

# Designing a model for evaluating the entrepreneurial qualifications of applied science university lecturers

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## Abstract

There are challenges in the practical method of transitioning knowledge in the academic field, even in the University of Applied Science and Technology, which is necessitate updating the assessment of entrepreneurial competencies of lecturers. Challenges such as poor knowledge of recent information, outdated teaching methods, lack of good communication with industries and, worst of all, poor quality of dissemination of knowledge, make it difficult achievement of universities vision of development. This research was conducted during doctoral program research with the aim of developing a model for evaluating the entrepreneurial competencies of university lecturers and specifically at the University of Applied Science and Technology. the mixed method of research was employed in which initially important components of the model were extracted using the grounded theory technique and then the developed model was finalized and each factor was weighted by the AHP multi-criteria analysis. Due to the large length of analysis, this paper is narrowed to the important components of the proposed model and also the data evaluation process by the AHP technique. Data evaluated by the AHP technique was collected through a pairwise comparison questionnaire collected from entire 36 informed respondents. The result provides a practical model of evaluating the entrepreneurial competencies of the university lecturer and in general, the three main factors of individual competencies, competencies in social communication, and also competencies in analyzing and decision-making were classified as main categories, respectively.

Keywords: lecturer' entrepreneurial competencies, university of applied science and technology, evaluation model  
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## Introduction

Various methods are introduced to evaluate the entrepreneurial qualifications of teachers, whose diversity is proof of the complexity, ambiguity and hypothetical nature of the studied problem, some of which are mentioned below:

- A) Humanistic approach in which the definition considers human knowledge as the basis of focused educational activity, the problems of revealing the basic forces of a person at work, and the formation of a person's mentality and the psychological world in education and culture.

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- b) Creative approach to designing educational work: This approach includes teacher professional training, individual preparation for personal development, self-organization, and self-regulation from the point of view of the innovative and creative potential of a creative and expert teacher.
- c) Personality-oriented approach: it focuses on the conditions that guarantee the teacher's personality development and includes: studying the teacher's mentality, understanding the nature of professional development activities, and determining significant milestones and significant changes in the personality and activities of an expert. slow
- d) The approach of values of culture and educational work: The guidelines for the development of education, self-development, and the development of common moral issues cover the basic values of the professional and humanitarian culture of the teacher.
- f) Ecological approach: It includes different strategies and tactics to achieve maximum educational work, normative criteria of the profession in professional qualification groups, and communication competence.
- j) Approach to the quality of education and human development: the development of methods for measuring the quality of educational needs is discussed.
- e) Management approaches: It is considered an organization-oriented approach for educational institution management.

As mentioned, such a variety of approaches is the reason for the objective complexity of this issue. It is clear that mastering all dimensions of the components of evaluating the entrepreneurial competence of teachers with such integrated features with traditional evaluation methods, especially in the situation where we are constantly witnessing changes in education issues, is a difficult and questionable task that necessitates conducting this research. It registers discovery. On the other hand, the change in working lifestyle and technological advances and the development of digital technologies have covered all important areas of society and their influence is constantly growing. Education has also provided various solutions to develop and solve existing problems, which change with the natural process of social development. Today, the impact of technology, or more specifically, digital, on education is evident, and digital technologies continue to transform public and social institutions related to education. For example, due to the spread of the coronavirus, the professional qualification of teachers has changed according to the current issues and includes familiarity with digital technologies and technological tools of distance teaching, in fact, it was considered part of the basic and necessary skills and not only A specialized and peripheral knowledge.

The issues raised in the review of previous findings show that a set of diverse skills is necessary for the successful presence of graduates in society and the future labor market, and their training should be different from what has been done traditionally from the past to today.

On the other hand, although some of the mentioned competencies can be useful for any university that is committed to teaching in an entrepreneurial way, it should be considered that in any educational institution, the commitment to developing entrepreneurial competencies among students is different and as it is evident in the literature review, no fixed, comprehensive and inclusive list has been introduced in the evaluation of the professional and entrepreneurial qualifications of lecturers. On the other hand, almost most of the studies carried out so far are about the introduction of the effectiveness and competence of teachers and not their ranking and determination of their importance.

Therefore, based on the analysis of the positions of previous researchers, we can conclude that the component of entrepreneurial competence includes the totality of a certain level of skills (professional skills) and personal characteristics of an expert, while in this view the teacher's competence is limited. It is considered the educational professional skills and specific individual qualifications of a lecturer, which has its own structure and allows an expert lecturer to carry out his professional activities in the most effective way, as well as to develop himself and Self-improvement of the individual helps to remain hidden from the views. A very important point about this fact is that professional qualification can also be a criterion of the quality of education of a university graduate and show the level of development of operations (practical, creative) in the professional and educational activities of that person.

