

TEACHER CANDIDATES' LEARNING STYLES AND CRITICAL THINKING DISPOSITIONS

ÖĞRETMEN ADAYLARININ SAHİP OLDUKLARI ÖĞRENME STİLLERİ VE ELEŞTİREL DÜŞÜNME EĞİLİMLERİ

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ABSTRACT

The main aim of this study is to evaluate teacher candidates learning styles and critical thinking dispositions in terms of different variables. This study was conducted at Anadolu University with 251 students. In this study Kolb Learning Style Inventory was used to determine the learning styles of pre-service teachers and in order to define their critical thinking dispositions the California Critical Thinking Disposition Inventory (CCTDI) was used. The results of this study indicated that the majority of teacher candidates have assimilator and converger learning styles, while the participants' critical thinking dispositions were low. Moreover, it was obtained that learning styles and critical thinking dispositions differ from according to teacher candidates' gender, departments, grades and academic successes.

Keywords: Learning, thinking, learning styles, critical thinking.

Özet

Bu araştırmanın genel amacı, öğretmen adaylarının sahip oldukları öğrenme stilleri ile eleştirel düşünme eğilimlerini çeşitli değişkenlere göre değerlendirmektir. Araştırma, Anadolu Üniversitesi Eğitim Fakültesinde öğrenim gören 251 öğrenci üzerinde gerçekleştirilmiştir. Araştırmada, öğretmen adaylarının öğrenme stillerinin belirlenmesi için Kolb Öğrenme Stili Envanteri ile eleştirel düşünme eğilimlerinin belirlenmesi için de California Eleştirel Düşünme Eğilimler Ölçeği kullanılmıştır. Araştırma sonucunda, öğretmen adaylarının büyük çoğunluğunun özümleyici ve dönüştürücü öğrenme stillerine sahip oldukları, eleştirel düşünme eğilimlerinin ise, genel olarak düşük düzeyde olduğu, öğretmen adaylarının cinsiyetlerine, devam ettikleri programlara, sınıf düzeylerine ve akademik başarı ortalamalarına göre öğrenme stillerinin ve eleştirel düşünme eğilimlerinin farklılaştığı sonucuna ulaşılmıştır.

Anahtar Sözcükler: Öğrenme, Düşünme, Öğrenme Stili, Eleştirel Düşünme

INTRODUCTION

Information society has necessarily led to many changes in human life. As a matter of fact, there are certain qualities that explain the concept of information society. Among these are such qualities as doing research, problem solving, creative thinking and critical thinking as well as

those related to learning. In this respect, information society places more importance in the qualities related to learning and thinking for individuals.

Learning Styles

Learning can be regarded as the qualities peculiar to individuals themselves. However, the learning process is considered to be a complex process, and it should be understood how it occurs. The need for this is that it is the very first of better-learning. This process, also defined as effective learning, is, in a sense that an individual knows how s/he learns. The individual that knows how s/he learns knows his/her own characteristics related to learning; in other words, s/he is aware of his/her own “learning style.” Learning style can be defined as characteristics related to cognitive, affective and physical attitudes of students in the process of their receiving information, interacting with the information and their responding to it during learning (Felder and Brent, 2005). That’s to say, learning style determines the cognitive, affective and physiological structure that influences a student’s perception, interaction with the outer elements and attitudes in his/her learning environment. In other words, learning style can be regarded as characteristics that represent an individual’s dispositions or preferences about learning (Güven, 2004). A learning style is not stronger or weaker than another (Felder ve Brent, 2005; Stenberg, 1994). Every individual has his/her own learning style (Coffield et al, 2004; Gagne and Briggs, 1979).

It is very important for an individual to know his/her learning style. The reason is that one of the most significant issues in learning to learn, or in becoming effective in the process of learning, is an individual’s taking the responsibility for learning. For this purpose, the individuals should know about what their own learning styles are and what characteristics this style has and should thereby behave according to this style. In this way, the individual can get the constantly-changing and increasing information without a need for others’ help (Coffield et al, 2004; Güven, 2004 and Biggs, 2001). Likewise teachers should never forget that students have different learning styles, for the preparation of learning environments appropriate to the learning styles of individuals is quite important for affective learning to occur (Özer, 1998).

Different models have been put forward related to learning styles since 1940s. Some of these models are Gregorc's model of learning style, Dunn and Dunn's model of learning style, Kolb's model of learning style, Grasha and Riechmann's classification of learning styles and Jung's theory of psychological types. Each of these learning-style models emphasizes on a different characteristic of individuals: cognitive, affective and physiological (Cornet, 1983). Kolb, whose model this study is based on, developed a model that classifies students with respect to their preferences. The model developed by Kolb is based on the empirical learning theory. In the empirical learning theory, learning is designed as a learning circle. Four learning styles are described in the learning circle: concrete experience, reflective observation, abstract conceptualization and active experimentation. There are different ways of learning in each of these learning styles. Concrete experience is based on learning through "feeling and touching", reflective observation "watching and listening", abstract conceptualization "thinking" and active experimentation is based on learning through "doing".

According to Kolb's learning styles, four learning styles are determined: converger, diverger, assimilator and accommodator (Felder and Brent, 2005; Ekici, 2002; Kolb et al., 2001; Özden, 1998; Butler, 1987 and Kolb, 1984).

Critical Thinking

On the other hand, thinking, the most outstanding characteristic of human that distinguishes human being from animals, is a goal-oriented effective mental process for understanding the present situation. Thinking can be performed for such reasons as achieving certain goals, problem solving and being capable of suggesting solutions. However, the basic point here is to know how to think rather than what to think about. And how to think is related to critical thinking. Paul (1992) defines critical thinking as "one's thinking about improving his/her own way of thinking while thinking" and states that critical thinking is not just thinking but also thinking about what is effective in developing oneself and also developing oneself in terms of thinking by using the standards that will evaluate thinking (cited in Güven and Kürüm, 2006).

Critical thinking is a process. This process includes a number of mental activities from the analysis of information to its evaluation. Kökdemir (2003) emphasizes that the most important characteristic of the process in critical thinking is to be able to ask the question 'why' when it is necessary to make comment or decision in the end or when it is necessary to express an opinion about the relationships between facts. According to Kökdemir (2003), "the question 'why' is not just a question that we should provide an answer to; it also helps to investigate the present causality relationships".

