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Research Article

Examining Teachers' Professional Relationships, Friendship, and Trust Networks via Social Network Analysis*

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Social network analysis, professional relationship, workplace friendship, trust networks, teacher

Abstract
In this study, Social Network Analysis method was used to determine the professional relationships, friendships and trust networks that teachers established with their colleagues. The study group of the research consists of 35 teachers working in a public secondary education institution in Aydın province. A three-question structured interview form developed by the researchers was used to determine teachers' social networks. Data analysis was carried out through the UCINET 6.0 program. When the findings regarding the positions of teachers in the professional relationship network, friendship network and trust network were examined, it was determined that the network structure with the highest number of connections was the friendship network (ties = 97), followed by the professional relationship (ties = 95) and the trust network (ties = 66). In all social networks, teachers with mathematics, guidance, literature and biology branches were found to be at the center of the network, acting as a bridge between other actors and providing information and resource flow. According to the findings, it was determined that the network with the highest density (dens. = 0.082), bilateral (dia. = 0.198) and triad (triad = 0.330) reciprocity rate was the friendship network. This study, which examines the professional relationships, friendships and trust networks that teachers establish with their colleagues, is thought to be important in revealing the relationships between teachers and analyzing the current situation.

Öğretmenlerin Mesleki İlişki, Arkadaşlık ve Güven Ağlarının Sosyal Ağ Analizi ile İncelenmesi

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Öz
Bu çalışmada öğretmenlerin meslektaşlarıyla kurdukları mesleki ilişkiler, arkadaşlıklar ve güven ağlarının belirlenmesi amacıyla Sosyal Ağ Analizi yöntemi kullanılmıştır. Araştırmanın çalışma grubunu Aydın ilindeki bir resmi ortaöğretim kurumunda görev yapan 35 öğretmen oluşturmaktadır. Öğretmenlerin sosyal ağlarını belirlemek amacıyla araştırmacılar tarafından geliştirilen üç soruluk yapılandırılmış görüşme formu kullanılmıştır. Veri analizi UCINET 6.0 programı ile gerçekleştirilmiştir. Öğretmenlerin mesleki ilişki ağı, arkadaşlık ağı ve güven ağı içerisindeki konumlarına ilişkin bulgular incelendiğinde, en fazla bağlantıya sahip ağ yapısının arkadaşlık ağı (bağ=97) olduğu, bunu sırasıyla mesleki ilişki ağının (ties = 95) ve güven ağının (ties = 66) takip ettiği belirlenmiştir. Tüm sosyal ağlarda matematik, rehberlik, edebiyat ve biyoloji branşına sahip öğretmenlerin ağın merkezinde yer aldığı ve diğer aktörler arasında köprü görevi görerek bilgi ve kaynak akışını sağladığı ortaya çıkmıştır. Elde edilen bulgulara göre yoğunluğun (yoğunluk = 0.082), ikili (dia = 0.198) ve üçlü (triad = 0.330) karşılıklılık oranının en yüksek olduğu ağın arkadaşlık ağı olduğu belirlenmiştir. Öğretmenlerin meslektaşlarıyla kurdukları mesleki ilişkiler, arkadaşlıklar ve güven ağlarının incelendiğini bu araştırmanın öğretmenler arasındaki ilişkilerin ortaya konmasında ve mevcut durumun analiz edilmesinde önemli olduğu düşünülmektedir.

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Introduction

Social network is the relationship patterns between individuals (actors) in a group (Degenne & Forse, 1999). Social network analysis is the holistic evaluation of an individual's behavior within the network system, as a result of examining the relationships an actor establishes with other individuals in the organization (de Nooy et al., 2005; Tichy et al., 1979). In social network analysis, the underlying causes and consequences of behavior are discussed (Freeman, 2004: 3, 5), taking into account the relationships between individuals (Wasserman & Faust, 1994) and the individual's interactions with others and the environment (Borgatti & Ofem, 2010). By revealing how communication, information, and resource flow occur in the organization through social network analysis (Agcasulu, 2019), informal groups and group leaders in the organization can be determined (Balkundi & Kilduff, 2006: 419; Er, 2017). By examining the position of individuals in the network through social network analysis, it is possible to make predictions about their behavior, performance, and tendencies (Borgatti, Everett & Johnson, 2013: 1-2). By revealing the relationship networks between individuals, managers in organizations can have an idea about how these relationships will be shaped in the future (Ibarra & Andrews, 1993). Since informal group leaders can be determined through social network analysis, managers in the organization can direct these leaders in line with the goals of the organization (Balkundi & Kilduff, 2006: 419), and reveal their potential contributions by including isolated actors who are outside the network and cannot communicate with other individuals in the network (Agcasulu, 2019).

Through social network analysis, network analyzes covering all schools can be carried out (Bakkenes et al., 1999). In addition, network maps can be created solely for the communications and interactions that teachers have with each other. As a result of these analyses, the support, trust, and cooperation networks that teachers establish with their colleagues can be obtained (Moolenaar, 2012). Integration and change activities targeted in schools can be achieved through the professional development of teachers and ensuring organizational effectiveness through strong social networks established among teachers. Examining social networks among teachers can identify groupings and communication gaps between actors. Thus, steps can be taken to eliminate the deficiencies experienced in the school (Hangul, 2018). In addition to educational research in which the social networks of the relations between teachers and school administrators are analyzed in the national literature (Er, 2017); social network is seen to be associated with organizational intelligence (Neyisci & Ercetin, 2020), organizational power distance (Yesilbas-Ozenc, 2022), classroom interaction (Eren, 2018), peer group support (Toytok et al., 2019), teacher career steps (Bakioglu & Banoglu, 2013) and social capital (Ozdemir, 2008). Considering the studies published in the international literature, it is seen that the social network taken as, teachers' self-efficacy level (Siciliano, 2016), professional collaboration (Lin et al., 2016), perception of professional and social support (Feroli, 2015), social capital (Conery, 2012; Liou & Daly, 2014), colleague cooperation and student success (Moolenaar et al., 2012), individual and school-related values (Spillane et al., 2012), teachers' perception of work (Daly et al., 2010), trust in the school principal and professional It is seen that its relationship with the perception of learning community (Liou, 2010), distributed leadership (Warfield, 2009), organizational power and power resources (Brass, 1984; Brass & Burkhardt, 1993) is discussed. Many studies conducted on teachers' social networks in the international literature have concluded that social networks among teachers strengthen shared responsibility to increase students' success, increase cooperation and cooperation among teachers, and enable the creation of appropriate learning environments to achieve the school's goals (Daly et al., 2010; Penuel et al., 2007; Penuel et al., 2009).

