



## SCIENCE PRODUCTION IN IRANIAN EDUCATIONAL SYSTEM BY THE USE OF CRITICAL THINKING

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*Growth and advancement in educational systems are the most important characteristics of the present societies. This phenomenon, especially in recent decades, has become an important and sensitive issue in developing countries. The role of educational systems in the process of growth and persistent advancement of countries is accepted by everybody and education is regarded as a main base of advancement and progress. The outcome of this growth is changing the educational systems into learners' organizations. The most observable and effective character in educational system is the thinking element. Thinking and acquiring new information and the method of thinking and learning are the most important characteristics of human being and from other perspective, in new approaches; the great attention has been paid to teaching and learning as well. For acquiring this goal, paying attention to critical thinking is one of the fundamental phenomena and dimensions. In this article first surveyed the critical thinking from the view point of many experts and then with the emphasis on the benefits of critical thinking, presented a framework for its implementation in Iran educational system.*

Key Words: science production, education, critical thinking, learning, teaching

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## **INTRODUCTION**

In those educational systems that don't pay great attention to critical thinking, the ultimate production is noncreative and narrow-minded students. These students may cause many obstacles on the way of spiritual and material progress. Iranian educational system always tries to accumulate the learner's mind with data and information instead of creating thoughtful individuals. This process is totally similar to a computer with the task of storing information. Critical thinking is of the most effective methods in transferring thought. The cultural advancement is the result of critical thinking. Let's not forget it's only education that causes human beings to leave narrow-mindedness behind and invariably to accept deep understanding and free choices. The education, itself, enhances the ability of human being for a higher understanding of the cases around. Those countries that understood the importance of critical thinking with a complex planning have provided the basement for its expansion as, they know, paying attention to the education of critical thinking will guaranty the progress of their countries from the economic and political and social and ... matters.

### **Concept of critical thinking**

One of the problems and barriers in training of critical thinking is the lack of a definition that can be agreeable to public in this field. A group have been defined critical thinking as an ability to recognize and regulate the matters, employing deductive and inductive reasoning, ability to extract the obtained information of different resources, supporting the individuals' reasonable conclusion and ability to distinct between realities and beliefs (Glasman et al., 1984).

Others freely have limited critical thinking to a high level thought like "reinforcement and continuity of cognitive activities for solving a complex problem" (Wisconsin center for educational research news, 1985).

Ennis believe that thought is critical only when a thinker exactly attempts to analyze subjects and to follow valuable evidences, and finally to reach to an intellectual judgment and good results. He considers the goal of critical thinking as educating the human beings the creature that is far from personal spites and, in contrast, is subtle and explicit (Ennis, 1985).

Beyer, in his books, has mentioned the critical thinking, as a collection of skills (Beyer, 1985).

Kneedler, like Beyer, points to specific skills in analysis and description of critical thinking (Kneedler, 1985).

Paul (1992), one of the number one experts, defines critical thinking as following: the art of thinking about your thought, when you think to improve your thought, ie say that brighter, correcter and more explainable (Smith - Stoner, 1999,).

In Jafi's (1994) view, critical thinking discovers thought process with the help of rules, that mean, both purposeful deep thinking, and testing documents and logic. The others and we use them, too (Johnson, 2002).

Lipman, in his new pattern, surveyed high level thinking in mind. High-level thinking, is thinking that has two characteristics: 1.Critical characteristic, 2. Creative characteristic. Critical thinking in essence is cognitive and come into the basis of criteria. But creative thinking is for values, and directs to meaning (Lipman, 1991).

In view of Johnson, generalizability, is the final aim of education, and this goal exists out of class and is obtained via critical thinking and by social interaction (Johnson, 1995).

Critical thinking deals with the opposing views and assumptions and is not biased toward a specific direction in advance (Blair, 2000).

Critical thinking is a constructive and positive process which might be caused by negative as well as positive events and is manifested in an individual's behavior in different ways (Lunney, 2003)

### **Review of literature**

Critical thinking is a necessary skill in promoting the students' thoughts. Critical thinking is one of the new models in education system. This model pays special attention to the development of individual and social features of people so that mental power and social responsibilities will be fostered among the learners.