## Review of research literature

### 1. Professionalism and professional competence of the teaching staff

In all educational systems of the world, the role of professors in teaching and learning is very important, because the quality and performance of teaching is considered the most important factor in improving the quality of students'

learning. Considering that most of the learning takes place in the teaching and learning environment, and the type and material of the students' learning is an inseparable part of the teaching and learning process, therefore, educational items and their presentation should be included in the context of this process so that The students' performance reaches the desired and expected level. Khodamoradi and Maqsoodi [12] state that professional competence is considered as a part of professional work, which should lead to increasing continuous learning, ethical standards, professional dependence and self-motivation for entrepreneurial professional competence. The Wisconsin Department of Public Instruction defines professional competence as: "The continuous process of training at all levels of education for entering the learning community that enables individuals to acquire the content, process, knowledge, skills, and competencies necessary to perform a specialized role to earn". In this perspective, professional competence can generally be defined as the process of developing self-awareness and competence in better understanding professional roles, duties and professional responsibilities. In the 2001 definition of the No Child Left Behind Act, known as NCLB, the United States Congress supported standards-based education reform based on the premise that setting high standards and setting measurable goals can improve individual outcomes. improve in education. In this law, professional qualification is mentioned and a detailed conceptualization is provided regarding what is professional qualification and what is not professional qualification in the field of education and training:

- 1- Improving and increasing knowledge about scientific subjects, improving technical skills and enabling people to excel their qualifications.
- 2- It is an inseparable and integrated part of the optimization plans of specialized education activities.
- 3- It equips all educational agents with knowledge and skills that prepare learners to take advantage of opportunities so that they can meet academic standards and academic success.
- 4- Improves classroom management skills.
- 5-
  - a) A high-quality, continuous, powerful and class-oriented process so that it can have positive and lasting effects on education and educational performance.
  - b) This process does not include short-term and one-day programs such as educational workshops and conferences.
- 6- It supports recruitment, employment and in-service training systems, especially for experienced and professional people who have shown this by obtaining certificates during professional courses.
- 7- They promote strategies that are based on scientific research and in order to improve scientific progress and improve knowledge and skills.
- 8- It is closely related to the following:
  - a) Scientific content standards, scientific progress standards and measurement of scientific capabilities
  - b) Curricula and class programs that are related to the standards of scientific progress.
- 9- It evolves with the constant and unlimited participation of educational agents and beneficiaries.
- 10- Promotes the skills of using technology and its effective application in educational and scientific activities.
- 11- The professional qualification program as a whole provides a suitable context for the evaluation of the program itself in order to determine its effects on the effectiveness of training and to improve the quality of professional qualification programs by applying the findings from the evaluations.
- 12- It provides instructions in the field of teaching methods for various age groups as well as special training.
- 13- It provides instructions in the field of evaluation and use of data that are informative and useful.
- 14- It includes teaching ways for educational stakeholders to communicate with each other in an effective way.

In addition to the above, professional qualification can also include the following activities:

1. Considering cooperation programs with higher education institutions for the formation and establishment of in-service training programs that can provide opportunities for future and novice educators to be trained under the supervision and guidance of experienced professors.

2. It provides the opportunity to create courses in which professionals can receive educational requirements and those who seek to acquire professional credentials and documents can obtain these documents.
3. Provides a follow-up training program for people who have received professional training and the possibility of knowing whether the necessary knowledge and skills are used in the real environment or not Provides.

Different definitions of professional competence are based on different attitudes that exist. On this basis, the structure and different nature models have been presented to explain it. The model introduced by Adolf et al. [3] includes professional competence based on individually guided development, professional competence based on observation/assessment, involvement in a development or improvement process, training and inquiry model. In another division, based on the findings of Box Tirovona (2021) in introducing the qualifications and competencies of future teachers, four major categories of education, assessment, job experiences and interpersonal relationships for Professional development suggests that most organizations use training or a combination of these methods. According to them, development is more focused on the future and its purpose is to prepare people for change. Most of the strategies that are used in practice for professional qualification among employees are divided into seven groups (1) training, (2) observation/measurement, (3) participation in the development and improvement process, (4) study groups, (5) action research, (6) self-directed actions and (7) guidance can be classified. The different models of professional qualification that are presented include different processes and stages that some professional organizations and institutions pay attention to many of these stages and use them in the activities necessary for their development. or some others are limited to parts of these steps, which is rooted in a different attitude towards professional qualification. Researches have shown that although some institutions do not define the professional evaluation of professional competence as a systematic and planned process, but it is based on the benefits for stakeholders such as the profession itself, a specific professional sector, employers, society, and the public sector are defined, without referring to the people themselves who are the target of professional qualification [19]. Meanwhile, a suitable framework for professional competence should consider all aspects and cover different objectives with different stakeholders and at the same time be adaptable to all contexts. For this reason, principles have been developed by the International Accounting Standards Board, which can respond to their different regional goals, and it is claimed that they can adapt to current conditions and future changes with continuous updates. IFAC's International Accounting Education Standards Board) whose guiding principles are summarized below:

- Professional competence is a long-term investment in adult education to strengthen and stabilize it.
- The result of professional qualification is improving learning activities and raising the level of learning
- Developmental activities respond to the needs of learners, participants, society and all stakeholders.
- Developmental activities, methods and situations, structures and values help to create a professional community and develop leadership.
- Professional competence emphasizes and focuses both on the improvement of the course and on the improvement of individuals. Also, professional qualification is based on research and selection of the best teaching and learning processes for adults, effective management of courses and efficient strategies in professional qualification.
- Course participants are also actively involved in the design, implementation and evaluation of development activities.
- Participants are encouraged to create and apply knowledge and are fully supported in this regard.
- Professional qualification is an inseparable element and a part of the work (and job) of the participants.