It is possible to reach three basic conclusions based on the findings of the research conducted to determine social networks in schools. These are; (1) The structure of social networks among teachers varies in each school. (2) The social network structure in schools is generally fragmented and consists of subgroups and cliques. (3) The social networks of school administrators and teachers are different from the hierarchical structure of the school. In social networks, informal leaders may emerge in addition to formal leaders at school (Eren & Kiral, 2018; Moolenaar, 2012). In social networks in schools, teachers can take part in various groups, act as a bridge between two groups, or become isolated by not communicating with other actors (Monge & Eisenberg, 1987). In addition, teachers in a central position in social networks can increase the capacity of the organization and determine the direction of relations (Er & Calik, 2017). Therefore, by identifying social networks in schools, school administrators can do the necessary work to include isolated actors in the social network by strengthening the relationship and support networks between teachers (Yesilbas-Ozenc, 2022).

In studies to determine social networks in schools, it is aimed to determine the relationship and behavior patterns of students as well as teachers. In these studies, teacher behaviors and cooperation networks between teachers, which have a significant impact on student achievement, are discussed (Eren & Kiral, 2018). In addition, one of the results obtained is that professional collaboration networks among teachers increase student success (Moolenaar et al., 2012). In summary, it is possible to make inferences about both teacher behavior and student success by examining the relationship networks between teachers. Unlike other studies in the literature, this research aims to determine the professional relationships, friendships, and trust networks that teachers working in a public secondary education institution establish with their colleagues. In

this context, the social network patterns at the school were revealed by examining the professional relationships, friendship, and trust networks that teachers working at X High School, one of the official secondary education institutions in Aydın Province, established with their colleagues. This research is thought to be important in terms of revealing the relationship patterns between teachers using the social network analysis method. Since the number of studies on teachers' social networks is limited in the national literature, this research is expected to contribute to the literature, school administrators, and policymakers. The problem statement of the research is; "What are the professional relationships, friendships, and trust networks of teachers working in a secondary education institution?" and the sub-problems of the research are as follows:

1. How is the network of professional relationships that teachers establish with their colleagues?
2. How is the network of friendship relationships that teachers establish with their colleagues?
3. How is the network of trust relationships that teachers establish with their colleagues?

Method

In this study, to reveal the social networks, in other words, the relationship patterns, of teachers working in a public secondary education institution with their colleagues, social network analysis method was used. Within the scope of this analysis method, relationship networks were created regarding the professional relationships, friendships, and trust networks that teachers established with their colleagues. Social network analysis is a research method in which an individual's behavior is discussed within the network system as a result of examining the relationships an actor establishes with other individuals in the organization (de Nooy et al., 2005; Tichy et al., 1979). Via social network analysis, network maps can be created for the communications and interactions that teachers establish with each other. As a result of these analyses, the support, trust, and cooperation networks that teachers establish with their colleagues can be obtained (Moolenaar, 2012). In this context, the study determined the relationship networks that teachers established with their colleagues, as well as which branch of teachers was in a central position in these relationships, and which provided the flow of information and resources by acting as a bridge between teachers.

Study Group

The study group of the research, which was carried out to determine the professional relationship, friendship, and trust networks of teachers, consists of 35 teachers working in an official secondary education institution in Aydın. The full network data collection method, which is one of the social network analysis data collection methods, was used in the research. The full network data collection method is to reach all the participants in the network, and this data collection method is frequently used in educational research (Eren, 2018; Moolenaar, 2012; Ugurlu, 2013). In this context, all teachers working at the school were reached, regarding the social network at the school; the opinions of 35 teachers in their fields as 1 Counselling, 5 Mathematics, 5 Literature, 4 Ing, 2 Physics, 1 Chemistry, 2 Physical Education, 2 Biology 2 History, 2 Geography, 2 French, 2 Philosophy, 2 Religious Culture and Ethics, 1 Visual Arts and 2 Music were obtained.

Data Collection Tool

A structured interview form developed by the researchers was used to determine teachers' social networks. An interview form called "Teachers' Social Networks", consisting of three questions, one each for determining teachers' professional relationships, friendship, and trust networks, was administered to the teachers. In the interview form, a code list containing the code numbers of each teacher was created, and the teachers were asked to answer the questions according to these code numbers. The questions in the interview form are as follows:

1. Can you share the code numbers of your fellow teachers at your school with whom you exchange ideas on professional issues such as lessons, teaching activities (projects, seminars, etc.), get help, and consult with?
2. Could you please share the code numbers of your teacher friends who you can define as close friends at your school, whom you are close to, and whom you meet outside of school (you talk on the phone or meet outside and spend time together)?
3. Can you share the code numbers of your teacher friends who you share your problems with, who support you and reassure you when you face a problem at school or when you face a situation that upsets you in your daily life?

