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# Analysis of LIS Research Articles 1997-2007: Critical Thinking, Gender, and Education

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## Introduction

Writing is a process. The beginning of the process will be with thinking, and what follows will not be obviously separated from thinking. An article must have components such as analysis, evaluation of the topic, examination of findings, and inference, conclusions, and discussion. A group of factors identified as the signs of critical thinking must also be strongly present in the writing process.

Bean (2001) reviewed writing as a process that intrinsically comes along with critical thinking. According to Kovalik & Kovalik (2007) academic writing cannot be separated from critical thinking. Fisher (2001) discusses how one must interpret or evaluate information resources. Nosich (2005) and Martinez (2006) interpret reflection, results, reasoning, and discussions as ways of evaluating resources.

Regarding critical thinking, some researches such as Ennis (1996-2006), Paul (1990), and Facione (2001) believe that critical thinking includes skills that can be developed in individuals (particularly students) by education to produce people of greater intellect. John Dewey, an educational science theoretician, suggests that critical thinking is a psychological issue existing intrinsically in human beings. He believed that "one can think reflectively only when one is willing to endure suspense and to undergo the trouble of uncertainty". He viewed this type of thinking as a set of interconnections and communications and believed that, "Only when relationships are held in view does learning become more than a miscellaneous bag" (Dixon, 2005). What is certain is that research (Ennis, 1979, Huff, 2000- Michita, 2001) indicates that teaching critical thinking skills can have a positive impact on improving the writing process, especially student compositions.

The role and importance of critical thinking in writing is clear. Researchers cannot rely on collecting and offering mere data and presenting a report based on

findings. Being a critical thinker means looking for hypotheses, searching various perspectives, and analyzing without prejudice.

## Context of Study

Writing as a process has been described by the Writing Center at the University of North Carolina (2003). First, writers start planning to state what they desire to write. Then, they collect and prepare subjects related to the topic. Next, they record and correct information. Finally, they record and present the writing for readers.

A process of trial and error helps writers select issues, words, and expressions to state the problem. The next stage is reconsider the idea by a rational method and find sensible arguments. The final stage is the satisfaction that the writer feels when obstacles have been successfully overcome. A scientific text has to pass through all these parts of the process. A variety of critical thinking factors have been listed by experts. Facione (2000) says that, "critical thinking, thinking with judgment, would be reflective and targeted. His suggested factors are: interpretation, analysis, evaluation, inference, explanation, and self-regulation.

Paul & Elder (2006) suggest eight points for critical thinking in a text :

1. Clarify purposes
2. Formulate clear questions
3. Distinguish accurate and relevant information from inaccurate and irrelevant information
4. Reach logical inferences or conclusions
5. Identify significant and deep concepts
6. Distinguish justifiable from unjustifiable assumptions
7. Trace logical implications
8. Identify and think within multiple viewpoints

A text that complies with these points must be organized in a standard framework. The organization of scientific articles follows a framework called IMRAD: "Introduction, Methods, Results, Discussion." The editors of scientific journals have accepted IMRAD and use it to validate their publications. This study will review the manifestation of critical thinking in research articles by Iranian researchers in library and information science (LIS) from 1997-2007.

## Literature Review

The review of research indicates that the critical thinking level is low (Mckinnon & Renner, 1991- Pikkert & Foster, 1996- Zoller and et al. 2000) and teaching it can have a positive impact (Ennis, 1979- American National Academic Achievement Assessment Association, 1981; Huff, 2000; Michita, 2001). Huff (2000) shows that both general and distance education have the same impact on critical thinking. It can be concluded that one should have greater consideration for critical thinking in various educational levels and national/international integrated planning must be done.

The studies on different critical thinking factors indicate that there is no correlation between learning methods and critical thinking, but there is correlation between age/gender and critical thinking, as well as between curriculum type and critical thinking. In some universities and schools where there are learners from different countries with English language background, using critical thinking for necessary

subjects is effective (Ennis, 1979; Perkins, 1985; Carrithers, Ling, and Beam, 2008; Weiler, 2005; Chen, 1996; Whitmire, 1998). Whitmire (1998) also found that there could be a positive relationship between scores, educational year, focus on library operations, casual interactions between professors and students in universities, active learning, and critical thinking. Chen (1996) observes finds a relationship between gender and critical thinking and in this field males performed better than females. Students' critical thinking may vary because of individual differences and different cultural, social, and educational opportunities.