The final goal of education is generalization which is achieved through critical thinking and social interactions, out of classrooms (Johnson, 1995, p38). This form of thinking helps a person to think deeply about the issues and criticize education system through true comprehension of the current issues. The learners' discussion is based on thinking and the learners understand the subject by thinking, and analyze the problems presented to them through asking suitable questions (Girle, 1991).

Dewey believes that schools should be based on people cooperation and its result should be training citizens (Haynes, 2002). In critical thinking strategy, the creation of thoughts, their expression and putting them to practice are

emphasized as a fundamental characteristic of judgment. Critical thinking is important in both individual and social aspects.

The societies which believe in democracy as a social philosophy which determines the behavior of their people provide an opportunity for selection and logical decision making for them. The systems which also believe in educational democracy respect the decision making power of people for their citizenship life. Critical thinking is the way and model of people's looking at the importance and use of thought in their life (Duchscher, 1999). Overloading students' minds with materials and handwritten texts is not so important today, but rather the learning process and the learners' activities during the training period are fundamental in educational democracy.

The main purpose of education is producing thoughtful people and the final result of education must be the contemplative mind. Critical thinking is a controllable and purposeful judgment which pays logical attention to proofs, fields, concepts, methods and criteria (Harkreder, 2000). The final product of the educational systems which do not pay attention to this issue is a non-creative person, and it is considered to be a serious problem in the material and spiritual development of the country.

#### **Advantages of critical thinking:**

Critical thinking has many advantages and can be helpful in individual growing in different field that will be investigated as following:

##### *1. Critical thinking and moral development:*

With acceptance of this point that critical thinking is the background of a better, deeper and wider cognition, one can easily jump to this conclusion that critical thinking frees human from blindly following moral rules, and guides us to such a position that comes nearer to Kant's opinion based on criterion selection and moral rules with freedom and with the intention of respect to it. Unfortunately many individuals submit to moral problems, only with the aim of reaching the profits or escaping from negative charges of moral matters abandonment, whereas such actions are without moral values. By accepting this view, clear critical thinking necessity for moral development is more obvious than ever; meanwhile by teaching it, individuals learn to respect to other ideas, take action to criticism, analyze and evaluate their opinions and even their owns. Even take a look at all things under the protection of criticism, don't admit any things without full investigating and assessment. In this view, if an individual reaches moral rules and goes to it, that action will consist of better moral value.

## *2. Critical thinking and social development*

Criticism and review of others ideas, are the generator of many positive cultures like: respect to the others' ideas, existence of difference taste and thinking and not receiving reflections absolutely and ....When graduated from high school, the students should be able to do some homework as the society expects legally. The society even expects them to behave intellectually and morally, and to follow valuable goals for themselves. These results can be trained through critical thinking training and should be the basis of curriculum planning.

Peak of critical thinking is reaching the self-evaluation, and real critical thinker is the person who not only does review other ideas successfully and views in the best way, but also can embark to criticism, review and construction of his ideas and beliefs in a proper way. It's obvious that reaching this level of critical thinking requires passage of lower stages based on criticism of other actions and opinions and this is not easily obtained except under the protection of social interactions. Interactions, either positive or negative, can provide a background for individuals' social developments; because when individuals follow all-channel criticism and review of others actions and thought those matters are making a generator of all-channel development, especially, their social development. It causes them to learn some thing and promote their social personalities. Furthermore, when individuals review other opinions and thoughts, they should transfer this criticism to them because this action causes the individuals to promote their social development.

## *3. Critical thinking and cognitive development*

Lipman is one of those philosophers that emphasize on education's cognitive aspect. He divides the cognitive criteria to four groups: exploratory, reasoning, information organization, and translation, and he believes the judgment and the reasoning power grow in individuals by the use of these criteria in different conditions (Lipman, 1988).