As it follows from the aforementioned principles, professional qualification should include setting goals and charting the process of achieving goals. Compliance with the aforementioned principles should lead us to provide a comprehensive framework of professional competence that is both theoretically and practically effective. Despite paying attention to these principles, the official educational professional qualification evaluation system and human resources training and improvement centers of organizations consider only the component of people's knowledge level and try to improve it, but they do not teach how to acquire knowledge independently. Considering the amazing changes in the level of knowledge and information, it is necessary for professors to learn how to learn as a life skill in job situations. Many of the programs for evaluation and selection and development of educational professors are carried out in a completely structured traditional environment and during in-service training courses, which are often passive. will be According to Abazari et al. [1], many professional qualification opportunities for professors do not lead to long-term reform

of curricula and do not meet the needs of students in society. Assessing the professional competence of teachers in the current form and without considering the current needs of society and stakeholders has had very little impact on teaching methods, organization of schools and curricula, and what students should learn. The studies of this researcher in the design of the third generation universities showed that the implementation problems in the lack of a systematic approach in the design, implementation and evaluation of education, lack of coordination between different types of educational programs, non-standardized non-attendance education, lack of a coherent and effective database, lack of continuity trainings, the lack of specialized personnel for work-oriented training and the absence of a professional association or publication regarding the evaluation, development and training of employees.

The study of previous research shows a set of components in the introduction of obstacles to the professional qualification of professors, such as: the low impact of trainings on career advancement, the lack of executive guarantees and supporting regulations for training courses, the lack of a long-term training program during the stages The occupation of a professor, the absence of electronic training, lack of attention to intra-university training (such as training groups of both basic and major), lack of opportunities for professors to visit each other's classes, the low level of activity of professors in training courses. , lack of attention to the basis and topic of teaching and providing the same education for all professors, lack of diversity in learning methods, weak interaction between professors in educational programs [5], lack of ownership of professors in the process and results of evaluation of educational courses, lack of participation of professors in determining one's educational needs [7], the non-compliance of content with job needs, the low impact of educational content on classroom processes [9], the lack of diversity in teachers' teaching methods, the low quality of materials designed by teachers [2].

Today, experts are of the opinion that: the comprehensive and fundamental role of the teacher is transformation, and the teacher is considered as a tool that carries stored information that should be distributed according to the capacity of the receivers, and this is a great risk in distortion. And it is a distortion of the teacher's mission. The feeling of this danger has made the planners and policymakers of the global education systems to make a new effort, and at the head of them, "UNESCO" has given shocking warnings to the higher education systems of the countries, acknowledging this distortion and transformation in the professor's mission. and states: "The conditions in which teachers are trained must be changed precisely, in such a way that teachers become educators and not specialists who only convey the content of the predetermined curriculum. Therefore, trying In order to improve and advance education, the higher education system should aim for professional and entrepreneurial aspects and acquire a necessary feature as a profession, because in this case, it will have more social dignity. and this is an important condition for the effectiveness and efficiency of higher education staff, especially professors, who adhere to the teaching profession while acquiring professional expertise in their work (source: UNESCO website). In terms of its form, it is a purposeful effort and the existence of a comprehensive and efficient model that can use this tool to check whether these activities have achieved their goals is important [20]. In fact, professional qualification is a necessary and sufficient level of professional skill of a teacher, which grows during professional activities. A very important point about this fact is that professional qualification can also be a criterion for the quality of university graduate education, and the level of operational development (practical, creative) in professional and educational activities should be considered. The findings of the research [11] indicated that information and communication technology, including the effect of automation, the effect of information and the effect of transformation, can influence the value chain of the skill training system and, as a result, have positive effects in improving efficiency and effectiveness. Pourhaji et. al. [17] also used the fuzzy hierarchy analysis technique in the experiment and analyzed the behavioral factors affecting students' entrepreneurship and concluded that the factors involved include the existence of a constructive culture, individual and personality characteristics of students and parents, The role of leadership instead of management by parents, the existence of an effective communication system between parents and students as well as with parents. Broumand et. al. [6] using structural equation modeling in a descriptive survey research of a sample of 165 people concluded that entrepreneurial skills training has a positive and significant relationship with entrepreneurial intention.