The complex and abstract structure of critical thinking makes it necessary to explain it with such characteristics as certain skills and dispositions. Researches carried out in this field suggest there are various classifications related to the skills and dispositions that may serve as indicators of critical thinking. For instance, California Critical Thinking Dispositions Inventory classification made for critical thinking tendencies, also used in this study, determines six critical thinking dispositions. These dispositions (Kökdemir, 2003) are: Truth-Seeking (*evaluating the alternatives or different thoughts*), *Open-mindedness* (an individual's being tolerant towards different approaches and sensitive to his/her own faults), *Analyticity* (being careful about situations in which problems may occur, acting wisely even against difficult problems and using objective evidence), *Systematicity* (*organized, planned and careful research*), *Self-confidence* (*one's confidence in his/her own processes of thinking wisely*), inquisitiveness (willingness to get information without any expectation of a benefit and to learn new things) and maturity (*mental maturity and cognitive development*).

THE AIM

Learning style and critical thinking are the two important characteristics and qualities that individuals should have. Individuals can gain these characteristics and qualities in their school lives, which is also among the responsibilities of teachers. However, for teachers to do so, they are supposed to own these characteristics and qualities in the first place. This study is designed with this fact in mind.

The overall objective of this study is to evaluate the learning styles and critical thinking dispositions the pre-service teachers' in accordance with certain variables. In line with this overall goal, the learning styles and critical thinking dispositions the pre-service teachers are defined. Whether their learning styles and critical thinking dispositions vary with respect to their gender, their level of academic achievement, their class and the current education program are also investigated.

METHOD

The population of this study designed according to the single-case research design that included 2780 students in total who were attending the Education Faculty of Anadolu University in the academic year of 2003 – 2004. However, due to the great size of the research population, sampling was done in the study. For the sampling, “proportional group sampling approach” was used (Karasar, 1998, p.115). According to this, each of the 11 programs was considered as a sub-universe, and for the convenience of practice in the study, 10% of the total number of students in these programs was thought to be adequate. At the end of this procedure, 278 the pre-service teachers attending these 11 programs at the Education Faculty of Anadolu University were taken as the sample of this study. However, there was no return from the students of the department of fine arts education who were actually included in the sample. Therefore, the research sample included 251 students attending 10 different teacher-training programs (Table 1).

As can be seen in Table 1, 70.9% of the pre-service teachers were female and 29.1% were male. In terms of the teacher-training programs, 10% of the students were from the program in Pre-School Education, 15.5% from the program in Primary School Education, 5.6% from the program in Social Studies Education, 8% from the program in Primary School Mathematics Teaching, 8.8% from the program in Computer And Instructional Technologies, 6.8% from the program in Education of the Hearing-Impaired, 13.1% were from the program in Education of the Mentally Disabled, 24.3% were from the program in English Language Teaching, 10% were from the program in German Language Teaching and 11% were from

the program in French Language Teaching. With respect to their class levels, 23.9% of the students were first-grade students, 25.9% were second-grade, 23.1% were third-grade and 27.1% were senior students. According to their average academic achievement, 21.9% of the students were at ‘medium’ level, 37.1% were at ‘good’ level, and 17.9% were at ‘very good’ level. On the other hand, 23.1% of the students did not respond to the question of academic average.

Table 1: Personal Characteristics of Pre-Service Teachers

Characteristic	(F)	(%)
Gender		
Female	178	70.9
Male	73	29.1
Program		
Pre-School Education Program	25	10.0
Primary School Education	39	15.5
Social Studies Education	14	5.6
Primary School Mathematics Teaching	20	8.0
Computer And Instructional Technologies	22	8.8
Education Of The Hearing Impaired	17	6.8
Education Of The Mentally Disabled	33	13.1
English Language Teaching	61	24.3
German Language Teaching	10	4.0
French Language Teaching	10	4.0
Class Level		
First Grade	60	23.9
Second Grade	65	25.9
Third Grade	58	23.1
Fourt Grade	68	27.1
Academic Achievement Means		
Medium Level	55	21.9
Good Level	93	37.1
Very Good Level	45	17.9
Not Respond Question	58	23.1
Total	251	100.0

Data Collection

The data for the research were collected with a data-collection tool that included three parts as “Personal Information”, “Learning Styles Inventory” and “Critical Thinking Dispositions Scale.” In the first part of the tool, “Personal Information”, there were questions

directed to know about the pre-service teachers and to obtain information that could be associated with the learning styles and critical thinking dispositions (gender, program, class, the level of academic achievement). The second part of the tool, “Learning Styles Inventory”, was developed by Kolb (1985) and translated into Turkish by Aşkar and Akkoyunlu (1993). It is a 12-item inventory whose validity and reliability were tested. The inventory includes twelve cases each of which had four choices. For each of the cases in the inventory, there is a rating scale of four choices as to be “most appropriate 4, the second appropriate 3, the third appropriate 2 and the least appropriate 1.” The reliability coefficients of the sub-scales of the “Learning Style Inventory” were found to be .58 for the concrete experience scale, .70 for the intellectual observation scale, .71 for the abstract conceptualization scale, .65 for the effective experience scale, .77 for the abstract-concrete scale and .76 for the effective-intellectual scale. In the last part of the data collection tool was the translated version (Kökdemir, 2003) of “California Critical Thinking Disposition Scale” which was prepared by American Philosophical Association (1990) and which originally consisted of 76 questions and seven sub-scales. The translated version, after its validity and reliability were tested, consisted of six sub-scales and a total of 51 items. The sub-scales of the inventory were the 10-item sub-scale of analyticity, the 12-item sub-scale of open-mindedness, the 9-item sub-scale of inquisitiveness, the 7-item sub-scale of self-confidence, and the 7-item sub-scale of truth-seeking and the 6-item sub-scale of systematicity. The scale was rated as “strongly agree (6)”, “agree (5)”, “slightly agree (4)”, “slightly disagree (3)”, “disagree (2)” and “strongly disagree (1).” The reliability coefficients of California Critical Thinking Dispositions Scale were .75 for the sub-scale of analyticity, .75 for open-mindedness, .78 for inquisitiveness, .77 for self-confidence, .61 truth-seeking and .63 for the sub-scale of systematicity.

