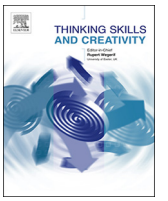
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Critical, Reflective, Creative Thinking and Their Reflections on Academic Achievement



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ABSTRACT

The present study was conducted with the aim of examining the structural relationship pattern among critical thinking, reflective thinking and creative thinking and their predictive power on academic achievement. To this end, a total of 227 students, 127 (56 %) male and 100 (44%) female, attending a state university preparatory classes in İstanbul, Turkey, formed the study group. "The Critical Thinking Scale", "The Reflective Thinking Scale" and "The Marmara Creative Thinking Dispositions Scale" were administered to the study group as data collection tools. To measure the academic achievement, the participants' overall average of grades, set by the institution, during the fall term of 2019-2020 academic year was taken as a basis. The collected data were analysed by applying SEM through AMOS 16 software program. The findings from the data revealed that critical thinking, reflective thinking and creative thinking correlated with each other in a positive and significant way and these variables all predicted academic achievement positively and significantly.

1. Introduction

Over the past decades, individuals have been confronted with the globalization along with the rapid dissemination of information which has left them to economic, social and technological changes to an extent that it has not ever been witnessed before (Anagün et al., 2016). The pervasive and formerly unaccustomed changes and developments triggered by the completely new phenomena have constantly been reversing the conventional paradigms in the natural flow of life (CCR, 2015). In face of such great changes and advances, especially in the digital era, individuals required to catch up with the latest innovations, are supposed to be good at selecting the appropriate information among the stacks as well as analysing, synthesizing and transferring it into new experiences (Anagün, et al., 2016). Easy access to information, which is totally independent from time and space, rapid exchange of information along with its multiple and diverse nature have also had individuals focus more on the process of self-development than ever before (Kozikoğlu & Altunova, 2018). Therefore, today's people are expected to acquire some certain skills to capture the spirit of time and in order not to fall behind the progress. Although there is no common consensus on these skills and their definitions, which are often referred to as 21 st century skills, they are often listed as self-efficacy, critical thinking, collaborative thinking, creative thinking, utilising or transferring knowledge in new situations (Ananiadou & Claro, 2009; ATCS21, 2015; CCR, 2015; Kozikoğlu & Altunova, 2018; Lamb et al., 2017; P21, 2011; Rotherham & Willingham, 2010; Wah Chu et al., 2017).

One of the principal thinking skills that is required to be taught at schools, in this century, is critical thinking along with creative and reflective thinking. In this sense, critical thinking is a kind of mental process where individuals purposefully act, the repetition of the usual patterns and stereotypes are prevented, prejudices, assumptions and all kinds of information presented are tested,

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evaluated, judged and the different aspects, expansions, meanings and results are discussed. It is a way of thinking in which logic, comparison and reasoning are used and as a result, certain ideas, theories or behaviours are reached (Gürkaynak et al., 2008). Although there are numerous attempts to define the term, the definition made by Facione (1990) is quite conclusive: "Critical thinking is purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (p. 3).

Upon reviewing the literature with regard to the definition, the term critical thinking revealed diverse illustrations. Halpern (1993), asserting that critical thinking and high order skills are used interchangeably, assesses it as a talent to synthesize and analyse information, extracting main ideas and drawing a conclusion as well as utilizing possibilities. Facione (1990), on the other hand, argues that critical thinking is a separate structure from the other thinking skills and asserts that not all cognitive skills should be interest of critical thinking except for interpretation, analysis, evaluation, inference, explanation and self-regulation.

It is observed that upon examining the studies which aimed to identify the relationship between critical thinking and academic achievement could reveal inconsistent results. Although several studies (D'Alessioa et al., 2019; Ghanizadeh, 2017; Grosser & Nel, 2013; Jacob, 2012; Kanbay et al. 2017; León et al., 2015; Siburian et al., 2019; Shirazi & Heidari, 2019; Vierra, 2014; Villavicencio, 2011) highlight positive relationships, while the others mark no significant association (Azar, 2010; Emir, 2009; Mahmoud, 2012; Mohammadi et al., 2016; Tafazzoli et al., 2015).