Participants were asked the questions above. The data collection tool was created via Google Forms and delivered to the participants online.

Validity and Reliability

In scientific research, it is important to present the process followed while reaching the results of the research in a detailed and clear way to ensure the validity and reliability of the research. Thus, the researcher will be

able to fully reflect the reality. In addition, the findings being consistent within themselves, being related to the previously created conceptual framework, identifying unclear issues, and making predictions based on the findings consistent with the data obtained (Yildirim & Simsek, 2011) may contribute to the validity and reliability of the research. In this context, expert opinion and participant confirmation were sought to ensure the validity of the research. During the development of the measurement tool to determine teachers' social networks, the interview form was finalized by obtaining opinions from two field experts. Following the interviews with the participants, feedback was received from two participants regarding their answers to the questions, and statements that were not understood or that might cause misunderstanding were clarified after the participant's feedback. A sample selection was made appropriate to the problem situation (full network data collection), and in this context, a holistic evaluation of the social network at the school was made by reaching out to all teachers working at the school. In addition, the findings of social network analysis are given in detail, to adapt the research to a different problem situation and give ideas to studies carried out under similar conditions. To ensure reliability, the data were collected using an online form and then transcribed on a computer. In addition, after the structured interview form was created, pilot applications were carried out and the quality of the data was tested before the actual interviews to be included in the research. The validity and reliability of a study also depend on ethical issues (Merriam, 2015).

Throughout the research process ethical issues must be taken into consideration. For instance, protection of personal data, respecting the feelings and thoughts of the participants, and minimizing the personal opinions and prejudices of the researchers can be considered as ethical issues of the research. In this context, researchers paid attention to ethical issues by abandoning their individual thoughts and prejudices as well as interpreting and discussing the findings in the light of the literature according to the data received from the participants.

Data Analysis

Data regarding teachers' social networks were analyzed using the Social Network Analysis method. Data analysis was carried out via the UCINET 6.0 program. Basic and descriptive social network analysis statistics regarding social networks were carried out through the program. In addition, visualizations of teachers' professional relationships, friendships, and trust networks were made with the NetDraw program, and network maps of the actors were presented. Within the scope of data analysis, network maps of teachers' social networks, structural features of the network, and measurements of the centrality of the actors in the network were made.

Results

In this section, within the scope of social network analysis, findings regarding teachers' professional relationship networks, friendship networks, and trust networks are included. Then, findings regarding the structure of these networks and the bond strength between actors are presented.

Findings Regarding the Positions of Teachers in the Professional Relationship Network, Friendship Network, and Trust Network

When teachers' professional relationship networks, friendship networks, and trust networks are examined, it is seen that the most complex and dense network structure is in the friendship network (Figure 2), followed by the professional relationship network (Figure 1). It is seen that 95 ties were established between 35 actors in the teachers' professional relationship network, 97 ties in the friendship network, and 66 ties in the trust network.

In the professional relationship network of teachers, actors MATHS1, COUNSELLING, ENG1, MUSIC1, and LITERATURE3 are seen to be at the center of the network and provide the connection between other actors. In other words, it can be said that some actors whose branches are Maths, Counselling, Music, and Literature have an important role in the professional relations network. However, the striking finding is that the teacher with the code number MATHS1, majoring in Mathematics, is at the center of the network, acting as a bridge between other teachers and playing an important role in transferring resources and information among his colleagues. It can be said that all actors in the teachers' professional relationship network establish relationships with each other and there is no actor outside the network.

