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# Examining creative and design thinking as drivers of entrepreneurial orientation among university students in the startup sector

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**Abstract---**This study aims to explore the impact of creative thinking and design thinking on the entrepreneurial orientation of university students, with a particular focus on the mediating role of design thinking within the startup ecosystem. The research was conducted on a purposive sample of 66 first-year Master's students majoring in Civil Engineering and Architecture at Ammar Telidji University of Laghouat. Data was collected through a structured questionnaire that addressed the dimensions of creative thinking (imagination, expression, and synthesis) and design thinking (inspiration, ideation, and implementation), in order to examine how these cognitive frameworks contribute to shaping students' entrepreneurial orientation. The data was analyzed using SmartPLS, Jamovi, and Excel. The findings revealed statistically significant positive relationships between creative thinking and design thinking, as well as between design thinking and entrepreneurial orientation. While imagination and expression positively influenced design thinking, their direct effects on entrepreneurial orientation were negative—highlighting the necessity of design thinking as a structural bridge that translates unstructured creativity into effective entrepreneurial behavior. The synthesis dimension demonstrated limited and negative effects, suggesting challenges in integrating complex information. On the other hand, inspiration emerged as the strongest positive predictor of entrepreneurial orientation, emphasizing the importance of empathy and user-centric insight in driving entrepreneurial intention. The study concludes that fostering entrepreneurial orientation among students requires an integrated approach that develops both creative and design thinking capabilities. It recommends supporting creative education, offering experimental learning spaces, and cultivating a university culture that encourages teamwork and innovative problem-solving.

**Keywords---**creative thinking; design thinking; entrepreneurial orientation; entrepreneurship; startups; Algeria.

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**-Introduction**

Countries it is increasingly viewed as a strategic option to address current economic challenges such as unemployment, sluggish growth, and the shrinking availability of traditional job opportunities—especially with the growing number of university graduates each year. In this context, entrepreneurship has garnered growing attention from governments, policymakers, academic institutions, and civil society due to its promising potential to generate wealth, stimulate economic activity, and foster a spirit of innovation and initiative, particularly among university students.

This interest has been reflected in the formulation of national policies aimed at supporting entrepreneurs, offering incentives to innovators, and facilitating the creation of small and medium-sized enterprises. Additionally, many universities have integrated entrepreneurship education into their curricula to build an entrepreneurial culture among students and encourage them to consider entrepreneurial careers as viable alternatives to traditional employment.

Within this framework, it has become increasingly important to understand the psychological and cognitive factors that influence students' entrepreneurial orientation, especially in today's dynamic economic environment that demands adaptability, creativity, and non-traditional thinking. In this regard, creative thinking plays a vital role, as it enables individuals to generate new and innovative ideas and to develop unconventional solutions to complex problems. Moreover, design thinking has emerged as a critical methodology in modern entrepreneurship. It emphasizes a user-centered approach to problem-solving through well-defined stages, including empathy, problem definition, ideation, prototyping, and testing.

Both creative thinking and design thinking are considered essential competencies for entrepreneurs, especially in the startup sector, which is characterized by rapid change, high competition, and a strong reliance on innovation as a key success factor. Therefore, investigating the impact of these two thinking approaches on students' entrepreneurial orientation is an important step in assessing the readiness of this vital demographic to engage in successful entrepreneurial ventures. Based on the above, this research seeks to answer the following central question:

**What is the impact of creative thinking and design thinking on the entrepreneurial orientation of university students in the startup sector?**

Based on the problem of the study identified in advance, it is possible to proceed from the following hypotheses in order to prove or deny, which are manifested in the following:

H1.There is a statistically significant positive effect of creative thinking (in its dimensions) on entrepreneurial orientation among students in the startup sector, with design thinking (in its dimensions) acting as a mediating variable in this relationship.
H2.There is a statistically significant positive effect of the dimensions of creative thinking on the entrepreneurial orientation of students in the startup sector.
H3.There is a statistically significant positive effect of the dimensions of creative thinking on design thinking among students in the startup sector.
H4.There is a statistically significant positive effect of the dimensions of design thinking on the entrepreneurial orientation of students in the startup sector.

This study derives its significance from its focus on understanding the interactive relationship between **creative thinking** and **entrepreneurial orientation** among university students, with a particular emphasis on the mediating role of **design thinking** in this relationship.
In the context of rapid economic transformations, it has become essential to develop students' abilities for innovative and practical thinking that enables them to confidently and effectively enter the world of

entrepreneurship. Here, **design thinking** emerges as a strategic tool that translates creative ideas into realistic solutions and viable projects.

The importance of design thinking as a mediating variable lies in its role as a bridge linking the **capacity for creativity** with **actual entrepreneurial behavior**, making it a critical component in shaping entrepreneurial orientation—especially within the startup sector, which demands flexibility, problem-solving, and user-centered design.
Accordingly, this study aims to present an analytical framework highlighting how both creative and design thinking can be leveraged to foster entrepreneurial orientation within the university environment, thereby supporting university entrepreneurship policies and enhancing students' contributions to local economic development and social innovation.

The main objective of this study is to investigate the impact of **creative thinking** and **design thinking** on **entrepreneurial orientation** among university students within the startup sector, with a focus on the mediating role of design thinking.
Specifically, the study aims to:
1. Examine the direct effect of the dimensions of **creative thinking** (synthesizing, articulation, and imagination) on the entrepreneurial orientation of university students engaged in startups.
2. Explore the influence of the dimensions of **creative thinking** on the development of **design thinking** (inspiration, ideation, and implementation) among these students.
3. Investigate the impact of the dimensions of **design thinking** on the entrepreneurial orientation of students in the startup sector.
4. Highlight the mediating role of design thinking in the relationship between creative thinking and entrepreneurial orientation.
5. Provide recommendations for integrating creative and design thinking approaches into university curricula to better foster entrepreneurship and startup initiatives among students.

This study adopts a quantitative approach to examine the relationship between creative thinking, design thinking, and entrepreneurial orientation among university students in the startup sector. A descriptive-correlational design was employed to explore the direct and indirect effects of creative thinking on entrepreneurial orientation, with design thinking considered as a mediating variable. The study sample consisted of 66 first-year Master's students specializing in Civil Engineering and Architecture at Ammar Telidji University of Laghouat, selected using purposive sampling based on their involvement or interest in startup initiatives. Data were collected through a structured questionnaire divided into three main sections covering the dimensions of creative thinking (synthesizing, articulation, imagination), design thinking (inspiration, ideation, implementation), and entrepreneurial orientation (risk-taking, innovativeness, proactiveness), utilizing a Likert scale to measure the level of agreement. Data analysis was conducted using statistical software including Jamovi, Smart-PLS, and Microsoft Excel, employing descriptive statistics, reliability and validity tests, correlation analysis, and structural equation modeling to test the hypotheses and the mediating role of design thinking. Ethical considerations were strictly observed by ensuring voluntary participation, data confidentiality, and obtaining informed consent from participants after explaining the study's objectives.

To address the topic of our research, we are based on some previous studies that have been conducted in a different environment, as we will present in the following the most important points that we have covered, in addition to trying and demonstrate the status of our current study from these studies. Several previous studies have explored the relationship between creative thinking, design thinking, and entrepreneurial orientation among university students, providing valuable insights relevant to our research.

