

# Dynamic Analysis of Verbal Aggressiveness Networks in School

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## Abstract

Aim of this study is to detect structures of verbal aggressiveness network and also reveal changes through time. Standardized questionnaires have been distributed to 168 students and 8 teachers at secondary schools in 2017. We performed complete social networks analysis and further processing by conventional statistics. According to the results, density could be a first indicator of verbal aggressiveness existence. The verbal aggressiveness seems to become denser through time. Most ties are asymmetric and only a small amount becomes mutual. Thus, inequality appears. Verbal aggressors seem to target more than one victim and use all forms of verbal aggression. Triad analysis can disclose elementary “sources of verbal aggressiveness”. More verbal aggression ties are added than deleted over time.

## Keywords

Verbal Aggressiveness, Network Analysis, Structure, Dynamic Analysis

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## 1. Introduction

Verbal aggressiveness has defined as an attack in the perception of the individual to cause psychological pain to a person’s self-concept through communication process [1]. Verbal aggressiveness is considered to be an important but a destructive feature of communication and therefore is worthy of attention in the classroom communication [1]-[11]. Research indicated that verbal aggressiveness affects student-teacher communication [12]-[18], interpersonal attraction [19] [20], Machiavellian tactics [21] [22], bullying [23] [24] and classroom climate [25] [26] [27], students’ affective learning [28] [29] [30] [31], discipline reasons [32] [33], fair play behaviours [34] and behaviour, thinking and motivation [26] [35]. Verbal aggressiveness has been examined through network analy-

sis with similar results [36]-[45].

Purpose of this study is to detect structures of verbal aggressiveness network and to reveal changes through time. The academic added value of this research consists in static and longitude detection and in the exploration of structure of verbal aggressiveness networks. Thereby, a more insightful view is expected to be achieved in the understanding of verbal aggressiveness. To describe the static situation of verbal aggressiveness is descriptive rather than analytical. The diachronic analysis depicts the deeper dynamic of this phenomenon and enables a more sound understanding of constructive or deconstructive tendencies in school socialization. The practical added value consists in using of the results for consulting and pedagogic action in the classes due to the field-specific empirical findings.

## 2. Method

### 2.1. Network Analysis

Complete network analysis emerges a set of methods to study the relations of participants [46] [47]. Network analysis is not based to participants as individuals, but considers the network as an entity, consisting of interacting individuals and measurable relations among them.

The fundamental question in social network analysis is the nature of a dyad. It is the minimal structural element (subgraph) in a social network and shows a probable relationship between two actors [47]. While the study of dyads is a simplest structure of interactions, it is argued that the minimal social group characterized by an interesting level of complexity is a triad. The study of triad's structure informs about transitive actions. Thus, transitivity Model is used to depict [48] used to depict triads.

Several other indicators were used to describe the structure of network like degree, transitivity, reciprocity. Such indicators have been used and interpreted in several empirical researches [22] [49]-[56]. Social network analysis focused on the creation and dissolution of relationships among individual people within a network through different time periods.

### 2.2. Sampling

The survey was conducted at two-time period. The first data set (Wave 1) collected in early fall (October) and the second one (Wave 2) at the late spring (May). The participants were belonging to four classes and the teacher was the one with most teaching hour at the class. Cluster sampling has been used [57] and performed complete network analysis at each class. In this case, the cluster sampling was network sampling (each class was examined as a network).The questionnaires were completed within a class hour (40 minutes). The anonymity of the informants was emphasized and the participation was voluntary.

The sample consisted of 176 individuals. The participants were 168 Greek students (47% boys, 53% girls) and 8 teachers (50% men, 50% women) from

third grade of a public secondary school (1st Gymnasium of Trikala). The mean age of students was 14.2 years (SD = 0.15) and the mean age of teachers was 46.5 years (SD = 1.6).

### 2.3. Questionnaire

The participants answered a questionnaire consisted of two parts: a) non-network variables (e.g. gender, times they travel abroad, appearance, etc.), and b) network variables based on the Greek version of Verbal Aggressiveness Scale [58] which consisted of eight items (e.g., “decrease students’ self-image”, “threats students”). Preliminary examination supported the psychometric properties of the instrument and Confirmatory Factor Analysis indicated satisfactory fit indices (CFI: 0.97, SRMR: 0.02), and internal consistency of the scale ( $\alpha = 0.96$ ).

### 2.4. Statistical Analysis

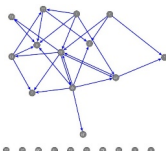

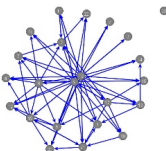
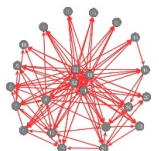
Visone (version 2.17) was used for the networks’ illustration and the computation of several indicators (e.g. node degree, average network degree). Additionally, through visone environment, igraph r-package was used for the computation of additional parameters (e.g. density, reciprocity, transitivity). Also, the visone software was used to depict the alteration of networks over time. Network and non-network data were entered into SPSS 21.0 for further statistical analysis.

