learnability of creativity, university and social environment are components of creative thinking intentions of students and some of these factors vary by year of study and university.

I. INTRODUCTION

Interrelations and causality between creativity, innovativeness and entrepreneurial skills of individuals have been widely explored by various scholars in the literature. Due to the challenges regarding the measurement of these traits, studies mostly focused on the intentions rather than the outcomes. Since the societies' future performance on innovativeness and entrepreneurship are strongly dependant on the young population's creativity potentials, studies about the factors affecting creativity intentions of university students reserved a critical place in the relevant literature. On the other hand, as the global community agreed that the sustainability of business can not be isolated from societal and environmental problems, social innovation received a significant attention in the last decades. Linkage between creativity and innovation also remains evident for social innovation. Among the six stages of social innovation that was conceptualized by Murray et al., [30] idea generation is the first phase that includes the creation of proposal and ideas referring to the creativity methods.

It must also be noted that the participation and motivation of academic community, and especially students in social

innovation practices will play a critical role in shaping the future. As stated by AshokaU's manifestation, "Students need interdisciplinary, entrepreneurial, and solutions oriented skillsets to succeed". On the other hand, there has always been a debate on understanding the common characteristics and motives of creative individuals.

In this context, this study aims to explore the factors that affect the creative intentions of engineering and management undergraduate students in order to provide insights to their potentials for generating and conceptualizing social innovation projects that can shape the future.

Interrelations and causality between creativity, innovativeness and entrepreneurial skills of individuals have been widely explored by various scholars in the literature. Due to the challenges regarding the measurement of these traits, studies mostly focused on the intentions rather than the outcomes. Since the societies' future performance on innovativeness and entrepreneurship are strongly dependant on the young population's creativity potentials, studies about the factors affecting creative intentions of university students reserved a critical place in the relevant literature. On the other hand, as the global community agreed that the sustainability of business can not be isolated from societal and environmental problems, social innovation received a significant attention in the last decades. Linkage between creativity and innovation also remains evident for in social innovation. Among the six stages of social innovation that was conceptualized by Murray et al., [30] idea generation is the first phase that includes the creation of proposal and ideas referring to the creativity methods.

It must also be noted that the participation and motivation of academic community, and especially students in social innovation practices will play a critical role in shaping the future. As stated by AshokaU's manifestation, "Students need interdisciplinary, entrepreneurial, and solutions oriented skillsets to succeed". On the other hand, there has always been a debate on understanding the common characteristics and motives of creative individuals. The call for creativity in education is in the agenda of policy makers since 1990s [66, 67]. "Creativity" has been a popular topic for the last two decades in the field of education, such as engineering, teaching, learning, designing, production, management, and leadership as a way to a solution, resolution, development, enhancement, and productivity [60, 63, 64]. It is discussed that creativity instills higher-order thinking skills in students [68], and hence it has a significant notion in the area of education, teaching and learning [65]. Thus, it appears that recently most educational policies take into account the

inclusion of creativity [60]. It is clear that creativity is important to university communities, and campus administrators should be interested in understanding the creativity narratives of students as a mechanism that can influence policy decisions [61]. However, we still have little understanding of the range of ways in which colleges nurture or impede its development [61, 62].

In this context, this study aims to explore the factors that determine the creative intentions of engineering and management undergraduate students. Our research also seeks to identify the impact of university education and the university as an ecosystem on the level of creative intentions. In doing so, we tend to contribute to broadening the understanding of creative intentions of university students.

Findings of the study are expected to provide insights to policy makers in enhancing the creative potentials of students that are required for generating and conceptualizing social innovation projects in universities. that can shape the future.

II. LITERATURE REVIEW ON CREATIVITY

Creativity is generally expected to be the essential component of problem solving and the driving force of innovation and entrepreneurship that are enablers of technological capability and sustainable economic development [2] [8] [20] [35]. Creativity is often perceived as the intellectual power that keeps up and enriches individual and societal progress. Thus, creativity seems to be one of the most valuable and sought after human resources [12] for social and economic development.

Creativity had been defined in various ways in the literature as;

- the ability to produce work that is both novel and appropriate [47]
- to create something new and useful [39] [40] [6] [28] and
- sensitivity to problems as well as redefinition abilities, such as transformation of thoughts or freedom from functional fixedness [23],
- a synthesis of figural, symbolic, semantic, and social-behavioral skills relevant to real life [14]
- the potential to create or a personality trait, as a sudden flash of idea or a long-lasting divergent thinking process, as a novel or original product or artistic expression [47].