In reviewing the existing literature, it is evident that both creative thinking and design thinking play crucial roles in enhancing entrepreneurial orientation among university students. **Zampetakis and**

**Moustakis** (Zampetakis, 2006) found that creative thinking significantly influences students' entrepreneurial intentions. However, their research focused primarily on intentions rather than actual entrepreneurial behavior and did not explore the mediating role of design thinking. **Liedtka** (Liedtka, 2015), on the other hand, highlighted the impact of design thinking in reducing cognitive biases and promoting innovation, although her study was centered on professional environments rather than university students. **Glen et al.** (Glen, Suciu, & Baughn, 2014) argued for the integration of design thinking into business school curricula, showing its effectiveness in nurturing entrepreneurial capabilities. Despite its relevance, this study did not include students from technical disciplines such as engineering or architecture and also neglected the role of creative thinking as a separate construct. **Fillis and Rentschler** (Fillis & Rentschler, 2010) provided a comprehensive theoretical framework linking creativity to entrepreneurship but lacked empirical analysis and did not focus on student populations. **Rauth et al.** (Rauth, Köppen, Jobst, & Meinel, 2010) delivered one of the most directly relevant contributions by examining the impact of design thinking education on creative confidence among design and engineering students. Their findings are particularly pertinent to the current research context, though limited in generalizability due to their focus on specific academic programs. Collectively, these studies underscore the significance of both creative and design thinking in entrepreneurial development. However, there remains a clear gap in integrating these constructs within a unified model—particularly one that positions design thinking as a mediating variable between creative thinking and entrepreneurial orientation among students in technical fields and within startup environments.

Therefore, the current study builds upon and extends the prior literature by proposing and empirically testing a model that integrates both creative and design thinking in shaping entrepreneurial orientation. Unlike previous studies that examined either creative or design thinking in isolation, this research seeks to clarify the interaction between these constructs, especially the mediating role of design thinking. Moreover, by focusing on first-year Master's students in architecture and civil engineering, the study addresses the lack of empirical research targeting technical disciplines. This methodological alignment allows for a more comprehensive understanding of how these cognitive processes contribute to entrepreneurial intentions and behavior in startup contexts, thereby filling an important research gap.
Overall, these studies collectively highlight the crucial role of creative and design thinking in fostering entrepreneurial orientation, especially within startup contexts. Most agree that design thinking serves as a bridge mediating the impact of creative thinking on entrepreneurial behavior. Research methods vary widely, from quantitative surveys to qualitative case studies, suggesting the need for mixed-method approaches to gain a fuller understanding. Common limitations include reliance on discipline-specific or small samples and self-reported measures, which may affect the objectivity and generalizability of findings. Future research would benefit from more diverse samples and the use of objective measurement tools to strengthen the evidence base.

**- Theoretical Framework of The Study**

**I.The Essence of Creative Thinking**

**1. Different Definitions of Creativity& Creativity Thinking**

It is necessary before we address creativity thinking, we should point out some ambiguity surrounding the concept of creativity through some terms that have the same significance, and it is about the elements of innovation and creation. In the remainder of this study, we chose to use the term creativity only to avoid confusion of concepts and definition.

Theorizing about creativity and elements forming it by social scientists, goes back to more than a century ago, but the first major research spark was struck by Gilford. Creativity is synonymous with divergent thinking (to find new approaches to solving problems) vs. convergent thinking (to obtain correct answers). (Moshabeki & Vafa, 2002).

Creativity can be defined in many ways. But most researchers consider it as a process. Thus creativity is defined as creating new and effective ideas. Being new refers to the purity and originality of an idea.
"It is very sad to hear these recipes that are said to be magical and that some of the specialists in the field of creativity to the owners of the institutions, through which they assert that it is the panacea for what I can not resolve. In doing so, they have contributed to shortening the role of creativity in the organization through quick recipes with timely solutions". (Camille, 1997)

Through this definition we see that the communication choices of the creative individual is the origin of the process of "creative" process where creativity "creation" is the phenomenon through which the individual communicates the term "new idea" to others, and therefore we see that the communication process through which we want to Communicating our creative ideas to others is an integral part of the creative process itself.

Creativity is not the missing link of success for the individual or the organization, but an integral part of the process
Several elements interact to produce what we call creativity. It is enough to look around those artists, writers, researchers, inventors, contractors and businessmen, we ask the following question:
Can anyone expect the success rate of any entrepreneurial project they want to launch once they recruit their creativity to make it work? The answer is inevitably "no" because creativity is not about ideas or techniques we apply, but rather a process that is integrated and overlapping.
We will review the following definitions of the concept of creativity issued by scientists and researchers and creative thinkers, each according to their specialization, so that we can come up with a procedural concept of this term:
-Definition (**De Bone Edward)**: Creativity aims to break the stalemate around us, in order to see different. (Edward , 1996)
-And he knows (**Louis George)**: creativity can find solutions to any problem difficult, creative action is out of the ordinary and break down barriers.
-As (**Roosevelt Franklin**) knew: happiness is not to have money, do not be fooled to reach ecstasy, the seal of happiness lies in the creative effort. (Kuniyoshi & all, 1983)
-Anddefine (**Harris)**Creativity is marked by the ability to create, bring into existence, to invent into a new form, to produce through imaginative skill, to make to bring into existence something new. Creativity is not ability to create out of nothing (only God can do that), but the ability to generate new ideas by combining, changing, or reapplying existing ideas. Some creative ideas are astonishing and brilliant, while others are just simple, good practical ideas that no one seems to have thought, of yet**.** (Friday , THE VALUE OF CREATIVITY AND INNOVATION IN ENTREPRENEURSHIP, 2007)
- Creativity is also viewed as a process in which creative individuals work diligently and consistently to enhance their ideas and solutions, making continuous improvements through gradual modifications and refinements to their work. Contrary to the mythology surrounding creativity, very few of creative excellence are produced with a single stroke of brilliance or in a frenzy of rapid activity. Much closer to the real truth are the stories of companies which had to take the invention away from the inventor in order to market it because the inventor would have kept on tweaking it and fiddling with it,, always trying to make it a little better. (Friday , op-cit).
-According to **(Okpara)** creative thinking has various definitions. However, it is the art of generating solution to problems by the force of imagination and reasoning. It is an activity of the mind seeking to find answer to some of life's questions. In a dynamic and changing world, the challenges of man are also not static. They take on new forms and require a deep creative thinking approach. (Okpara, 2000)
Every idea is a product of thinking and every product is the manifestation of idea naked in a thinker's mind. These are people who see problems as opportunities to improve and do something new or something better, people who keep these two vital questions on their mind. "What can I do to make things better, or what can I do to make better things? This is the product of thinking.

Creative thinking can be defined as the entire set of cognitive activities used by individuals according to a specific object, problem and condition, or a type of effort toward a particular event and the problem based on the capacity of the individuals. They try to use their imagination intelligence, insight, and ideas when they face to such situations. In addition, they try to suggest an authentic and new design, generate different hypotheses, solve the problem with the help of discovering and finding new applications. (Young & Balli, 2014)

Observations of these different definitions of creativity from people who are very different in their disciplines, while agreeing to give a concept of creativity thinking, can therefore be defined procedurally as:

**-Those efforts that the individual changes to present things in a different way that we are not used to seeing in this way.**

**-Creativity thinking is the ability to develop new ideas and to discover new ways of looking at problems and opportunities.**

By talking about creativity thinking, it comes to our minds about the production of new, unprecedented things; imitation, transmission, reproduction or reproduction have never been regarded as creativity except for people who have been able to appear differently in front of others and fascinate them with their ideas. What is meant by something new or renewed does not in any way mean that it is a very different and unrecognized, or we can attribute it to creativity, and from this point of view we can provide a definition of renewal as a process that goes through stages, (and expresses: things unfamiliar with a creative touch of a different character, based on pre-existing objects)

## 2. Techniques for the production of creative ideas

According to **(De Bono Edward)** a pioneer of the School of Creativity in Europe, introduced several innovative technologies that have changed the world and applied them by several leading institutions that have proven the efficacy of these methods the process of normal thinking in ourselves as a large river. (To get out of it, energy must be available to help jump). So creative thinking is to make an extra effort to reach the other bank of the river.