Another main thinking skill which is thought to be efficacious, together with critical thinking, on academic achievement is reflective thinking (Ghanizadeh, 2017). The term itself initially articulated by Dewey (1933) whose main interest, among others, was the mode of reflective thinking (Rodgers, 2002). The term, claimed to have a stimulating impact on critical thinking (Bell et al., 2011; Choy et al., 2019), connotes the learner's ability to reflect on their prior learning and experiences when confronting new ones (Choy, et al., 2019). In this sense, reflective thinking is related to endeavours to rationalize matters, trying to establish connections among ideas and choosing the most suitable strategy to apply. Further, it points out a kind of ability to respond to matters utilising prior knowledge and experiences, to make sensible decisions (Salido & Dasari, 2018). In this context, Knapp's (1992) attribution to the term as a way of casting back to one's experiences in the past and combine them to handle the future's events is rather explicit.

Though, on occasions, regarded as a part of critical thinking, reflective thinking principally stands apart from critical thinking in certain ways. Critical thinking is a purposeful and organized judgment that results in interpretation, analysis, evaluation and inference and it seeks for ascertaining the defects in an argument. In this aspect, critical thinking refers to some certain mental and intellectual skills such as reasoning, inference, correlation and analysis. On the other hand, reflective thinking highlights reviewing the past experiences, knowledge, perceptions, reasoning and comprehensions. In this regard, since it enables learners to determine facts, to find ways for solutions and identify formulas, reflective thinking is particularly practical to figure out complicated and sophisticated problems or tasks (Altın & Saracaloğlu, 2018; King & Kitchener, 1994; Knight, 2005; Liao & Wang, 2019).

Just as the studies examining the correlation between critical thinking and academic achievement at times display inconsistent findings, the results gained through studies which investigated the relationship between reflective thinking and academic achievement are sometimes found to be controversial, as well. While BuQhoos (2017), Cengiz, Karataş and Yadigaroğlu (2014), Deringöl (2019), Ghanizadeh (2017), Toisercani Ravari, Arabzadeh and Kadivar (2015) and Tok (2008) have found positive and significant link between reflective thinking and academic achievement, Asakereh and Yousofi (2018), Phan (2008) and Tican and Taşpınar (2015) have found that there is no significant correlation between the two variables.

While defining reflective thinking as an integrated thinking process, Chen and Seng (1992) assert that reflective thinking emerges from the interaction between critical and creative thinking in the context of integrated thought. Brookfield (1987), similarly, argues that creative thinking paves the way for the emergence of critical thinking. Within this scope, creativity, which is almost always considered as one of the crucial skills that the 21 st century requires (Ananiadou & Claro, 2009; Wah Chu et al., 2017), is identified as one of the forms of high thinking skills closely related to problem solving, critical thinking, reflective thinking (Facione, 1990). However, as Facione (1990) points out, the relationships among them should be scrutinized precisely. Defined as noteworthy changes and notable differences in the acts, practices, products and minds (Beghetto, 2016), creativity has been argued to have distinct features: "originality, newness, difference, or uniqueness and effectiveness, meaningfulness, or meeting task constraints" (Beghetto, 2019). In other words, as it is identified in the formula (C = O x TC), creativity is a multiplicative process of originality and task constraints (Gajda, 2017).

Gajda (2017) asserts that, since creativity is closely related to, among others, problem-solving, deductive and inductive thinking, it will be sensible to make it connected with academic success. There are studies which highlight the fact that there is a positive relationship between creative thinking and academic achievement (Gajda, 2016; Nami, Marsooili, & Ashouri, 2014; Pastor & David, 2017; Surapuramath, 2014). Some other studies, however, emphasize the non-significant or negative relation (Mohammadi et al., 2016; Olatoye et al., 2010). Chamorro-Premuzic (2006) asserts that the impact of creative thinking on academic achievement varies in accordance with the assessment methods applied. In the study, it has been concluded that creative thinking is positively correlated with speaking exams, group work and final assignments whereas as far as multiple choice and essay type exams are concerned, a negative relationship reveals.