Creative potential exists in every individual and can be improved through learning [51] [48]. However, according to Williams [58] artistic ability should not be confused with creativity; “Artistic ability includes skills and talent to create fine works of art: painting, drawing, sculpting, musical composition, etc. Creativity ability is the skill and talent to use our imagination to create and solve. A better artist is creative. But, you don’t have to be an artist to be creative”.

Creative thinking that is the main focus of this study, stands as the major construct of creativity concept. It is the attitude that provides the ability to sense problems, make guesses, generate new ideas and communicate results [52].

III. FACTORS THAT INFLUENCE CREATIVITY AND CREATIVE THINKING

A significant amount of research explored the factors that affect creative thinking and creative activity such as gender, socioeconomic status, family aspects, geographic region or ethnicity [56] [2] [4] 1999; [10] [11] [15] [32] [39]. Feldman [17] conceptualized creativity to have multiple manifestations, namely [12];

- personal cognitive and social/emotional processes,
- family aspects,
- education,
- characteristics of the domain and fields,
- social/cultural contextual aspects as well as
- historical forces,
- events, and trends.

Among the wide-ranging literature about the determinants of creativity, four major dimensions has been identified; (1) genetic factors, (2) demographic factors, (3) personality related factors / personal traits [2] [37], (4) contextual (environment – climate related) factors [12] [19] [54] [46] [9].

Gender: Gender differences in creative thinking among students have been examined [12], a significant majority of the researches did not found any impact of gender on creative traits (Barrantes Vidal, Caparros, & Obiols, 1999; [25] [31] while some male students were found to have higher levels of creativity [25], in terms of divergent thinking (Chadha, 1985; [1] [27], initiative [34] or flexibility [7].

A. Creative personality traits:

The personal traits that foster creative thinking potential of individuals are examined as “the ability to generate various alternative ideas / solutions in a divergent way and then to come up with a solution towards a convergent attitude (thus, the ability to combine divergent and convergent thinking approaches during the entire creative thinking process), (Barron and Harrington, 1981; Torrance 1966, [55], questioning the rules and assumptions, asking “what if / what if not” questions in order to develop alternative solutions to the currently existing ones, and ability to see the problems (critical thinking), asking how and why questions (childlike curiosity), the ability to interpret issues and generate ideas from various different perspectives, the ability to create new connections between seemingly unrelated issues and applying knowledge about a certain field or issue in another field or in combination with knowledge gained somewhere else, the ability to elaborate the ideas with further details, (elaboration) intrinsic motivation and goal-orientation for creating something new and valuable [2] [41], openness to learning and new ideas, the desire for independence and self-autonomy, the courage to take risks and try unknowns, and the ability to learn from trial and error, [49], in depth experience and knowledge about a certain issue at vertical dimension and at the same time, multi-disciplinary

knowledge and interest about various seemingly unrelated issues at horizontal dimension [18] [2] [29]. Wang [56] stated that creative thinking may have more to do with beliefs and less to do with practices.

According to the study of Rudowicz and Hui [37], descriptors of a creative trait may be treated as indigenous in nature. Positive personal trait indicators for creativity are found to be: curiosity, flexibility, having original ideas, being bold, willing to try, and being observant. On the other hand negative indicators are being unimaginative, non-resourceful, and having no insight. For creativity self-perceptions of university students, Jaba et al. [21] concluded that students who are using their creativity individually with better results consider creativity as something strictly personal, spontaneous and uncontrollable, associated with emotion and fantasy. For them, creativity is putting into scene of their own personality, consisting in illuminations that are based on innate talent, under the action of external stimuli.

B. Contextual Factors: Environment, Education and Impact of University :

Climate basically means the environment in which the individual lives and interacts, and climate related factors refer to the policies, vision, strategies, management approaches, structure, resources and competencies of the organization, the norms, values, practices and routines as well as the interactions among individuals that all may influence the performance and attitudes of the individual. The environments includes the family environment [59] social – friendship and education environment [12] [13] [14] [36] [21] and workplace environment [2]. Kishor [25] found differences between creativity level of students from urban and rural areas. It is generally argued that the environments that are open to differences, tolerating failures, allowing freedom and free time – flexibility for thinking and making trials, giving a certain degree of autonomy to individuals to make their own decisions, supporting and awarding creative ideas, and allowing an innovative vision, goals, strategies and culture are more supportive for individuals to improve their creative potentials.