It is clear that taking the risk is an inevitable part of our daily life, and this matter requires that the individual evaluates probability of happening future events. Because of non-cognitive development as a result of not using the critical thinking, problems, losses and most unpleasant charges occur in individual life. Whereas, with training the critical thinking, we will observe reason improvement and so destroying at least a part of negative charges arising for incorrect decision. Indeed, with exploitation of critical thinking formulas and techniques, pupils learns to promote reasoning power, and calculating

power and amount of probability of a matter, that is arising of individuals' cognitive development. In other words, with exploitation of critical thinking, individual increase his perceptive and analytic power little by little. To become a criticism thinker, a comprehension of logical norms and merit in development and debates analysis should be obtained. Plans of critical thinking conform to this interpretation, emphasize on forming creditable deductive arguments and cognition of wrong reasons and not using them.

Skillful use of critical thinking enables us to throw away these non-reflective habits, and nearly overcoming them is an answer to this question that why the growth of the skills of critical thinking is so valuable? Only the teacher that knows what critical thinking is and encounters with it purposefully can help the youth in critical thinking skills. So, in order to make Iranian students familiar with critical thinking and to provide a useful background for a critical society, critical thinking in questions and content of different lessons, especially social science should be paid attention. If we don't pay attention to this subject and neglect it, students will be led to imitation and passively acceptance preservation learning and in this case we will be deprived of having criticizer society and citizens and be deprived of critical thought.

#### *4. Critical thinking and science development:*

Education systems that comprehend the requirement of critical thinking creation are settler to this problem that science growth and development is possible besides attention to critical thinking in science centers. Science development works when individuals review problems with the attention to the mental power and besides this examination can obtain new thoughts of those. In addition to the critical thinking, pupils consider the matters with more accuracy and this order prepares a background of science development: and this matter, provides more accuracy background for individuals that are thinkers and clear-sighted, because they understand this point that their thoughts are to be criticized. Thus one of critical thinking's opinions is the science development and this matter obtains a background for science center's improvement and dynamism and at last leads to science production.

#### *5. Critical thinking and mental development*

One of the countries retardation factors is inattention to critical culture creation in society. In retarded societies no attention is paid to the creation of critical thinking in pupils, and also individuals resist against the other opinions and

don't tolerate them. Paying attention to the critical thinking makes a background generator for the society mental relaxation and individuals' mental development against other opinions so that, individuals with respect to other individuals, review their opinions and survey them with tolerance.

### **Education and critical thinking**

The use of critical thinking in education began when critical thinking became a synonym of logic. Dewey mentions judgment and hesitation as the nature and the essence of critical thinking, and knows it willing to active, permanent and subtle survey of opinion and knowledge.

Critical thinking is the thinking skill, and is the learning tool that trains the pupils with logic and reason art, and increases their readiness for encountering out of class positions.

Experts of education and curriculum planning recommend training, manner reinforcement and science attitudes instead of science realities' transfer, and pay attention to process instead of science realities reproduction. They believe that students should pay attention to the manner of obtaining science realities in place of obtaining science realities (Matthews, 1994).

In an enriched educational environment, an individual should investigate freely and thoughtfully without force. He should unify his/her acquired subjects and walk for elevation. Unfortunately, most of the schools not only forget such mission, but also walk in the opposite direction (Macdonald & Wolfson, 1973).

If the student is active in the learning process, and feels he/she needs learning and perceives the relation with the other matters his understanding becomes permissible and consequently he/she acquires materials deeper.

Dewey knows concentration on occasions and position the only direct way for learning and teaching methods improvement. He names problematic situation the factor that causes thought that is conditions that encounter pupils with doubt and vagueness, because till human beings don't encounter doubt, their thought won't be persuaded to stimulation. Thoughts test with beliefs evaluation and in other words with a critical look to problems lead to a deeper perception and understanding of matter, and whatever is learned by pupils by the help of experiment and assessment, increase possibility of better learning and better transmission of learning.