Analysis of the Data

In order to reveal the learning styles and critical thinking dispositions of the students, “number and percentage” were used; for quantitative comparisons to determine whether the learning styles of students vary with respect to their certain characteristics, “chi-square (χ^2) test” was applied; and “t-test” was run for pared-group comparisons and “one-way ANOVA”

for multiple-group comparisons so as to find out if their critical thinking dispositions vary according to their certain characteristics. For the purpose of revealing the source of the difference in the comparisons, “Tukey HSD test” was applied. The level of significance was taken as .05 for the statistical analyses in the study.

FINDINGS AND INTERPRETATIONS

1. The Learning Styles of Pre- Service Teachers: The first question to be answered in this study was what the learning styles of were. The findings obtained are shown in Table-2.

Table 2: Distribution the Learning Styles Possess of Students

Styles	(F)	(%)
Accommodator	33	13.1
Diverger	31	12.4
Converger	75	29.9
Assimilator	112	44.6
Total	251	100.0

As can be seen in Table-2, the learning styles of the pre-service teachers have a very different distribution. According to this, the largest student group has the learning style of assimilator, followed in the second place by converger, accommodator and lastly the learning style of diverger. This result shows that a great number of the pre-service teachers have assimilator and converger learning styles; few have accommodator and diverger learning styles. According to this, In Kolb’s learning circle, prefer mostly the learning modes of abstract conceptualization and intellectual observation. Fewer pre-service teachers prefer the learning modes of concrete experience and active experimentation. These findings are mostly consistent with other research findings. The study carried out by Çağiltay and Tokdemir (2004) found out that 47% of the students of engineering had the assimilator learning style, 32% converger, 15% diverger and 6% had the accommodator learning style. In another study carried out by Güven (2004) on middle education students, it was revealed that 46.0% of the students had the assimilator learning style, 27.1% diverger, 16.8% converger and only 9.5% had the accommodator learning style. Kılıç (2002) found out that the largest part of the

university level students (43.2%) had the assimilator learning style and the smallest part (14.5%) had the accommodator learning style.

According to these findings, students at different levels in Turkey can be said to have mostly the assimilator learning style.

2. The Learning Styles of Pre-Service Teachers with Respect to Certain Variables:

The second question related to the research problem was whether the learning styles of the pre-service teacher vary with respect to such certain personal characteristics as their gender, the program they were attending, their class level and their level of academic achievement.

Gender and Learning Style

The results of the analysis of whether the learning styles of the pre-service teachers vary with respect to their gender are shown in Table-3.

Table 3: The Learning Styles Possess of Students to Gender (N=251)

Group	Accommodator		Diverger		Converger		Assimilator		Total	
	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)
Female	26	14.6	20	11.2	50	28.1	82	46.1	178	100.0
Male	7	9.6	11	15.6	25	34.2	30	41.1	73	100.0

$\chi^2 = 2.55$ S.d. = 3 p= 0.046

When the results in table-3 are examined, it is seen that the learning styles of males and females are different from each other. The chi-square test run on the learning styles of males and females revealed a chi-square value of 2.55 and $p < .05$. There are also other similar research findings both in foreign countries and in Turkey. Studies carried out by Wynd and Bozman (1996), Baran (2000) and Ergür (1998) on university level students and the one carried out by Güven (2004) on middle education students revealed that the learning styles of students vary with respect to their gender. Depending on this, it can also be said that students' dispositions or preferences about learning vary with respect to their gender. As a consequence, it can be said that there are significant differences between the learning styles of students in terms of their gender.

The Program and Learning Style

The results of the analysis of whether the learning styles of the pre-service teachers vary with respect to the current program they were attending are presented in Table-4.

Table 4: The Learning Styles Possess of Students to the Attend Program (N=251)

Group	Accommodator		Diverger		Converger		Assimilator		Total	
	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)
Pre-School Education	9	36	3	12	4	16	9	36	25	100.0
Primary School Education	2	5.1	7	17.9	13	33.3	17	43.6	39	100.0
Social Studies Education	2	14.3	2	14.3	5	35.7	5	35.7	14	100.0
Primary School Math. T.	1	5.0	1	5.0	7	35.0	11	55.0	20	100.0
Comp. And Inst. Technolog.	6	27.3	0	0	9	40.9	7	31.8	22	100.0
Educ. of The Hearing Impaired	1	5.9	3	17.6	5	29.4	8	47.1	17	100.0
Educ. of The Mentally Disabled	1	3.0	4	12.1	6	18.2	22	66.7	33	100.0
English Language Teaching	11	18.0	8	13.1	16	26.2	26	42.6	61	100.0
German Language Teaching	0	0	1	10.0	4	40.0	5	50.0	10	100.0
French Language Teaching	0	0	2	20.0	6	60.0	2	20.0	10	100.0
$\chi^2 = 43.972$ S.d. = 27 p= 0.021										

When the results in Table-4 are examined, it is seen that the learning styles of students attending different programs are vary depending on the program. The chi-square (χ^2) test applied to determine if the differences between the learning styles of the students of different teacher-training programs are statistically significant revealed a chi-square value of 43.972' and $p < .05$. According to this, it can be said that the learning styles of the teacher candidates vary depending on the program they are attending. These findings are similar to those of the studies carried out by Matthews (1994) and Baran (2000) on university level students and also to those of the one carried out by Güven (2004) on middle education students. In these studies, it was found out that the learning styles of students varied depending on the departments they were attending in the university and in the high school. These results suggest that students attending different programs have different learning styles. In other words, it can be said that the dispositions or preferences of students about learning have a significant effect on the program they attend.

Class Level and Learning Style

The results of the analysis of whether the learning styles of the pre-service teachers vary with respect to their class levels are shown in Table-5.

Table 5: The Learning Styles Possess of Students to the Class Level (N=251)

Group	Accommodator		Diverger		Converger		Assimilator		Total	
	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)
First Grade	7	11.7	10	16.7	11	18.3	32	53.3	60	100.0
Second Grade	8	12.3	5	7.7	18	27.7	34	52.3	65	100.0
Third Grade	12	20.7	6	10.3	22	37.9	18	31.0	58	100.0
Fourt Grade	6	8.8	10	14.7	24	35.3	28	41.2	68	100.0
$\chi^2 = 15.301$		S.d. = 9		p= 0.0						

When the results in Table-5 are examined, it is seen that the learning styles of the first, second, third and forth grade the pre-service teachers are different for each class level. The chi-square (χ^2) test applied to determine if the differences between the learning styles of the students from different grade classes are statistically significant revealed a chi-square value of 15.301 and $p < .05$. In a study carried out by Matthews (1996), significant differences were found between the learning styles of high school students and their class levels. In another study carried out by Mahiroğlu in 1999 on the students of Technical Education Faculty, it was also found out that their learning styles differed with respect to their class levels. To conclude, it can also be said that the dispositions or preferences of the pre- service teachers about learning vary depending on their class levels.