Bartzer [5] explored the development of creative thinking through an adequate engineering education and concluded that in creativity process, knowledge, skills, habits, practical and theoretical concepts are playing role actively.

Family Aspects: Parents' educational background affects the level of creativity of students [25]. The social environment, school, community of an individual which includes the culture that he or she was educated and/or lives in, and the people and institutions around him or her influence the individuals' creative skills and attitudes [17] [12] [59]. Children of the families with higher socioeconomic status are likely to be more creative [14]. Material, financial, and cultural resources that are provided by the family probably facilitate the development of creativity. Hence it can be argued that students attending more competitive and

selective courses will tend to demonstrate greater creativity [12].

It is widely argued that creative thinking potential already exists from birth and at the highest level at the childhood, yet, tends to decrease in years when growing up [57] [14] [43] [42] [12] [59]. The childhood curiosity, the habit of asking questions, the courage to try new things and retry due to failures are replaced with the fear of failure, accepted assumptions, obliged rules, standardized information and knowledge gained through passive and ineffective learning at schools. Standardized test approach, commonly applied through the world in order to assess the performance of students, works on the contrary of divergent thinking philosophy.

According to Gestalt theory, formulation of a holistic mental frame is more useful than focusing on specific details to creative development [14] [57]. It is argued that although knowledge is essential for critical thinking, too much knowledge may hinder the use of creative analogies. According to Weisberg [57] senior students can depend too much on their "expert" knowledge and this may undermine students' ability to go beyond stereotyped thinking [57] [14] [43] [42] [12] [36].

Empirical evidence suggests that an individual's creativity declines as the number of years spent in formal education increases [14] [43] [42]. An inverted-U shape relationship between education and creativity, with the peak of creativity at the junior years of university, has been documented by Simonton [43] [42]. He concluded that general knowledge and skills acquired up to the first two years of university foster development of creativity and hinder dogmatism, however, beyond these first two years, education becomes too specialized and the effect is the reversed [42] [43] [44]. On the other hand, the general decline of creativity with education may be attributable to the increasing complexity in problems and problem solving among people with higher education [14].

According to Bio-cognitive theories, creativity results from activation of primary process cognitions, which is typically associated with the right hemisphere of the human brain, and with the extreme cortical arousal states, that is, either high or low [13] [26]. Here, artistic creatio and holistic thinking is hindered by analytic, logical, and reality oriented cognition [26]. Bio-cognitive theory have some commons with social learning theory, and the discipline can affect creative thinking. It was also argued that a student who majors in science and technology will have a lower level of creativity than a student majoring in humanities and social science, and the former will have a higher level than a student majoring in business [12] [26].

The social learning approach also points out that role models, masters, and mentors are important for an individual to develop creativity [17]. The positive outcomes, however, are most likely when a large number of diverse mentors and models is available. Otherwise, there is a danger of excessive imitation of the work of others [44]. These theories may be

useful in explaining the variation in the level of creativity among students of different years and fields of study in university. In this study, we are mainly concerned with the demographics, personal traits and environment (university, in this case) related factors and the relationship among these factors.

IV. METHODOLOGY AND RESEARCH DESIGN

This study aims to explore the factors affecting the creative intentions of university students in generating social innovation projects for which a literature research is conducted to provide the basic potential constructs. In the literature, there are widely accepted measuring techniques for creative thinking [50, 55, 3] summarized by Villaba. However in the large samples, measuring creative performance with these methods is problematic due their complexity. An alternative approach to measure the “creativity performance” can be understanding the “creativity potential” through the self-perceptions of the sample units about their own personal traits. “Creative Perception Inventory” Test that is developed by Kathena and Torrance [53] can be an example of this approach.