This creative thinking can only be calculated by creating an " Gap " in the normal thinking scheme. It is termed"Keep the Gap" (Backerra & all, 2002), he also sees the techniques Creativity is one of the tools that aim to raise the barriers of thinking in the brain, they are amazing solutions that are characterized by regeneration.

### 2.1. Method 635

This technique is very similar to **(Osborn's)** whirlwind technique, but **(De Bono)** principle is different. It is a written whirlwind technique, and the number 635 means:

**06 participants 03 suggestions 05 minutes**

Each participant in this technique receives a paper with a question to answer. Within five minutes three suggestions must be submitted. The paper is then passed to his colleague who sits on his left where he writes three other suggestions on his colleague's paper and so on.

The duration of the technique with six participants is 30 minutes, and finally we get (6x3x5 =90) proposals for six 06 ideas, an average of 18 suggestions per paper.

The application of 635 technology is accompanied by a high degree of stress and pressure, which may generate an infinite number of On the other hand, some participants may find it difficult to adapt to the situation, which hinders the process associated with the element of time. Therefore, we advise the contractor when choosing this technique to find creative ideas to apply with a small team of 03 to 04 people limited to friends before thinking. In its expansion on a larger number.

**2.2. Method Mental Provocation**

This technique considered as the best offer **(De Bono)** it is a departure from traditional thinking models using contradictory methods of incitement that may create instability situations that allow creative ideas to emerge out of the ordinary, for familiar solutions to this problem.

In this technique, we stimulate our thinking through an induction medium which he calls "Mental Provocation", the impact of this on the abstract ideas of the individual was analyzed by focusing on the unfamiliar characteristics of the ideas and extracting the positive aspects.

**2.3. Method the Control List**

It is one of the most effective creative techniques, thanks to its emergence to (Osborn Alex), the owner of the whirlwind technology, developed by **(De Bone)** and used in the case of known products or ideas have not yet come up with creative ways to develop them, the watch list is a series of questions that need to be answered.

They are more suitable for individual use than for the collective and can be applied by the entrepreneur alone to develop and improve their ideas, and they can ask for help from other people so that they can better break up their idea and get more creative ideas. The following are the ten questions in the control list:

-**Different Uses:** Are there other methods of use? Can they be applied in another area?
- **Adaptation:** What is the similarity between the idea and other ideas? Can they be copied?
- **Modification:** Can meanings, colors, shape, writing ... be modified?
- **Zoom:** Is the shape zoomable? Adding other things?
- **Shrink:** Can it be reduced? Delete an item? Split it?
- **Replacement:** Can we call other items? Change the order of constituent elements?
- **Compensation:** What can we compensate for in the idea? Can we imagine other uses?
- **Reverse Figure:** Can we do the opposite in this idea? Can roles be exchanged?
- **Clustering:** Is it possible to combine the idea with another or break it up into partial units?
- **Convert:** Can clips be created? Conversion of form or materials used? (Swiners & Briet , op-cit).

These precise questions will facilitate the process of producing ideas at the entrepreneur if answered carefully, but no one can be sure of the full effectiveness of these techniques, which always need to be adjusted and evaluated. Since there are no direct costs when applying these techniques other than the time component, we invite the entrepreneur to take the time necessary to select the appropriate technology to produce creative ideas.

**3. Creative Thinking Skills**

There is a near agreement between the two researchers on the determinants, components or dimensions of creative thinking. Actually, there are three dimensions of creative thinking as synthesising, articulation and imagination having the following qualities:

**3.1. Synthesising**

This dimension includes various activities such as getting benefit from analogous thinking, deducing original result from small parts, presenting novel and authentic suggestions to the solution of the problem.

**3.2. Articulation**

It involves forming the old and new knowledge or expanding the current knowledge with the help of the new one, constructing unusual relationship to produce authentic solutions and making thoughts concrete with the help of imagination and use of the materials.

**3.3. Imagination**

This dimension is consisted of constructing relationship between valid and reliable thoughts, presenting flexible ways of thought with the help of imagination, to come up with different insights during idea producing process. (Strenberg, 2009); (Arslan, 2007); (Rhods, 1961).

Based on the dimensions of the creative thinking, its general characteristics can be listed as the following:
− Flexibility; Authenticity; Multiple thinking; Wondering; Thinking fast and independent; To be open to criticism; Rationalism; Being suspicious; To come up with different solutions; To realize and define the problem; To suggest possible solutions. (Gilhooly, Ball, & Macchi, 2015)

The conjecture that only particular types of people can be creative is demoded thanks to educational developments because creative thinking is not merely based on art-based activities such as dance, music, drama,...etc, as previously assumed. In recent years, creativity has been valued as universal capability that it can be applied in everyday situations. It is interpreted as capability of human intelligence instead of a subject. **(Sternberg)** defines creativity as an imaginative action fashioned so as to produce outcomes which are both original and of value. (Robson L. , 2013)
Also novelty is necessary rather than originality meaning that "someone's idea does not have to remark thinking that has never been thought before by anyone". This thinking should be new for that individual, not necessarily for society as a whole.

According to a set of skills, creative thinking is distinct from analytical and practical thinking. Choices and critical evaluations, however, are made by participants and observers as a part of creativity process. Wright (2010) also points out that creativity integrates both problem setting and problem-solving skills with meaningful solutions. (Robson S. )

In addition, according to Newbill and Baum (2012) for today's technology-driven, problem-riddled world, creative and critical thinking skills are vital for students who are faced with situations. In this purpose, idea generation, reflective judgment, self-regulation and attitude-disposition, which are both intuitive and teachable, are needed.

For instance, in the idea generation phase, children can have an opportunity to look at their idea from various perspectives and expand them on a theme. In reflective judgement, analysing, synthesising, evaluating ideas from the idea generation phase become utilized as consistent with higher order thinking ability. It expands participant's creative thinking ability beyond their comfort zone. While in self-regulation phase monitoring and reflecting on progress and product are valued during attitude disposition part, someone present idea while others not only listen but also add to the idea. (Newbill & Baum)

## II. An Overview of Design Thinking

### 1. Definition of Design Thinking

Design thinking is a relatively new and loosely defined concept, which requires examination from various perspectives to clarify its contribution to research. It has gained significant attention in the business world due to its role in enhancing competitiveness through innovative product and service design.

(**Tim Brown**) defines it as a system that matches human needs with technical possibilities and viable business strategies (Razzouk & Shute , 2012). **(David Kelley)** describes it as a method for solving human problems using the tools of designers (Brenner W & et, 2016), while **(Roger and Karen)** consider it a distinctive approach organizations should adopt to solve complex challenges (Braun & et al, 2014).

Design thinking is widely regarded as a human-centered innovation process involving inspiration, ideation, and implementation through prototyping. **(Gruber and al)** emphasize its focus on identifying and meeting human needs.

Unlike traditional design, design thinking is not limited to a specific profession or academic background. It can be practiced by both designers and non-designers across various fields. It is often seen as a way of thinking like a designer to creatively and empathetically address seemingly unsolvable problems.