As previously mentioned, confronting the great challenges of the era, the individuals of 21 st century are supposed to adopt the priorly not much unappreciated skills such as critical thinking, creative thinking and reflective thinking. It is, thus, of vital importance to specify the link among them and their associations with the outcomes of education, specifically academic achievement. Though, many researchers have increasingly been engaged in the concept of high-order thinking skills, the scarcity of studies focusing on the interactive relations among specific thinking skills such as critical, creative and reflective thinking along with their impact on academic achievement draws attention. Within this context, the purpose of the present study is to shed light the interplay among the

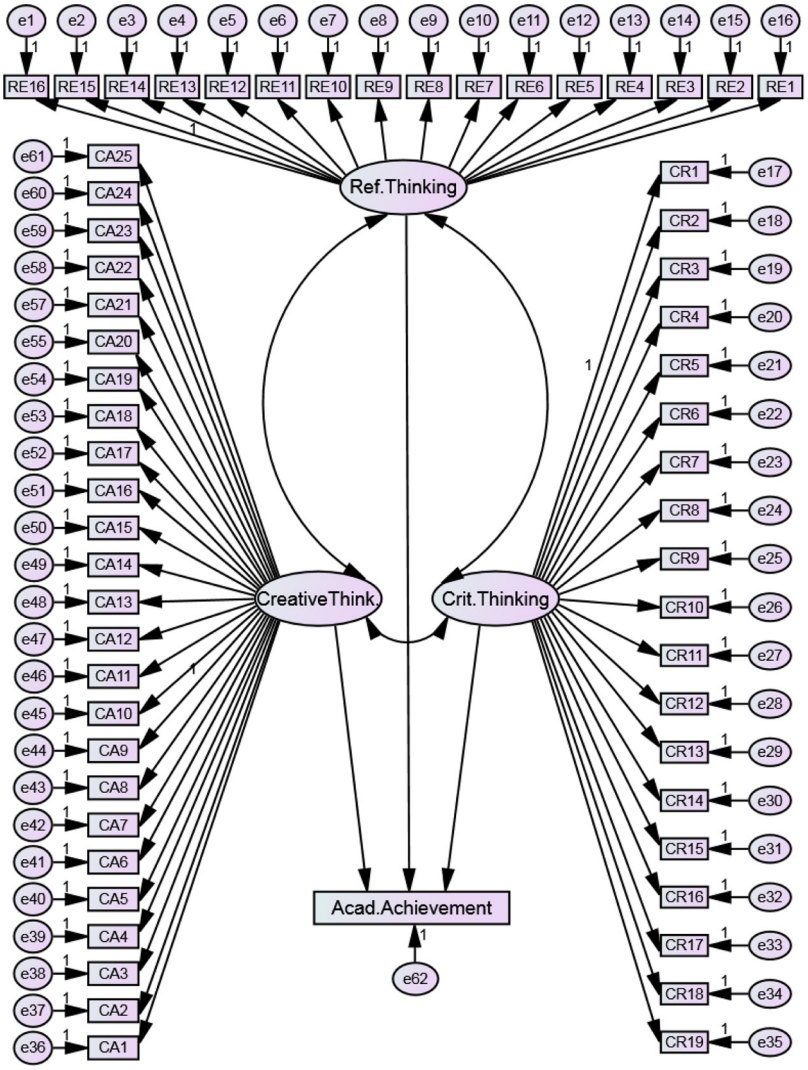


Fig. 1. The structural relationship among critical thinking, reflective thinking and creative thinking and their predictive power on academic achievement.

aforementioned thinking skills and their potential impact on academic achievement. It is believed that, the present study will help provide a distinct and new perception of certain high-order thinking skills' reciprocal relations with each other as well as with the academic achievement and further it is thought to help illuminate the associations among the aforementioned variables.

Consistent with the frame of the study, a structural equation modelling has been formed to explore the structural relationship pattern among the variables and to give an answer to the following research question:

What is the interplay among critical, reflective and creative thinking and their predictive power on academic achievement?

In Fig. 1, in line with the theoretical context and empirical studies of the mentioned variables (critical thinking, reflective thinking, creative thinking and academic achievement) a structural model has been formed.