Academic Achievement Means and Learning Style

The results of the analysis of whether the learning styles of the pre- service teachers vary with respect to their academic achievement average are shown in Table-6.

Table 6: The Learning Styles Possess of Students to Academic Achievement Means (N=193)

Group	Accommodator		Diverger		Converger		Assimilator		Total	
	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)	(F)	(%)
Medium Level	4	7.3	6	10.9	15	27.5	30	54.5	55	100.0
Good Level	12	12.9	13	14.0	31	33.3	37	39.8	93	100.0
Very Good Level	10	22.2	3	6.7	17	38.8	15	33.3	45	100.0

$$x^2 = 12.975 \quad \text{S.d.} = 9 \quad p = 0.016$$

When the results in Table-6 are examined, it is seen that the learning styles of the pre-service teachers are different in terms of their academic achievement average. The chi-square (x^2) test applied to determine if the differences between the learning styles of the students who had average, good and very good achievement mean averages are statistically significant revealed a chi-square value of 12.975 and $p < .05$. There are some other research findings similar to these results. In a study carried out by Morgil et al. (2004), it was found that a learning style had significant effects on the academic achievement of students. In another study carried out by Güven (2004), it was also revealed that the learning styles of students varied depending on their academic achievement levels. In the light of these results, it can be said that the dispositions or preferences of students about learning have a significant effect on their academic achievement averages.

3. Critical Thinking Dispositions of the Pre- Service Teachers: The third question in this study was at what level the critical thinking dispositions of the pre- service teachers were. Certain scores were determined for each sub-scale for the calculation of the scores of "California Critical Thinking Dispositions Scale." According to this, it was thought that those whose score for each of the sub-scales was lower than 40 had low critical thinking dispositions and those with a score above 50 had a high power of critical thinking. Furthermore, those student teachers whose total score of California Critical Thinking Dispositions Scale was lower than 240 (40x6) had low general critical thinking dispositions and those with a total score of 300 (50x6) had high dispositions (Kökdemir, 2003). However, there was no explanation about the scores (41-49) lower than 40 and higher than 50. Depending on these, the critical thinking disposition levels of the pre- service teachers were

identified for each sub-scale and expressed with numbers and percentages according to their total scores of these sub-scales. The results of the analysis are shown in Table-7.

Table 7: The Critical Thinking Dispositions on Possess Level of Students (N=251)

Scale	Score	(F)	(%)
Analyticity	Lower than 40	0	0
	Between score 41 by 49	10	4
	Higher than 50	241	96
Open-Mindedness	Lower than 40	218	86.9
	Between score 41 by 49	29	11.5
	Higher than 50	4	1.6
Inquisitiveness	Lower than 40	89	35.5
	Between score 41 by 49	144	57.3
	Higher than 50	18	7.2
Self-confidence	Lower than 40	251	100.0
	Between score 41 by 49	0	0
	Higher than 50	0	0
Truth-seeking	Lower than 40	251	100.0
	Between score 41 by 49	0	0
	Higher than 50	0	0
Systematicity	Lower than 40	251	100.0
	Between score 41 by 49	0	0
	Higher than 50	0	0
Total	Lower than 240	246	98.0
	Between score 241 by 299	5	2.0
	Higher than 300	0	0

When the results in Table-7 are examined, it can be said that a very big part of the the pre- service teachers (96%) had high level of analyticity dispositions, most (86.9%) had low level of open-mindedness dispositions and that more than half (57.3%) had neither low nor high level if inquisitiveness dispositions. Moreover, is seen that all the pre- service teachers had low level of dispositions of self-confidence, truth- seeking and systemacity. On the other hand, it can be stated that a very big part of the pre- service teachers (98%) had low level of general critical thinking dispositions.

There are several research findings that either support or differ from the findings of the present study. In a study carried out by Hamurcu et al. in 2005, the critical thinking dispositions of the pre- service teachers attending the programs in science education and primary school education were found to be generally strong or positive. In another study

carried out by Kürüm in 2002 on the pre- service teachers, the critical thinking skills of the student teachers were found to be at a medium level. These findings are different from the findings of the present study.

Consequently, it is obvious that among the critical thinking dispositions of the pre-service teachers, only their analyticity dispositions were at a high level; their inquisitiveness dispositions were between the low and high levels; and their dispositions of open-mindedness, self-confidence, truth-seeking and of systematicity were at a low level. When considered as a whole, it was concluded that the critical thinking dispositions of the pre-service teachers were low.

4. Critical Thinking Dispositions of the Pre- Service Teachers with Respect to Certain Variables: The fourth question related to the research problem was whether the critical thinking dispositions of the pre- service teachers vary with respect to such certain personal characteristics as their gender, the program they attend, class levels and their level of academic achievement.

Gender and Critical Thinking Disposition

The results of the analysis of the mean scores for each sub-scale and of the mean scores for the total of all the sub-scales in the California Critical Thinking Dispositions Scale regarding gender are shown in Table-8.

Table 8: The Critical Thinking Dispositions Between of Differents of Gender on Students (N=251)

Scale	Gender	(N)	(\bar{X})	(S.D.)	(t)	(d.f.)	(Sig.)
Analyticity	Female	178	58.20	4.72	0.07	249	p>0.05
	Male	73	58.24	4.49			
Open-Mindedness	Female	178	31.98	6.70	0.63	249	p>0.05
	Male	73	32.60	7.87			
Inquisitiveness	Female	178	41.41	5.88	1.30	249	p>0.05
	Male	73	42.47	8.90			
Self-confidence	Female	178	25.02	4.72	0.20	249	p>0.05
	Male	73	25.16	4.83			
Truth Seeking	Female	178	22.63	4.94	2.50	249	p<0.05
	Male	73	24.42	5.61			
Systematicity	Female	178	21.00	3.57	0.19	249	p>0.05
	Male	73	21.09	3.42			
Total	Female	178	200.25	15.96	1.62	249	p>0.05
	Male	73	204.01	18.16			

