# Investigation of Pedagogical Belief Systems and Teacher Efficacy of Teachers in Turkey

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## Abstract

Pedagogical belief systems and the teacher efficacy could be used as a key concept to evaluate the teacher's pedagogical background. Therefore, this study aims to examine pedagogical belief systems and the teacher efficacy of teachers, especially in science and art centers (BİLSEM). The sample of the study consists of 388 teachers were selected by convenience sampling method. The findings of the study show that the gender and experience variables don't make any significant difference in teacher's pedagogical belief systems and teacher efficacy. Besides affiliation variable makes a significant difference in teacher's pedagogical belief systems but make no significant difference in their teacher efficacy except for their teaching skills. Independent variable importance analysis shows that affiliation is the most important factor for pedagogical belief systems in comparison to experience and gender dimensions. Independent variable importance analysis shows that experience is the most important factor for teacher efficacy in comparison to experience and gender dimensions. Independent variable importance shows that the most important factor is the guidance for sub-dimensions of teacher efficacy in terms of neural networks for explaining pedagogical belief systems. The second one is the assessment and evaluation and motivation. Moreover, all the sub-dimensions of the learner-centered approach are in low level positive significant correlations with the pedagogical belief systems. But no correlation is found with the teacher-centered approach except assessment and evaluation dimension. According to the findings, the learner-centered approach is the most important dimension of pedagogical belief systems in terms of neural networks for explaining teacher efficacy. Therefore a new model was created based on this fact so that path analysis results show that there is a causal connection from learner-centered approach to guidance, behavioral-ınstructional-management, motivation, and teaching skills dimensions to some extend.

**Keywords:** Pedagogical Belief Systems, Teacher Efficacy, Teachers working in BILSEM, Special Education

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## 1.INTRODUCTION

Teachers' ability to serve their responsibilities well with their students in the classroom is all about their beliefs about their career and position in the classroom, their students, themselves, and how a person should be raised. Assessing the self-perception of teachers' capacity is a significant element in evaluating the quality of education as well as the quality of the curricula. It can be concluded that education is realized by the skill and competence level of the instructor. Therefore, two factors that can be regarded as the dimensions affecting this perception can be given as teacher self-efficacy and teacher pedagogical belief systems (Atıcı, 2001: 196).

Efficacy is the level to which teachers feel they have the capacity to improve students' progress (Ashton, 1984:28). Pajares (1995:3) claimed that the notion of efficacy has three impacts on human's actions:

1. It affects the choice of behavior people seem to choose activities on which they are knowledgeable and optimistic about. It also affects the choice of them on which they dislike tasks that they are anxious and concerned about.

2. Self-efficacy beliefs describe the level of internal assurance the person has. High efficacy means greater commitment and persistence.

3. A person's belief has a huge effect on one's emotions and thoughts. Low efficacy people feel that the activities are more complicated to accomplish than they are.

The first research studies conducted regarding teacher efficacy were based on Rotter's Social Learning Theory (Tschannen-Moran and Hoy, 2001). Then Bandura (1997) claimed that there is a distinction between self-efficacy and self-esteem. Perceived self-efficacy is the belief in one's capability, while self-esteem reflects one's positive opinions of oneself. Bandura (1997) proposed that the "agency" is the action performed deliberately. Personal efficacy beliefs form an essential aspect of human agency. When people do not trust in their abilities to do anything, they do not attempt to realize it. However, as mentioned by Labone (2004), Bandura's self-efficacy paradigm lacks the understanding of teachers' daily activities. Tschannen-Moran, Woolfolk Hoy and Hoy (1998: 233) presented a model that addressed teachers' self-efficacy in this respect. Accordingly, teacher efficacy is described as the teachers' capacity to coordinate and perform acts of a specific teaching activity in a particular sense. Moreover, Tschannen-Moran and Woolfolk Hoy (2001) developed the Teachers' Sense of Efficacy Scale (TSES) where they determined three levels of teacher efficacy as student engagement, instructional behaviors, and classroom management. Today, teacher efficacy is regarded as an important idea with significant implications for evaluating many educational outcomes such as achievement, motivation, the behavior of teachers in classroom management. Tschannen-Moran and Woolfok Hoy (2001) emphasized that there is a clear association between instructor efficacy and different educational outcomes including teacher persistence, motivation, dedication, and instructional actions along with the student outcomes like success, inspiration, and self-efficacy beliefs. Erawan (2011) also indicated that instructor efficacy refers to the teacher's awareness, abilities, and attitudes as the key to effective teaching. Therefore, teachers' confidence and self-efficacy have gained an increasingly significant role in educational psychology research since its implications for teaching effectiveness, instructional practices, and students' academic achievement (Klassen and Tze, 2014). Accordingly, it is important to investigate teacher efficacy in terms of different variables to better understand or at least conceptualize the important factors and relations with teacher efficacy and other cognitive elements in the educational process.

Another important factor that can be related to effective teaching is the pedagogical belief systems of teachers. It is defined as all the beliefs of teachers about learning and teaching (Doğan, 2013: 6). As Bandura (1997) argued, our minds are shaped much more by assumptions than by reality. Teachers have started to embrace certain pedagogical belief systems before they start their education profession and they engage in teacher certification processes with these teacher models (Clark, 1988:

7; Soysal, Radmard and Kutluca, 2018). Miheala and Oana (2014) stated that the belief systems of teachers are the preconditions of teachers' behavior patterns and classroom motives. Turner et al. (2009) stressed that belief has an impact on the behavior of teachers and should therefore be considered because it fosters the learning of students. Smith (2005) stated that teachers have cognitive filters regarding teachers' pedagogical beliefs so that they anticipated how they would act in the face of events and problems. According to Vartuli and Rohs (2009), teachers' values can easily inculcate their educational activities on abrupt occasions. In reality, teachers frequently rely on their personal biases, first impressions, and some long-held beliefs as they perform daily tasks for the task. Teacher beliefs affect participation by framing and guiding practice, teaching participants what is important, and providing learning opportunities. Therefore this research was conducted because beliefs are fundamental parts of understanding who the teachers are and what their duties are (Gill and Fives, 2015).

Knowing what is happening in the world of thoughts of teachers during the teaching process will be effective in forming the basis of qualified and quality education (Gill and Fives, 2015). In educational contexts, teachers' self-efficacy may be better conceptualized in terms of their beliefs in the capacity to plan, coordinate, and carry out tasks necessary to achieve educational objectives (Skaalvik & Skaalvik, 2010). Pedagogıcal Belief Systems And The Teacher Efficacy are important concepts for teaching and training practices since they are effecting the efficacy of these processes. Altough in the literature, experimental studies as well as action studies seem to be more valuable with respect to quantitative studies, the results of quantitative studies can give more grounded insights especially for meta-analysis and meta-sythesis studies to make more generalizations. Qualitative studies are important because they give snapshots in terms of specific characteristics to enable researchers to comprehend the dynamic nature of the puzzle of education practice. Therefore, in this respect, it is thought that pedagogical belief systems and their teacher efficacy are conceptually similar topics in terms of sharing pedagogical beliefs, so that, pedagogical belief systems and their teacher efficacy could be used as key concepts to understand to evaluate the teachers' pedagogical background. Therefore in this study, we seek the answers to the following questions given below:

1- Is there any significant difference between teachers' pedagogical belief systems and teacher efficacy in terms of their gender?