## 2. Stages of the Design Thinking Process for User Experience

Proponents of design thinking describe it as a process in which interdisciplinary teams apply a set of design practices to any challenge or problem that requires a solution. The process itself is often described as a series of repeatable steps.

Given the various applications of design thinking, different process models have emerged, leading to a wide range of interpretations of what design thinking should entail. Reviewing and interpreting these different models of design thinking will help us develop a general understanding of the concept and its processes for the purpose of entrepreneurial leadership. Therefore, selected articles related to design thinking will be analyzed on two levels, aiming to understand both the concept of design thinking and its process model.

Design thinking processes in the literature are typically presented as consisting of three to five stages, regardless of the number or naming of the phases. The design thinking process generally varies from one researcher to another. To better understand the processes represented in the core literature, the key stages of the design thinking process have been identified below.

### 2.1.Inspiration

According to **(Brown)**, design projects must go through three spaces: inspiration, ideation, and implementation. "Inspiration" refers to the circumstances—whether a problem, an opportunity, or both—that trigger the search for solutions. "Ideation" is the process of generating, developing, and testing ideas that may lead to solutions. "Implementation" involves charting the path to the market. Projects often cycle back through these spaces, especially the first two stages, multiple times as ideas are refined and new directions are explored (Brown , 2008).

In **(Brown's)** concept, inspiration represents the starting point of the design thinking process, aimed at identifying and understanding the constraints of the problem and the opportunity. After that, in the ideation space, multiple ideas are generated, providing possible solutions to the problem. The final space is used to implement the idea and learn from the process.

As suggested in the inspiration space, which calls for an exploratory process, the goal of this exploration is to identify the constraints that define the problem and to gain insights from the inspiration phase to the ideation phase. **(Brown)** describes these constraints in three themes: feasibility (what is functionally possible in the future), viability (what is likely to become part of a sustainable business model), and desirability (what makes sense to people). (Camacho , 2020). Inspiration is considered the first step toward creating a product or service. Observing how things and people function in the real world is extremely useful for generating ideas.

### 2.2. Ideation

Although **(Brown's)** innovation spaces are not formally part of his design thinking model, they differ from the models proposed by **(Frases, Dunne & Breslin, Liedtka & Ogilvie, and Stanford D)**, which highlight the aspects considered central by the institution in the design thinking process. However, **(Brown)** defines innovation in the ideation space as "the process of generating, developing, and testing ideas," which is essential for building prototypes to refine ideas and ensure they meet market demands (Camacho , Op-cit).

While there is greater variation among processes regarding the number of steps in this stage, all generally envision ideation, prototyping, and testing as key activities for deciding on the final solution. However, prototyping and testing methods, as well as ideation and concept selection, are less frequently discussed in the literature, such as in works by **(Clark & Smith, IDEO, and Beckham & Barry)**.
Ideation often involves forms of brainstorming to generate a wide range of ideas. The goal is to create a broad set of potential solutions that can then be organized and combined to develop a range of options for prototyping.

According to **(Frazer)**, this stage focuses on addressing unmet needs identified during the initial inspiration phase. It then moves to prototyping by using imagination and visualization to generate new solutions inspired by a deeper understanding of human needs. These experiences have proven that prototypes are effective tools for thinking and communication to enhance and accelerate the strategic planning process. Prototyping is a creative and dynamic method that helps teams explore and quickly test possible ideas with users as a foundation for new value creation strategies.

### 2.3. Implementation

**(Brown's)** understanding of implementation is "the development of the best ideas into a business plan, which will guide the proposal from the project room to the targeted market (Camacho , Op-cit, 2020)."
**(Fraser)** describes business design as "the integration of the three core stages." To influence organizational outcomes, design must be the pathway to understanding stakeholder needs, the tool for envisioning new solutions, and the process of translating developed ideas into effective strategies (Fraser , 2009).
According to **(Fraser)**, the final step involves aligning concepts with future realities by formulating strategy and designing the business model. This includes identifying what is required to make the idea commercially viable by clarifying the strategies that will lead to success and the capabilities needed to deliver business value and competitive advantage.
By navigating through **(Fraser's)** three stages, teams can achieve greater success more quickly by using insights and unmet needs to inspire high-value conceptual solutions and extract from these concepts to reshape strategic business models.
However, **(Fraser)** refrains from using the term "design thinking" in her work, instead preferring the concept of "business design." This appears to be a strategic choice to rebrand design thinking in the business world with a more acceptable label.
Meanwhile, **(Clark & Smith)** present the design thinking process as a five-step model, which begins with problem identification, followed by understanding the user through observation, conceptualizing and validating the solution, and finally implementing the solution.
Among all the models compared, **(Fraser's)** model is the closest in structure to **(Brown's)**, particularly in terms of deep user understanding, conceptual ideation, and strategic business design, which align respectively with **(Brown's)** inspiration, ideation, and implementation stages. Therefore, our current study will adopt his model.

In this way, design thinking enables organizations to understand users, empathize with them, and uncover their needs. The main advantage of the design thinking process—composed of a series of stages—is that the information obtained in later stages is informed and enriched by feedback from earlier ones.

As design thinking has evolved and gained popularity, various processes have emerged—some consisting of six steps, others of four or even just three. The number of steps, however, is not what truly matters; what is essential is the core of design thinking as a continuous experience that must be initiated through entrepreneurial leadership.

## 3. Characteristics of Design Thinking

The digital age compels organizations to adopt the best methodologies and approaches, integrating them into problem-solving processes. One effective method for addressing these challenges is to understand design thinking and examine its key characteristics that help define it. While many of these traits are central to the concept of design thinking, only the most significant ones—those emphasized in the design thinking literature—will be discussed here.

Accordingly, a number of distinctive characteristics that play a fundamental role in understanding the thinking process of a design thinker have been summarized, as identified by **(Owen)** (Owen , 2007):

### 3.1. Creativity

At its core, design thinking is a problem-solving process, and a designer is more likely to succeed when the problem is approached creatively. Designers tend to experiment in a somewhat random manner, gathering ideas through research or trial and error. Gradually, a particular issue becomes the focus of experimentation and is refined through iterative design. Thus, the creative ability to experiment, evaluate mistakes, learn from them, and build on acquired experience is a defining trait of a creative designer, regardless of the field.

Creative thinking is a fundamental requirement for designers; however, design must go beyond mere invention or innovation. It should occur within a human-centered mindset, be environmentally conscious, and transcend traditional solutions.

### 3.2. Human-Centered Focus

Many innovations created over the past centuries may not have explicitly followed the principles of modern design thinking, yet what made them enduring is their human-centered nature and the value they generated for people around the world. The true value of a product or service lies in its design that simply considers the target user. Therefore, organizations need to merge innovation with human-centered design thinking.

A human-centered focus is essential for the success of products and services, as it enables a high degree of deep empathy and the development of prototypes that provide effective solutions. Design thinking methodology begins with the users you are designing for and ends with new solutions tailored specifically to their needs. It combines what is desirable from a human perspective with what is technologically feasible and economically viable.

### 3.3. Environmental Concern

In recent years, design thinking has gained a second, omnipresent, and higher-level client: the environment. Today, environmental concerns are increasingly regarded as fundamental constraints in the design process, placing them on the same level as human interests. Sustainable design focuses not only on human-centered solutions but also on environmental well-being, aiming to create long-term solutions.

Design thinking can contribute to sustainability by shifting attention from solely human needs to broader ecological impacts. It encourages viewing product and service design through a holistic lens, emphasizing ecological responsibility. If sustainability and human needs are not considered during project design, the purpose of the initiative becomes questionable.