The current research fills the gap in the theoretical literature with the view that the entrepreneurial creativity characteristics of teachers should be considered as an integral part of their professional competence, that this component is the ability of a person to solve unpredictable problems and with a method. is defined as non-standard and normal and directly affects the quality of university education and the future performance of students in the future working life. These components are considered as a set of educational skills, professional skill level and capabilities of implementing educational activities and as a criterion for evaluating the professional qualifications of teachers. This approach is determined by reviewing previous findings and combining these approaches in theoretical literature and quantitative and qualitative analysis of models and theories of professional competence by experts in this industry. Such a consideration leads to the understanding of a complex system of interactions of the components of professional competence.

## Research methodology

The conducted research completes the existing gap in the theoretical literature with the view that the entrepreneurial creativity characteristics of teachers should be considered as an integral part of their professional competence, that this component is in the individual's ability to solve unpredictable problems and it is characterized by non-standard and conventional methods and directly affects the quality of university education and the future performance of students in their future working life. These components are considered as a set of educational skills, the level of professional skills and the capabilities of implementing educational activities and as a criterion for evaluating the professional qualifications of teachers. This research, using the ground theory method (foundation data), seeks to discover this approach and find a suitable answer to this comprehensive question, which are the components involved in evaluating the entrepreneurial competences and qualifications of lecturers at the University of Applied Sciences. The answer to this question and the explanation of this new approach will be determined by reviewing the previous findings and by combining the approaches in the theoretical literature and quantitative and qualitative analysis of the professional opinions of experts in this industry, which included the statistical population of Alborz province in this research. Such a consideration leads to the understanding of a complex system of interactions of the components of professional competence and finally providing a framework for evaluating the entrepreneurial competences of teachers. Therefore, the main objectives of this research are as follows:

- 1) To determine the understanding of competence components and entrepreneurial qualifications in the education of a comprehensive scientific and applied university.
- 2) Presenting the competence model and entrepreneurial qualifications needed for the lecturers of the Applied Scientific University. In selecting the sample of this research with the aim of making the findings of the research comprehensive, it was tried to include a wider community including all the managers of the scientific core of the selection staff of the Central University of Alborz province and those responsible for the relationship with the industry/research and the graduate unit. was used and a total of 36 people participated in the collection of information.

## Analytical hierarchy process

Saaty [18] developed a strong and helpful tool for managing qualitative and quantitative multi-criteria elements involving in decision-making behavior. This model is called Analytical Hierarchy Process (AHP) and is based on a hierarchical structure. This procedure occupied an assortment of options in the decision and capable to apply sensitivity analysis on the subsequent criteria and benchmarks. In addition, it makes judgments and calculations easy because of paired comparisons. Moreover, it demonstrates the compatibility and incompatibility decisions which is the recompense of multi criteria decision making [14]. Analytical Hierarchy Process is one of the most inclusive system is considered to make decisions with multiple criteria because this method gives to formulate the problem as a hierarchical and believe a mixture of quantitative and qualitative criteria as well. The first step is to create a hierarchy of the problem. The second step is to give a nominal value to each level of the hierarchy and create a matrix of pairwise comparison judgment [13].

## Steps to conduct AHP

At the first stage, the issue and goal of decision making brought hierarchically into the scene of the related decision elements. Decision making elements are decision indicators and decision choices. The group established a hierarchy according to Figure 1 which should reflect the understudy problem.



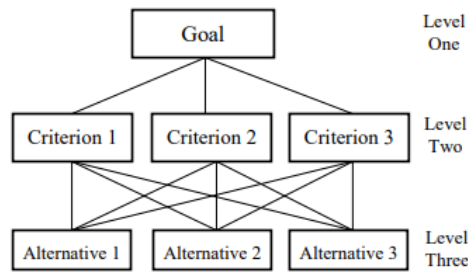


Figure 1: Sample Hierarchical tree

In second step and in order to conduct pair comparison, a questionnaire should be designed and distributed among the respondents (can be managers, experts, users and etc.) to collect their opinion. It is noteworthy that each decision maker entered their desired amount for each member and then individual judgments (of each respondents) have been converted into group judgments (for each one of the pair comparison) using their geometrical average. The scale ranges from one to nine where one implies that the two elements are the same or are equally important. On the other hand, number nine implies that one element is extremely more important than the other one in a pairwise matrix. The pairwise scale and the importance value attributed to each number are illustrated in the Table 1, 2 shows the sample of the questionnaire.

Table 1: Relative scale for paired comparison

Intensity of importance		Description
Equal importance	1	Both activities equally contribute to the objective.
Moderate importance	3	Weak or slight importance over another – Experience and judgment slightly favor one activity over another
Strong importance	5	Greater or more essential importance when compared with another – Experience and judgment strongly favor one activity over another.
Very strong importance	7	Very high or demonstrated importance – An activity is favored very strongly over another; its dominance is demonstrated in practice.
Extreme importance	9	Extremely high importance – The evidence favors one activity over another with the highest level of certainty

Source: Adapted from Saaty [18]

Table 2: Sample AHP Questionnaire How important are the following security criteria in comparison

Factor	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor
Privacy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Reliability
Privacy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Validation
Privacy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Verification
Privacy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Integrity
Privacy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Confidentiality
Privacy	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Available

The data analyze procedure involves the following steps. First the pairwise comparison matrix which is called matrix  $A$  is extracted from the data collected from the interviews. The principal right eigenvector of the matrix  $A$  is computed as ' $w$ '.