2- Is there any significant difference between teachers' pedagogical belief systems and teacher efficacy in terms of their experience?

3- Is there any significant difference between teachers' pedagogical belief systems and teacher efficacy in terms of their affiliation?

4- Which is the most important factor among the variables of affiliation, experience, and gender in terms of neural networks for explaining teachers' pedagogical belief systems and teacher efficacy?

5- Which is the most important factor among the sub-dimensions of teacher efficacy in terms of neural networks for explaining pedagogical belief systems?

6- What are the correlations among the sub-dimensions of teacher efficacy?

## 2. METHOD

In this study, "correlational survey model" was used to determine the relationship between teacher efficacy and pedagogical belief systems. "Correlational survey model" aims to determine the existence or level of co-change between variables for the situation where there are at least two independent variables (Karasar, 1999: 81). This model tries to determine not the causes of the events, but the situations they are in, their characteristics, and the relationship between them (Kaptan, 1998: 53). The sample of the study consists of 388 teachers randomly selected from the population. The

simple random sampling method was used to determine the sample of the study. In this sampling, when selecting each unit in the universe population, the neutrality rule prevails because of the possibility of being equal and independent (Balcı, 2001: 95). The study aims mainly at gifted students. Therefore teachers in science and art centers (BILSEM) are selected for the major part of the sample. Gifted and talented children need help in pre-school, primary, secondary, and high schools as well. Science and art centers are educational centers that are founded to support the unique educating needs of the students who are gifted, talented, and eligible in the pre-school and secondary schools by the General Directorate of Special Education and Guidance Services, Ministry of Education in Turkey (Donmez 2004: 72). If a student shows the characteristics of a gifted and talented person, a primary school teacher recommends him or her for the science and art center to apply for the special talent test. Next, the committed students conduct a group screening evaluation. Person assessment is expected of students who pass this community screening level. Students that fulfill these processes are eligible for science and art centers (Baykoç-Dönmez, 2014). Science and art center teachers are also evaluated and taken to the centers based on particular standards. So understanding teachers in science and art centers need to provide better educational opportunities for gifted students.

A random sampling of the variables involves completing a questionnaire centering on the variables of the topic the researcher is interested in. Additionally, for correlational survey models, the number sample size is taken into consideration as a result of the calculation made with the following formula (Tabachnick and Fidell, 2007):

$N > 50 + 8m$

N: Number of participants m: number of independent variables where m= 7 (5 independent variables from teacher efficacy, 2 from pedagogical belief systems, 3 from demographic variables)

N> 130 where the target sample size for this study is 388 which meets the requirement.

**Table 2.1. The descriptive results of the sample of the research**

**Affiliation * Gender Crosstabulation**
Count

| | | *Gender* | | |
|---|---|---|---|---|
| | | *Female* | *Male* | *Total* |
| Affiliation | Primary School | 26 | 17 | 43 |
| | Secondary School | 59 | 44 | 103 |
| | High School | 27 | 32 | 59 |
| | Science and art centers | 89 | 94 | 183 |
| Total | | 201 | 187 | 388 |

Measurement tools of this study are ‘Ohio Teacher-Efficacy Scale’ and ‘Pedagogical Belief Systems Scale’. Moreover, the ‘Ohio Teacher-Efficacy Scale’ was applied to evaluate the efficiency of the teachers. This scale was first improved by Tschannen-Moran and Woolfolk-Hoy (2001) and it was adapted into Turkish by Baloğlu and Karadağ (2008). ‘Ohio Teacher-Efficacy Scale’ is made up of sub-dimensions of ‘behavioral management’, ‘motivation’, ‘guidance’, ‘teaching skills’, and ‘assessment and evaluation’.The pedagogical Belief Systems Scale was developed by Chan (2001), whose validity and reliability studies were performed by Soysal, Radmard, and Kutluca (2018), which Chan, Tan, and Khoo (2007) gave their final form was used in this study. Cronbach alpha internal consistency coefficient was found to be 0.77 for the Turkish adapted version of this scale by Soysal, Radmard, and Kutluca (2018). Neural networks are the preferred tool for many predictive data mining applications because of their power, flexibility, and ease of use and it can be used a wide range of statistical models since its minimal demands on model structure and assumptions[1]. Therefore, because our variables are quantitative one, we conclude that it is better to use neural networks in this study.

[1] https://www.sussex.ac.uk/its/pdfs/SPSS_Neural_Network_22.pdf retrieved from 17.09.2021

### 3. Limitation of the Study

The first limitation of this study is the population which is limited by the Central Anatolia Region. The second limitation is indeed measurement tools and their theoretical basis. Thirdly, and most importantly, the main limitation of this study is the analysis methods. Since the data is not normally distributed according to Kolmorov-Smirnov and Shapiro-Wilk tests, Mann-Whitney U, Kruskal Walliswere used in this study because it is based on quantitative data. Neural network analysis were also used in this study.

**Table 3.1. Tests of normality**

| Tests of Normality | | | | | | |
|---|---|---|---|---|---|---|
| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Learnercentered | ,178 | 388 | ,000 | ,854 | 388 | ,000 |
| Teachercentered | ,095 | 388 | ,000 | ,968 | 388 | ,000 |
| Guidance | ,109 | 388 | ,000 | ,952 | 388 | ,000 |
| Behavioral instructional management | ,103 | 388 | ,000 | ,959 | 388 | ,000 |
| Motivation | ,103 | 388 | ,000 | ,954 | 388 | ,000 |
| Teaching skills | ,103 | 388 | ,000 | ,963 | 388 | ,000 |
| assessment-evaluation | ,176 | 388 | ,000 | ,899 | 388 | ,000 |
| a. Lilliefors Significance Correction | | | | | | |

## 4. FINDINGS

### 4.1.First finding for the question as "Is there any significant difference between teachers pedagogical belief systems and teacher efficacy in terms of their gender?"

The first finding for the question as "Is there any significant difference between teachers pedagogical belief systems and teacher efficacy in terms of their gender?" shows that the gender variable doesn't make any significant difference between teacher's pedagogical belief systems and their teacher efficacy.

**Table 4.1. Mann-Whitney U test statistics in terms of gender**

| Test Statistics[a] | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *learner-centered* | *teacher-centered* | *Guidance* | *behavioural-instructional management* | *motivation* | *teaching skills* | *assessment-evaluation* |
| Mann-Whitney U | 16874,000 | 17231,000 | 18248,000 | 18466,000 | 18286,000 | 18728,500 | 18525,000 |
| Wilcoxon W | 34452,000 | 37532,000 | 35826,000 | 36044,000 | 35864,000 | 36306,500 | 36103,000 |
| Z | -1,751 | -1,417 | -,497 | -,299 | -,463 | -,059 | -,250 |
| Asymp. Sig. (2-tailed) | ,080 | ,157 | ,619 | ,765 | ,643 | ,953 | ,802 |
| a. Grouping Variable: Gender | | | | | | | |

### 4.2.Second finding for the question as "Is there any significant difference between teachers' pedagogical belief systems and teacher efficacy in terms of their experience?"

The first finding for the question as "Is there any significant difference between teachers pedagogical belief systems and teacher efficacy in terms of their experience?" shows that the experience variable doesn't make any significant difference on teacher's pedagogical belief systems and teacher efficacy.