However, sustainable projects often demand greater investment and higher costs. Thus, a major challenge for design thinkers is to find innovative, sustainable solutions that also optimize the use and reuse of resources. Environmental awareness becomes most powerful and effective when it is embedded in the core principles of design thinking.

### 3.4. Visualization Ability

At its core, visualization is the gateway to design thinking, as it involves building a mental process, understanding information, and the ability to communicate it. Visualization also plays a vital role in all stages of design thinking, especially in defining the problem and imagining products and services in the form of diagrams or sketches.

Thus, visualization helps design thinkers convey a specific idea or innovative solutions. Design thinking can be described as a method that combines rational thinking, data, and knowledge to form a vision of business opportunities.

### 3.5. Adaptability

The core philosophy of adaptable design thinking lies in the ability of a design or product to adjust to new requirements.

Two types of adaptability are considered in design: design adaptability and product adaptability. The design can be modified by the manufacturing organization to create new designs or to enhance a variety of products (Yi L , 2008).

Although adaptable design is a relatively new concept, many existing design methods can be utilized and improved to create adaptable products that can be easily modified to meet different requirements.

### 3.6. Multiple Solutions

Sometimes, presenting the product or service to the user can be the most challenging phase of the project for design thinkers, depending on their ability to offer multiple solutions to the problem.

Users typically prefer having multiple options, as each solution may have its own strengths and weaknesses. It is the role of design thinkers to discuss these points with the user and determine the best solution for their prototypes by combining features from multiple designs and selecting the optimal solution.

### 3.7. Systemic (Holistic) Vision

Design thinking shifts the perspective of design thinkers from focusing on individual elements to encouraging a view of the whole picture. It no longer involves just looking at individual components such as products or services but attempts to see the system as a whole. Integrating systems thinking into the design thinking process is an emerging field to address today's challenges. This is often referred to as "systemic design," where the approach moves from a reductionist method to a holistic approach to problem-solving.

### 3.8. General Specialization

Design thinking is not limited to designers only; it has been practiced by professionals across sciences, engineering, and business. Design thinking is considered broad in both preparation and implementation, and the wider the knowledge base, the greater the likelihood of inspiration for design thinkers.

### 3.9. Using Language as a Communication Tool

Design thinking uses language as a tool to communicate with the user through the selection of shape, color, size, etc. Each of these elements is integrated into the design to become a product or service.

In an era of endless communication channels, language helps design thinking convey ideas and solutions in a practical way, aligning design goals and unifying the language of everyone involved through connected thinking. Overall, the role of language is evident as a means of communication throughout the process between design thinkers and the user.

### 3.10. Multidisciplinary Teams

**(Brown)** prefers "a multidisciplinary team because there is collective ownership of ideas, and everyone shares the responsibility." (Camacho , Op-cit, 2020)

Through their diverse thinking, they can critique and discuss anything, which may foster the emergence of innovative ideas. Unlike non-multidisciplinary teams, where each individual tends to defend their own ideas, multidisciplinary design thinkers understand that good solutions arise when people from different disciplines exchange ideas, consider different perspectives, and work together to integrate them.

**III. Models and Concepts about Entrepreneurship Orientation**

**1. Definition Entrepreneurship Orientation**

Many researchers have given definitions of what they are entrepreneurial orientation among them:**(Bruyat& Bird)** who defined the entrepreneurial orientation "as an individual will or intellectual readiness, and **(K.E. Learned)** he sees that confronting the individual to some circumstances, and its interaction with the psychological characteristics of the individual and his professional or entrepreneurial experiences would induce his orientation towards entrepreneurship ". (Azzedine, L'intention entrepreneurial,une recherche compatative entre des etudiats suivant des formation en entrepreneuriat (bac+5) et des etudiantes en dess caae, 2003)

The researcher confirms in his study, **(Tounès)** is that although entrepreneurial orientation is an individual will recorded within the cognitive stages, but dependent on social, cultural and economic conditions.

As we can see, there are many possible definitions of the concept of entrepreneurial orientation others do not, but everyone agrees on the status of the orientation in the mind and mind of the individual who develops it and then relates it to the outcome of the transition to the implementation of the project.

The basis for assuming an earlier stage in the process of establishing an enterprise is inspired by many study models that place the individual actor in the central location and surrounded by different locations, often represented by elements of the entrepreneur surroundings that complete the construction process and represent the rest of the actors and include time periods. It is difficult to identify, going through the person of the originator, because it is not possible to imagine any construction without the entrepreneur and its surroundings and the various media, which lived and what it can provide financial resources and moral and encouraging and help to do without the time given, and this confirms It a lot of researchers like **(C.Bruyat)**"who believes that the construction process is recorded in the framework of the construction of the engine and is influenced by the strength of the paths, or the factors that make up, and believes that all these factors interact and overlap with the central actor (the creator) or entrepreneur to produce or Not producing it". (Christian, 1993) and **(Candido Borges)** "it gives us a linear conceptual framework that distinguishes the existence of previous stages from the start of the act of establishing an institution, like parent entrepreneurs, experience, ability to learn, etc, and on the other hand (such as social network partnership, access to capital, etc.)". (Candido, Louis, & Germain, 28-31 Octobre2008)

The general model proposed by the researcher **(A.Chapéro)** which dates back to 1975, is one of the oldest and most prominent models built for the birth of the entrepreneurship event and help to understand and understand this event, which is based on the power explained to the establishment of an enterprise derived from within and at the same time its environment, which includes the various media that it lived in, is in fact linked first to the mobility of the entrepreneur born, and psychological variables such as its preparations and tendencies towards action, and sociological variables such as: family environment and the importance of the parents of the entrepreneurs, reference team, local environment and the resources it provides to complete the act is like a hand Labor, capital sufficient funds, equipment ... etc". (Sonda & Younes, 2015)

There are many other modeling processes that focus on the factors influencing the structural work of the institutions, which are not beyond the environments of the potential contractor and its internal incentives, which depend on the multiplicity of factors.

**2. Intellectual Trends Orientation Entrepreneurship**

There are many currents and schools of thought in the field of entrepreneurial orientation that try to explain the phenomenon of establishment of enterprises, and we will try through this element to conduct a survey of the most important of these schools:

**2.1. Characteristic of the Entrepreneur**

Early researchers in the field of enterprises-building questioned why some individuals made the decision to establish an institution, and in the same circumstances others decide not to establish their own enterprise. The first answer, developed by these researchers, is that the individuals who create the enterprises or the entrepreneurs, have certain characteristics and special personality distinguishes them from the rest of the individuals.

Among the characteristics and attitudes that distinguish entrepreneurs are: the need for achievement, the need for autonomy, creativity, creation and endurance when there is uncertainty great self-confidence …etc. The logic used by this approach wants to prove that we can predict the behavior of individuals, or the tendency to establish an enterprise, and this through the combination of personal traits they possess in addition to other psychological characteristics.

**2.2. Environment Perspective**

This theory came as a critique of the perspective of attributes, which further diminished the role played by the environment in which entrepreneurs grow, and which urges them to establish enterprises, which means that several events that can be a positive decision can be ignored. Such as identifying business opportunities (or negative) (such as loss of work), as well as individuals do not live in a closed environment, meaning the medium in which the individual grows and grows, and affects his or her professional orientation.