Critical theory emphasizes on human's freedom dependency and autonomy to social development, historical stages and human's changes. According to critical theory, freedom situations can't be searched only in individual's education, but it depends on social conditions that are acquired via political fighting together. According to this definition, explanatory means questioning about authority and sovereignty of the society that hasn't any intellectual reason and explanation and doesn't persist to freedom and maturity as the basic aims of human's development.

Iranian education system's emphasis on knowledge transmission and learning is limited to memorizing materials, because of the formulation of plans subject-matters, methods of formulation and educational assessment and etc. The main problem that Iranian education system encounters is the goal-centered being instead of being process-centered.

The contents of many text-books are presented vaguely. Ambiguity is one of the cultural characteristics of a society that thought and critical thinking isn't basic in it. When critical thought is well trained, it leads to doubt, so prepares curiosity and different ideas and statement about subject; criticism begins with doubt and criticizer tries to awaken the doubt to make the base of certainty firm.

Many learning theories support the existence of critical thinking in education. Cognitive theoreticians, look to students as active processors of information in learning process, those who experience and seek the information for problem-solving. They employ whatever they recognize useful for solving new problems in the structure of their mind. Instead of passively being affected by the environment, they actively select, exercise or ignore it (Wolffolk, 1990).

In addition to cognitive theories, metacognitive approaches support reinforcement and fostering of critical thinking in education process. In metacognitive view, student should have active control in his/her mental process, and regulate and reconstruct his/her mental activities. In metacognitive thinking "conditional knowledge" that is one of the most basic factors in metacognition, has been presented as a component of the critical thinking in curriculum planning (Marzano et al., 1988).

One of the theories that protects critical thinking, and has root in cognitive thinking, is constructionism. Philosophy foundations of such an approach stand for fallibility of epistemology. On the basis of such approach, all knowledge of human is fallible, for limitation and relativity of human perceptions (Cobern, 1992).

Constructivists, like cognitive psychologist, look at learning as a perception process, resulted from experience, and believe that executives of lesson plans should provide a situation that students, via reasoning debates which facilitate and accelerate interaction and analysis action, do critical thinking (Zahorik, 1995).

Concentration to students' metacognition and self-regulatory, learning in an enriched environment and valid to problem-solving, consistently are settled in the center of constructionism approach (Cobern, 1992).

Researchers show this reality that still many teachers consume most of their instruction-time to speaking or asking questions that seek abstract reminding of simple science realities and only one percent of consumed time in class is allocated to questions that need thoughtful answer (Sirotnik, 1983).

One of the ways that lead to critical thinking is problem-solving method in group-work form. This method in group work form will reinforce critical thinking skills of students in the interaction classroom in an active atmosphere. In this method, skills like observation, comparison, organization of information, control and determination of variables, hypothesis testing and formulation, analysis, inference, assessment and judgment are reinforced. In addition to mentioned skills, active learning, reasonable thinking, tolerance of complexity, attitude about temporary being of all knowledge, and tolerance of each other views are properties of problem-solving and group-work (Joyce & Marsha, 1986).

Now, with regard to the importance of educational system in the new millennium to which human life development is related, it is essential for this matter to adopt foundational plans. One of the main phenomena for this matter is critical thinking.

Results of Tim's international studies show that the Iranian students in a collection of 286 questions and operation test in proportional to our lesson plans comparatively are in an upper level for comprehension and memorization. But about skills like making theories, data analysis, problem-solving, using the instruments and scientific methods or doing research and investigation about nature are in a lower level.

So, granting existence for education without attention to critical thinking is a meaningless idea, and the training that in its real meaning should establish a field of individual's evolution is impossible without critical thinking.

**A comparison between traditional education and education based on critical thinking**

In traditional instruction, the teacher is in charge of main activities, and he/she, actively, presents organized knowledge and information, and decides how to transfer them to pupils' mind, and students should memorize relevant information passively, and remember it and answer to the questions on the assessment time. In this way emphasis is on subject-matters, and often, teacher and the text book are real information resources.