Other important points in these studies are as follows:

- A positive relationship between information-seeking behavior and critical thinking (Weiler, 2005)
- Curriculum justification is more important than critical thinking/attitude to be chosen by students (Michita, 2001)
- In finance majors, curriculum does not affect students' critical thinking development (Kayes, Ling, Beam, 2008)
- Group critical thinking has direct impact on critical thinking development and learning is effective as well (Kayes, 2006)

The studies reviewing the relationship between critical thinking and literature indicate that group learning affects critical thinking in literature and improves it (Finlay & Faulkner, 2005). Studies performed by Scanlan (2006) and Carroll (2004) show that teaching critical thinking to students has had a positive impact on the learning process and class compositions. Quitabamo & Kurtz's study (2007) suggests that group writing significantly improves students' critical thinking skill.

## Purpose, Research Questions, and Hypotheses

The purposes of the study:

- Realize authors' rate of critical thinking factors in research articles.
- Specify personal data (gender, education) in studied resources.
- Specify authors' use of "analysis" as a critical thinking factor in the studied articles.
- Specify authors' use of "assessment" as a critical thinking factor in the studied articles.
- Specify authors' use of "inference" as a critical thinking factor in the studied articles.
- Specify authors' use of "explanation" as a critical thinking factor in the studied articles
- Specify authors' use of "self- regulation" as a critical thinking factor in the studied articles

By referring to the findings of this research, LIS authors may be able to realize strengths and weaknesses of the literature to improve writing quality. By using the research findings, editors and peer reviewers can improve their review of submitted articles. The data may affect future policy and planning of Journal Assessment Commissions. The findings could be employed by committees for selecting books, journals, and other library resources.

Research questions:

1. To what rate have critical thinking factors been used in the research articles?
2. What is the quantity of critical thinking factors used in studied articles regarding authors' gender?
3. What is the quantity of critical thinking factors used in studied articles regarding authors' education?

Research hypotheses:

1. The reviewed articles rate of critical thinking factors is less than average.
2. There is a significant relationship between gender and the use of critical thinking factors in the studied articles.
3. There is a significant relationship between education and the use of critical thinking factors in the studied articles.

## Methodology

### Statistical population

Statistical population of the study consists of 138 samples out 521 research-compiled articles published in Persian nucleus journals in library- information science from 1997- 2007. The

The journals are:

- Fasl-nam-e-ketab (Book Quarterly): Library and information studies
- Information science & Technology
- Library & Information science: The Quarterly Journal of Library Organization, Museums & Documents Center of Astan-e-Quds-e-Razavi
- Payam-e-Ketabkhaneh (Library Message Quarterly)
- Librarianship (Tehran University)
- Informology

Sampling method is based on systematic stratified random sampling.

### Methodology

Content analysis method has been employed for the study. Although the purpose of the study is to review critical thinking factors in research literature and this includes searching and finding critical thinking factors or their signs in purposed articles, the best method to perform the study is considered content analysis.

### Information collecting tools

A checklist based on Facione's critical thinking factors (1990) and "international reading-writing critical thinking test: accurate reading and basic writing assessment"(Paul & Elder, 2006) was used. In this inventory, major factors based on Facion's plan were developed, then auxiliary factors were specified below each major factor based on international test of Paul & Elder. Major factors and their auxiliaries are as follows:

- Interpretation: indirect citation (with reference), data setting, keywords.
- Analysis: purpose, main problem, main question, assumption, assumption test, view point.
- Assessment: up-to-date resources, similar subject of resources and text, analogy topic within text, and perspectives without prejudice.
- Inference: inductive, deductive, synthetic paragraph, inference words, and conclusion.
- Explanation: metaphors, illustrating by using figures, charts, and graphs.
- Self-regulation: discussion, illustrating.

To assess the factors, a Likert scale was used (very poor = 0, poor = 1, average = 2, good = 3, excellent = 4).

To specify the research tool validity, LIS professors' views about the factors and each relevant rate were collected by using Delphi method.

The tool reliability is assessed by Cronbach's Test with calculated statistics 73%.

## Data Analysis

To describe data, common methods in descriptive statistics such as frequency, calculating average indices, column/bar/dot charts were used. Inferential statistics methods include parametric tests: T-test, one sample T-test, and non-parametric tests: Mann-Whitney U, and Kruskal-Wallis.

## Findings

### Research questions

Q1. At what rate do the research articles have regarding critical thinking factors?