**2.3. Behavior Perspective**

The third school of thought began with the idea: "the search for the entrepreneur must be about identifying the skills and competencies he must possess if he ever wants to set up his own business". Here, the researchers attention is directed towards the stages that lead to the establishment of an enterprise, and the actions and decisions that the future entrepreneur must adopt if he wants to achieve his project, but it shows the importance of this approach in the period of completion of the project, because identifying the behaviors necessary to establish an enterprise is of little importance to predict the extent of individuals to go to the entrepreneur.

**2.4.Entrepreneurial Orientation Perspective**

The fourth school of thought emerged as a result of the failure of the previous schools, and the theoretical foundations of this school were drawn from social psychology, and more accurately than the theory of planned behavior 1991 Ajzen"the theory of planned behavior" , such as the establishment of an organization, can precede the intention of having such behavior. (Josee, 2004)

By examining the entrepreneurial orientation of individuals, we can predict whether that individual truly establishes an enterprise or not.

**3. Models and Theories to Approach Entrepreneurship Orientation**

The two most important models used by many researchers who have adopted this approach, in order to explain and predict the behavior of individuals, are the theory of planned behavior of **(Ajzen)** 1991, which concludes that the entrepreneurial orientation of individuals, as the individual stages, is the individual, **(Socol&Shapero)**1982 entrepreneurship event formation model better known as the social dimensions of the entrepreneurship model.

### 3.1. Model Formation The Entrepreneur Event A.SHAPERO & L. SOKOL

The work of **(Shapero.A&Sokol.L)** is the oldest and most influential in the entrepreneurial academy, where the researchers have established a model that has so far remained the primary reference for research in the entrepreneurship field.

The basic idea of the model is that "in order for an individual to initiate a significant and significant change in his or her orientation in life, such as making the decision to establish his own enterprise, this decision must be preceded by an event that stops and breaks the routine." This is indicated in his model by three sets of factors:Negative Transitions;Situations Moderation;Effects Positive;Perception Desires;Perception Possibility Achievement;Establishment of an Enterprise. (Azzedine, op-cit)

### 3.2. PlannedBehavior Theory of I.AJZEN

The theory of planned behavior of **(I.AJZEN)** 1991 is an extension of "L'action raisonnée theory" developed in **(Fishebein&Ajzen)** 1975, where the basic hypothesis of that theory is that all Conduct is entirely under the control of the person who will decide whether to adopt the behavior.

Years later, however, **(Ajzen)** came to the important observation that behaviors were not entirely under the control of the person so he decided to add a new variable to the previous theoretical model, namely, the perception of control over behavior, this addition allowed the researcher to get closer to the truth and allow prediction and more accurately, With behaviors that are not entirely voluntarily adopted. (Azzedine, op-cit).

### 3.3. The Standard Model of the Theory of Planned Behavior of (Ajzen) & and (Shapero&Sokol) Model

According to the **(Shapero)** model, the realization of desire and the possibility of achievement is dependent on several variables such as characteristics and personal characteristics, access to financial resources, human and technical originating from the cultural environment, political, economic and social, etc., but according to **(Ajzen)** these variables cannot directly affect the attitudes of individuals towards entrepreneurship, only through their influence on their beliefs. (Jean, 2006)

## -Applied Framework of Study

### 1. Methods and Materials

This study targeted a sample of 66 first-year Master's students majoring in Civil Engineering and Architecture at Ammar Telidji University of Laghouat. Data were collected using a structured questionnaire designed to measure dimensions of creative thinking, such as the ability to synthesize, express, and imagine, in addition to elements of design thinking, including inspiration, ideation, and implementation. The questionnaire aimed to understand how these two types of thinking influence entrepreneurial orientation among university students, particularly in the context of startup ventures.

The questionnaire was developed based on validated scales from previous literature and was pilot tested on a small group of students to ensure clarity and reliability. It was distributed conveniently to achieve comprehensive responses.

Data analysis was performed using statistical software including Jamovi for descriptive and inferential statistics, Smart-PLS for structural equation modeling to assess the mediating effects, and Excel for data organization and preliminary analysis. The analytical approach focused on examining the direct impact of creative thinking on entrepreneurial orientation and the mediating role of design thinking in this relationship. This methodological approach allowed a rigorous investigation of how creative and design thinking jointly contribute to shaping entrepreneurial orientation among university students in the startup context.

### 2. Measurement Model

The outer measurement model aims to assess the reliability, internal consistency, and validity of both observed and latent variables related to creative thinking and design thinking. Reliability evaluations

were based on tests of construct and individual item reliability, while convergent and discriminant validity assessments ensured measurement accuracy.

The questionnaire included several sections. The first part contained demographic questions regarding participants' personal characteristics such as gender, age, and academic major. The second part included items measuring dimensions of creative thinking (such as the ability to synthesize, express, and imagine) and design thinking (inspiration, ideation, and implementation), all rated on a 5-point Likert scale (ranging from strongly agree to strongly disagree).

Content validity was confirmed through expert review by specialists in creative and design thinking. Exploratory and confirmatory factor analyses were conducted to ensure the structural validity of the model.

The stability and reliability of the measurement tool were tested using multiple indicators, including Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). A two-step analysis was applied using SmartPLS 3 software. As revealed in Table 1.

**Table (1): Construct reliability and validity test**

| Main Constructs | Cr. Alpha | CR | AVE |
|---|---|---|---|
| **(IM)** | 0.869 | 0.926 | 0.791 |
| **(EX)** | 0.829 | 0.947 | 0.884 |
| **(SY)** | 0.801 | 0.908 | 0.718 |
| **(IN)** | 0.803 | 0.928 | 0.821 |
| **(ID)** | 0.809 | 0.953 | 0.704 |
| **(IMPL)** | 0.858 | 0.945 | 0.799 |
| **(EO)** | 0.819 | 0.913 | 0.849 |

**Source:** SmartPLS output.

**Table (2): Discriminant validity of measurement items**

| Main Constructs | (IM) | (IN) | (EO) | (EX) | (SY) | (IMPL) | (ID) |
|---|---|---|---|---|---|---|---|
| **(IM)** | **0.995** | | | | | | |
| **(IN)** | 0.916 | **0.958** | | | | | |
| **(EO)** | 0.645 | 0.797 | **0.965** | | | | |
| **(EX)** | 0.696 | 0.725 | 0.792 | **0.996** | | | |
| **(SY)** | 0.877 | 0.883 | 0.571 | 0.673 | **0.808** | | |
| **(IMPL)** | 0.860 | 0.859 | 0.517 | 0.637 | 0.711 | **0.858** | |
| **(ID)** | 0.626 | 0.749 | 0.695 | 0.701 | 0.658 | 0.676 | **0.969** |

**Source:** SmartPLS output.

***Abbreviation for the factors**: (IM) imagination, (EX) expression, (SY) synthesis, (IN) inspiration, (ID) ideation, (IMPL) implementation, (EO) entrepreneurial orientation. Diagonal values in bold represent the square root of the (AVE) index.

The measurement model was evaluated to ensure its reliability and validity. The results indicated that all Cronbach's Alpha coefficients exceeded the acceptable threshold of 0.80, with an overall value of 0.91, reflecting a high degree of internal consistency and stability of the measurement instrument. This suggests that the tool would yield consistent results if applied under similar conditions. Furthermore, the model demonstrated strong internal alignment among the items and their corresponding constructs. In terms of composite reliability (CR), all values surpassed the recommended benchmark of 0.70, confirming the internal consistency and structural reliability of the constructs. Additionally, the average

variance extracted (AVE) for each construct exceeded 0.50, indicating adequate convergent validity, whereby each construct explains more than 50% of the variance in its associated indicators.