## 3. Results and Discussion

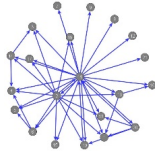
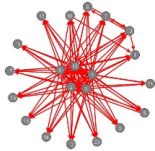
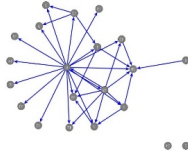
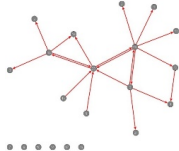
### 3.1. Structures in Verbal Aggressiveness

In **Table 1** and **Table 2**, all networks of verbal aggressiveness are depicted. The networks with blue edges represent first wave and the one with red edges the second wave.

**Table 1.** Depiction of networks A, B (verbal aggressiveness) and their descriptive indicators.

Class	A		B	
Wave	Wave 1	Wave 2	Wave 1	Wave 2
Graph				
Participants		23		23
Female		15		10
Male		8		13
Density	0.0513	0.025	0.144	0.262
Diameter	3	3	5	6
Avg. degree	2.261	1.130	6.348	11.565
Ratio in/out degree	1.130	0.565	3.174	5.783
Reciprocity	0.153	0.000	0.082	0.285
Transitivity	0.222	0.000	0.394	0.551

**Table 2.** Depiction of networks C, D (verbal aggressiveness) and their descriptive indicators.

Class	C	C	D	D
Wave	Wave 1	Wave 2	Wave 1	Wave 2
Graph				
Participants	21	21	21	21
Female	9	9	13	13
Male	12	12	8	8
Density	0.104	0.254	0.080	0.047
Diameter	2	4	2	4
Avg. degree	4.190	10.190	3.238	1.904
Ratio in/out degree	2.095	5.095	1.619	0.952
Reciprocity	0.136	0.280	0.058	0.300
Transitivity	0.243	0.492	0.274	0.133

The density varies among networks and seems to be correlated with the average degree of the network, the ratio of in-degree to out-degree and with transitivity. So, the density could be a first indicator of the existence of verbal aggression with multiple properties. The density of all networks is at low level (below 0.30) but networks A and D have the minimum density (below 0.08). Also, the range of reciprocity in networks has been ranged at low level (below 0.30).

### 3.2. Degree Correlation

In **Appendix**, Spearman correlation of degree is being presented. All items of verbal aggressiveness scale have been correlated at both waves of the research. If someone uses verbal aggressiveness it is likely to practically use all its forms.

Comparing the two phases could be observed that most items also correlate between two waves. Only “mocking behaviour” and partial “lessening behaviour” seem not to be associated. This could be explained by social learning. If someone experienced verbal aggressiveness is in part susceptible not to pay attention to future behaviours, thinking that behaviours are “normal” for the particular person. From an additional point of view, one could distinguish between cohesive core of verbal aggressiveness dimensions and not cohesive ones.

### 3.3. Dyads

In **Table 3**, the dyad census (MAN) is presented as percentage. The number in the parenthesis depicts the existing dyads. The null relations have the majority of the interactions and represent the absence of verbal aggressiveness. The null dyads are increased in networks A and B so the verbal aggressiveness is de-

creased. On the contrary, at the networks C and D null dyads decreased and the verbal aggressiveness increased.

A small amount of the relations is mutual. As expected, only in the networks with high density the mutual dyads have shown high percentage. The majority of existing verbal aggressiveness is asymmetric. It could be explained by the “usual” process of verbal aggressiveness leading to inequality. First someone uses verbal aggressiveness (asymmetric relation) with purpose to hurt somebody. Only if the “victim” similarly reacts, then the relation becomes mutual.