Analyzing articles rate by isolating critical thinking factors

Table 1. Descriptive Statistics for Q1 based on critical thinking factors

Rate Factors	0		1		2		3		4		Total	
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Interpretation	45	32.6	42	30.4	27	19.6	15	10.9	9	6.5	138	100
Analysis	6	4.3	4	2.9	11	8	34	24.6	83	60.1	138	100
Evaluation	16	11.6	37	26.8	27	19.6	58	42	0	0	138	100
Inference	21	15.2	10	7.2	39	28.3	51	37	17	12.3	138	100
Explanation	40	29	22	15.9	14	10.1	47	34.1	15	10.9	138	100
Self – Regulation	118	85.5	3	2.2	2	1.4	0	0	15	10.9	138	100
Total	246	29.7	118	14.2	120	14.5	205	24.8	139	16.8	828	100

Interpretation has the highest percentage (32.6%) at the poor rate, and analysis has the highest percentage (60.1%) at the excellent rate. Assessment, inference, and explanation have 42%, 37.5%, and 34.15% for the good rate respectively, and none could reach 50%. Self-regulation has the highest percentage (85.5%) at the poor rate.

Analyzing total rate of the articles based on all critical thinking factors

Table 2. Descriptive statistics for Q1 based on critical thinking factors in general

Rate Frequency	0	1	2	3	4	Total
N	7	12	26	26	67	138
Percent	5.1	8.7	18.8	18.8	48.6	100

As it can be seen, 67 articles have 48.6%, very good rate, the rest (71 articles)

with 51.4% indicate rates between very poor and good.

Q2. What is the quantity of critical thinking factors used in studied articles regarding authors' gender?

Table 3. Distribution of authors' gender

gender	N	Percent
female	54	39/1
male	84	9/60
Total	138	100

The table shows that the number of male authors (82 = 60.9%) is more than female ones (54 = 39.1 %).

Chart 1. frequency distribution of articles rate regarding critical thinking factors by isolating them based on gender

The chart shows males' articles excellence at the highest and lowest rates. In self-regulation, the number of female authors' articles is at the very good rate.

Q3: What is the quantity of critical thinking factors used in studied articles regarding authors' education?

Table 5. Descriptive Statistics for Q3 base on educational degree

educational degree	N	Percent
B.D.	3	2.2
M.D.	100	72.5
Ph.D	30	21.7
Other	5	3.6
Total	138	100

The table shows that most and least articles are written in master and bachelor educational degree with 72.5% and 2.2% respectively.

Chart 2. articles rate frequency regarding critical thinking factors based on educational degree.

The chart shows that master's degree has the highest and lowest rates for all factors.

As a result of testing research hypotheses, research findings are offered as follows:

## Research hypothesis

H1 . The reviewed articles rate considering critical thinking factors is less than

average.

*Null hypothesis:* Reviewed articles rate regarding critical thinking factors with predicted average has no significant difference.

*Alternative hypothesis:* Reviewed articles rate regarding critical thinking factors with predicted average has significant difference.

*Research hypothesis:* Reviewed articles rate regarding critical thinking factors in research articles is below average.

Hypothesis review based on six critical thinking factors

To review this, the data of one-sample T-test for each factor are as follows:

Table 7. one-sample T-test for each critical thinking factors

Main element	t	df	p value	Empirical and theoretical means difference	Empirical mean	Std. Deviation
Interpretation	6.941-	137	0.000	0.71739-	1.2829	1.21421
Analysis	15.036	137	0.000	1.3333	3.333	1.04171
Evaluation	0.872-	137	0.385	0.07971-	1.9203	1.07433
Inference	2.296	137	0.023	0.23931	2.2391	1.22358
Explanation	1.477-	137	0.142	0.18116	1.8188	1.44098
Self - Regulation	-14.089	137	0.000	1.51449-	0.4855	1.26281

The data indicate that P value is statistically significant ( $< 0.05$ ) for interpretation, analysis, inference, and self-regulation factors. The null hypothesis is rejected and the alternative hypothesis confirmed.

The review of empirical and theoretical mean difference for interpretation, analysis, inference, and self-regulation indicate a significant difference for both analysis and inference factors. This suggests that the empirical mean is higher than the theoretical mean; that is, the articles rate mean would be higher than the predicted mean. As a result, the research hypothesis could be rejected. The data for inference and analysis indicate that the empirical mean is lower than the theoretical mean. Therefore the research hypothesis, that the number of critical thinking factors used in reviewed literature is below average, is confirmed.