2. Method

2.1. Research Design

In the pattern of the current study, causal research design was applied to examine the structural relationships among critical, reflective and creative thinking and to what extent these variables predict academic achievement. What a cause explains is the certain characteristics, manners, behaviours or traits of individuals or other bodies (Chambliss & Schutt, 2019). In this context, the causal pattern examines the cause-effect relationships that have appeared or that already exist between variables. In this method, the causes of the existing situation or the effects of the variables that may affect it are determined. Although it is similar to correlational studies in terms of investigating the relationship between the two variables, unlike in the correlational studies, in causal pattern the causal

variable that affects the outcome variable is attempted to be determined (Akarsu & Akarsu, 2019).

2.2. Research Sample

After ignoring thirteen sheets in view of the poor feedback, the participants of the present study consists of 227 students attending preparatory classes of a state university in İstanbul Turkey due the fall term of the academic year 2019-2020. Chosen in accordance with convenient sampling method, the study group includes 127 (56 %) male and 100 (44%) female participants.

2.3. Research Instruments

2.3.1. The Critical Thinking Scale

The Critical Thinking Scale used in the study was developed by Saracaloğlu and Yılmaz (2011). The scale consists of 19 items and four sub-dimensions: Reasoning, Decide Based upon Evidence, Recognizing the Problem and Information Acquisition. The last validity-reliability study of the scale was carried out on 307 university students and Cronbach alpha reliability coefficients for each subscale were calculated as .69 (Reasoning), .71 (Decide Based upon Evidence), .70 (Recognizing the Problem), .62 (Information Acquisition). The results of Confirmatory Factor Analysis (CFA) conducted in this study also confirmed the four-factor structure of the scale. The obtained values of $x^2 = 398.703$, df / $x^2 = 0.36$, RMSEA = 0.07, NNFI = 0.85, CFI = 0.87 and GFI = 0.88 show the suitability and reliability.

2.3.2. The Reflective Thinking Scale

The Reflective Thinking Scale was developed by Kember et al. (2000) and was adapted into Turkish by Başol and Evin-Gencel (2013). Having four sub-scales (Habitual Action, Understanding, Reflection and Critical Reflection), the scale is in the five-point Likert type, consisting of 16 items, which range from Definitely Disagree (1) to Definitely Agree (5). Cronbach Alpha reliability coefficient for the subscales was found between .62 and .76. The highest score from the scale is 20, while the lowest is 4.

2.3.3. The Marmara Creative Thinking Dispositions Scale

Developed by Özgenel and Çetin (2017), The Marmara Creative Thinking Dispositions Scale has 25 items and 6 factors (innovation search, courage, self-discipline, inquisitive, doubt and flexibility). It is a five-point Likert scale and the responses range from Never (1) to Always (5). After the test and re-test analysis, the correlation coefficient was found to be significant among the factors ($r = .88$). The Cronbach Alpha internal consistency coefficient for all the scales was 0.87.

2.4. Academic Achievement

To measure the academic achievement, the participants' overall average of grades during the fall term was taken as a basis, which is set by the institution. The assessment procedure is an integral system where students are formally tested by a certain number of written tests such as quizzes, progress exams and a speaking exam along with a course participation grade, given five times a semester. In addition, during the term, students are required to keep portfolios composed of several writing assignments which are graded separately from the exams.

3. Data Analysis

The structural relationship pattern between critical, reflective, creative thinking and academic achievement was analysed by applying SEM through AMOS 16 software program. SEM allows the direct and indirect relationships between variables to be measured with a single model. Being a statistical method used to test the relationships between observed and latent variable, SEM also takes into account the measurement errors in the observed variables and the relationships between the errors, thereby minimizing the measurement errors (Civelek, 2017). SEM holds many statistical methods in its body, and thus enables the researcher to analyse complicated relations among variables where even there is more than one dependent variable (Ullman & Bentler, 2013).

4. Findings

The present study's aim is to examine the structural relationships among critical, reflective and creative thinking and their predictive power on academic achievement. To this end, the data have been analysed through SEM and the values of the relationship pattern are illustrated in the Fig. 2.