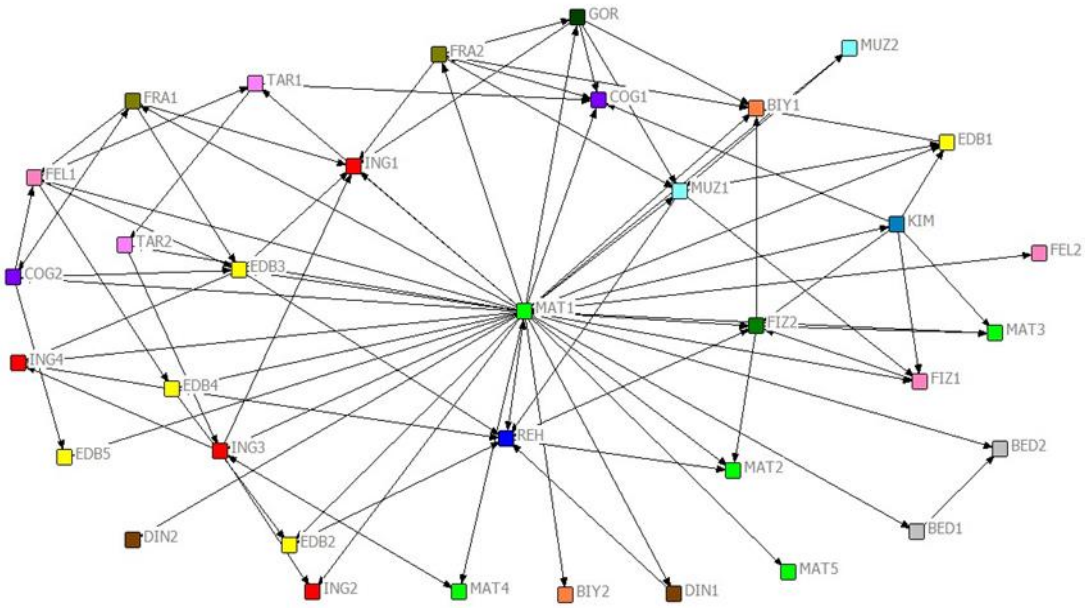

Figure 1. *Professional Relationship Network of Teachers*

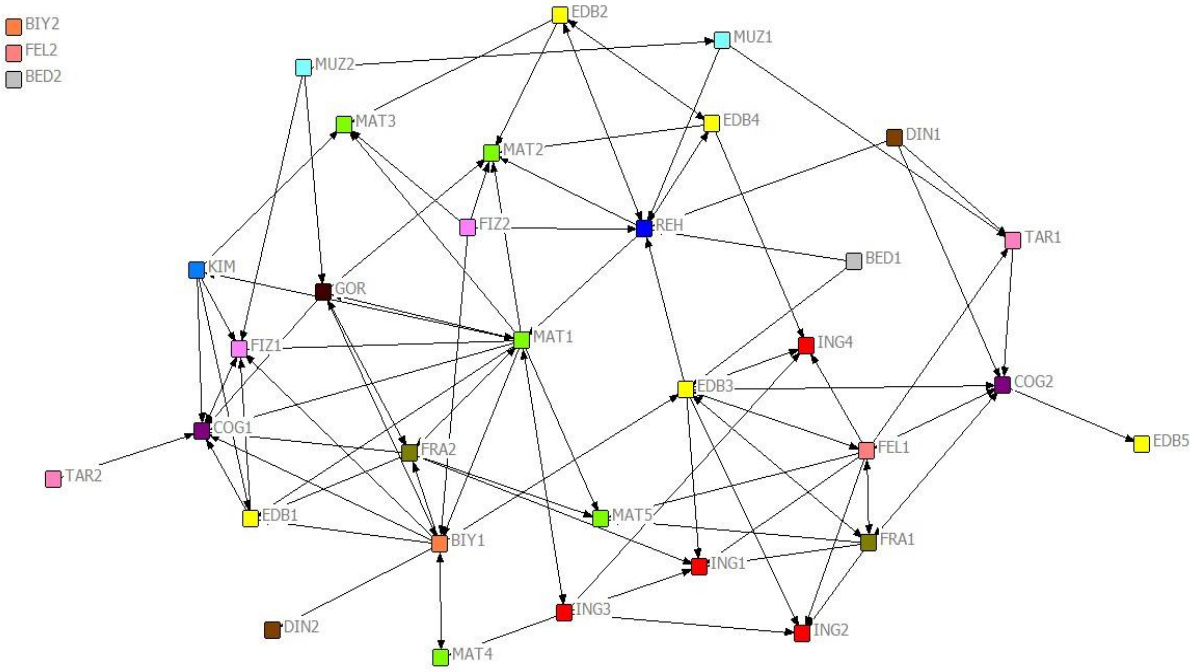

Figure 2. *Teachers' Friendship Network*

When the friendship networks established by the teachers with their colleagues are examined, it is seen that the most intense relations between the teachers are in the friendship network (97 bonds). When the friendship network is examined, it can be said that the actors MATHS1, COUNSELLING, LITERATURE3, MATHS2, FRENCH2, and BIOLOGY1 are at the center of the network. In the friendship network, it is seen that the actors with the branches of Mathematics, Counselling, Literature, French, and Biology are frequently contacted. In the friendship network, similar to the professional relations network, MATHS 1, COUNSELLING, AND LITERATURE3 actors have an important position in the network. It is seen that not all actors in the teachers' friendship network are included in the social network, and the actors in the branches of Biology, Philosophy, and Physical Education with code numbers BIOLOGY2, PHILOSOPHY2, and PE2 are isolated in the social network and do not/cannot establish relationships with other actors.