**Table 4.2. Kruskal Wallis Test statistics in terms of experience**

| Test Statistics[a,b] | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *learner-centered* | *teacher-centered* | *guidance* | *behavioural-instructional management* | *motivation* | *teaching skills* | *assessment-evaluation* |
| Chi-Square | 10,267 | 6,844 | 2,813 | 1,620 | 5,607 | 1,884 | 9,581 |
| df | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Asymp. Sig. | ,114 | ,335 | ,832 | ,951 | ,469 | ,930 | ,143 |

a. Kruskal Wallis Test
b. Grouping Variable: Experience

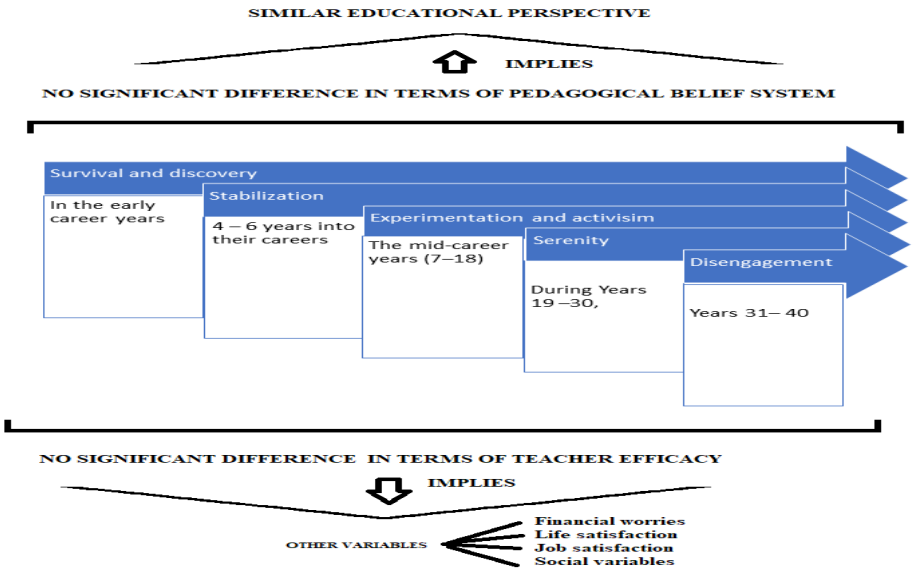


**Figure 4.1. Implications of no significant difference in terms of job experience**

### 4.3.Third finding for the question as "Is there any significant difference between teachers pedagogical belief systems and teacher efficacy in terms of their affiliation?"

The first finding for the question as "Is there any significant difference between teachers pedagogical belief systems and teacher efficacy in terms of their affiliation?" show that the affiliation variable makes a significant difference in teacher's pedagogical belief systems but make no significant difference in their teacher efficacy except for their teaching skills.

**Table 4.3. Kruskal Wallis Test statistics in terms of affiliation**

| Test Statistics[a,b] | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Learner-centered* | *teacher-centered* | *guidance* | *behavioural-instructional-management* | *motivation* | *teaching skills* | *assessment-evaluation* |
| Chi-Square | 8,066 | 30,520 | 5,021 | 1,326 | 3,355 | 9,466 | 2,439 |
| Df | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Asymp. Sig. | ,045 | ,000 | ,170 | ,723 | ,340 | ,024 | ,486 |

a. Kruskal Wallis Test
b. Grouping Variable: Affiliation

When the source of the significant difference in teacher's pedagogical belief systems is investigated, the learner-centered approach is mostly adopted by primary school teachers, and compared to primary school teachers secondary school and science and art centers teachers have less mean rank in this respect. In terms of the teacher-centered approach, the highest mean rank belongs to secondary schoolteachers whereas the lowest value belongs to science and art centers teachers.

**Table 4.4. The mean rank values of teachers in terms of their "Pedagogical Belief Systems"**

| | *Affiliation* | *N* | *Mean Rank* |
|---|---|---|---|
| Learner-centered | primary school | 43 | 239,86 |
| | secondary school | 103 | 188,12 |
| | high school | 59 | 191,74 |
| | science and art centers | 183 | 188,32 |
| | Total | 388 | |
| Teacher-centered | primary school | 43 | 200,65 |
| | secondary school | 103 | 239,19 |
| | high school | 59 | 206,01 |
| | science and art centers | 183 | 164,19 |
| | Total | 388 | |

When the source of the significant difference in teaching skills dimensions in the teacher efficacy scale, the highest mean rank belongs to science and art center teachers whereas the lowest mean rank secondary schoolteachers.

**Table 4.5. The mean rank values of teachers in terms of teacher efficacy**

| **Ranks** | | | |
|---|---|---|---|
| | *Affiliation* | *N* | *Mean Rank* |
| Teaching skills | primary school | 43 | 182,07 |
| | secondary school | 103 | 169,91 |
| | high school | 59 | 196,17 |
| | science and art centers | 183 | 210,72 |
| | Total | 388 | |

### 4.4.Fourth finding for the question as "Which is the most important factor among the variables of affiliation, experience, and gender in terms of neural networks for explaining teachers pedagogical belief systems and teacher efficacy?"

### 4.4a. Finding for the question as "Which is the most important factor among the variables of affiliation, experience, and gender in terms of neural networks for explaining teachers pedagogical belief systems?"

Case processing summary can be given as below for neural networks for explaining pedagogical belief systems. It is seen that 281 individuals in the sample are used for training and 107 individuals are used for testing of neural networks and all of them are valid for the analysis.

**Table 4.6. Case processing summary for neural network analysis**

| **Case Processing Summary** | | | |
|---|---|---|---|
| | | *N* | *Percent* |
| Sample | Training | 281 | 72,4% |
| | Testing | 107 | 27,6% |
| Valid | | 388 | 100,0% |
| Excluded | | 0 | |
| Total | | 388 | |

Network information for neural network analysis can be given in Table 4.7. As can be seen in the table, the activation function is the sigmoid function, and the number of hidden layers is two.

**Table 4.7. Network Information for the analysis**

| Network Information | | | |
|---|---|---|---|
| Input Layer | Covariates | 1 | Affiliation |
| | | 2 | Experience |
| | | 3 | Gender |
| | Number of Units[a] | | 3 |
| | Rescaling Method for Covariates | | Standardized |
| Hidden Layer(s) | Number of Hidden Layers | | 2 |
| | Number of Units in Hidden Layer 1[a] | | 3 |
| | Number of Units in Hidden Layer 2[a] | | 2 |
| | Activation Function | | Sigmoid |
| Output Layer | Dependent Variables | 1 | Learner-centered |
| | | 2 | Teacher centered |
| | Number of Units | | 2 |
| | Rescaling Method for Scale Dependents | | Normalized |
| | Activation Function | | Sigmoid |
| | Error Function | | Sum of Squares |

a. Excluding the bias unit

The general structure of the neural network for pedagogical belief systems is given in Figure 4.2.