When the results in Table-8 are examined, it is seen that male and female students had different mean scores for some of the sub-scales related to critical thinking dispositions and different scores for the total of these sub-scales and that they had quite similar mean scores for some other sub-scales. According to this, there are significant differences between the mean scores of male and female students regarding the sub-scale of truth-seeking. On the other hand, it is seen that there is not any significant difference between the mean scores of male and female students in terms of the sub-scales of analyticity, open-mindedness, inquisitiveness, self-confidence and systematicity and between the mean scores for the total of these sub-scales. These findings are similar to some other research findings. Hamurcu et al. (2005) found that some of the critical thinking dispositions of students differed with respect to their gender. Bökeoğlu and Yılmaz (2005), in their study, revealed that some of the critical thinking dispositions of students had an effect on gender. Kökdemir (2003) found out

significant differences between the critical thinking dispositions of students in terms of their gender. This finding is different from that of the present research to some extent. In the light of these results, it can be said that the critical thinking dispositions of teacher candidates partly differ from each other regarding their gender.

Consequently, it can be stated that male students' dispositions of truth-seeking are higher than those of the girls and that both male and female students have similar levels of dispositions of analyticity, open-mindedness, inquisitiveness, self-confidence and systematicity.

Program and Critical Thinking Disposition

The results of the analysis of the mean scores for each sub-scale and of the mean scores for the total of all the sub-scales in the California Critical Thinking Dispositions Scale regarding the program they attend are shown in Table-9.

Table 9: The Critical Thinking Dispositions of Students to the Attend Program (N=251)

Scale	Attend Program	(N)	(\bar{X})	(S.D.)
Analyticity	Pre-School Education Program	25	59.00	4.19
	Primary School Education	39	59.46	5.06
	Social Studies Education	14	56.85	5.78
	Primary School Mathematics T.	20	56.85	4.47
	Comp. And Inst. Technologies	22	57.40	4.74
	Educ. of The Hearing Impaired	17	59.64	3.31
	Educ. of The Mentally Disabled	33	58.09	3.60
	English Language Teaching	61	57.39	4.16
	German Language Teaching	10	61.30	4.94
	French Language Teaching	10	57.70	4.13
Open-Mindedness	Pre-School Education Program	25	33.16	7.08
	Primary School Education	39	31.41	5.50
	Social Studies Education	14	29.85	6.11
	Primary School Mathematics T.	20	32.00	5.84
	Comp. And Inst. Technologies	22	34.22	5.27
	Educ. of The Hearing Impaired	17	33.41	6.06
	Educ. of The Mentally Disabled	33	29.51	7.58
	English Language Teaching	61	32.22	7.90
	German Language Teaching	10	37.80	10.51
	French Language Teaching	10	32.20	6.7
Inquisitiveness	Pre-School Education Program	25	42.20	5.53
	Primary School Education	39	42.56	5.11
	Social Studies Education	14	41.85	7.47
	Primary School Mathematics T.	20	40.25	5.63
	Comp. And Inst. Technologies	22	41.81	4.77
	Educ. of The Hearing Impaired	17	41.82	5.45
	Educ. of The Mentally Disabled	33	41.63	5.63
	English Language Teaching	61	40.73	6.48
	German Language Teaching	10	47.70	5.20
	French Language Teaching	10	39.90	6.35

Self-confidence	Pre-School Education Program	25	25.68	4.19
	Primary School Education	39	26.30	4.49
	Social Studies Education	14	24.57	4.43
	Primary School Mathematics T.	20	24.40	3.40
	Comp. And Inst. Technologies	22	26.04	4.31
	Educ. of The Hearing Impaired	17	25.94	4.45
	Educ. of The Mentally Disabled	33	24.96	5.08
	English Language Teaching	61	23.22	5.23
	German Language Teaching	10	29.20	3.29
	French Language Teaching	10	24.50	4.69
Truth-seeking	Pre-School Education Program	25	22.08	4.08
	Primary School Education	39	24.71	4.62
	Social Studies Education	14	23.85	5.05
	Primary School Mathematics T.	20	22.70	4.94
	Comp. And Inst. Technologies	22	25.31	4.77
	Educ. of The Hearing Impaired	17	23.00	3.95
	Educ. of The Mentally Disabled	33	20.84	5.85
	English Language Teaching	61	22.67	5.62
	German Language Teaching	10	26.00	4.96
	French Language Teaching	10	22.90	5.72
Systematicity	Pre-School Education Program	25	21.00	4.27
	Primary School Education	39	21.15	3.44
	Social Studies Education	14	20.07	3.60
	Primary School Mathematics T.	20	22.20	3.53
	Comp. And Inst. Technologies	22	21.90	3.58
	Educ. of The Hearing Impaired	17	22.29	3.63
	Educ. of The Mentally Disabled	33	20.36	3.71
	English Language Teaching	61	20.83	3.22
	German Language Teaching	10	19.70	2.86
	French Language Teaching	10	20.20	2.57
Total	Pre-School Education Program	25	203.12	12.72
	Primary School Education	39	205.61	18.28
	Social Studies Education	14	197.07	13.68
	Primary School Mathematics T.	20	198.40	15.43
	Comp. And Inst. Technologies	22	206.72	16.37
	Educ. of The Hearing Impaired	17	206.11	14.66
	Educ. of The Mentally Disabled	33	195.42	12.14
	English Language Teaching	61	197.09	17.17
	German Language Teaching	10	221.70	22.64
	French Language Teaching	10	197.40	11.24

According to the results in Table-9, there is difference between the pre-service teachers mean scores of critical thinking dispositions in terms of the program they attend. In order to determine whether the differences between the pre- service teachers mean scores of the sub-scales of critical thinking dispositions are statistically significant with respect to the program they attend, analysis of variance between groups was applied. The results of the analysis are shown in Table-10.

As can be seen in Table-10, as a result of the analysis of variance of the mean scores for the sub-scales and of the mean scores for the total of these sub-scales, F values of the pre- service teachers attending different programs for the sub-scales of self-confidence and truth-seeking and for the total of

these sub-scales (2.584, 2.184 and 3.875 in turn) were found to be higher at the significance level of .05 than the values of F table. These values indicate that there are significant differences between the mean scores that describe the dispositions of self-confidence and truth-seeking as well as the total of the sub-scales. On the other hand, the analysis of variance revealed that F values for the sub-scales of analyticity, open-mindedness, inquisitiveness and systematicity (1.861, 1.819, 1.729 and 1.139 in turn) were lower at the significance level of .05 than the values of F table. This finding shows that regarding the program the pre- service teachers attend, there is not any significant difference between the mean scores that describe their dispositions of analyticity, open-mindedness, inquisitiveness and systematicity.