As can be seen in Fig. 2, the structural pattern was analysed through AMOS program and the maximum likelihood method. In SEM, there are a number of fit indices that the system requires to evaluate the compatibility of the data. The ranges of these indexes are especially important in that the analysis of the model can provide compatible and reliable results (Bayram, 2013; Civelek, 2017).

In Table 1, the value ranges of the most addressed fit indices used in the analysis of SEM are presented.

Table 1 presents the goodness of indices obtained from the data regarding the structural relationship pattern among the variables. As it is demonstrated, the chi-square value was found as 2.1 ($2 \leq \chi 2/df \leq 3$); RMSEA is .06 ($0 \leq RMSEA \leq .08$); NFI is .91 ($.90 \leq NFI \leq .95$); CFI is .95 ($.95 \leq CFI \leq .97$); GFI is .90 ($.90 \leq GFI \leq .95$) and the AGFI is .86 ($.85 \leq AGFI \leq .90$). In compliance with referenced and obtained values, it can be concluded that the values gained from the data are in the acceptable ranges.

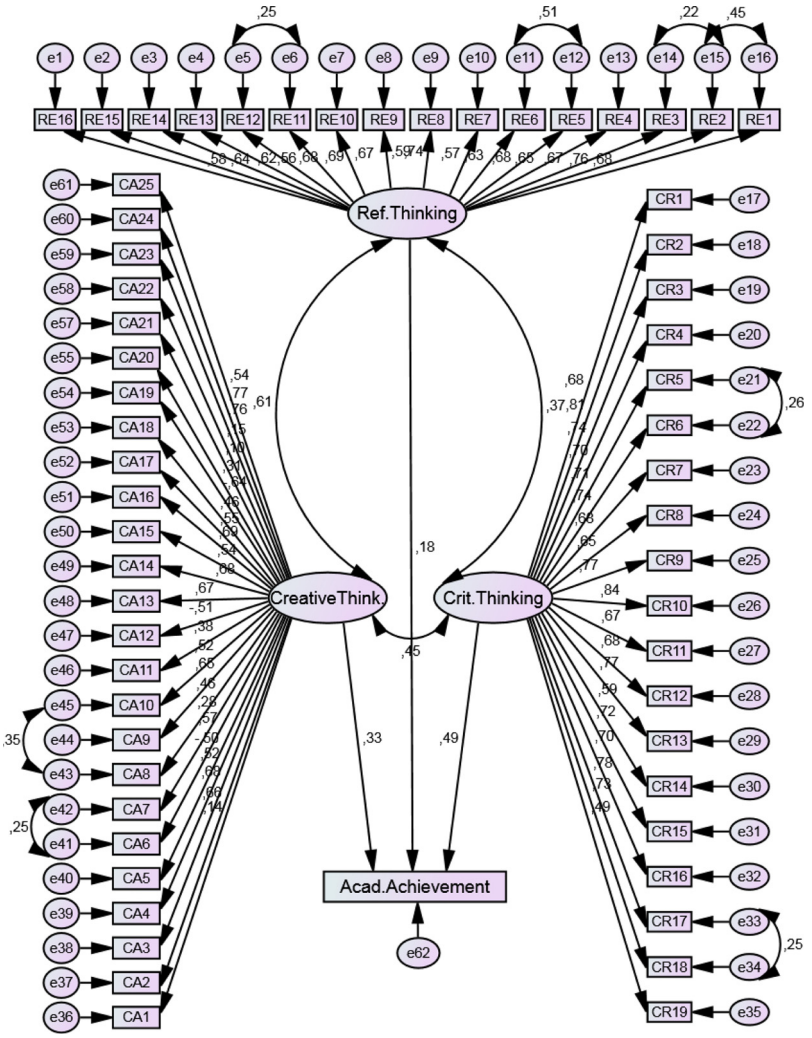


Fig. 2. The values obtained from the structural relationship between critical, reflective and creative thinking and their predictive power on academic achievement.

Table 1
Recommended Values for Evaluation and the Obtained Values.