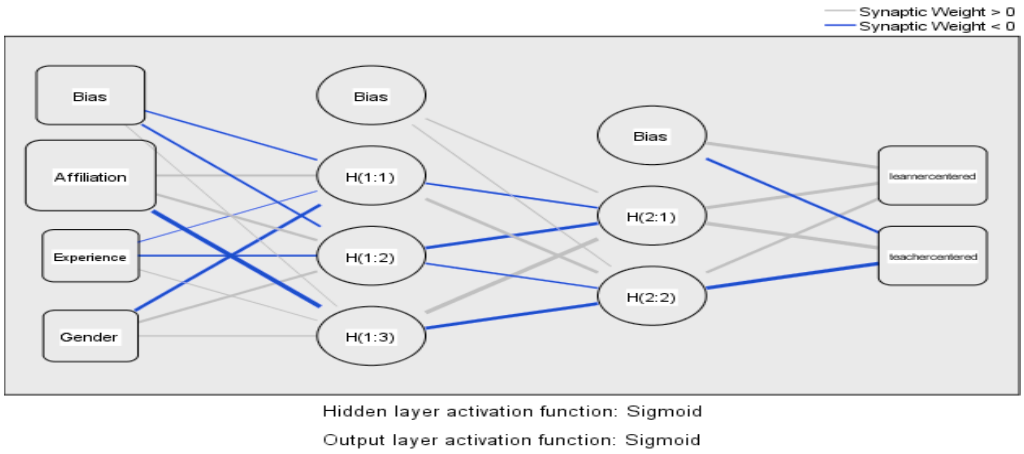


**Figure 4.2. Neural network for pedagogical belief systems**

Model summary of the neural network structure is given below. In the table training and testing, dimension is shown.

**Table 4.8. Model summary of the neural network structure**

| Model Summary | | | |
|---|---|---|---|
| Training | Sum of Squares Error | | 8,543 |
| | Average Overall Relative Error | | ,962 |
| | Relative Error for Scale Dependents | Learner-centered | ,990 |
| | | Teacher centered | ,937 |
| | Stopping Rule Used | | 1 consecutive step(s) with no decrease in error[a] |
| | Training Time | | 0:00:00,06 |
| Testing | Sum of Squares Error | | 3,397 |
| | Average Overall Relative Error | | ,983 |
| | Relative Error for Scale Dependents | Learnercentered | 1,007 |
| | | Teacher centered | ,960 |

a. Error computations are based on the testing sample.

Independent variable importance analysis shows that affiliation is the most important factor for pedagogical belief systems in comparison to experience and gender dimensions.

**Table 4.9. Independent variable importance analysis**

| Independent Variable Importance | | |
|---|---|---|
| | *Importance* | *Normalized Importance* |
| Affiliation | ,711 | 100,0% |
| Experience | ,159 | 22,3% |
| Gender | ,130 | 18,3% |

### 4.4b. Finding for the question as which is the most important factor among the variables of affiliation, experience, and gender in terms of neural networks for explaining teachers' teacher efficacy?

Case processing summary can be given as below for neural networks for explaining teacher efficacy. It is seen that 264 individuals in the sample are used for training and 124 individuals are used for testing of neural networks and all of them are valid for the analysis.

**Table 4.10. Case processing summary for neural network analysis**

| Case Processing Summary | | | |
|---|---|---|---|
| | | *N* | *Percent* |
| Sample | Training | 264 | 68,0% |
| | Testing | 124 | 32,0% |
| Valid | | 388 | 100,0% |
| Excluded | | 0 | |
| Total | | 388 | |

Network information for neural network analysis can be given in Table 4.11. As can be seen in the table, the activation function is a sigmoid function, and the number of hidden layers is two.

**Table 4.11. Network information for neural network analysis**

| Network Information | | | |
|---|---|---|---|
| Input Layer | Covariates | 1 | Affiliation |
| | | 2 | Experience |
| | | 3 | Gender |
| | Number of Units[a] | | 3 |
| | Rescaling Method for Covariates | | Standardized |
| Hidden Layer(s) | Number of Hidden Layers | | 2 |
| | Number of Units in Hidden Layer 1[a] | | 4 |
| | Number of Units in Hidden Layer 2[a] | | 3 |
| | Activation Function | | Sigmoid |
| Output Layer | Dependent Variables | 1 | Guidance |
| | | 2 | Behavioral-instructional-management |
| | | 3 | Motivation |
| | | 4 | teaching skills |
| | | 5 | assessment-evaluation |
| | Number of Units | | 5 |
| | Rescaling Method for Scale Dependents | | Normalized |
| | Activation Function | | Sigmoid |
| | Error Function | | Sum of Squares |

a. Excluding the bias unit

The general structure of the neural network for teacher efficacy is given in Figure 4.3.

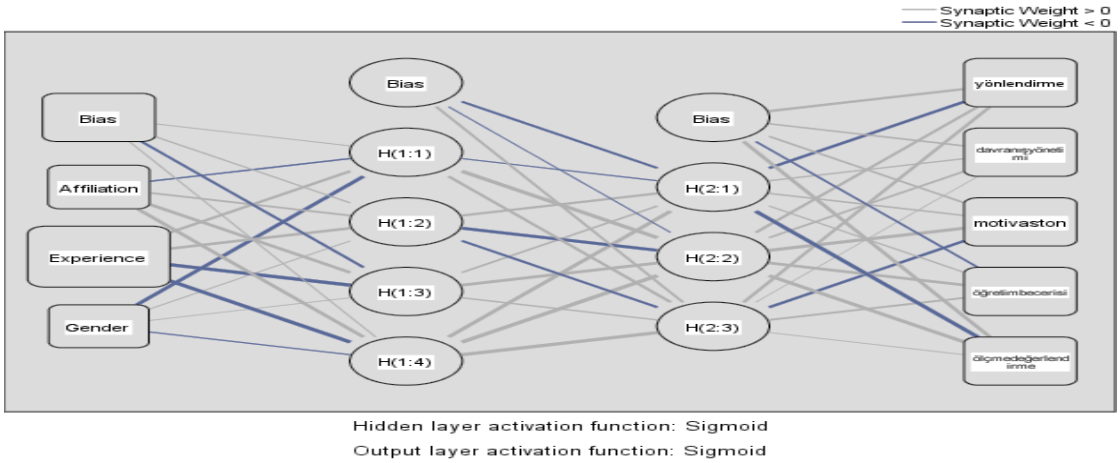


**Figure 4.3. The general structure of the neural network for teacher efficacy**

Model summary of the neural network structure is given below. In the table training and testing, dimension is shown.

**Table 4.12. Model summary of the neural network structure**

| **Model Summary** | | | |
|---|---|---|---|
| Training | Sum of Squares Error | | 34,864 |
| | Average Overall Relative Error | | ,993 |
| | Relative Error for Scale Dependents | Guidance | ,999 |
| | | Behavioural-Instructional-Management | 1,001 |
| | | Motivation | ,988 |
| | | teaching skills | ,989 |
| | | assessment-evaluation | ,991 |
| | Stopping Rule Used | | 1 consecutive step(s) with no decrease in error[a] |
| | Training Time | | 0:00:00,07 |
| Testing | Sum of Squares Error | | 15,500 |
| | Average Overall Relative Error | | ,996 |
| | Relative Error for Scale Dependents | Guidance | ,995 |
| | | Behavioural-Instructional-Management | 1,001 |
| | | Motivation | 1,000 |
| | | teaching skills | ,995 |
| | | assessment-evaluation | ,991 |

a. Error computations are based on the testing sample.

Independent variable importance analysis shows that experience is the most important factor for teacher efficacy in comparison to experience and gender dimensions.