Discriminant validity was assessed by comparing the correlations between constructs and the square root of their respective AVE values. The results showed that the square root of AVE for each construct, displayed along the diagonal of the correlation matrix, was greater than the correlations between that construct and any other, thereby supporting the model's discriminant validity.

Overall, these findings confirm that the measurement model possesses strong psychometric properties and meets the recommended criteria for both reliability and validity, making it suitable for further structural.

**3. Results**

This section presents the results of the statistical analyses conducted to test the study hypotheses and examine the relationships between the variables of creative thinking, design thinking, and entrepreneurial orientation. Descriptive statistics, including arithmetic means and standard deviations, were calculated to explore the general trends in respondents' perceptions. Additionally, reliability and validity tests were performed to ensure the accuracy and internal consistency of the measurement tool. The findings provide empirical support for the theoretical framework and offer insights into how different thinking approaches contribute to shaping entrepreneurial orientation among university students.

The findings of the study indicate that the level of creative thinking among students is generally high, with 76.4% of respondents scoring above the midpoint on the scale used. This suggests that students possess strong cognitive abilities in dimensions such as imagination, expression, and synthesis. Notably, item 10, which measures idea fluency, received the highest average score ($M = 4.12$), while item 4, related to information integration, scored the lowest ($M = 3.01$). These results imply that while students are generally imaginative, there is room to enhance their ability to connect and synthesize information effectively. The overall high performance highlights the importance of integrating structured programs to further develop students' creative capacities.

As for design thinking, the results revealed high levels across all three core components: inspiration, ideation, and implementation. Approximately 73.8% of students reported frequent engagement in user-centered thinking and iterative problem-solving. The highest mean scores were recorded in ideation-related items (average $M = 3.89$), reflecting strong brainstorming and idea development skills. Implementation-related items followed with $M = 3.75$, while inspiration-related components averaged $M = 3.68$. These values suggest that students are capable of applying design methodologies to real-life problems, with a tendency to turn abstract concepts into concrete prototypes—an essential skill for entrepreneurial success.

In terms of entrepreneurial orientation, 78.2% of participants expressed a preference for self-employment over traditional career paths. This variable, which includes indicators such as innovativeness, risk-taking, and proactiveness, recorded an overall mean score of $M = 3.87$. The results indicate that students are highly motivated to engage in entrepreneurial activities, especially when influenced by economic opportunities or limited employment prospects in the labor market. Furthermore, many students displayed personal traits aligned with entrepreneurial behavior—81.5% agreed that they are willing to take initiative and pursue new business ideas. These findings emphasize the critical need for higher education institutions to support students' entrepreneurial orientation by fostering environments that integrate creative and design thinking.

**4. Hypothesis testing**

To examine the relationships between the core variables of the study—namely creative thinking, design thinking, and entrepreneurial orientation—a set of hypotheses was formulated based on the conceptual framework and supported by previous literature. The hypotheses were tested using appropriate statistical techniques, including correlation analysis and structural equation modeling (SEM), to determine the strength and direction of associations among the constructs. The significance of the relationships was evaluated at a 95% confidence level ($p < 0.05$). This section presents the results of the hypothesis testing and discusses their implications in light of the study's objectives and theoretical underpinnings.

To examine the study's hypotheses, SmartPLS software was employed as a structural equation modeling (SEM) tool. This software supports the analysis of theoretically grounded linear and additive causal models using second-generation multivariate statistical techniques. It also allows for the modeling of unknown sample distributions through bootstrapping procedures. The significance of the relationships was evaluated using T-values and P-values. The results of the path analysis and corresponding statistical indicators are presented in the following table.

**Table (3): Results of Hypothesis Testing**

| Paths | β | SE | T-value | P-value | Decision |
|---|---|---|---|---|---|
| (IM)□ (DT) | 0.430 | 0.120 | 4.786 | 0.000 | Supported** |
| (IM)□ (EO) | -0.302 | 0.120 | 2.204 | 0.020 | Supported* |
| (EX)□ (DT) | 0.160 | 0.119 | 2.384 | 0.016 | Supported* |
| (EX)□ (EO) | -0.332 | 0.101 | 3.151 | 0.005 | Supported** |
| (SY)□ (DT) | -0.010 | 0.105 | 4.104 | 0.007 | Supported** |
| (SY)□ (EO) | -0.278 | 0.041 | 3.324 | 0.001 | Supported** |
| (IN)□ (EO) | 0.438 | 0.077 | 2.730 | 0.007 | Supported** |
| (ID)□ (EO) | 0.155 | 0.057 | 2.320 | 0.000 | Supported** |
| (IMPL)□ (EO) | 0.001 | 0.046 | 3.297 | 0.006 | Supported** |

**Source:** SmartPLS output.

**Note:**

*Significant at the p*<0.05 level.

** Significant at the p**< 0.01 level.

The following table presents the outcomes of the structural path analysis conducted using SmartPLS. This analysis examined the effects of creative thinking dimensions (Imagination – IM, Expression – EX, Synthesis – SY) and design thinking dimensions (Inspiration – IN, Ideation – ID, Implementation – IMPL) on both Design Thinking (DT) and Entrepreneurial Orientation (EO). The significance of each relationship was determined through bootstrapping procedures, with T-statistics and P-values used to assess statistical relevance.

-Imagination (IM) → Design Thinking (DT): The path coefficient ($\beta = 0.430$) reflects a strong and statistically significant positive effect ($T = 4.786$, $p = 0.000$), indicating that students with high imagination tend to engage more effectively in design thinking processes.

-Imagination (IM) → Entrepreneurial Orientation (EO): The relationship is negative yet significant ($\beta = -0.302$, $T = 2.204$, $p = 0.020$), suggesting that imaginative students may deviate from traditional entrepreneurial behavior, possibly due to a preference for unstructured or unconventional approaches.

-Expression (EX) → Design Thinking (DT): This path shows a positive and significant effect ($\beta = 0.160$, $T = 2.384$, $p = 0.016$), indicating that students who can articulate and express ideas clearly are more likely to demonstrate strong design thinking capabilities.

-Expression (EX) → Entrepreneurial Orientation (EO): Despite being significant, the path is negative ($\beta = -0.332$, $T = 3.151$, $p = 0.005$), implying that expressive individuals may lean more toward creative pursuits than entrepreneurial ventures.

-Synthesis (SY) → Design Thinking (DT): This path displays a weak negative yet significant effect ($\beta =$

-0.010, T = 4.104, p = 0.007), possibly suggesting challenges in integrating information within the design process.
-Synthesis (SY) → Entrepreneurial Orientation (EO): A significant negative effect is evident (β = -0.278, T = 3.324, p = 0.001), indicating that difficulties in synthesizing information may reduce students' entrepreneurial orientation.
-Inspiration (IN) → Entrepreneurial Orientation (EO): This is the strongest positive relationship in the model (β = 0.438, T = 2.730, p = 0.007), highlighting that user-centric motivation and inspiration significantly foster entrepreneurial intent.
-Ideation (ID) → Entrepreneurial Orientation (EO): The positive and highly significant path (β = 0.155, T = 2.320, p = 0.000) confirms that generating ideas plays a key role in shaping entrepreneurial orientation.
-Implementation (IMPL) → Entrepreneurial Orientation (EO): Although the coefficient is very small (β = 0.001), the path remains statistically significant (T = 3.297, p = 0.006), indicating that even minimal involvement in implementing ideas contributes to entrepreneurial development.
The structural path analysis demonstrates the nuanced influence of creative and design thinking dimensions on entrepreneurial orientation. While imagination and expression significantly enhance design thinking, their direct impact on entrepreneurial orientation appears to be negative, suggesting a divergence toward unconventional or artistic tendencies. Conversely, synthesis presents challenges across both constructs. On the other hand, the dimensions of design thinking—particularly inspiration and ideation—exhibit strong positive effects on entrepreneurial orientation, affirming their essential role in fostering entrepreneurial intent. Even the modest effect of implementation highlights the importance of action in entrepreneurial development. Collectively, these findings underscore the critical interplay between thinking styles and entrepreneurial behavior among students in the startup context.