Fit Measure	Acceptable Fit	Obtained Values
χ2/df	2 ≤ χ2/df ≤ 3	2.1
RMSEA	0 ≤ RMSEA ≤ .08	.06
NFI	.90 ≤ NFI ≤ .95	.91
CFI	.95 ≤ CFI ≤ .97	.95
GFI	.90 ≤ AGFI ≤ .95	.90
AGFI	.85 ≤ AGFI ≤ .90	.86

RMSEA = Root Mean Square Error of Approximation; NFI = Normed Fit Index, CFI = Comparative Fit Index; GFI = Goodness-of-Fit Index; AGFI = Adjusted Goodness-of-Fit-Index (Schermelleh-Engel et al. 2003).

In Table 2, the regression weights, standard errors, critical ratios and 'p' values of the variables in the structural pattern are illustrated.

As can be seen in Table 2, the predictive power of critical thinking on academic achievement 3.80 (CR = 8.34; p < .01); the power of reflective thinking is 2.12 (CR = 2.12; p < .05) and the predictive power on achievement is 3.31 (CR = 5.20; p < .01). All the mentioned values of the independent variables over the dependent variable are positive and significant.

Table 3 presents the correlation weights, standard errors, critical ratios and 'p' values of the variables in the structural pattern.

Table 2
Regression Weights, Standard Errors, Critical Ratios and 'p' Values of the Variables of the Structural Pattern.

Variables	Estimate	Standard Error	Critical Ratio	p Value
Crit. Think. Acad. Achiev.	3.80	.46	8.34	.00**
Ref. Think. Acad. Achiev.	2.12	.70	3.03	.02*
Creat. Think. Acad. Achiev.	3.31	.64	5.20	.00**

* $p < .05$.
** $p < .01$.

Table 3
Correlations, Standard Errors, Critical Ratios and 'p' Values of the Variables of the Structured Pattern.

Variables	Estimate	Standard Error	Critical Ratio	p Value
Crit. Think. Creat. Think.	.27	.05	5.00	.00**
Ref. Think. Crit. Think.	.18	.04	4.20	.00**
Creat. Think. Ref. Think.	.23	.04	5.42	.00**

** $p < .01$.

In Table 3, correlations, standard errors, critical ratios, "p" values of the variables in the structure pattern are presented. As it is demonstrated, there is a positive and significant relationship between critical thinking and creative thinking (CR = 5.00; $p < .01$). Likewise, the relationships between reflective thinking and critical thinking (CR = 4.20; $p < .01$) along with the relationship between creative thinking and reflective thinking (CR = 5.42; $p < .01$) is also positive and significant.

5. Discussion

The present study examined the structural relationship pattern among critical, reflective and creative thinking along with their predictive power on academic achievement. The findings of the data obtained from the study group revealed that there was a positive and significant relationship among critical, reflective and creative thinking and these variables all predicted academic achievement positively and significantly. The results of the study regarding the positive and significant relationship between critical and creative thinking offer supportive evidence with many other studies in literature. Hidayati, Zubaidah, Suarsini and Praherdhiono, (2019), Susanti and Hartono (2019) and Ülger (2016, 2020) found positive and significant relationships between the two thinking styles in their studies. The finding of the present study with regard to the positive and significant relationship between reflective and critical thinking is also, to a large extent, consistent with the findings of some studies. For example, Aşkın, Tekkol and Bozdemir (2018), investigating teacher candidates' reflective thinking tendencies and their critical thinking skills, found a positive and moderate relationship between the variables. Furthermore, just as Semerci's (2007) confirmation of the relationship between reflective and critical thinking, Evin-Gencel and Güzel (2014) also concluded that the relationship between the two ways of thinking was positive and significant. This supports the theoretical framework that reflective thinking is believed to promote critical thinking (Dewey, 1933) and reflective and critical thinking are interacting, and both are the ways of thinking that enable individuals to identify areas where they are sufficient or inadequate while raising awareness in their learning processes and to plan actions to increase their development (Evin-Gencel & Güzel, 2014). As for the positively significant correlation between creative and reflective thinking found in the present study, it can be seen that few studies have examined the link and present supportive results. Erol, Erol, Çalışır, and Bozan (2019) found a positive and significant correlation between the sub-dimensions of reflective thinking and creative thinking. Likewise, in Baki's (2019) study, creative thinking tendencies predicted reflective thinking significantly and in a positive way. As seen, it can be argued that critical, reflective and creative thinking skills are closely related to each other and the correlation among them is significant in most cases. Within this context, as Deringöl (2019) states, critical thinking is employed in the process of being aware of a problem and individuals utilize critical thinking along with other metacognitive thinking skills to be aware of learning process and all these steps could expose creative ideas. Furthermore, as Çardak (2019) states, although these three types of thinking skills might be described separately, differentiating them is not an easy task in that the purpose of critical thinking could be a reflective activity. In addition, the process of critical thinking could be a result of creative thinking or problem solving. Thus, it can be concluded that they are closely interrelated.