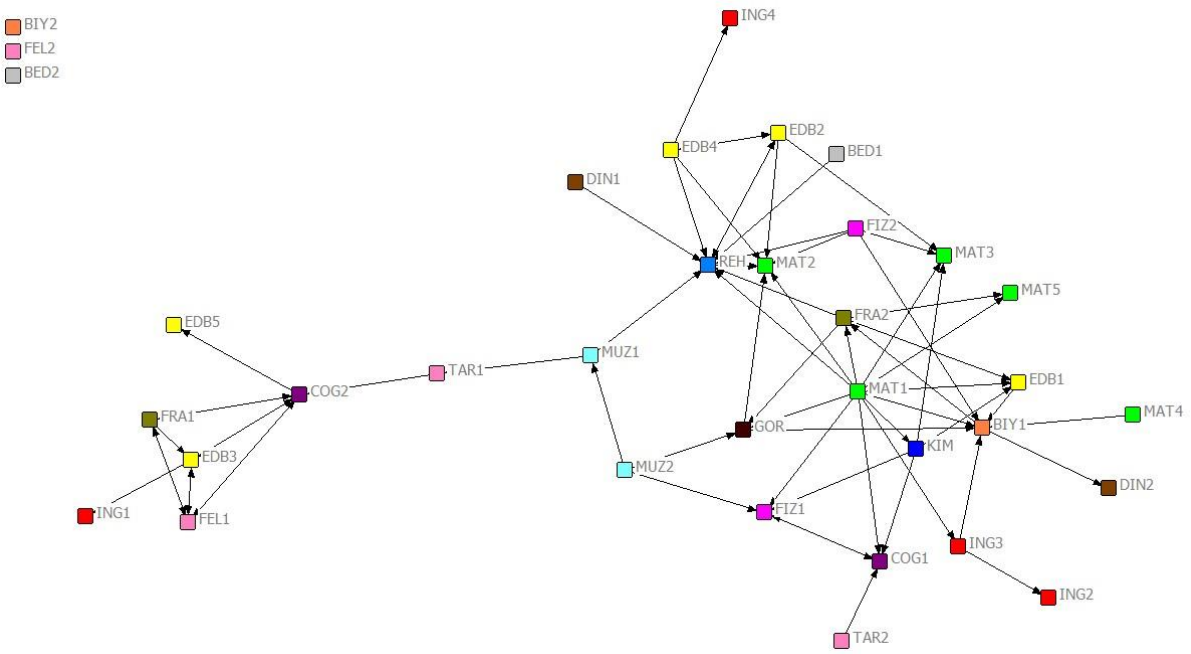

Figure 3. *Teachers' Trust Network*

It can be said that the weakest network structure among teachers is the trust network. Teachers exchange ideas on professional matters; courses, professional development activities, legislation, etc. They establish professional relationships and meet many colleagues to consult on academic matters. However, the number of colleagues that teachers meet outside school, establish close relationships with, and trust are fewer. When the trust network of teachers is examined, it is seen that the actors with the branches of Mathematics, Counselling, Biology, Geography, and Chemistry with code numbers MATHS1, COUNSELLING, MATHS2, BIOLOGY1, GEOGRAPHY1, and CHEMISTRY are at the center of the network. When the social networks established by teachers are examined, it is seen that the friendship network and the trust network have a similar structure, and it has been determined that the actors MATHS1, COUNSELLING, MATHS2, and BIOLOGY1 have an important role in both networks. When all social networks are examined, it is possible to say that participants with Mathematics and Counseling branches with code numbers Maths1 and Counselling are effective actors in social networks. In the teachers' trust network, not all actors are included in the social network; similar to the friendship network, it is seen that the actors in the branches of Biology, Philosophy, and Physical Education with code numbers BIOLOGY2, PHILOSOPHY2, and PE2 do not / cannot establish relationships with other actors in the network and do not communicate and interact. Although these actors establish relationships with their colleagues to establish professional relationships, it can be said that they do not maintain friendships in their daily lives and outside school.

In social network analysis research, visualizing the network makes it easier to examine the structural features of the network and to consider the connections between actors in detail (Yesilbas-Ozenc, 2022). In addition to network visualization, it is important to determine the positions of actors in the network and interpret the structural features of the network. In this context, firstly, the findings regarding the structure of teachers' professional relationship network, friendship network, and trust network, and then the findings regarding the centrality degree of teachers in these networks are included.

Findings Regarding the Structure of Teachers' Professional Relationship Network, Friendship Network, and Trust Network

In social network research, in addition to visualizing the network structure, various measurements can be made such as the density of the relationships established by the actors, the closeness between the actors, and the ratio of mutual relations between the actors. Through these measurements, it is possible to make various comments about the structure of social networks. findings regarding the structure of teachers' professional relationship network, friendship network, and trust network are summarized in Table 1.

As seen in the Table 1, the network with the most connections among the participants is the teachers' friendship network. Density in a social network refers to the frequency of connections between actors. Density takes a value between 0 and 1, and a density of 0 indicates that there is no interaction between the actors, while a density of 1 indicates that there are strong relationships between the actors (Carrington, Scott & Wasserman, 2005; Eren, 2018; Everett & Borgatti, 2005). In this study, the networks with the highest density

are the friendship network (D=0.082, Avg. Degree=2.771), professional relationship network (D=0.080, Avg. Degree=2.714) and trust network (D=0.055, Avg. Degree=1.886). Based on this, it can be said that teachers' friendship networks and professional relationship networks are networks with high density, as they take values close to 1.

Table 1. *Structural characteristics of teachers' professional relationship network, friendship network, and trust network*

	Professional relationship network	Friendship network	Trust network
Network size	35	35	35
Ties	95	97	66
Density	0.080	0.082	0.055
Reciprocity (dual-diad)	0.118	0.198	0.138
Reciprocity *(triple-triad)*	0.211	0.330	0.242
Transivity	0.429	0.399	0.459
Cluster coefficient	0.383	0.238	0.268
Average distance	3.124	2.697	2.461

Whether social networks are structured or not is important in interpreting the network. The structured structure in the network is determined by reciprocity and transitivity analyses. Reciprocity gives an idea about the symmetry of the network and whether the actors are in a balanced position (Kilduff & Tsai, 2007; Krackhardt, 1998), and with this analysis, it can be determined whether the relations between the actors are reciprocal (Tunali, 2016: 42). In the study, the network reciprocity rate was calculated as 21% (Arc Reciprocity=0.211) in the professional relations network, and the reciprocity rate in bilateral connections was calculated as 12% (Dyad Reciprocity=0.118). According to these findings, it appears that the reciprocity of teachers' professional relationships network is at a low level. In the friendship network, the network reciprocity rate was calculated as 33% (Arc Reciprocity=0.330), and in bilateral connections, the reciprocity rate was calculated as 20% (Dyad Reciprocity=0.198). Based on this, it can be seen that the reciprocity of the teachers' friendship network is at a low-medium level. Finally, in the teachers' trust network, the network reciprocity rate was calculated as 24% (Arc Reciprocity=0.242), and the reciprocity rate in bilateral connections was calculated as 14% (Dyad Reciprocity=0.138). It was found that the reciprocity of the teachers' trust network was at a low level. When teachers' social networks are compared, the network with the highest level of reciprocity is the friendship network. Based on the findings, it can be said that teachers' friendship networks include higher levels of mutual relations than professional relationships and trust networks.

Another measurement regarding the structure of the network, transitivity, is the determination of three-person groups in the network. Triad groups in the network are indicators that the structure of the network is balanced and sustainable (Kilduff & Tsai, 2007; Krackhardt, 1998). The network with the highest transitivity in the study is the teachers' trust network with a transitivity rate of 46% (Triplet Transitivity = 0.459). This is followed by a professional relationship network with 43% (Triplet Transitivity=0.429). The network with the lowest transitivity rate is the friendship network (Triplet Transitivity=0.399). According to this finding, it can be said that the trust network is more structured and sustainable compared to professional relationships and friendship networks.