In this study, however, we developed a unique questionnaire that is more appropriate for the specific problem of this research, based on the discussions and previous findings in the literature. Hence, based on the constructs from theory (social learning theory, creative personality, self-reported creative product, personality traits, Resistance to Change Scale, Curiosity and Exploration Inventory, cognitive approaches) the survey topics are identified to explore the students’ level of curiosity, passion to learn, goal-orientation, intrinsic motivation, divergent thinking abilities, critical thinking and questioning habits during the undergraduate university education. The survey is composed of questions on the demographic characteristics, environmental factors, motivators, university/institutional context and education, perceptions and creative thinking attitudes. Theories and the topics relevant to understanding the creative thinking intentions of university students are summarized on Table 1. Therefore, we collected the basic constructs from previous researches and literature in a survey and formed the questionnaire. To test the validity of the designed survey structure, we adopted Factor Analysis.

TABLE 1. TOPICS OF QUESTIONS BY REFERENCES THAT ARE USED IN THE SURVEY

Survey Constructs /Topics	Theory	Reference
Curiosity	Curiosity and Exploration Inventory (CEI) -disposition to curiosity; Exploration subscale; disposition to activity seek out novel and challenging situations IDEAS Creativity Scale Creative personality traits/Positive indicators	Kashdan et al., [22] Rudowicz and Hui [37], Amato-Henderson et al., [3]; Cheung et al., [12]
Attitude for change, learning	Resistance to Change Scale (RTC); dispositional inclination to resist change; -Routine Seeking; extent to which one seeks out stable routines - Short-term focus; whether one focuses on the short term hassle or long term benefit of change -Emotional Reaction ; response to imposed change – whether excited or anxious	Amato-Henderson et al., [3], Oreg, [33]
Attitude for Own creativity	Own Creativity; one’s attitude regarding their own creativity Creative personality traits/Positive indicators/having original ideas	Zampetakis & Moustakis Scale (Z & M scale); Amato-Henderson et al., [3]; Rudowicz and Hui [37],
Flexibility, collaboration	Creative personality traits/Positive indicators/Flexibility	Rudowicz and Hui [37],
Impact of Family and friends	Family Creativity/whether creativity was promoted in one’s family.	Zampetakis & Moustakis Scale (Z & M scale)
Impact of University Environment	University Creativity/one’s attitudes toward a university environment that promotes creativity	Zampetakis & Moustakis Scale (Z & M scale)
Problem solving attitude	Cognitive Approaches/confidence in preferred problem solving tactics such as “thinking outside the box” Impulsivity in problem solving (confidence in ability to solve problems without being impulsive) -Cognitive Preparedness (negatively associated with creative self efficacy) anxiety or frustration experienced with ill-defined problems or situations in which one feels unprepared	Amato-Henderson et al., [3]

TABLE 2. DEMOGRAPHICS OF RESPONDENT STUDENTS

University		Frequency	%
University	ITU-Istanbul Technical University	276	45,1
	ISIK University/Istanbul	164	26,8
	MARMARA University/Istanbul	172	28,1
Grade	1st Grade	354	57,8
	4th (last) Grade	258	42,2
Gender	Female	299	48,9
	Male	312	51,0
Programme	Engineering	185	30,2
	Management Engineering	164	26,8
	Management	263	43,0

In the questionnaire, we also included the following topics as personality traits:

- a) Perception about the creativity,
- b) Failure acceptance,
- c) Motivation,
- d) Knowledge acquisition, learning,
- e) Divergent thinking,
- f) Critical thinking, judgement,
- g) Teamwork and collaboration,
- h) Participating in activities on creative thinking.

Survey questionnaire also included the following demographic factors:

- a) Gender
- b) Year of Study
- c) Type of high school that the student graduated from,
- d) Place of residence/ origin region (student and parents) in Turkey,
- e) Family Aspects: (Education level of parents, Occupation of parents, Profession of parents)

This survey is conducted among management, engineering and management engineering students (total 600 responses) from 3 universities (2 public and 1 private) that are selected from the different percentiles of the Entrepreneurial and Innovative University Index for 2012 of Ministry of Science, Industry and Technology of Turkey¹. The demographics of these students are shown on Table 2.

5 point Lykert scale (1- Strongly disagree, 2- Disagree, 3- Somewhat agree, 4- Agree, 5- Strongly agree) is used for the questions in the second part of the questionnaire. Due to the

lack of an validated questionnaire/scale that focuses on the “creative intentions of university students”. Therefore, we collected the basic constructs from previous researches and literature in a survey and formed the questionnaire. To test the validity of the designed survey structure, we adopted Factor Analysis.