Jean Piaget, after surveying and criticizing different methods knows active method as the best method and for this reason this method is compatible with what is acceptable in educational psychology. The active method facilitates fostering new goals of education which are training creative and researcher individuals.

In education based on critical thinking, teacher plays the role of a guide and facilitator, and students are active. They look for information from resources other than teacher and text book; they emphasize on method instead of contents, and don't volume perceived information in first level, and it isn't necessary to memorize subject-matters without comprehending and perceiving them. Thinkers know the dependency of traditional instruction to meaningless statements, and reliance on habits, instead of thoughts as the source of wrong education. They believe that education should be established on exchange of thoughts, participation, and discussion, so that it could lead the individuals to the critical thinking.

Considering the importance of critical thinking the researchers have investigated the use of critical thinking in high school social science textbooks based on Fars Province (Iran) teachers' attitudes in order to present a model for textbook development. To achieve this goal, the use of the following skills in the social science textbooks was analyzed: reasoning, questioning, assessment of examples and statements, group work, interpretation, true judgment about issues, analysis and evaluation, logicity, and explicitness.

The result showed that the teachers of the Social Studies Textbook evaluated assessment of examples and statements, and analysis and evaluation skills as not satisfactory respectively. They evaluated the other skills as fairly satisfactory. Teachers of Sociology Textbook 1 evaluated explicitness, assessment of examples and statements, analysis and evaluation, and interpretation skills as not satisfactory respectively. They also evaluated other skills as fairly satisfactory. Teachers of Sociology Textbook 2 evaluated explicitness as not satisfactory, logicity as satisfactory, and other skills as

fairly satisfactory. As it is shown in the following Table in all three books the status of the skills of critical thinking were analyzed as fairly satisfactory to unsatisfactory.

Table: The Status Of Skills Based On Their Use In Social Science Textbooks

Rank	Skill	Status	Textbook
1	Logicity		
2	Questioning		
3	Group work		
4	True judgment about issues	Fairly	
5	Reasoning	satisfactory	
6	Interpretation		<i>Social studies</i>
7	Explicitness		
8	Analysis and evaluation	Unsatisfactory	
9	Assessment of examples and statements		
1	Logicity		
2	Questioning		
3	True judgment about issues	Fairly	
4	Reasoning	satisfactory	
5	Group work		
6	Interpretation		
7	Analysis and evaluation	Unsatisfactory	<i>Sociology (1)</i>
8	Assessment of examples and statements		
9	Explicitness		
1	Logicity	satisfactory	
2	Questioning		
3	Analysis and evaluation		
4	Reasoning		
5	True judgment about issues	Fairly	
6	Interpretation	satisfactory	
7	Assessment of examples and statements		<i>Sociology (2)</i>
8	Group work		
9	Explicitness	Unsatisfactory	

### Manner of classroom organization for encouragement and critical thinking creation

#### 1. Creating equivalence between content and teaching process

If teacher's effort in learning process is finishing books and making students ready for final exam, this method will prevent happening the other instructional actions in class such as critical thinking education.

#### 2. Creating equivalence between lecture and interaction

The teacher, by using the other suitable methods for thought exchange in class, should make equivalence between his/her lecture and interaction of students via encouragement, argument and question.

### *3. Organization and designing of physical environment of the classroom*

Educational environment has a very fundamental role in fostering critical thinking skills. Organization and arrangement of class for providing opportunity for interaction is very hard but effective. Five basic tips for this matter to be more effective come below:

A: Begin each session with a question:

For teaching, first start with an exciting question or problem. That attracts the students attention to the lesson.

B: Use silence to encourage the pondering:

In addition to problem-solving method, discussion, conversation and even exchange of attractive beliefs, silence can help critical thinking development

C: Arrange the class environment so as to cause interaction:

Physical conditions of classroom are so important in establishment of suitable environment for critical thinking. Classroom environment should be designed so that it facilitate that can exchange of the thoughts. Setting chairs and tables in a direct line and behind of each other, makes students' collective-thought and thought exchange impossible. Teachers can reform classroom physical condition by use of imagination and a little attempt and establish atmosphere that causes students to exchange their thoughts.