The clustering coefficient is the calculation of the probability that two neighboring actors are connected. This coefficient takes a value between 0 and 1, and a high value indicates that internal connections between actors are high and external connections are low (Eren, 2018). In the study, the clustering number of the professional relationship network was found to be 0.383 (Clustering Coefficient = 0.275), the friendship network was 0.238 (Clustering Coefficient = 0.238), and the trust network was 0.268 (Clustering Coefficient = 0.268). Although it was determined that the social network with the highest clustering coefficient was the professional relationship network, clustering was observed to be at a low level in all social networks. Therefore, it can be said that the ratio of actors with whom the actors are directly connected in these networks is low.

Findings on the Centrality of Teachers in Professional Relationships, Friendships, and Networks of Trust

Through social network analysis, the positions of actors in the network can be determined, and actors with high influence capacity within the network can be identified (Oztas & Acar, 2004). Various centrality measurements such as degree, closeness, betweenness, and eigenvector centrality values are used to determine these actors in the network. Below are the degree centrality measurements for professional relationships, friendships, and trust networks (Table 2).

Table 2. *Rank centrality measures of professional relationships, friendship, and trust networks*

Degree	Professional Relation Network	Friendship Network	Trust Network
0	-	PHILOSOPHY2, BED2, BIOLOGY2	BIOLOGY2, PHILOSOPHY2, PHYSICAL EDUCATION2
1	MATHS5, BIOLOGY2, PHILOSOPHY2, RELIGION2	RELIGION2, LITERATURE5, HISTORY2	MATHS4, EDB5, ENGLISH1, ENGLISH2, ENGLISH4, PHYSICAL EDUCATION1, HISTORY2, RELIGION1, RELIGION2
2	LITERATURE5, ENGLISH2, PHYSICAL EDUCATION1, PHYSICAL EDUCATION2, RELIGION1	PHYSICAL EDUCATION1	MATHS5, HISTORY1
3	MATHS2, MATHS3, MATHS4, HISTORY2, MUZ2	MUSIC1, MUSIC2, MATHS4, RELIGION1	ENGLISH3, MUSIC1, MUSIC2
4	LITERATURE1, LITERATURE2, ENGLISH4, PHYSICS1, HISTORY1	ENGLISH2, ENGLISH4, HISTORY1, MATHS3, MATHS5	MATHS3, LITERATURE1, PHYSICS2
5	-	PHYSICS2, CHEMISTRY	LITERATURE4, PHYSICS1, CHEMISTRY, GEOGRAPHY1, FRENCH1, GEOGRAPHY
6	LITERATURE4, ENGLISH1, CHEMISTRY, BIOLOGY1, GEOGRAPHY1, GEOGRAPHY2, FRENCH1, PHILOSOPHY1	LITERATURE1, LITERATURE2, LITERATURE4, ENGLISH1, ENGLISH3, MATHS2	MATHS2, LITERATURE2, LITERATURE3, FRENCH2, PHILOSOPHY1
7	LITERATURE3, ENGLISH3, GEOGRAPHY	PHYSICS1	-
8	PHYSICS2, MUSIC1	GEOGRAPHY	BIOLOGY1, GEOGRAPHY2
9	FRENCH2	GEOGRAPHY1, GEOGRAPHY2, FRENCH1, FRENCH2	-
10	-	-	COUNSELLING
11	-	BIOLOGY1, PHILOSOPHY1	-
12	COUNSELLING	COUNSELLING, LITERATURE3	MATHS1
15	-	MATHS1	-
35	MATHS1	-	-

Degree centrality refers to the direct connections an actor establishes with others (Everett & Borgatti, 2005), and actors with a high number of connections in the network are at the center of the network and have an important position in the network (Scott, 2000). According to degree centrality measurements, it is seen that the highest degree actors in the professional relations network are MATHS1 (deg=35), COUNSELLING (deg=12), FRE2 (deg=9) and PHSICS2 and MUSIC1 (deg=8). In the friendship network, the highest-ranking actors were calculated as MATHS1 (deg=15), COUNSELLING and LIT3 (deg=12), BIOLOGY1 and PHILOSOPHY1 (deg=11), respectively. Finally, when the degree centrality in the trust network was examined, it was determined that the actors with the highest degrees were MATHS1 (deg=12), COUNSELLING (deg=10), BIOLOGY1, and GEOGRAPHY2 (deg=8). When these three social networks were examined, it was revealed that the actors with a high degree of centrality, in other words, those with a high number of ties with other actors, were the actors with code numbers MATHS1, COUNSELLING, LIT3, BIOLOGY1, PHILOSOPHY1 and FRENCH2, respectively. Based on these findings, it can be said that these six actors with the branches of Mathematics, Counselling, Literature, Biology, Philosophy, and French listed above are at the center of the network and have an important position in providing a transition between other actors in the relationship network.

Calculating the closeness centrality value is important in determining the centrality of actors in the network. Closeness centrality refers to an actor's ability to directly reach others and access information (Carrington et al., 2005; Marsden, 2005). Findings regarding actors with high closeness centrality in teachers' professional relationships, friendship relationships, and trust networks are included in Table 3.