For evaluation and explanation factors  $P > 0.05$  so null and alternative hypotheses would be confirmed and rejected respectively showing research hypothesis rejection for these two factors. The review of empirical and theoretical mean difference indicates that mean usage of these factors is close to average.

Hypothesis review based on total rate of articles regarding critical thinking factors

Table 8. one-sample T-test for total rate of articles

t	df	P- value	Empirical and theoretical means difference	Empirical mean	Std. Deviation



9.350	137	000	0.971	2.97	1.220
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The data of one-sample T-test indicate that the P value is statistically significant (-0.05). The null hypothesis is rejected and the alternative hypothesis confirmed. As a result there is a significant difference between empirical mean and theoretical mean and research hypothesis, reviewed articles rate regarding critical thinking factors is below average, would be rejected. In other words the total rate of articles based on critical thinking factors is above average and nearly good.

H 2: There is a significant relationship between gender and the usage of critical thinking factors in the studied articles.

Statistical hypotheses are as follows:

*Null hypothesis:* There is no significant relationship between gender and articles rate based on critical thinking factors

*Alternative hypothesis:* There is a significant relationship between gender and articles rate based on critical thinking factors

*Research hypothesis:* It is similar to the alternative hypothesis.

Hypothesis review based on critical thinking factors following data for each factor are collected by using Mann-Whitney U test

Table 9. The relationship between gender and articles rate based on critical thinking factors.

Main element	Mann-Whitney U	Z	P value	Mean	
				Females	Meals
Interpretation	2267	0.004-	0.996	69.52	69.43
Analysis	1926.5	1.512-	0.130	75.82	65.43
Evaluation	1888	1.687-	0.096	74.54	64.98
Inference	2110	0/712-	0.477	72.43	67/62
Explanation	2161	0.483-	0.629	71.48	68.23
Self - Regulation	1023.5	1.681-	0.093	73/86	66.70

The table values indicate that P value is statistically bigger than 0.05, so the null hypothesis is confirmed. The alternative (research) hypothesis, a significant relationship between gender and each critical thinking factor, is rejected. The review of collected means for male and female authors indicates that there is a slight difference between males and females' scores mean in articles. The means of all factors for female authors are higher than males.

Hypothesis review based on total rate of articles regarding critical thinking factors

Table 10. The relationship between gender and articles rate based on critical thinking factors in general

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Mann-Whitney U	Z	P value	Mean	
			female	male
1685.5	2.545	0.011	80.29	62.57

Since  $P < 0.05$  therefore, the null hypothesis is rejected and the alternative (research) hypothesis is confirmed. The comparison of articles rate mean of male and female authors indicates that the average rate of females' compiled articles is better than males' and there is a difference between male and female authors in whole population with 95% assurance.

H 3: There is a significant relationship between education and the usage of critical thinking factors in the studied articles.

Statistical hypotheses are as follows:

*Null hypothesis:* There is no significant relationship between education and articles rate based on critical thinking factors

*Alternative hypothesis:* There is a significant relationship between gender and articles rate based on critical thinking factors.

*Research hypothesis:* It is similar to the alternative hypothesis.

Hypothesis review based on the six critical thinking factors

Kruskal-Wallis test date for each factor is as follows:

Table 11. The relationship between education and articles rate for each critical thinking factors

Main Factors	Kruskal-Wallis statistic	P value	df	Mean			
				BD	MD	Ph.D	other
Interpretation	1.339	0.720	3	56.17	70.35	70.80	52.70
Analysis	3.380	0.025	3	73.33	72.55	67.60	17.60
Evaluation	4/689	0.196	3	71.33	65.68	77.40	97.40
Inference	0.416	0.937	3	72.83	68.27	72.13	76.30
Explanation	1.428	0.699	3	47	69.54	72.85	62.10
Self - Regulation	3.545	0.315	3	50.59	68.41	75.82	50.59

Statistically  $P > 0.05$  for each factor except analysis therefore, which confirms the null hypothesis. There is a significant relationship between education and articles rate based on critical thinking factors.

The null and alternative hypotheses for analysis factor are confirmed. The comparison of means for analysis factor shows article rate reduction in PhD degree.

Hypothesis review based on total rate of articles regarding critical thinking factors

The data of Kruskal-Wallis test are as follows:

Table 12. The relationship between education and articles rate based on critical thinking factors in general

Kruskal-Wallis statistic	P value	df	Mean			
			BD	MD	Ph.D	Other
4.905	0.179	3	62.83	69.74	75.43	33.10

Since  $P > 0.05$ , which confirms the null hypothesis. There is no significant relationship between education and article rate based on critical thinking factors, and the alternative (research) hypothesis is rejected.