If  $a_{ik} \cdot a_{kj} = a^{ij}$  is not confirmed for all  $k, j$ , and  $i$  the Eigenvector method is selected [10]. If the matrix is incompatible and in case of incomplete consistency, pair comparisons matrix cannot be used normalizing column to get  $W_i$ . For a positive and reversed matrix, Eigenvector technique can be used which in it:

$$e^T = (1, 1, \dots, 1)$$

$$W = \lim_{k \rightarrow \infty} \frac{A^k \cdot e}{e^T \cdot A^k \cdot e}$$

To reach a convergence among the set of answers in to successive repetition of this process, calculation should be repeated several times in order to take a decision when facing an incompatible matrix. Then, the following formula is applied to transform the raw data into meaningful absolute values and normalized weight  $w = (w_1, w_2, w_3, \dots, w_n)$ :

$$Aw = \lambda_{\max}w, \quad \lambda_{\max} \geq n$$

$$\lambda_{\max} = \frac{\sum a_j w_j - n}{w_1}$$

$$A = \{a_{ij}\} \text{ with } a_{ij} = \frac{1}{a_{ij}}$$

$A$  : pair wise comparison  
 $w$  : normalized weight vector  
 $\lambda_{\max}$  : maximum eigen value of matrix  $A$   
 $a_{ij}$  : numerical comparison between the values  $i$  and  $j$ .

In the next step, in order to validate the results of the AHP, the consistency ratio (CR) is calculated using the formula,  $CR = CI/RI$  in which the consistency index (CI) is, in turn, measured through the following formula:

$$CI = \frac{\lambda_{\max} - n}{n - 1}.$$

The value of RI is related to the dimension of the matrix and will be extracted from Table 3. It should be noted that consistency ratio lower than 0.10 verifies that the results of comparison are acceptable.

Table 3: The value of Random Consistency Index, Source: Golden and Wang [8]

Demention	RI
1	0
2	0
3	0.5799
4	0.8921
5	1.1159
6	1.2358
7	1.3322
8	1.3952
9	1.4537
10	1.4882

Considering that this method is also an expertise-oriented technique and the sample size should be less than 10 people, therefore, in this section, the opinions of the same 12 people selected from the previous stage are again used. Its calculations using Expert choose software, during three stages of pairwise comparisons, normalization, weighting and final ranking, calculation of compatibility rate in judgments, calculation of vectors of local priorities and finally determination of final priorities, market share development criteria based on strategies Entering international markets were prioritized.

### Examining competence components and entrepreneurial qualifications and the presented conceptual model

The term “qualification” means competence or expertise, which is used in order to have quality or physical and intellectual competence in doing the work of teaching. Therefore, entrepreneurial qualifications are the faculty’s teaching ability and possessing knowledge, skills and entrepreneurial attitude in line with the overall goals of the applied scientific university and performing the task assigned to him. In fact, the vision of the Comprehensive University of Applied Science is the transfer of powerful technical and applied knowledge, the development of manpower required by the industry, and the promotion of fields related to applied science and technology. Therefore, it is important to recognize that some aspects of entrepreneurial competence are knowledge, attitudes, and professional skills that are relevant to applied science education instructors and that students who are educated with the transfer of these skills may eventually acquire such competencies in use their workplaces, institutions or organizations.



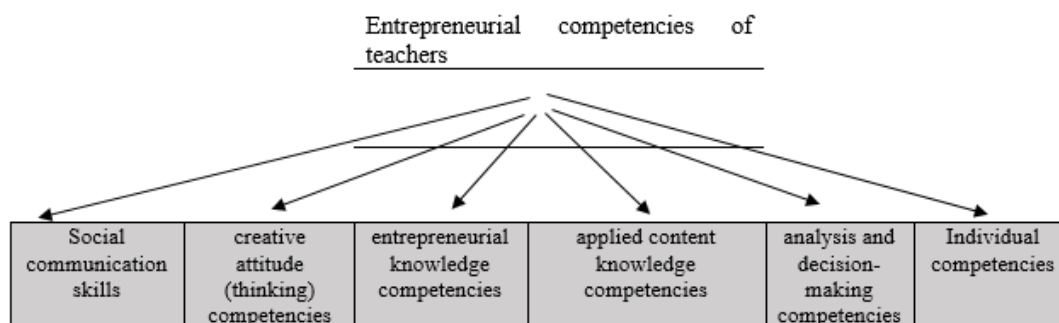


Figure 2: The presented conceptual model of evaluating the entrepreneurial competencies of lecturers