Table 3. *Closeness centrality measurements of professional relationships, friendships, and trust networks*

Professional Relationship Network	Closeness	Friendship Network	Closeness	Trust Network	Closeness
PHILOSOPHY2, RELIGION2, BIOLOGYLOGY2	411.000	PHILOSOPHY2, PHYSICAL EDYCATION2, BIOLOGYLOGY2	476.000	PHILOSOPHY2, RELIGION2, BIOLOGYLOGY2	544.000
PHYSICAL EDUCATION1	408.000	HISTORY2	465.000	HISTORY2, ING2	531.000
LITERATURE5	406.000	LITERATURE5	410.000	RELIGION1, PHYSICAL EDUCATION1	511.000
LITERATURE2	405.000	RELIGION2	409.000	ENGLISH1	507.000
MATHS3	404.000	ENG2	392.000	LITERATURE5	504.000
MATHS5	397.000	MATHS3	389.000	PHYSICS1	503.000
ENG2	392.000	ENG1	388.000	HISTORY1	495.000

As seen in Table 3, the actors who can establish connections with other actors in a short time in the professional relations network and have the highest access to information are; It can be said that they are PHILOSOPHY2, RELIGION2, BIOLOGYLOGY2 (Clo = 411.000), PE1 (Clo = 408.000), LITERATURE5 (Clo = 406.000), PE2 (Clo = 405.000) and MATHS3 (Clo = 404.000). The actors with the highest closeness centrality in the friendship network are; It was calculated as PHILOSOPHY2, PE2, BIOLOGYLOGY2 (Clo=476.000), HISTORY2 (Clo=465.000), LITERATURE5 (Clo=410.000), RELIGION2 (Clo=409.000) and ENG2 (Clo=392.000). In the trust network, the actors with the highest closeness centrality are; Actors with code numbers PHILOSOPHY2, PE2, BIOLOGY2 (Clo=544.000), HISTORY2, And ENG2 (Clo=531.000), RELIGION1 and PE1 (Clo=511.000) and ENG1 (Clo=507.000). The degree of closeness centrality in the trust network was determined to be higher than in other networks. It is seen that the close centrality of the actors PHILOSOPHY2, RELIGION2, BIOLOGY2, PE1, PE2, HISTORY2, MATHS3, ENG1, and ENG2 is at a high level in all networks. Based on this, it can be said that these actors can establish connections with other actors, directly or indirectly, in a short time and access information.

Betweenness centrality, another degree of centrality, refers to the fact that the actors who act as a bridge between other actors in the social network and thus ensure the flow of information are in an important position in the network (Borgatti et al., 2013: 174-175). Actors with a high degree of betweenness centrality are in an advantageous position due to their access to information and resources in the network (Burt, 1992). Below are the actors with the highest betweenness centrality values in professional relationships, friendship networks, and trust networks (Table 4).

Table 4. *Betweenness centrality measures of professional relationships, friendship, and trust networks*

Professional Relation Network	Betweenness	Friendship Network	Betweenness	Trust Network	Betweenness
COUNSELLING	461.300	COUNSELLING	202.150	BIOLOGYLOGY1	61.000
MATHS1	401.233	MATHS1	165.650	COUNSELLING	55.000
MUSIC1	200.500	LITERATURE3	165.450	FRENCH2	54.000
FRENCH2	132.867	BIOLOGYLOGY1	129.833	LITERATURE2	40.000
PHYSICS2	70.233	GEOGRAPHY2	53.683	GEOGRAPHY2	18.500
LITERATURE3	60.233	PHYSICS2	26.667	LITERATURE4	15.000

As seen in the Table 4, the actors with the highest betweenness value in the professional relationship network are; COUNSELLING (Betw.=461.300), MATHS1 (Betw.=401.233), MUSIC1 (Betw.=200.500), FRENCH2 (Betw.=132.867) and PHYSICS2 (Betw.=70.233). In the friendship network, successively the betweenness values of COUNSELLING (Betw.=202.150), MATHS1 (Betw.=165.650), LITERATURE3 (Betw.=165.450), BIOLOGY1 (Betw.=129.833) and GEOGRAPHY2 (Betw.=53.683) actors are high. Finally, betweenness values in the trust network were calculated as BIOLOGY1 (Betw.=61.000), COUNSELLING (Betw.=55.000), FRENCH2 (Betw.=54.000) and LITERATURE2 (Betw.=40.000). When all three social network structures are examined, it can be said that the actors who play a critical role among the actors by acting as a bridge between the other actors are the actors with code numbers COUNSELLING, MATHS1, LITERATURE3, BIOLOGY1, FRENCH2, and GEOGRAPHY2. In summary, it can be said that teachers in the branches of Counselling, Mathematics,

Literature, Biology, French, and Geography ensure communication between other teachers and have a significant impact on the flow of information through the connections they establish.

Eigenvector centrality, which is another measure of centrality, states that the quality of these connections is important as well as the number of ties an actor establishes to be at the center of the network (Eren, 2018; Marsden, 2005; Oztas & Acar, 2004). The actors with high eigenvector centrality in professional relationships, friendship networks, and networks of trust are listed below (Table 5).

Table 5. *Eigenvector centrality measurements of professional relationships, friendships, and trust networks*

Professional Relation Network	Eigenvector	Friendship Network	Eigenvector	Trust Network	Eigenvector
MATHS1	0.575	MATHS1	0.413	MATHS1	0.482
COUNSELLING	0.209	BIOLOGY1	0.342	COUNSELLING, FRENCH2	0.308
LITERATURE3	0.201	GEOGRAPHY1	0.319	BIOLOGYLOGY1	0.307
MUSIC1	0.193	FRENCH2	0.287	MATHS2	0.274
PHYSICS2	0.189	LITERATURE1	0.280	GEOGRAPHY	0.260
ENG1	0.184	PHYSICS1	0.253	LITERATURE1	0.234

Based on the Table 5, it can be said that MATHS1 is the actor with the highest eigenvector centrality in professional relationships, friendship, and trust networks. In addition to this actor, it was observed that COUNSELLING, BIOLOGY1, FRENCH2, and LITERATURE1 actors had high eigenvector values in all social networks. It is possible that these actors in the branches of Mathematics, Counselling, Biology French, and Literature listed above will have various advantages (information flow, distribution of resources, etc.) since they are close to the actors who are at the center of the network and play an active role in the network.