## Conclusion

The research data indicate that analysis as a means of critical thinking has been frequently used by authors (60.1%, mean = 3.33). The analysis factor consists of "purpose", "statement of problem", "main problem", "hypothesis", "hypothesis test", and "viewpoint". Many experts (Facione, Paul & Elder, Fisher, Ennic, etc.) consider critical thinking factors to be skills. Therefore, it will be claimed that the analysis skill of researchers is favorable, but the data indicate that 85.5% of articles have reached null rate (mean=0.48) that is very poor. Since this factor consists of "discussion", and "illustration", LIS researchers slightly benefit from self-regulation skill and are not able to present appropriate discussion. Researchers need to focus on discussion to challenge their work and reconsider data.

Critical thinking factors interpretation, evaluation, and explanation have the most articles at the third rate (good), but the average of articles is low. Since the reviewed articles are research articles, it is important to consider these factors. There is a difference between the inference factor and the others. This factor has gained the highest percentage of articles at average rate and the usage mean (2.23) is slightly more than 2 (average). Therefore, it could be concluded that by training appropriate writing styles this factor will be promoted. Most articles have been placed at rate 4 (excellent).

Although the obtained percentage is below average, nearly 50% of articles are at the high level. In this case the rate mean of works is 2.97 (good). Other studies on critical thinking quality in literature (high school/university students' assignment) indicate a level that is below average (Ennis, 1979; Mckinnon & Renner, 1991, Pikkert & Foster, 1996; Zoller et al., 2000) but the present study shows that the critical thinking quality in reviewed articles to be above average.

Male authors have gained the highest and lowest percentage for using all critical thinking factors and female authors have excelled at self-regulation, reaching an excellent rate in 10 out of 15 articles. It is interesting that this factor is considered the weakest. Total rate of articles for critical thinking factors indicates that gender is a significant factor; that is, female authors have a higher rate of critical thinking skills than males, although the number of male authors is larger. But for each factor by itself, there is no significant relationship between articles by males and females. Chen (1996) also found a difference between gender and critical thinking, with males more successful than females, unlike the conclusion of this study. The disagreement may depend on cultural or social differences, which require further research.

The review of the relationship between education and critical thinking indicates no

significant relationship among all factors except analysis. This factor is gradually reduced from B.S. to PhD educational degree; that is, articles whose authors have a PhD degree have a lower mean than those with B.S and M.S. regarding this factor. Although higher degrees are supposed to increase authors' analytical skill, the reverse is true in the articles studied.

The review of the articles for the relationship between education and critical thinking factors indicates that generally there is no significant relationship between education and critical thinking factors in the articles. Collected means show the same result. In furthering one's education, scientific and empirical abilities are developed, and researchers can use more knowledge to improve scientific products. The study indicates that instructional programs do not increasingly employ critical thinking factors. For analysis factor the trend is moving backwards. Evaluation and inference move up down and up from B.S. to PhD. Researchers do not use critical thinking factors consciously for three reasons:

- They may not become acquainted with the factors.
- They are not able to learn and use them properly.
- Although they know that they need to use critical thinking factors, their knowledge is not practical.

This study also indicates that interpretation, explanation, and self-regulation show better positions than analysis, evaluation, and inference. Although mean growth, except for explanation, has not shown a big difference, mean growth for explanation improved from 47% to 69.54% (20%).

The quality of critical thinking in the articles analyzed is above average and nearly good. There is a significant relationship between gender and use of critical thinking factors in reviewed articles and female authors have a higher mean than males. There is no significant relationship between education and usage of critical thinking factors in reviewed articles.

## Recommendations

Considering the data following Recommendations are presented to improve articles by using critical thinking factors:

1. Start teaching critical thinking skills in primary education and continue it in higher education.
2. Organize expert teams acquainted with critical thinking and its supplies to qualify articles for journals.
3. Put authorities' emphasis on using critical thinking factors rather than article forms. In the other words there must be consideration for quality of subjects, reasoning, conclusion, etc.
4. Perform similar research of foreign literature and compare its data with this study or other studies to find appropriate strategies to improve using critical thinking factors.
5. Perform similar research on literature of other scientific fields to review other authors' competence of various subjects and realize their strengths and weaknesses.

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