**Table 4.13. Independent variable importance analysis**

| **Independent Variable Importance** | | |
|---|---|---|
| | *Importance* | *Normalized Importance* |
| Affiliation | ,197 | 31,6% |
| Experience | ,624 | 100,0% |
| Gender | ,179 | 28,7% |

### 4.5.Fifth finding for the questions as "Which is the most important factor among the sub-dimensions of teacher efficacy in terms of neural networks for explaining pedagogical belief systems? and "What are the correlations among the sub-dimensions of teacher efficacy?"

Case processing summary can be given as below for neural networks for explaining pedagogical belief systems. It is seen that 264 individuals in the sample are used for training and 124 individuals are used for testing of neural networks and all of them are valid for the analysis.

**Table 4.14. Case processing summary for neural network analysis**

| **Case Processing Summary** | | | |
|---|---|---|---|
| | | *N* | *Percent* |
| Sample | Training | 264 | 68,0% |
| | Testing | 124 | 32,0% |
| Valid | | 388 | 100,0% |
| Excluded | | 0 | |
| Total | | 388 | |

Network information for neural network analysis can be given in Table 4.7. As can be seen in the table, the activation function is a sigmoid function, and the number of hidden layers is two.

**Table 4.15. Network Information for the analysis**

| **Network Information** | | | |
|---|---|---|---|
| Input Layer | Covariates | 1 | guidance |
| | | 2 | Behavioral-instructional-management |
| | | 3 | motivation |
| | | 4 | teaching skills |
| | | 5 | assessment-evaluation |
| | Number of Units[a] | | 5 |
| | Rescaling Method for Covariates | | Standardized |
| Hidden Layer(s) | Number of Hidden Layers | | 2 |
| | Number of Units in Hidden Layer 1[a] | | 4 |
| | Number of Units in Hidden Layer 2[a] | | 3 |
| | Activation Function | | Sigmoid |
| Output Layer | Dependent Variables | 1 | learner-centered |
| | | 2 | teacher-centered |
| | Number of Units | | 2 |
| | Rescaling Method for Scale Dependents | | Normalized |
| | Activation Function | | Sigmoid |
| | Error Function | | Sum of Squares |

a. Excluding the bias unit

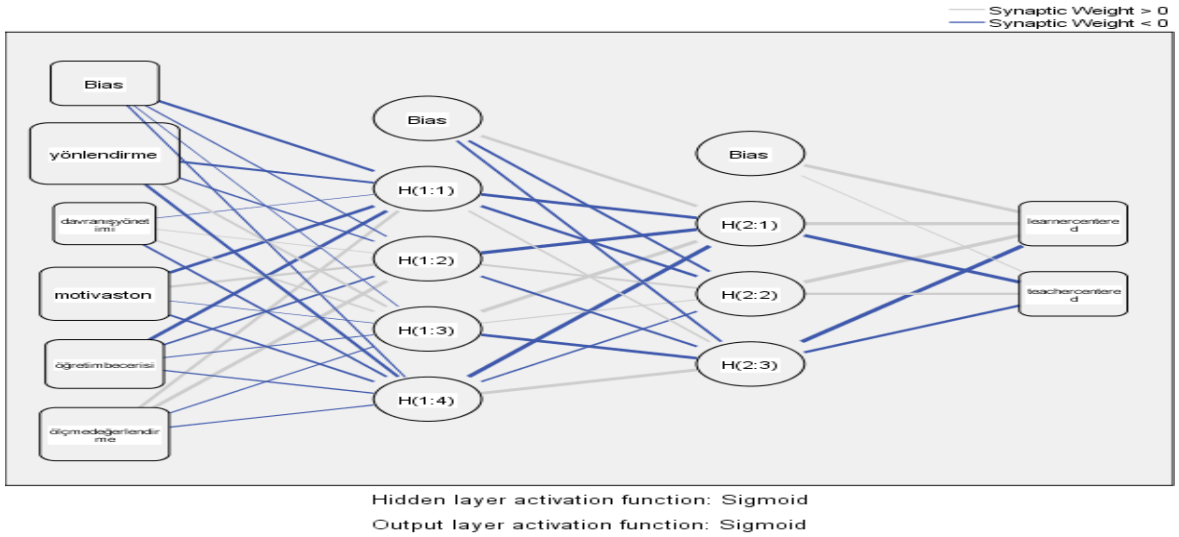


**Figure 4.4. Neural network for the sub-dimensions of teacher efficacy in terms of neural networks for explaining pedagogical belief systems**

Model summary of the neural network structure is given below. In the table training and testing, dimension is shown.

**Table 4.16. Model summary**

| Model Summary | | | |
|---|---|---|---|
| Training | Sum of Squares Error | | 7,465 |
| | Average Overall Relative Error | | ,921 |
| | Relative Error for Scale Dependents | learner-centered | ,875 |
| | | teacher-centered | ,960 |
| | Stopping Rule Used | | 1 consecutive step(s) with no decrease in error[a] |
| | Training Time | | 0:00:00,12 |
| Testing | Sum of Squares Error | | 3,924 |
| | Average Overall Relative Error | | ,924 |
| | Relative Error for Scale Dependents | learner-centered | ,841 |
| | | Teacher-centered | 1,000 |

a. Error computations are based on the testing sample.

Independent variable importance shows that the most important factor is the guidance for sub-dimensions of teacher efficacy in terms of neural networks for explaining pedagogical belief systems and the second one is the assessment and evaluation and motivation.

**Table 4.17. Independent variable importance analysis**

| Independent Variable Importance | | |
|---|---|---|
| | *Importance* | *Normalized Importance* |
| Guidance | ,280 | 100,0% |
| Behavioural-Instructional-Management | ,120 | 42,9% |
| Motivation | ,212 | 75,5% |
| Teaching skills | ,175 | 62,5% |
| Assessment-evaluation | ,212 | 75,7% |

It seems that the Spearman correlation constant is in parallel with the independent variable importance analysis. According to this, all the sub-dimensions of the learner-centered approach are in low level positive significant correlations with the pedagogical belief systems but no correlation is found with the teacher-centered approach except assessment and evaluation dimension.

**Table 4.18. Correlation analysis among the sub-dimensions of teacher efficacy and pedagogical belief systems**

| | | | *guidance* | *behavioral-instructional-management* | *Motivation* | *teaching skills* | *assessment-evaluation* |
|---|---|---|---|---|---|---|---|
| Spearman's rho | learner-centered | Correlation Coefficient | ,343** | ,258** | ,328** | ,312** | ,207** |
| | | Sig. (2-tailed) | ,000 | ,000 | ,000 | ,000 | ,000 |
| | | N | 388 | 388 | 388 | 388 | 388 |
| | teacher-centered | Correlation Coefficient | ,026 | ,058 | ,065 | ,037 | ,150** |
| | | Sig. (2-tailed) | ,604 | ,257 | ,201 | ,463 | ,003 |
| | | N | 388 | 388 | 388 | 388 | 388 |

When path analysis is conducted from teacher efficacy to pedagogical belief systems given as below, causal links cannot be modeled in the model presented below based on the correlation analysis although model fit values are very close to ideal values.