The accuracy of the data is proved by the reliability analysis that is shown in Table 3. As can be seen from the table, the validity of responses to the questionnaire is tested, primarily by factor analysis (to find out which questions in the designed survey measure which factors). During the factor analysis, 14 iterations were performed. The final total variances explained in the 14th iteration are shown on Appendix A, and constructed seven components explains the 57% of the total variances which is satisfactory for the validity. In accordance with this finding, the questions that are grouped within the 7 components (factors) are found to be valid and applicable to future research. Components (Factors) which were found in the end of factor analysis are matched with the theoretical approaches in the literature (Table 1) for their content and these factors are named in accordance with their linkages with these theoretical topics.

When the average scores of 7 components are analyzed (Table 3), we can conclude that the for the total sample, Self-Esteem, Environment, Self Perception factors (2, 3, 6, 7) are above medium score and corresponds almost to “4- agree” scale, meaning that the sample university students have creative intentions for these components. However, curiosity factor, average score seems to be under medium score and approaches to “2-disagree” scale that means the sample students lack the curiosity that is required for creative thinking. Impact of university factor received the medium score, hence the impact of university seems to be unclear on the creative thinking intentions of the students.

¹ To cover students from different university environment, universities from different percentiles of the Entrepreneurial and Innovative University Index for 2012 of Ministry of Science, Industry and Technology of Turkey are selected. This index that has been published for the first time in 2012 evaluates and ranks the universities in terms of their entrepreneurial and innovative competencies, resources and activities under five major factors of Scientific and technological research competency, IPRs, Collaboration and Interaction, Entrepreneurial and innovative culture, economic contribution and commercialization. In this index, Istanbul Technical University is 5th (in first percentile), Işık University is 32nd (in the sixth percentile) and Marmara University is the 42th.

V. RELATIONSHIPS BETWEEN DEMOGRAPHIC FACTORS AND CREATIVE THINKING FACTORS OF STUDENTS

For understanding the impact of demographic factors of students on their creative intentions, appropriate difference tests are applied. Demographic factors included gender, year of study, university, Type of high school that the student graduated from, Place of residence/ origin region (student and parents) in Turkey, Family Aspects: (Education level of parents, Occupation of parents, Profession of parents). These demographics are tested by their ability to create significant difference on the creative intentions components (factors) that were found by factor analysis and given in Table 3 in the previous section. In the end of the tests, significant differences by “Year of Study” and “University” were found by Factors of creative intentions. For other demographics, tests did not prove significant differences in factor values.

A. Impact of Year of Study” on Factors of Creative Intentions of Students

t-test and Variance Analysis (ANOVA) is conducted for the demographic variables for each factor. Confidence level that is used in statistical tests is %90. For testing the significance of difference of each component (factor) by “Year of Study”, F test for two sample of variances is applied. Parametric tests are conducted for finding out whether there are any significant differences in the values of components by other demographics of respondents. In the end of the t-test for independent two samples (Table 5), we found a significant difference for factor 1 (Impact of University Environment (UE) and factor 3 (Attitude for own creativity/self esteem) by “Year of Study (1st grade and final year). Factor 3 included questions like “I believe I am good at finding creative solutions for problems that I face”, “I am good at coming up with creative ideas” and “I am motivated for finding creative ideas”. Hence, it can be argued that “being knowledgeable” by being educated, increases the creative ideation and problem solving attitudes.

TABLE 5- F-TEST TWO-SAMPLE FOR VARIANCES – FACTORS BY YEAR OF STUDY

Independent Samples Test										
FACTORS		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Factor 1 Impact of University	Equal variances assumed	17,864	,000	3,243	601	,001	,20945	,06458	,08263	,33628
	Equal variances not assumed			3,141	478,504	,002	,20945	,06667	,07844	,34046
Factor 2 Curiosity and Problem Solving Attitude	Equal variances assumed	1,143	,286	-1,454	603	,147	-,07271	,05002	-,17095	,02553
	Equal variances not assumed			-1,451	547,537	,147	-,07271	,05013	-,17118	,02575
Factor 3 Attitude for own creativity / Self Esteem	Equal variances assumed	4,071	,044	-2,316	606	,021	-,15270	,06593	-,28218	-,02322
	Equal variances not assumed			-2,280	516,027	,023	-,15270	,06698	-,28429	-,02111
Factor 4 Vision/Term of Focus (Long/short	Equal variances assumed	,244	,622	-3,398	606	,001	-,28454	,08374	-,44899	-,12009
	Equal variances not assumed			-3,417	564,990	,001	-,28454	,08326	-,44808	-,12100
Factor 5 Exploration and Learning	Equal variances assumed	,940	,333	-2,790	606	,005	-,19973	,07158	-,34031	-,05915
	Equal variances not assumed			-2,790	553,938	,005	-,19973	,07158	-,34033	-,05912
Factor 6 Perception on the “learnability of creativity	Equal variances assumed	,563	,453	-1,965	608	,050	-,13992	,07121	-,27977	-,00007
	Equal variances not assumed			-1,982	570,211	,048	-,13992	,07060	-,27860	-,00124
Factor 7 Perception on Supporting Social Environment	Equal variances assumed	,179	,672	1,800	609	,072	,13234	,07351	-,01203	,27671
	Equal variances not assumed			1,796	549,278	,073	,13234	,07368	-,01239	,27707