Table 10: The Critical Thinking Dispositions Between of Differents of the Attend Program on Students (N=251)

Scale	Source of Variance	(S.S.)	(d.f.)	(M.S)	(F)	(Sig.)
Analyticity	Between Groups	327.741	9	36.416	1.861	P>0.05
	Within Groups	4716.642	241	19.571		
	Total	5044.383	250			
Open Mindedness	Between Groups	791.582	9	87.954	1.819	P>0.05
	Within Groups	11652.721	241	48.352		
	Total	12444.303	250			
Inquisitiveness	Between Groups	527.241	9	58.582	1.729	P>0.05
	Within Groups	8165.237	241	33.881		
	Total	8692.478	250			
Self Confidence	Between Groups	496.120	9	55.124	2.584	P<0.05
	Within Groups	5141.729	241	21.335		
	Total	5637.849	250			
Truth Seeking	Between Groups	509.931	9	56.659	2.184	P<0.05
	Within Groups	6253.009	241	25.946		
	Total	6762.940	250			
Systematicity	Between Groups	126.555	9	14.062	1.139	P>0.05
	Within Groups	2976.250	241	12.350		
	Total	3102.805	250			
Total	Between Groups	8799.449	9	977.717	3.875	P<0.05
	Within Groups	60805.698	241	252.306		
	Total	69605.147	250			

In order to determine the source of the significant difference between the pre- service teachers mean scores that describe the dispositions of self-confidence and truth- seeking as well as the total of the sub-scales, Tukey HSD test was applied. As a result, the difference between the mean scores of the sub-scale of self-confidence was found to be between the mean scores of the students attending the program in primary school education and the mean scores of the students attending English language teaching and between the mean scores of the students attending English language teaching and the mean scores of the students attending German language teaching. This difference is an advantage for the students attending primary school education and for those attending German language teaching. Consequently, it can be said that the self-confidence dispositions of the students attending primary school education and those of the students attending German language teaching are higher than the self-confidence dispositions of the students attending English language teaching. The difference between the mean scores of the sub-scale of truth-seeking is found to be between the mean scores of the students attending primary school education and the mean scores of the students attending the program in education of the mentally disabled and between the mean scores of the students attending computer and instructional technologies and the mean scores of the students attending the program in education of the mentally disabled. This difference is an advantage for the students attending primary school education and for those attending computer and instructional technologies. According to this, the truth-seeking dispositions of the students attending primary school education and of those attending computer and instructional technologies are at a higher level than those of the students attending the program in education of the mentally disabled. On the other hand, the difference between the mean scores of the total of the sub-scales was observed to be between the mean scores of the students attending social studies education, primary school mathematics teaching, program in education of the mentally disabled, English language teaching and French language teaching and the mean scores of the students attending German language teaching. This difference is an advantage to the students of the program in German language teaching. Depending on this finding, the critical thinking dispositions of the students

attending German language teaching can be said to be higher than those of the students attending social studies education, primary school mathematics teaching, program in education of the mentally disabled, English language teaching and French language teaching.

There are other research findings that support the findings of this study. Hamurcu et al. (2005) found out that certain critical thinking dispositions vary with respect to the programs students attend. Furthermore, Kürüm (2002) determined that the critical thinking dispositions of the pre- service teachers vary in terms of the program they attend. However, the critical thinking dispositions of the students attending German language teaching were found to be low. In the present study, it is concluded that the critical thinking dispositions of the students attending German language teaching are higher. According to this, this finding can be said to differ from the research finding.

Consequently, it can be said that the critical thinking dispositions of the pre- service teachers vary with respect to the programs they attend; in other words, it can be stated that there is a significant relationship between the program students attend and their critical thinking dispositions.

Class Level and Critical Thinking Disposition

The fourth question of the study investigated whether the critical thinking dispositions of the pre- service teachers varied with respect to their class levels. According to this, the mean scores of the university students for each sub-scale of California Critical Thinking Dispositions Scale and for the total of the sub-scales were analyzed with respect to the variable of class level. The results of the analysis are shown in Table-11.

Table 11: The Critical Thinking Dispositions of Students to the Class Level (N=251)

Scale	Class	(N)	(\bar{x})	(S.d.)
Analyticity	First Grade	60	59.20	4.74
	Second Grade	65	57.06	4.23
	Third Grade	58	58.06	4.31
	Fourth Grade	68	58.57	4.49
Open - Mindedness	First Grade	60	31.81	6.85
	Second Grade	65	31.10	5.92
	Third Grade	58	32.00	5.94
	Fourth Grade	68	33.61	8.79
Inquisitiveness	First Grade	60	42.78	5.54
	Second Grade	65	39.93	6.59
	Third Grade	58	41.37	5.76
	Fourth Grade	68	42.77	5.25
Self-Confidence	First Grade	60	26.08	4.39
	Second Grade	65	24.36	4.54
	Third Grade	58	24.24	5.30
	Fourth Grade	68	25.54	4.60
Truth-Seeking	First Grade	60	23.21	5.51
	Second Grade	65	23.89	4.54
	Third Grade	58	21.29	5.24
	Fourth Grade	68	23.98	5.18
Systematicity	First Grade	60	21.51	3.79
	Second Grade	65	20.63	3.31
	Third Grade	58	20.53	3.26
	Fourth Grade	68	21.39	3.64
Total	First Grade	60	204.61	18.44
	Second Grade	65	197.00	13.91
	Third Grade	58	197.51	15.02
	Fourth Grade	68	205.89	17.34

When the results in Table-11 are examined, it is seen that the pre-service teachers had different mean scores for each of the sub-scales of critical thinking dispositions and for the total of these sub-scales in terms of their class levels. The first-grade students had the highest mean scores for four of the sub-scales, and the fourth-grade students had the highest mean scores for two sub-scales and for the total of the sub-scales. The first-grade students had their highest mean scores in the sub-scales of analyticity, inquisitiveness, self-confidence and systematicity. The fourth-grade students had the highest mean scores for the sub-scales of open-mindedness and truth-seeking and for the total of the sub-scales. The students in the first and fourth grades had mean scores between the levels of low and high for the other sub-scales. On the other hand, the second and third grade students did not have any highest mean scores for any of the sub-scales. The second-grade students had the lowest mean

scores for three sub-scales and for the total of the sub-scales, and the third-grade students had the lowest mean scores for three of the sub-scales. The second-grade students had the lowest scores for the sub-scales of analyticity, open-mindedness and inquisitiveness and for the total of the sub-scales, and the third-grade students had the lowest mean scores for the the sub-scales of self-confidence, truth-seeking and systematicity. Furthermore, for the other sub-scales, the second and third grade students had mean scores mostly close to the low mean scores. In order to determine whether the differences between the mean scores of the pre- service teachers for the sub-scales of critical thinking dispositions are statistically significant in terms of their class levels, analysis of variance between groups was run. The results of the analysis are shown in Table-12.