Another finding of the study was that critical, reflective and creative thinking predicted academic achievement in a positive and significant way. Many studies also present supportive results with the finding. For example, Kanbay et al. (2017) found that there was a positive and high-level relationship between academic achievement and critical thinking. Similarly, D'Alessio et al. (2019), Ghanizadeh (2017), Siburian et al. (2019), and Vierra (2014) marked the impact of critical thinking over academic achievement. On the other hand, Tafazzoli et al. (2015) highlighted no significant relationship between the two variables. Similarly, like the inconsistent findings between critical thinking and academic achievement, the results investigating the link between reflective thinking and academic achievement are also controversial. For instance, BuQhoos (2017), Deringöl (2019), Ghanizadeh (2017) and Toisercani Ravari et al. (2015) highlighted the positive and significant link, whereas Asakereh and Yousofi (2018), Tican and Taşpınar (2015)

found no significant relationship between reflective thinking and academic achievement. As for the relationship between creative thinking and academic achievement, the findings of the related studies yielded similar contradictory results. Although Nami et al. (2014), Surapuramath (2014) along with Pastor and David (2017) found that creativity had a significant effect on academic achievement, some other studies, displayed the non-significant or negative relation (Mohammadi et al. 2016; Olatoye et al. 2010).

It is argued that the inconsistent findings of the related studies could stem from various factors. The assessment methods, such as multiple choice or essay type questions, administered to test the level of academic achievement may have a determinant role that leads to different results. Another possible explanation regarding different findings could be related to the diverse nature of data collection tools administered to the participants. In this sense, applying different types of scales that measure the aforementioned variables may be one of the reasons that paves the way for different findings of the research in literature. In addition, the responses of different study groups and populations may be another factor responsible for the diverse results of similar research.

Considering the results of the current study, it is thought that, supplying students, in learning environments, with enough time to contemplate on inquiry-based issues, creating and developing materials that would be appropriate and helpful for pair or group works, encouraging students to think over and seek for the reasons and results of a given situation, urging them on writing down their thoughts and feelings as well as the points that they disagree, giving an opportunity to compare and contrast as well as to draw conclusions of a certain occasion would be helpful to promote the mentioned skills.

6. Conclusion

To conclude, from the examination of the structural relationship pattern of the present study, it has been revealed that critical, reflective and creative thinking have positive and significant relationships with each other and each of them has a positive and significant predictive power on academic achievement. The present study, therefore, offers a quantitative support for the theoretical framework that high-level thinking skills promote and predict academic achievement. Nevertheless, further research could be helpful to clarify and to generalize the link among the variables by utilizing other data collection tools and by applying them to different populations.

7. Limitations

As with other research, the present study has some limitations. First of all, to measure the academic achievement, the participants' overall average of grades during the fall term was taken as a basis. The integral assessment system consisted of quizzes, progress tests, speaking exams as well as a course participation grade. The data could reveal different results if a kind of standardized test was utilized. In addition, the study group of the present study consisted of preparatory class students. Studying with a population with different age groups and majors could lead to different results.

Author Statement

I, as an author of the article titled "Critical, Reflective, Creative Thinking and Their Reflections on Academic Achievement", have participated in every step of the conception, design, analysis of the data, discussion along with the writing of the manuscript and I take public responsibility for its publication. I have checked the final version, and I approve it for publication. I acknowledge that not any part of the manuscript has been published before its appearance on *Thinking Skills and Creativity*.

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