TABLE 6. DESCRIPTIVE STATISTICS OF FACTORS BY YEAR OF STUDY

FACTORS	Year of Study	N	Mean	Std. Deviation	Std. Error Mean
Factor 1 Impact of University	1st year	346	2,8783	,70577	,03794
	Final year	257	2,6689	,87890	,05482
Factor 2 Curiosity and Problem Solving Attitude	1st year	348	3,7611	,60467	,03241
	Final year	257	3,8338	,61297	,03824
Factor 3 Attitude for own creativity / Self Esteem	1st year	352	3,3864	,76755	,04091
	Final year	256	3,5391	,84855	,05303
Factor 4 Vision/Term of Focus (Long/short	1st year	350	3,3414	1,03651	,05540
	Final year	258	3,6260	,99836	,06215
Factor 5 Exploration and Learning	1st year	350	2,1362	,87240	,04663
	Final year	258	2,3359	,87230	,05431
Factor 6 Perception on the “learnability of creativity	1st year	352	3,4957	,88875	,04737
	Final year	258	3,6357	,84096	,05236
Factor 7 Perception on Supporting Social Environment	1st year	353	3,7564	,89196	,04747
	Final year	258	3,6240	,90509	,05635

By considering the survey results that are given in Table 6, we argue that in these findings, final year students believe that the Factor 1 - Impact of University Environment has less contribution to their creative intentions, while their own creativity and self esteem (Factor 3) is higher than the first year students.

B. Impact of “University” on Factors of Creative Intentions of Students

For finding out whether there are any significant differences in the values of components by “University”

ANOVA Test (a parametric test) for Variances is applied (Table 7; where factors are shown in row groups with their numbers). In the end of ANOVA Test, significant differences for factor 1 (Impact of University Environment), factor 4 (Vision/Focus Term) and factor 6 (Perception on the “learnability of creativity) were found by university. In other words, the values by these factors of creative intentions differed by university.

TABLE 7 – ANOVA TEST FOR VARIANCES – FACTORS BY UNIVERSITY

FACTORS		Sum of Squares	df	Mean Square	F	Sig.
Factor 1 Impact of University	Between Groups	21,468	2	10,734	18,162	,000
	Within Groups	354,600	600	,591		
	Total	376,068	602			
Factor 2 Curiosity and Problem Solving Attitude	Between Groups	,319	2	,160	,430	,651
	Within Groups	223,519	602	,371		
	Total	223,839	604			
Factor 3 Attitude for own creativity / Self Esteem	Between Groups	,425	2	,212	,327	,722
	Within Groups	393,428	605	,650		
	Total	393,853	607			
Factor 4 Vision/Term of Focus (Long/short	Between Groups	8,075	2	4,038	3,847	,022
	Within Groups	635,055	605	1,050		
	Total	643,130	607			
Factor 5 Exploration and Learning	Between Groups	,850	2	,425	,551	,577
	Within Groups	466,248	605	,771		
	Total	467,098	607			
Factor 6 Perception on the “learnability of creativity	Between Groups	7,302	2	3,651	4,875	,008
	Within Groups	454,608	607	,749		
	Total	461,910	609			
Factor 7 Perception on Supporting Social Environment	Between Groups	,946	2	,473	,584	,558
	Within Groups	492,244	608	,810		
	Total	493,190	610			

VI. CONCLUSION AND DISCUSSION

The creative thinking literature is mostly focusing on the impact of work place environment on creativity potential of professionals. There are relatively less studies [16] [12] [13] [14] [36] [21] concerned with the impact of university environment, education, personal traits, demographics and social environment on the creativity potential of students. Understanding the level and factors influencing students' creative thinking skill is critically important for developing well-designed policies and plans for effectively promoting creativity, and hence for establishing an innovative human resource base required for an innovation-based society and economy.