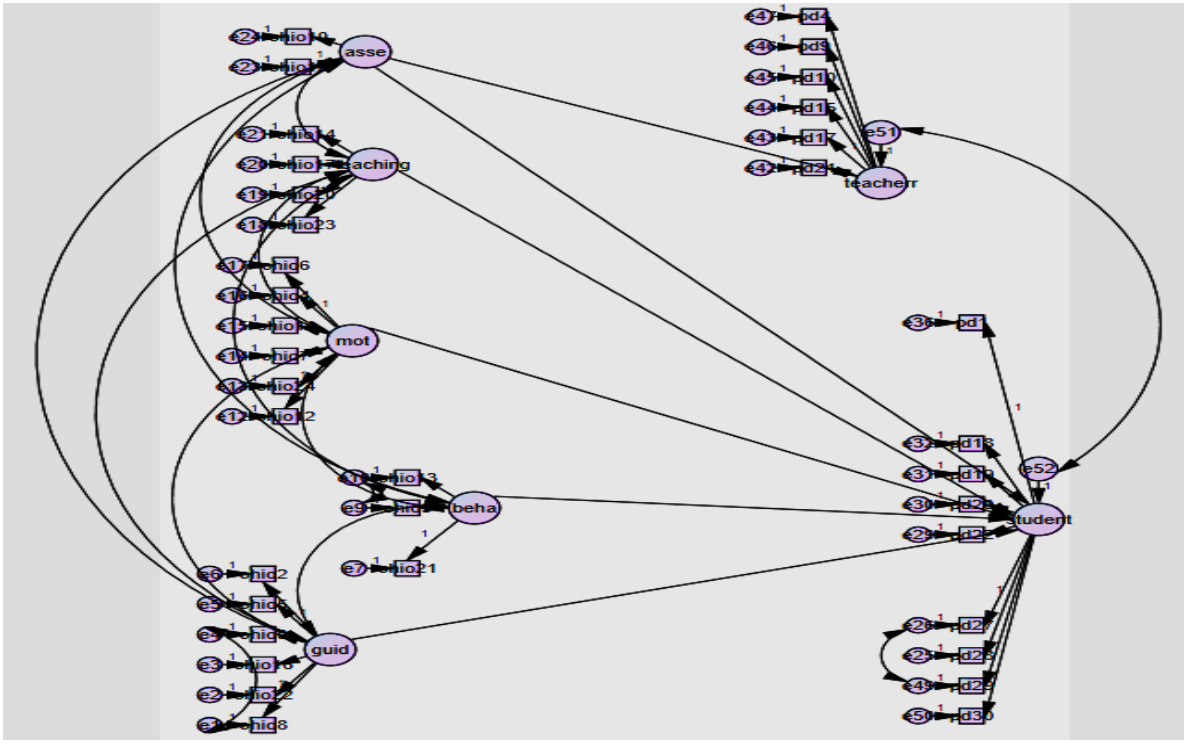


**Figure 4.5. Path analysis from teacher efficacy to pedagogical belief systems**

As it can be seen in table 4.19 p values are not significant so that the causal link cannot be inferred.

**Table 4.19. Regression weights**

| | | | *Estimate* | *S.E.* | *C.R.* | *P* | *Label* |
|---|---|---|---|---|---|---|---|
| Teacher-centered | <--- | Assessment-evaluation | ,150 | ,089 | 1,674 | ,094 | |
| Student-centered | <--- | Teaching skills | ,426 | 8,607 | ,049 | ,961 | |
| Student-centered | <--- | Assessment-evaluation | -1,097 | 35,968 | -,030 | ,976 | |
| Student-centered | <--- | Motivation | 7,555 | 358,127 | ,021 | ,983 | |
| Student-centered | <--- | Behavioural-Instructional-Management | 5,089 | 218,168 | ,023 | ,981 | |
| Student-centered | <--- | Guidance | -11,735 | 536,209 | -,022 | ,983 | |

### 4.6.Sixth finding for the questions as "Which is the most important factor among the sub-dimensions of pedagogical belief systems in terms of neural networks for explaining teacher efficacy?

Model summary of pedagogical belief systems in terms of neural networks for explaining teacher efficacy can be given as in Table 4.19. According to this sum of squares error is 29,718 for training and 12,589 for testing.

**Table 4.19. Model summary of pedagogical belief systems in terms of neural networks for explaining teacher efficacy**

| Model Summary | | | |
|---|---|---|---|
| Training | Sum of Squares Error | | 29,718 |
| | Average Overall Relative Error | | ,911 |
| | Relative Error for Scale Dependents | Guidance | ,893 |
| | | Behavioural-Instructional-Management | ,925 |
| | | Motivation | ,887 |
| | | Teaching skills | ,905 |
| | | Assessment-evaluation | ,943 |
| | Stopping Rule Used | | 1 consecutive step(s) with no decrease in error[a] |
| | Training Time | | 0:00:00,12 |
| Testing | Sum of Squares Error | | 12,569 |
| | Average Overall Relative Error | | ,887 |
| | Relative Error for Scale Dependents | Guidance | ,820 |
| | | Behavioural-Instructional-Management | ,897 |
| | | Motivation | ,889 |
| | | Teaching skills | ,870 |
| | | Assessment-evaluation | ,960 |

a. Error computations are based on the testing sample.

According to findings, the learner-centered approach is the most important dimension of pedagogical belief systems in terms of neural networks for explaining teacher efficacy.

**Table 4.20. Independent variable ımportance of pedagogical belief systems in terms of neural networks for explaining teacher efficacy**

| Independent Variable Importance | | |
|---|---|---|
| | *Importance* | *Normalized Importance* |
| Learnercentered | ,611 | 100,0% |
| Teachercentered | ,389 | 63,7% |

Based on the neural network analysis, it is thought that it will be appropriate to create a model from a learner-centered approach to guidance, behavioral-ınstructional-management, motivation, and teaching skills dimensions given in Figure 4.6.

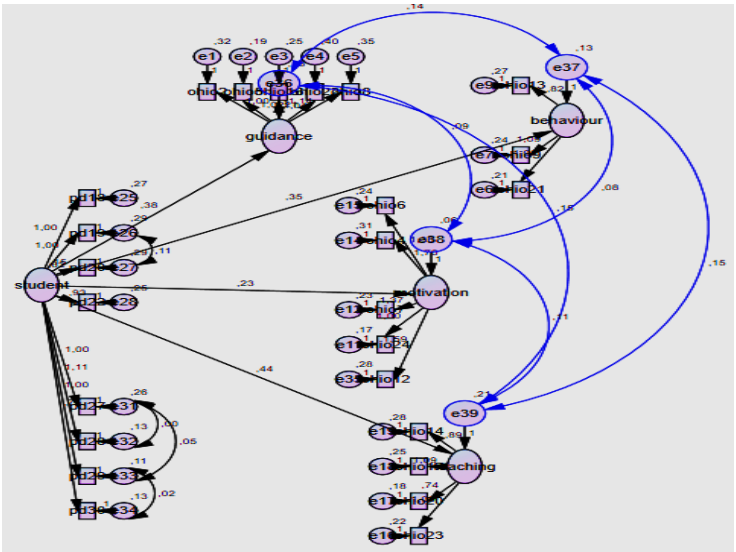


**Figure 4.6. Path analysis from learner-centered approach to guidance, behavioral-ınstructional-management, motivation, and teaching skills dimensions**

Path analysis results show that there is a causal connection from learner-centered approach to guidance, behavioral-ınstructional-management, motivation, and teaching skills dimensions in Table 3.23. Most of the model fit values are at an acceptable level.