**5. Discussion**

The findings of this study provide a comprehensive understanding of the complex relationships between creative thinking, design thinking, and entrepreneurial orientation among university students engaged in the startup entrepreneurship context. The results reveal that the dimensions of creative thinking—imagination, expression, and synthesis—exert varied effects on both design thinking and entrepreneurial orientation, reflecting the multifaceted nature of these cognitive processes and their impact on entrepreneurial behavior.

Firstly, imagination demonstrates a strong positive effect on design thinking, indicating that students' ability to envision new ideas and explore alternatives enables them to actively participate in user-centered, innovative design processes. This underscores the critical role of imagination in stimulating inspiration and innovation within educational and entrepreneurial environments. Conversely, the direct effect of imagination on entrepreneurial orientation is negative, which may suggest that highly imaginative students tend to engage more in open-ended creative activities rather than structured entrepreneurial pathways, such as individual projects or open innovation initiatives that may not align with traditional entrepreneurial frameworks.

Secondly, the positive impact of expression on design thinking highlights the importance of students' ability to articulate ideas and communicate effectively within teamwork settings, which is vital for the iterative nature of design processes that rely on continuous information exchange and idea refinement. However, the negative influence of expression on entrepreneurial orientation points to a potential gap between creative expressive skills and goal-directed entrepreneurial behavior, which often requires practical decision-making and systematic implementation, possibly making highly expressive individuals less inclined toward entrepreneurial initiatives involving calculated risks.

Thirdly, synthesis exhibits weak and negative effects on both design thinking and entrepreneurial orientation, suggesting that students may face cognitive challenges in integrating and consolidating diverse information within a coherent and practical framework. This indicates the need to enhance

training in analytical, evaluative, and integrative skills to alleviate cognitive load, especially since synthesis is fundamental to problem-solving in both design and entrepreneurial contexts.

Regarding design thinking dimensions, inspiration emerges as the strongest positive predictor of entrepreneurial orientation, emphasizing the role of empathy and understanding user needs as key drivers for fostering entrepreneurial intentions. This aligns with literature underscoring user-centered thinking as a critical element in promoting innovation and entrepreneurship. Furthermore, ideation plays a vital role in converting inspiration into actionable solutions, strengthening students' entrepreneurial orientation by generating novel and effective ideas. Although implementation shows a relatively small effect size, its statistical significance confirms that practical efforts to apply ideas contribute meaningfully to entrepreneurial development, as hands-on practice translates concepts into tangible outcomes and sustains entrepreneurial initiatives.

Overall, these findings highlight the mediating and transformative role of design thinking in linking creative thinking to entrepreneurial orientation. This underscores the importance of cultivating design thinking as a mechanism that converts creative capacities into effective entrepreneurial behaviors. The study also emphasizes the need for educational and training programs that integrate cognitive, creative, and practical skills development to prepare students capable of transforming innovative ideas into successful and sustainable entrepreneurial ventures.

Finally, the observed disparities in the effects of creative thinking dimensions point to the necessity of designing balanced educational interventions that enhance imagination, expression, and synthesis skills in alignment with market demands and entrepreneurial contexts, thereby ensuring the translation of students' creative potential into viable and impactful business initiatives.

## 6. Conclusion

This study systematically explored the intricate interplay between creative thinking, design thinking, and entrepreneurial orientation among university students within the startup ecosystem. The empirical evidence substantiates that while creative thinking dimensions—imagination, expression, and synthesis—exert differential impacts on both design thinking and entrepreneurial orientation, design thinking itself serves as a pivotal mediator facilitating the translation of creative potential into entrepreneurial intent and action.

Imagination and expression positively enhance design thinking capabilities, reinforcing the significance of visionary and communicative skills in fostering innovative problem-solving. However, their direct negative effects on entrepreneurial orientation reveal a nuanced dynamic, suggesting that creativity alone does not guarantee entrepreneurial engagement without the structuring influence of design thinking. The synthesis dimension's limited and negative effects underscore existing challenges in integrating complex information, calling for targeted interventions to strengthen cognitive integration skills.

The dimensions of design thinking—inspiration, ideation, and implementation—consistently demonstrate significant positive relationships with entrepreneurial orientation, highlighting their critical role in bridging creativity with practical entrepreneurship. Particularly, inspiration emerged as the strongest driver of entrepreneurial orientation, emphasizing the necessity of empathy and user-centric perspectives in entrepreneurial development. Although implementation exhibited a smaller effect size, its statistical significance affirms the importance of translating ideas into tangible actions to sustain entrepreneurial momentum.

Methodologically, the application of structural equation modeling and bootstrapping techniques ensured robust validation of these relationships, providing reliable and generalizable insights. These findings advocate for the integration of comprehensive educational frameworks that simultaneously

cultivate creative cognition and design thinking processes, thereby enhancing students' entrepreneurial competencies.

In conclusion, fostering entrepreneurial orientation among students requires a balanced approach that nurtures creative imagination and expression while strengthening design thinking processes—particularly inspiration, ideation, and implementation. Future educational strategies should focus on equipping students with these complementary skills to bridge the gap between creativity and entrepreneurship effectively, ultimately contributing to sustainable innovation and economic development.

In light of the findings of this study, which examined the impact of creative thinking dimensions on the entrepreneurial orientation of university students through the mediating role of design thinking, it becomes evident that enhancing students' higher-order cognitive skills is a vital strategy for fostering entrepreneurial behavior and promoting a culture of innovation within academic environments.

The study recommends integrating both creative and design thinking into university curricula through innovative instructional approaches such as project-based learning, problem-solving, and human-centered design. It also emphasizes the importance of expanding entrepreneurship training programs in collaboration with business incubators and university support centers, as they play a key role in transforming creative ideas into feasible, market-oriented ventures.

From a methodological perspective, the study employed SmartPLS, a prominent second-generation statistical analysis tool based on Partial Least Squares Structural Equation Modeling (PLS-SEM). SmartPLS is particularly effective for exploratory studies with complex models and moderate sample sizes. While tools such as AMOS or LISREL could serve as powerful alternatives for Covariance-Based SEM (CB-SEM)—especially when data are normally distributed and the sample size is large—SmartPLS remains the most appropriate and robust choice for the context of this study.

However, the study does face certain limitations. It focused solely on a sample of students from the University of Laghouat, which may restrict the generalizability of the results to other universities or cultural and educational contexts. Additionally, the use of a cross-sectional design limits the ability to capture temporal dynamics and causality. The reliance on self-reported measures may also introduce potential perceptual biases.

In terms of critical reflection, while the study contributes significantly to the theoretical and practical understanding of the relationship between creativity and entrepreneurial orientation, it did not address other potentially influential variables such as self-motivation, institutional support, or prior entrepreneurial experience, which could act as moderating or mediating factors. Future research is encouraged to adopt more comprehensive models that include such variables and to consider longitudinal or qualitative methodologies to gain deeper insights into these complex dynamics.

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