Entrepreneurial competencies are those characteristics that bring performance quality in the world of work. The main goal of entrepreneurial competencies in organizations is to authenticate the level of skills of individuals in order to recognize a new combination of skills and knowledge that should be transferred to the workplace. Hence, they are always looking for higher competency levels of entrepreneurial skills and knowledge that can easily respond to the specific competitive requirements of their industry. Therefore, the goal of the University of Applied Sciences is to evaluate its professors in the performance of relevant tasks, which can be classified into the following groups: identification of critical business issues, communication, dynamics of work groups, analysis of the work environment, implementation of goals, purchasing/ Advocacy, consulting, negotiation/contracting, systems thinking and entrepreneurial perspective.

Creative thinking competencies are also more related to the combination of skills and knowledge that help people to perform their tasks effectively and efficiently in their portfolio. In particular, creative thinking skills are one of the most effective and important components in terms of focusing on long-term plans, considering the career development process and professionalism of people in an organization. Creative thinking competencies can help people to create, develop, process and produce good ideas or approaches that shape the organization. This set of influential components can be defined as the ability to predict and make decisions, soft and hard skills, individual and group performance in the workplace, learning and evaluation strategies, ability to facilitate the process, standard identification, questioning ability, model building. Analytical thinking and leadership were categorized.

Individual competences, as the name suggests, are more or less said about the behaviors and attitudes of professors to be applied in the university and during teaching. These competencies help people understand the attitude, values, work ethic and behavior required. A set of these competencies, which are more related to the individual behavior and attitude of people, can easily affect the main aspects of the job in the organization. Individual competences can be categorized as follows: selection of communication and teaching methods, skills of applying motivational theories, method of transferring educational items, method of receiving feedback, understanding and application of reward and punishment systems, understanding and application of development theories. Organization, perceptions and theory of student development and skills in counseling process.

## Specialized validation of research tools

The proposed conceptual framework of this research shows the relationship between the groups of entrepreneurial competencies, which are influenced by creative thinking competencies and entrepreneurial competencies and individual competencies as a combination of skills, knowledge and attitude or behavior that should be used by professors of university centers. Applied scientific comprehensive for the purpose of professional professional evaluation.

This research was conducted in a mixed way (qualitative and quantitative) and the foundation's data strategies were used in the qualitative phase and the AHP technique was used in the survey phase of the research. The tools used in the qualitative phase were interviews and in the quantitative phase standard questionnaires were paired comparisons. In selecting the sample of this research in the quantitative phase with the aim of making the research findings comprehensive, it was tried that in addition to the statistical population in the first (qualitative) phase, which included all 24 heads of applied scientific centers in Alborz province, a wider population including all the managers of the scientific core The selection staff of the Central University of Alborz province and the people in charge of the relationship with the industry/research and the students' unit should be considered, so the total number method was used and a total of 36 people were involved in the collection of information, which described the demographic characteristics of the respondents in Table 4 is given.

Table 4: Description of the demographic characteristics of the respondents

Percent	Abundance	subject		row
%72	%72	26	gender	1
%28	%28	10		
%14	%14	5	work experience	2
%78	%78	28		
%8	%8	3		
%19.5	%19.5	7	education	3
%78	%78	28		
%2.5	%2.5	1		
%0	%0	0	Age	4
%3	%3	1		
%99	%99	35		
%66	%66	24	organization level	5
%11	%11	4		
%4	%4	1		
% 5.5	% 5.5	2		
% 5.5	% 5.5	2		
%8	%8	3		

### Research method based on AHP hierarchical analysis

After determining the indicators and components, they are ranked using the AHP method, which includes the following steps:

- (a) creating a hierarchy chart;
- (b) calculation of weights;
- (c) Calculate the degree of compatibility of the system.

(b) Weight calculation: In this technique, the elements of each level are compared in pairs to their corresponding element at a higher level and their weight is calculated. Each option is specified, which we call absolute weight.

There are different methods to calculate the weight, but first, the preference of each option is calculated over the other option, for this purpose, the table of verbal judgments introduced by Mr. Thomas L. Saati is used. These verbal judgments are converted into small values between 1 and 9. are given in table number 2.