**Table 3.23. Path analysis results and model fit values**

| Hypothesis | *Estimate* | *S.E.* | *C.R.* | *P* | *Result* |
|---|---|---|---|---|---|
| *H1: learner-centered → Guidance* | ,376 | ,069 | 5,438 | *** | ✔ |
| *H2: learner-centered → Behavioural-Instructional-Management* | ,355 | ,072 | 4,954 | *** | ✔ |
| *H3: learner-centered → Motivation* | ,231 | ,048 | 4,852 | *** | ✔ |
| *H4: learner-centered → Teaching skills* | ,443 | ,081 | 5,463 | *** | ✔ |
| CMIN/DF= 1,935 CFI= ,930 RMSEA= ,049 AGFI= ,879 PNFI= ,760 GFI= ,930 RMR= ,019 NFI= ,867 IFI= ,931 RFI= ,848 | | | | | |
| P values less than 0.001 are indicated by ***. | | | | | |

## 5. DISCUSSION AND CONCLUSION

It was shown that the gender variable doesn't make any significant difference in teacher's pedagogical belief systems and teacher efficacy. This shows that gender has no role in affecting pedagogical belief systems and their teacher efficacy for this sample. Some studies support the finding of this study in terms of teacher efficacy. For instance, Bilali (2013) expresses that female and male teachers had similar levels of self-efficacy. However, some studies show that gender had a statistically significant influence on teachers' self-efficacy (Sarfo et al. 2015; Lesha, 2017; Aurah and McConnell, 2014; Butucha, 2013; Butucha, 2014; Kinyua and Oboko, 2013; Klassen and Chiu, 2010). Some studies (Coladarci & Breton, 1997; Romi & Leyser, 2006) found higher efficacy scores in favor of female teachers, which Ross et al. (1996) explained by the perception of teaching as a more female profession. Similarly, in the studies conducted by Can and Çelik (2018), Sosyal, Kutluca, and Radmard (2018), Tezci, Dilekli, Yıldırım, Kervan, and Mehmeti (2017), Çoşkun (2020), it was concluded that female teacher candidates were more prone to student-centered understanding compared to male teacher candidates. Akay ve Boz, (2011), Saracaloğlu et al (2013), Kutluca (2018), and Yaralı (2019), however, found that pedagogical beliefs did not differ concerning the gender variable of teachers and teacher candidates so that this researches also support the findings of this study. This study shows that gender is not an affecting factor for pedagogical belief systems and teacher efficacy because these dimensions should be affected by more cognitive and affective dimensions rather than a sociological dimension like gender. It can be concluded that the teacher education system might be effective for eliminating the effect of this variable in terms of pedagogical perspective in this respect or at least for his sample it is observed no such an effect. Another reason for this result may be stemmed from the heterogeneous character of the sample of this study. Maybe in terms of specific levels, the gender variable can show its effect depending on the branch, school, or specific location. It should be noted that it is investigated the perception of pedagogical belief systems and teacher efficacy of teachers so, in reality, these can differ according to gender in real teaching and learning process also. Besides, as the sample of this study, science and art centers are one of the extensive participant groups. So that in consideration of the findings and discussion above, these teachers are also chosen according to their professional capacity through some criteria. Some of these criteria are scientific studies, projects, awards, postgraduate education, etc…of the applicants. So it is not important for the Ministry of National Education to level the gender effect.

It was shown that the experience variable doesn't make any significant difference in teacher's pedagogical belief systems and their teacher efficacy. This result is found to be very surprising for the researchers of this study for the teacher efficacy as emphasized by Bandura (1997), the most significant source for developing self-efficacy belief is actual experiences. According to research on teacher self-efficacy beliefs and resources, experienced teachers ' self-efficacy beliefs are more resistant to change than are new teachers and that experience play the main role in changing teachers' self-efficacy beliefs (Tschannen-Moran & McMaster, 2009; Tschannen-Moran & Johnson, 2011; Woolfolk-Hoy & Spero, 2005). Researchers believe that teachers' self-efficacy can be expressed as

"can-do rather than will-do" since self-efficacy must contain the assumption in capacity. Can is a judgment on competence; Will is linked to intention (Bandura, 2006: 308; Klassen and Chiu, 2010). Klassen and Chiu (2010) found that teachers' self-efficacy was influenced by years of experience in a nonlinear relationship, with the three factors of teacher efficacy increasing with experience for early and mid-career stage teachers and declining for teachers in the late-career stages'. The finding of this research is also against Huberman's (1989) professional life cycle of teachers implying that there should be variations according to those stages as the experience increases. Therefore, job experience should be an important factor since their teacher efficacy is thought to be learned in the process and practice of education. This can be explained by other contextual variables mediated by financial worries, job or life satisfaction, or other social factors, etc. However, no variation in pedagogical belief systems implies that teachers have similar belief systems regarding education. Variations in pedagogical belief systems are especially expected to be seen in a sudden shift from a particular educational philosophy to another one. For example, In 2004, the Ministry of National Education launched primary and secondary education initiatives and then devised plans to execute the programs. Till 2004, the Ministry pushed the behaviorism, which is the dominating psychological paradigm in our educational system, and historically called essentialist and permanent in education, and instead followed progressive social-cognitive psychological constructivist methods which was a result of the pragmatism in educational thought. Along with this, the teaching and learning results in the course were redesigned to encourage a more constructivist method. Here, it cannot be assumed that the systems fully adopt teachers. This improvement was introduced without sufficient experimentation and the teachers were not pleased. Many teachers were unwilling to adjust to the modern teaching style, they knew that their best years had passed (Baş,2011). In such phases, it can be observed more dichotomies and variations in terms of the job experience of teachers. However, after passing 17 years, it is probable that most teachers adopt a similar philosophy because there is no abrupt change in the philosophy of education since then. When it is taken into consideration about science and art centers, teachers that are a participant for this study may answer the questions of the scale according to their perceptive situations about their experimentation in their affiliations. Because gifted learners' curricula are completely different from a standard curriculum. There are many more recent models for the education of the gifted. The applicants who want to teach in science and art centers may have a long experience of their occupation but when they started to teach in science and art centers for the gifted, they have to be like a new candidate, have to be always a learner and have to produce new plans for each student group. Because gifted students never accept a traditional and normal school-based curriculum and they are always eager to gain recent and top-level information and abilities.

It was shown that the affiliation variable makes a significant difference in teacher's pedagogical belief systems but makes no significant difference in their teacher efficacy except for their teaching skills. It is found that the learner-centered approach is mostly adopted by primary school teachers and compared to primary school teachers, secondary school and science and art centers teachers have less mean rank in this respect. While the teacher-centered approach takes the transfer of information independent from the individual, student-centered understanding accepts, by contrast, that knowledge may differ depending on the experience and interpretation of the individual (Ertmer & Newby, 2013). Hence maybe because of the complication of the information in different affiliations or maybe the student characteristics may result in such a finding. Independent variable importance analysis of this study also shows that affiliation is the most important factor for pedagogical belief systems in comparison to experience and gender dimensions so that it implies affiliation has some sort of effective role shaping pedagogical beliefs of the teachers. In terms of the teacher-centered approach, the highest mean rank belongs to secondary school teachers whereas the lowest value belongs to science and art center teachers which are expected from science and art centers teachers because of the nature of the students they are dealing with since those student needs to be more independent and more autonomous activities than others. For the science and art center teachers, teacher-centered results' low appearance may have seen normal because of the gifted program requirements, but it may not have seen normal for student-centered results' low appearance. But as stated through the previous paragraphs about findings, it may differ about teachers' proficiency perception who started to work in science and art centers in recent years. So the teachers who are accepted for these centers recently maybe haven't adapted to the students yet. Because gifted students

sometimes have behavioral disturbances. Hence it is one of their natural characteristics. It is not only a binding discussion for science and art centers but also the same for some schools that have a problematic socio-cultural environment. This differentiation affects the students' tendency to education, so at the same time, it also affects teachers' approach to teaching.