Table 12: The Critical Thinking Dispositions Between of Differents of the Class Level on Students (N=251)

Scale	Source of Variance	(S.S.)	(d.f.)	(M.S)	(F)	(Sig.)
Analyticity	Between Groups	154.672	3	51.557	2.604	P>0.05
	Within Groups	4889.710	247	19.796		
	Total	5044.382	250			
Open-Mindedness	Between Groups	225.014	3	75.005	1.516	P>0.05
	Within Groups	12219.288	247	49.471		
	Total	12444.303	250			
Inquisitiveness	Between Groups	357.195	3	119.065	3.528	P<0.05
	Within Groups	8335.284	247	33.746		
	Total	8692.478	250			
Self Confidence	Between Groups	148.638	3	49.546	2.229	P>0.05
	Within Groups	5489.210	247	22.224		
	Total	5637.849	250			
Truth Seeking	Between Groups	283.508	3	94.503	3.603	P<0.05
	Within Groups	6479.432	247	26.233		
	Total	6762.940	250			
Systematicity	Between Groups	47.973	3	15.991	1.293	P>0.05
	Within Groups	3054.832	247	12.368		
	Total	3102.805	250			
Total	Between Groups	4128.202	3	1376.067	5.191	P<0.05
	Within Groups	65476.946	247	265.089		
	Total	69605.147	250			

As can be seen in Table-12, as a result of the analysis of variance of the mean scores for the sub-scales and of the mean scores for the total of these sub-scales, F values of the pre-service teachers for the sub-scales of inquisitiveness and truth-seeking and for the total of these sub-scales (3.528, 3.603 and 5.191 in turn) were found to be higher at the significance level of .05 than the values of F table. These values indicate that there are significant differences between the mean scores that describe the dispositions of inquisitiveness and truth-seeking as well as the total of the sub-scales. On the other hand, the analysis of variance revealed that F values for the sub-scales of analyticity, open-mindedness, self-confidence and systematicity (2.604, 1.516, 2.229 and 1.293 in turn) were lower at the significance level of .05 than the values of F table. This finding shows that regarding the pre-service teachers' class levels, there is not any significant difference between the mean scores that describe their dispositions of analyticity, open-mindedness, self-confidence and systematicity.

In order to determine the source of the significant difference between the pre-service teachers mean scores that describe the dispositions of inquisitiveness and truth-seeking as well as the total of the sub-scales, Tukey HSD test was applied. As a result, the difference between the mean scores of the sub-scale of inquisitiveness was found to be between the mean scores of the first-grade students and the mean scores of the second-grade students and between the mean scores of the second-grade students and the mean scores of the fourth-grade students. This difference is in favour of the first and fourth grade students. As a result, it can be inferred that the inquisitiveness dispositions of the first and fourth grade students are higher than the second-grade students' inquisitiveness dispositions.

It is determined that the difference in the mean scores of the sub-scale of truth-seeking is between the mean scores of the second-grade students and mean scores of the third-grade students. Moreover there is also difference between mean scores of the third-grade students and the mean scores of the fourth-grade students. This difference is in favour of the second and fourth grade students. Depending on this finding, it is clear that the truth-seeking dispositions of the second and fourth grade students are higher than those of the third-grade students.

On the other hand, the difference in total scores of the sub-scales is between the mean scores of the first-grade students and the mean scores of the second-grade students and also between the mean scores of the second and third grade students and the mean scores of the fourth-grade students. This difference is favour of the first and fourth grade students. Based on this finding, the critical thinking dispositions of the first and fourth grade students are higher than those of the second and third grade students.

There are other research findings that support the findings of this study. Hamurcu et al. (2005) found out that certain critical thinking dispositions of students vary with respect to their class levels. Furthermore, Kürüm (2002) found difference in only one of the critical thinking skills of students in terms of their class levels. This finding is partly similar to the research finding.

Consequently, it can be said that the critical thinking dispositions of teacher candidates vary with respect to their class levels; in other words, it can be stated that there is a significant relationship between students' class levels and their critical thinking dispositions.

Academic Achievement Means and Critical Thinking Dispositions

Lastly, the fourth question of the study investigated whether the critical thinking dispositions of the pre- service teachers varied with respect to the academic achievement means. According to this, the mean scores of each sub-scale of California Critical Thinking Dispositions Scale and the mean scores of the total of the sub-scales were analyzed in terms of academic achievement means. The results of the analysis are shown in Table-13.

Table 13: The Critical Thinking Dispositions of Students to the Academic Achievement Means (N=193)

Scale	Academic Achievement	(N)	(\bar{x})	(S.d.)
Analycity	Medium Level	55	58.01	4.91
	Good Level	93	57.44	3.88
	Very Good Level	45	58.37	5.01
Open Mindedness	Medium Level	55	32.92	7.77
	Good Level	93	32.27	6.56
	Very Good Level	45	31.11	7.56
Inquisitiveness	Medium Level	55	41.07	5.83
	Good Level	93	40.62	6.43
	Very Good Level	45	42.97	5.52
Self Confidence	Medium Level	55	24.05	5.00
	Good Level	93	24.63	4.58
	Very Good Level	45	25.71	5.00
Truth Seeking	Medium Level	55	24.38	4.43
	Good Level	93	22.51	5.08
	Very Good Level	45	23.35	5.88
Systematicity	Medium Level	55	21.23	3.13
	Good Level	93	20.43	3.73
	Very Good Level	45	21.24	3.10
Total	Medium Level	55	201.69	18.17
	Good Level	93	197.92	14.91
	Very Good Level	45	202.77	15.37