This research aimed to make a contribution to the literature by developing a unique set of factors to understand creative intentions of university students in generating innovative projects. The factor analysis of the study provided a valid list of components as visionary attitude, curiosity, willingness for exploration and learning, attitude for own creativity, self-esteem, perception about the learnability of creativity, impact of university and social environment.

Findings reveal that some of the explored demographic characteristics have an impact on some of the factors that are related to creative thinking perceptions and attitudes of students. There is a significant difference between first year and final/senior year students for factors regarding "Impact of university environment" and "Attitude for own creativity/Self esteem". Senior students have a lower perception about the impact and need of supporting university environment for creativity, while they have higher attitude for their own creativity and have higher self-esteem. For other factors no significant difference was observed among the compared sample groups. Hence, it can be concluded that, creative thinking attitudes and intentions vary by year of study. This finding corresponds to previous research, but it does not support the theory of inverted U shape relationship between education and creativity [14] [42] [43]. It underlines the fact that, university environment enhances the self-esteem of the students when it is supportive, and the impact of university and expectations from university declines as year of study advances. As the "impact of university environment" is perceived less, and self esteem improves in the final year of study, it can be argued that the "education" contributes to development of self-confidence due to "being knowledgeable". Knowledge increases the creative ideation and problem solving attitudes.

On the other hand, Impact of University Environment, Vision for future/focused term and Perception on the learnability of creativity are found to be differing by university. Students from universities that are ranked higher in the Entrepreneurial and Innovative University Index, have scored higher in these factors. While the students from the private university have high perceptions about impact of university and learnability of creativity, the students from the public technical (engineering) university has longer term

visions for the future. Hence it can be concluded that "education" and "university" has impact on creative thinking intentions and attitudes, and the "context" significantly matters when dealing with creativity of students. To enhance creativity among university students, curriculum and university eco-systems should be structured in a way to promote creative practices.

The study revealed that the university environment and education may play a significant role in students' creative thinking attitudes. Therefore, decision makers and administrators of universities and higher education institutions should be aware of their impact and role on creativity level of the students, and hence should create, design and maintain the ecosystems and climate in universities that can foster creativity.

A task for future research is to understand the ways in which individuals balance creativity and conformity and to better understand under what conditions creative intentions of students can improve and lead to innovativeness and entrepreneurial intentions. As well, a quantitative and qualitative research on the curriculum, structures, policies of the universities can contribute to develop an understanding on the interrelations between the university context and the creative intention levels of students. This study can also be expanded to a larger number of universities in Turkey, and also benchmarks with best practices from EU or US universities can be applied.

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APPENDIX A. TABLE 4. TOTAL VARIANCES EXPLAINED IN THE FINAL ITERATION OF THE FACTOR ANALYSIS

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,704	19,668	19,668	4,995	17,226	17,226
2	3,890	13,412	33,080	2,883	9,940	27,166
3	1,592	5,491	38,571	2,071	7,140	34,306
4	1,574	5,429	44,000	1,849	6,374	40,680
5	1,435	4,949	48,949	1,731	5,970	46,651
6	1,222	4,212	53,161	1,536	5,298	51,949
7	1,117	3,852	57,013	1,469	5,065	57,013
8	,947	3,264	60,278			
9	,895	3,085	63,362			
10	,865	2,982	66,344			
11	,806	2,778	69,122			
12	,761	2,625	71,748			
13	,698	2,405	74,153			
14	,687	2,369	76,521			
15	,638	2,200	78,721			
16	,607	2,093	80,815			
17	,582	2,007	82,822			
18	,567	1,956	84,778			
19	,547	1,886	86,664			
20	,534	1,841	88,506			
21	,500	1,725	90,231			
22	,441	1,521	91,752			
23	,406	1,399	93,150			
24	,393	1,357	94,507			
25	,353	1,218	95,725			
26	,336	1,159	96,885			
27	,319	1,099	97,983			
28	,296	1,021	99,004			
29	,289	,996	100,000			