(c) Calculating the compatibility rate of the system: In order to calculate the compatibility rate of a matrix, the following steps are taken:

1. Forming the primary pairwise comparison matrix ( $A$ )
2. Determine the weight vector ( $W$ )
3. Determining the largest eigenvalue of matrix  $A$  ( $\max \lambda$ ) and if the answer is positive, we go to the fourth step.
4. By multiplying the vector  $W$  in the matrix  $A$ , a suitable estimate of  $W \max \lambda$  is obtained, which is represented by  $(A.W)$ .
5. By dividing the values obtained for  $W \max \lambda$  by the corresponding  $W$ , we calculate estimates of  $\max \lambda$ .
6. Averages, we determine the obtained  $\max \lambda$ s.
7. We get the value of the incompatibility index ( $I.I$ ) from the equation  $I.I = (\max \lambda - n)/(n - 1)$
8. We get the inconsistency rate from the relationship  $C.I = (I.I)/(I.I.R)$

Table 5: Classification of main components and indicators

Social communication skills	Competencies of creative attitude (thinking).	Entrepreneurial knowledge competencies	Applied content knowledge skills	Analytical and decision-making skills	Individual competencies
Networking skills and organizational sociability		Theoretical educational knowledge (having appropriate basic knowledge)	Having applied expertise and related skills - previous experience	The ability to identify and define growthable needs in the market and industry	Learning and assessment competencies
	Management attitude and transformational leadership				Individual and group performance competencies in the workplace
		Knowledge of the future of research and consulting (familiarity with existing opportunities)		Problem diagnosis and optimal decision making and problem solving skills	
		The ability to understand the business model and knowledge of entrepreneurship and entrepreneurial management			
		Financial knowledge, accounting, liquidity management, and budgeting			

Table 6: Values of preferences in pairwise comparisons

Description	low score	Description	High score
Same utility	1	Same utility	1
A little unpleasant	1.3	A little more favorable	3
without utility	1.5	High utility	5
Very unfavorable	1.7	Very high utility	7
The most undesirable	1.9	Absolutely more desirable	9

Below are the relevant calculations:

In table number 8, the points given in the pairwise comparison table are normalized.

In table number 9, the ranking of the indicators was done and after that the matrix incompatibility rate is calculated, which is actually done according to the pairwise comparison table of relative weights and then the eigenvector. The calculations are shown in the following tables.

We calculate the  $\max \lambda$  value of each factor using the arithmetic mean of the division of the previous step, and after that we calculate the total  $\max \lambda$  of the factors.

Table 7: Shows the average score given to each of the main factors, which is considered the first table for making comparisons.

Individual competencies	Social communication skills	Analytical and decision-making skills	Entrepreneurial knowledge competencies	Entrepreneurial competencies of teachers	Competencies of creative attitude (thinking).	Applied content knowledge skills
0.14	0.50	0.25	1.00	4.00	1.00	Applied content knowledge skills
0.11	0.33	0.13	0.25	1.00	0.25	Competencies of creative attitude (thinking).
2.00	2.00	2.00	1.00	4.00	1.00	Entrepreneurial knowledge competencies
0.50	3.00	1.00	0.50	8.00	4.00	Analytical and decision-making skills
0.33	1.00	0.33	0.50	3.00	2.00	Social communication skills
1.00	3.00	2.00	0.50	9.00	7.00	Individual competencies
4.08	9.83	5.71	3.75	29.00	15.25	Total

Table 8: Normalized entrepreneurial qualifications of teachers

average	Individual competencies	Social communication skills	Analytical and decision-making skills	Entrepreneurial knowledge competencies	Competencies of creative attitude (thinking).	Applied content knowledge skills	Entrepreneurial competencies of teachers
1.000	0.035	0.051	0.044	0.267	0.138	0.066	Applied content knowledge skills
0.033	0.027	0.034	0.022	0.067	0.034	0.016	Competencies of creative attitude (thinking).
0.252	0.490	0.203	0.305	0.267	0.138	0.066	Entrepreneurial knowledge competencies
0.212	0.122	0.305	0.175	0.133	0.276	0.262	Analytical and decision-making skills
0.101	0.081	0.102	0.058	0.133	0.103	0.131	Social communication skills
0.301	0.245	0.305	0.351	0.133	0.310	0.459	Individual competencies
	1.000	1.000	1.000	1.000	1.000	1.000	Total

Now we calculate the incompatibility index of this matrix based on the following formula.

$$I \cdot I = 0.11 \quad I \cdot I = \frac{6.54-6}{6-1} \quad I \cdot I = \frac{\max \lambda - n}{n-1}$$

Then we extract the inconsistency index of the random matrix for matrices of different orders.

Table 9: Ranking of indicators of entrepreneurial qualifications of teachers

Index rank	Percentage importance of each index	The result of the previous step divided by relative weights	The product of the relative weights in the matrix	Entrepreneurial competencies of teachers
6	15.630 %	6.327	0.633	Applied content knowledge skills
5	15.904 %	6.438	0.215	Competencies of creative attitude (thinking).
4	16.786 %	6.795	1.714	Entrepreneurial knowledge competencies
3	16.980 %	6.873	1.460	Analytical and decision-making skills
2	16.981 %	6.874	0.697	Social communication skills
1	17.720 %	7.173	2.156	Individual competencies
		40.479	6.874	Total