When the results in Table-13 are examined, it is seen that the pre- service teachers had different mean scores for the sub-scales of critical thinking dispositions and for the total of the sub-scales in terms of academic achievement means. According to this, students with very good achievement means had their highest mean scores for the sub-scales of analyticity, inquisitiveness, self-confidence and systematicity. On the other hand, these students had the lowest mean scores for the sub-scale of open-mindedness. Students with average achievement means had the highest mean scores for the two of the sub-scales. Open-mindedness and truth-seeking were the two sub-scales for which the students with average achievement means had the highest mean scores. These students had the lowest mean scores for only the sub-scale of

self-confidence. Students with good achievement means did not have any highest mean scores in any of the sub-scales. These students had the lowest mean scores for five of the sub-scales. The students with good achievement means had their lowest mean scores for the sub-scales of analyticity, inquisitiveness, truth- seeking and systematicity and for the total of the sub-scales.

In order to determine whether the differences between the mean scores of the pre-service teachers for the sub-scales of critical thinking dispositions was statistically significant in terms of their academic achievement means, analysis of variance between groups was applied. The results of the analysis are shown in Table-14.

Table 14: The Critical Thinking Dispositions Between of Differents of the Academic Achievement Means on Students (N=193)

Scale	Source of Variance	(S.S.)	(d.f.)	(M.S)	(F)	(Sig.)
Analyticity	Between Groups	157.415	2	52.472	2.652	P<0.05
	Within Groups	4886.967	190	19.785		
	Total	5044.382	192			
Open Mindedness	Between Groups	83.694	2	27.898	.557	P>0.05
	Within Groups	12360.609	190	50.043		
	Total	12444.303	192			
Inquisitiveness	Between Groups	319.808	2	106.603	3.145	P<0.05
	Within Groups	8372.670	190	33.897		
	Total	8692.478	192			
Self Confidence	Between Groups	170.112	2	56.704	2.562	P>0.05
	Within Groups	5467.737	190	22.137		
	Total	5637.849	192			
Truth Seeking	Between Groups	127.525	2	42.508	1.582	P>0.05
	Within Groups	6635.415	190	26.864		
	Total	6762.940	192			
Systematicity	Between Groups	58.116	2	19.372	1.572	P>0.05
	Within Groups	3044.689	190	12.327		
	Total	3102.805	192			
Total	Between Groups	2147.082	2	715.694	2.621	P>0.05
	Within Groups	67458.065	190	273.110		
	Total			69605.147		192

As can be seen in Table-14, as a result of the analysis of variance of the mean scores for the sub-scales and of the mean scores for the total of these sub-scales, F values of the pre-service teachers for the sub-scales of analyticity and inquisitiveness (2.652 and 3.145 in turn) were found to be higher at the significance level of .05 than the values of F table. These values indicate that in terms of their academic achievement means, there are significant differences between the mean scores that describe the pre- service teacher's dispositions of analyticity and inquisitiveness. On the other hand, the analysis of variance revealed that F values for the sub-scales of open-mindedness, self-confidence, truth- seeking and systematicity and for the total of the sub-scales (.557, 2.562, 1.582, 1.572 and 2.621 in turn) were lower at the significance level of .05 than the values of F table. This finding shows that regarding the academic achievement means of the pre- service teachers, there is not any significant difference between the mean scores that describe their dispositions of open-mindedness, self-confidence, truth-seeking and systematicity and the total of these dispositions.

Tukey HSD test was applied to determine which between groups differences resulted in the significant difference between the pre-service teachers mean scores of dispositions of analyticity and inquisitiveness. Therefore, the difference between the mean scores of the sub-scale of analyticity is between the mean scores of the students with average achievement means and the mean scores of the students with good achievement means. This difference is in favour of the students with average achievement means. Consequently, it can be said that the analyticity dispositions of the students with average achievement means are higher than those of the students with good achievement means.

The difference between the mean scores for the sub-scale of inquisitiveness is between the mean scores of the students with average and very good achievement means and the mean scores of the students with good achievement means. This difference is in favour of the students with average and very good achievement means. Based on this finding, it can be said that the inquisitiveness dispositions of the students with average and very good

achievement means are higher than those of the students with good achievement means. Consequently, as seen, the critical thinking dispositions of the pre-service teachers vary with respect to their academic achievement means; in other words, it can be stated that there is a significant relationship between the students' academic achievement means and their critical thinking dispositions.

Conclusion and Suggestions

The following conclusions are drawn from this study that tried to investigate the learning styles and critical thinking dispositions of the pre-service teachers in terms of several variables:

- A big part of the students (%74.5) in the study have the assimilator and diverger learning styles, and their learning styles differ with respect to their gender, the program they attend, their class levels and their academic achievement means.

- In the study, the critical thinking dispositions of the pre- service teachers are low in general. However, when the sub-scales of critical thinking dispositions are considered, it is seen that the analyticity dispositions of the pre-service teachers are high, their inquisitiveness dispositions are between the low and high levels and that their other dispositions are at low levels. Besides this, it has been concluded that there is a significant relationship between the critical thinking dispositions of the pre-service teachers and their gender, the program they attend, their class levels and their academic achievement means.

Both learning styles and critical thinking dispositions have a very significant and effective place in the learning process of individuals. On the other hand it is necessary to determine the characteristics of individuals related to learning and to make thinking effective. Thus, this study should be replicated on students who are in different learning mediums as well as on those in the same learning environment. Moreover, in future studies, besides the inventory used in the present study to determine the learning styles and the scale used to identify the critical thinking dispositions, other tools developed, or to be developed, for the same purposes can be used. Furthermore, it will be acceptable to have courses related to

learning styles and critical thinking dispositions in teacher training programs. Also, the number of activities that will help to increase the critical thinking dispositions of the pre-service teachers should be increased. Such an implementation can increase the critical thinking dispositions level of teacher candidates. In addition, it should be illustrated in a separate course or practically taught to students in their programs how they will use their critical thinking dispositions with respect to their own learning styles. It is quite significant that the pre-service teachers primarily have the necessary information and skills so as to inform their future students about learning styles and to educate their future students as to be individuals who have critical thinking dispositions. This can be achieved with the support of related studies and research.

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