It is also shown that teaching skills dimensions in the teacher efficacy scale, the highest mean rank belongs to science and art centers teachers whereas the lowest mean rank belongs to secondary school teachers. According to Hoy and Davis (2006), lower time spent on tasks, willingness to feedback, motivation in the classroom, higher goals, and persistence in the face of obstacles is the direct implications of teacher efficacy. In this respect, it is expected that teacher efficacy should vary from affiliations since those dimensions are also related to the characteristics of the students as well. Independent variable importance analysis of this study supports this claim by showing that experience is the most important factor for teacher efficacy in comparison to experience and gender dimensions. Some studies also support this assumption. For example, Klassen and Chiu (2010) and Wolters and Daugherty (2007) observed that teachers in higher grades have low self-efficacy and that the inverse association between grade level and self-efficacy. The reason why it is found that teaching skills dimensions in teacher efficacy scale, the highest mean rank belongs to science and art centers teachers can be explained by teachers in the science and art centers is specially chosen ones based on particular criteria such as having an M.S or Ph.D. degree, making national or international projects, etc. Therefore, the finding of the study may imply the result of this filtering process in science and art centers. According to Tweed (2013), the perception of self-efficacy defines when instructional acts can be enforced, how much commitment will be placed into the practice, and how long the activity will continue in the face of setbacks and failures. Highly effective people have a greater chance of success than those with low self-efficacy so that this can reflect itself in this dimension as a significant difference. Hence, our result implies that teachers in science and art centers as more efficacious teachers can handle complex situations easily, have good decision - making and management skills, use instructional strategies more effectively, sustain the students' interest, maintain the continuity of the task, have better classroom management skills and are more willing to embrace novel teaching methods (Tschannen-Moran & Woolfolk Hoy, 2001; Milner & Woolfolk Hoy, 2003; Hansen, 2005) so that their characteristics are compatible with the standards of gifted education. Science and art teachers always have to be ready and researchable for gifted education. As stated before, the teachers working in these centers are being gone through an interview by the Ministry of National Education. For this interview, not all the applicants have a chance to be accepted. Before some criteria about their competences and documents designate their situation to attend the interview. So these teachers already think that they will be benignant for the education and also for the gifted. They may believe it and they are professional than the other applicants as they could attend the interview and be accepted by the Ministry of National Education.

Independent variable importance shows that the most important factor is the guidance for sub-dimensions of teacher efficacy in terms of neural networks for explaining pedagogical belief systems and the second one is the assessment and evaluation and motivation. It seems that the Spearman correlation constant is in parallel with the independent variable importance analysis. According to this, all the sub-dimensions of teacher efficacy are in low level positive significant correlations with the pedagogical belief systems but no correlation is found with the teacher-centered approach except assessment and evaluation dimension. When path analysis is conducted from teacher efficacy to pedagogical belief systems, causal links cannot be modeled based on the correlation analysis although model fit values are very close to ideal values so that p values are not significant so that the causal link cannot be inferred. According to findings, the learner-centered approach is the most important dimension of pedagogical belief systems in terms of neural networks for explaining teacher efficacy. Therefore a new model was created based on this fact so that path analysis results show that there is a causal connection from learner-centered approach to guidance, behavioral-ınstructional-management, motivation, and teaching skills dimensions to some extend. When the literature is examined studies are supporting the finding of this study. Çoşkun (2020) found a low-level positive relationship between "student-centered" understanding and self-efficacy beliefs. Ocak, Ocak ve Kalender (2017) observed a modest positive correlation between student-centered beliefs and self-efficacy while they could not

find a relationship between teacher candidates' self-efficacy beliefs and pedagogical beliefs in a teacher-centered perspective. Kutluca (2018) stated that there is a moderate positive relationship between teacher self-efficacy beliefs and pedagogical beliefs, and pre-service teachers with high self-efficacy use pedagogical approaches better. When the items of the teacher efficacy and learner-centered approach are examined by considering independent variable importance analysis it can be easily predicted why there is a low-level correlation found between them. Items of Guidance dimensions are like this "What level of power do you have to explain to your student what behavior you expect from him/her?"(item 5) or "How strongly do you have to contribute to the critical thinking of your students?" (item 2) so that they are all concerned with the needs of the students. Additionally, the low-level positive correlation may imply the perception and behavior dichotomy in this regard. Maybe teachers don't internalize teacher-centered beliefs or teacher self-efficacy beliefs so that it reflects itself in this low-level correlation. The teacher's beliefs' who are good at and belive learner-centered approach are expected to guide students with their best effort. These teacher characteristics manifest themselves in all ambiance and have multifarious competencies. So by the guidance competency of them and teaching skills abilities, motivation comes automatically for all fields. The teachers who have these competencies always motivate themselves and their students under all circumstances. Thoroughly the most important factor about learning and teaching process assessment comes into view. As reported by the percent factors of sub-dimensions of pedagogical belief systems, motivation and assesment are so close to each other. These sub-dimensions are generally the most important factors in the teaching and learning process, so it can be specified that the findings of the study show confidential results. Besides, when checked about the teacher-centered approaches' correlations, to a specific degree assesment evaluation has a positive relationship. The other sub-dimensions that are the most important respects about effective education can't be seen in the teacher-centered approach. This is why from 2004, constructivism was detected by the curricula development specialists that only assesment and evaluation can't be successful in education that innovative approach term has begun and student-centered approach has shown its important side.

## 6. RECOMMENDATIONS

First of all, the reason why the experience variable doesn't make any significant difference on teacher's pedagogical belief systems and their teacher efficacy could be revealed by qualitative or mixed research designs. For data acquisition only using quantitative methods like scales may not be enough for acquiring extensive results. By the qualitative data, participants can reflect their perspectives extensively and also limited but general discussions can be presented for research. Secondly, the sources of affiliation variable making a significant difference on teacher's pedagogical belief systems but making no significant difference on their teacher efficacy except for their teaching skills could be revealed by different methods such as interviews or focus-group interviews. Finally, the perception and behavior dichotomy both in pedagogical belief systems and their teacher efficacy can be examined by subsequent studies. Moreover, according to the results of the findings of this research, the highest percent proportion of teaching skills is seen for science and art center teachers. This may mean that the other affiliations of teachers except for science and art centers don't need to improve their teaching skill competencies, maybe because of the students' reluctant and usual learning atmospheres. But this factor shouldn't be an obstacle for their teachers to develop their teaching competencies. As teachers enhance their competencies, in direct proportion, their efficacy will enhance automatically. Starting from this point of view, teachers, whatever the seniority of their occupation is, should get in-service training programs. Innovative techniques and methods take an important role in this fact. By the global updating of educational methods and approaches, by the globalization of the world and by the general development of the whole countries, students' educational requirements also increase. When the teachers can't encounter these requirements students may not be satisfied and their attitude toward schools and education also decreases. So to feel benignant throughout the teaching environment, in-service training should be planned innovatively and let the teachers have this education properly.

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