Table 10: Special vector for the main indicators of entrepreneurial competencies of teachers

matrix sum product in the row of the original matrix	Total	Individual competencies	Social communication skills	Analytical and decision-making skills	Entrepreneurial knowledge competencies	Competencies of creative attitude (thinking).	Applied content knowledge skills	Entrepreneurial competencies of teachers
3.80	0.60	0.03	0.05	0.04	0.027	0.14	0.07	Applied content knowledge skills
1.29	0.20	0.03	0.03	0.02	0.07	0.03	0.02	Competencies of creative attitude (thinking).
10.29	1.51	0.49	0.20	0.35	0.27	0.14	0.07	Entrepreneurial knowledge competencies
7.16	1.27	0.12	0.31	0.18	0.13	0.28	0.26	Analytical and decision-making skills
4.18	0.61	0.08	0.10	0.06	0.13	0.10	0.13	Social communication skills
12.93	1.80	0.24	0.31	0.35	0.13	0.31	0.46	Individual competencies

Table 11: Calculation of Landa Max  $\lambda$

6.33	Applied content knowledge skills max $\lambda$
6.44	Competencies of creative attitude (thinking). max $\lambda$
6.79	Entrepreneurial knowledge competencies max $\lambda$
5.62	Analytical and decision-making skills max $\lambda$
6.87	Social communication skills max $\lambda$
7.17	Individual competencies max $\lambda$
6.54	total average max $\lambda$

We calculate the inconsistency rate of the matrix using the following equation.

$$C.I = 0.09 \quad C.I = \frac{0.11}{1.24} \quad C.I = \frac{I \cdot I}{I \cdot I \cdot R}$$

Table 12: I.I.R index coefficient

9	8	7	6	5	4	3	2	1	<i>n</i>
1.45	1.41	1.32	1.24	1.12	0.9	0.58	0	0	<i>I.I.R</i>

Considering that the inconsistency rate is less than 0.1, the matrix is consistent. According to the calculations, the general results of the calculations are summarized in Table 13.

Table 13: Summary of AHP technique results

incompatibility rate	third rank		Second place		First Place		Component	Row
	Score	Description of the agent	Score	Description of the agent	Score	Description of the agent		
0.09	16.980 %	Analytical and decision-making skills	16.981 %	Social communication skills	17.720 %	Individual competencies	The main components	1
0.1	16.116 %	Theoretical educational knowledge (having appropriate basic knowledge)	17.127 %	Strategic management competence	19.228 %	Knowledge of the future of research and consulting (familiarity with existing opportunities)	Indicators of entrepreneurial knowledge competencies	2
0.075	0.127 %	Knowledge and creative and progressive thinking	17.046 %	Thinking skills	82.827 %	Management attitude and transformational leadership	Indicators of creative attitude (thinking) competencies	3
0.022	33.126 %	The ability to identify and define growthable needs in the market and industry	33.383 %	Problem diagnosis and optimal decision making and problem solving skills	33.491 %	Knowing how to prioritize and manage risks (ambiguity management)	Indicators of analysis and decision-making skills	4

The results show that in evaluating the entrepreneurial qualifications of its professors, the university should focus its efforts on two sub-factors (management attitude and transformational leadership) and (knowing how to prioritize and manage risks/ambiguity management).

### Conclusion

In this article, the model for evaluating the entrepreneurial qualifications proposed for the professors of the Comprehensive University of Applied Sciences is presented, using a mixed method (qualitative and quantitative), from the foundation’s data strategies in the qualitative phase and the AHP technique in the survey phase of the research, it was concluded that the scale The questionnaires have the necessary reliability and can be used to measure what is considered. The results show that in evaluating the entrepreneurial qualifications of its professors, the university



should focus its efforts on two sub-factors (management attitude and transformational leadership) and (knowing how to prioritize and manage risks/ambiguity management).

The target community in this article was Alborz province. This study can be repeated in other regions. Another thing is that answering the questionnaire was not mandatory for the lecturers and the heads of the centers or the evaluation officials who were more interested in entrepreneurship were more likely to answer with a tendency and this may cause some biases in the data. In addition, other factors can also be effective in choosing the teaching method, such as the academic background of the lecturer, the size of the student groups, etc., which can also be examined in turn. Despite these limitations, the data are significant and provide new knowledge about the entrepreneurial competencies of instructors and their effects on teaching methods and the way instructors develop entrepreneurial competencies in students. It should also be noted that this research has only investigated the competencies of lecturers from the perspective of entrepreneurial skills and its effect on the choice of teaching methods, and it will be useful to study its components in depth and add students' perspectives to the analysis. In addition, mediating factors of regional and university culture, the support and guidance of the heads of centers, as well as management practices can be investigated with regard to the relationship between lecturers, teaching methods and the development of entrepreneurial skills in students.

Competence and knowledge of entrepreneurship in business management is an important factor in the economic health of a society, so teachers should also have these competencies in keeping up with the demand of the surrounding world, because they are the reference for knowledge transfer. Most of the methods used in teaching are just lectures in the classroom. It is recommended that instructors use teaching methods outside the classroom, such as industrial tours and exposure to the real world and production. Perhaps a workshop or seminar on teaching methods that promote interactive learning in entrepreneurship education is necessary.

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