Discussion and Conclusion

In this study, teachers' professional relationships, friendships, and trust networks were examined using the social network analysis method. According to the results of the research, the density of social networks that teachers establish with their colleagues are friendship networks, professional relationship networks, and trust networks, respectively. According to this result, it can be said that teachers develop the most friendship networks with their colleagues. Teachers meet with their colleagues in their daily lives outside of school and share various experiences. Studies have shown that there is a positive relationship between workplace friendship and professional satisfaction (Bozanoglu, 2020; Yavuzkurt, 2017), and that workplace friendship plays an important role in increasing the happiness level of employees (Craig & Kuykendall, 2019; Yücel & Minotte, 2019; Zhang et al., 2022). In addition, research has shown that workplace friendship positively affects employees' performance (Aksoy, 2019; Asgharian et al., 2015; Chen et al., 2012, Ulucay & Zengin, 2020). Therefore, it is expected that the performance of teachers who have a dense network of friendships will increase and their professional satisfaction will increase. Another important finding regarding the friendship network in this research is that actors with Mathematics, Counselling, and Literature branches have an important role in this network. It is thought that these actors at the center of the network have leadership potential. It is expected that these actors will have an influence on other teachers by ensuring the flow of information in the school and thus gain a certain power. Moreover, based on this finding, it can be said that teachers establish relationships with colleagues in different branches rather than clustering by establishing relationships with teachers in the same branch. Unlike this result, Conery (2012) concluded in his study that teachers generally establish relationships with teachers in the same branch as themselves. It is also a remarkable finding that the counselor is at the center of social networks. Because research shows that counselors, in particular, make significant contributions to students' personal, social, and psychological development and the solution of problems experienced at school (Can & Nikolayidis, 2021; Cop et al., 2023; Karatas & Polat, 2015). As a result of this research, the fact that the school counselor is at the center of the friendship network gives an idea about the effectiveness of the school. In theory, in this school where strong friendship relations between teachers emerge, teachers' effective communication with each other and development of close relationships can increase their performance, commitment to work, and job satisfaction, and this can positively affect the climate of the school.

Within the scope of the research, the most intense relationship after the friendship network emerged in the professional relationship network. However, Er (2017) concluded in his study that the professional relationship network of teachers working in primary and secondary schools has a denser network structure than the friendship network. To maintain organizational functioning and increase qualitative capacity, there may be a need for information sharing among employees. Research shows that information sharing among employees is important in achieving organizational goals (Ozkan & Kaygısız, 2020). Thomas (2017) stated that

one way for teachers to ensure their professional development is to share professional knowledge. Sharing professional knowledge can contribute to the professional development of teachers and also increase their commitment to the school. For this reason, the high level of professional relationship network in the school where the research was conducted may indicate that teachers are open to professional development. Research has revealed that professional knowledge sharing positively affects the perception of organizational support (Ceylan et al., 2022; Ozdevecioglu, 2003; Yoon & Thye, 2002), and this makes employees come to their institutions happy, thus increasing the success of the institution.

In the research, the relationship patterns with the lowest density emerged in the trust network. The fact that teachers' friendship and professional relationships are high but their trust networks are low can be considered as one of the important results of the research. In organizations with trust-based relationships, employees perform assigned tasks voluntarily, without the need for any coercion (Reynolds, 1998). Creating an environment of trust in organizations increases cooperation among employees and strengthens communication (Tschannen-Moran & Hoy, 2000). In addition, an environment of trust ensures the emotional commitment of employees to their organization and increases their job satisfaction (Demircan & Ceylan, 2003; Ozer et al., 2006) and life satisfaction (Yilmaz & Sunbul, 2009). Teachers' trust in school administrators and colleagues also affects the quality of teaching and the effectiveness of the school (Hoy et al., 1992; Tarter et al., 1995). Many studies have revealed that there is a positive relationship between workplace friendship and organizational trust (Ayas & Atmaca, 2023; Bozanoglu, 2020; Ozmen, 2020). However, in this research, despite the high density of professional and friendship networks, the low level of trust networks may indicate that teachers tend to exhibit political behavior, and it leads to the conclusion that relationships are established with the understanding of achieving mutual benefit. It is possible to explain this situation with social capital theory. Social capital theory is closely related to the social network approach (Eren & Kiral, 2018) and expresses that the individual can benefit from the relationships he or she establishes with others (Portes & Landolt, 2000). Individuals can obtain various benefits, such as having a flow of information and resources, through their social relationships (Coleman, 1990). Therefore, teachers can access and benefit from various resources in the school by establishing professional and friendship relationships with their colleagues. However, these relationships may not include mutual love and trust. Teachers' low level of trust in their colleagues may have an impact on many issues, from teachers' performance to the quality of the education process. In this context, it is important for the school administrator to implement behaviors and practices that increase teachers' feelings of solidarity and trust in each other and integrate them. The recommendations made based on the results of the research are as follows:

- School administrators can create an effective and sustainable vision that brings together all stakeholders of the school to strengthen the professional relationship network and trust network of teachers and encourage teachers to work collaboratively and teamwork.
- Learning communities can be created in schools. To develop workplace friendships, strengthen peer relationships and increase peer support, school administrators can benefit from group teacher committees and make group dynamics more effective.
- In addition to social network analysis, more counseling research can be conducted to determine the relationships between teachers' organizational trust and workplace friendship in schools.
- Current results can be compared by performing social network analysis in different schools to determine teachers' professional relationships, friendships, and trust networks.

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Ethics Committee Permission Statement

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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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