In small and uncrowded classes the chairs and tables can be arranged in form of circles, semicircle, square, or u-form (horseshoe), and in large classes students can be divided to small groups. In this kind of class organization, the main goal is for students to see each other, argue and discuss with each other.

D: Add to the class time, if possible:

Critical thinking fosters when students have enough time for thought and deep thinking. Classroom will not be effective and useful with a limited time for fostering thought. Long-term classes are better and more effective than short-term classes for training techniques of critical thinking:

So, the teachers should try to add to the class time, so that students can obtain this opportunity to analyze information, exchange thought and survey.

E: Establish a receptive environment:

The attempt for encouraging students to discuss and exchange thought requires a receptive environment. That is, where students feel security in, and teachers can rely and trust each other. Teachers should listen to student's statements with respect and accuracy. They can reject student's incorrect statements reasonably and documentarily. But never should reject the students themselves or taunt them. Teachers should grant the same worth for students' correct or incorrect statements in thought exchange and discussion process because they are the production of their thoughts and will provide a field for their thought dynamic and further thought.

### **Stages of teaching method performance based on critical thinking**

First stage: matter comprehension and perception: In this stage, we try to help pupil comprehend the matter given. Because comprehension and perception are the main keys for other activities in critical thinking process.

Second stage: Information judgment: In this stage, the students are encouraged to present some information based on their designed questions and judge this information in reality.

Third stage: Applying judged information: In this stage, the results of the two previous activities are put to use, that means they employ that group of thoughts that have been judged and produced.

Fourth stage: Presentation of feedback and complementary strategy: In the final stage, the teacher gives a feedback to the students about the manner of their operations.

### **CONCLUSION**

Critical thinking presents a new pattern based on thought in education and contains important and centered concepts and tenacious, wisdom or rationality, and democracy (related to social characteristic). This pattern not only emphasize on critical thinking importance, but also on creative thought and thought with interest. This plan emphasizes on creation, stating, act and feel as a main circulation of judgment and distinction. Critical thinking is important in two sides: personal and social aspects.

In the light of personal, since human has authority, he necessarily, should decide for appointing his direction in life, that his life with this decisions will take form, in other words, in this unrepeatable life he should give himself opportunities for selection. Good selection gives us the possibility to have a

better position and irresponsibly in selections, and draw us to a naught. For attaining a subtle selection, a kind of thinking is required, and should search different opinions, colorful suggestion and various temptations with critical thinking. Critical thinking helps us not to admit any speech blindly and without reason; and place a question sign opposite of colorful models that are inspired smartly. Critical thinking helps us to be reasonable and civilized citizens; other usage that this thinking has in society, is establishing a critical morale in people. Critical thinking by establishing this morale goes under the service of social discipline and critical morale in citizens becomes a guarantee for rule and order in a society.

In philosophers, psychologists and teachers' ideas, critical and wise thinking don't need to be explained and their importance is clear in education. Although it isn't difficult to find most realistic reasons in this field, certainly success of every democratic system depends on the ability of people on analyzing the matters and adopting the reflective decisions.

Some suggestions will be presented here for better use of critical thinking in Iran educational system:

1. Developing of active learning methods in the classrooms.
2. Writing the different books in instructional program divisions on the basis of critical thinking indexes.
3. Paying attention to thought and opinions of the critical thinking field thinkers, in compilation of curriculum plans.
4. Acquainting all teachers with instructional program periods with the help of the method of critical thinking and the in-service training in this field.
5. Paying attention to the experiences of the different countries in the field of developing the critical thinking in education.

Providing real situations in classrooms to transmit learning

Planning and creating learning environments to develop thinking in learners

Providing situations for the students in order to express their thoughts and ideas

Developing self-awareness and self-adjustment skills in the students

Teachers should be consultants instead of transmitters of information and lesson skills

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