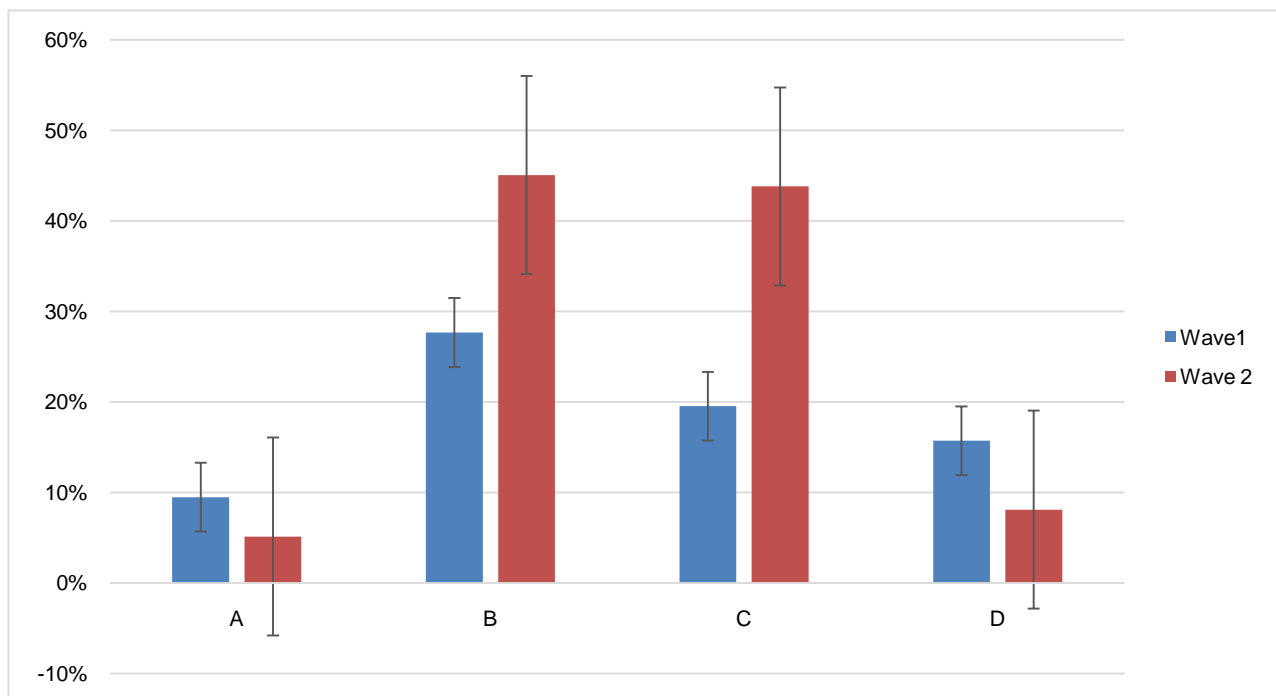
**Figure 1** shows the existence of verbal aggressiveness based on the sum of mutual and asymmetric dyads in four classes. Standard error bars are also presented. In networks B and C, verbal aggressiveness increased and at the networks A and D verbal aggressiveness decreased. In the networks B and C, there is a strong evidence for verbal aggressiveness proliferation.

### 3.4. Change of Verbal Aggressiveness over Time

The change over time can be depicted in four networks (**Table 4** and **Table 5**). Between the two phases no intervention took place.

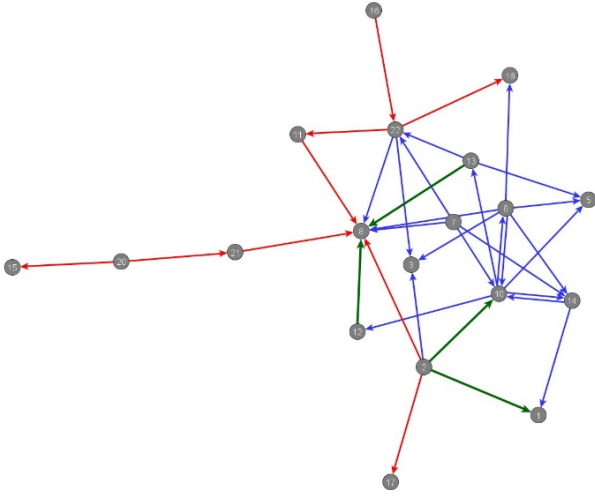
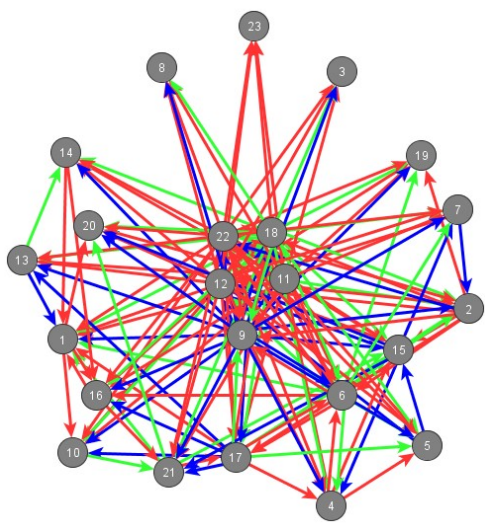
**Table 3.** Dyad census.

	A Wave 1	A Wave 2	B Wave 1	B Wave 2	C Wave 1	C Wave 2	D Wave 1	D Wave 2
Mutual	0.79% (2)	0.00% (0)	1.19% (3)	7.51% (19)	1.43% (3)	7.14% (15)	0.48% (1)	1.43% (3)
Asymmetric	8.70% (22)	5.14% (13)	26.48% (67)	37.55% (95)	18.10% (38)	36.67% (77)	15.24% (32)	6.67% (14)
Null	90.51% (229)	94.86% (240)	72.33% (183)	54.94% (139)	80.48% (169)	56.19% (118)	84.29% (177)	91.90% (193)

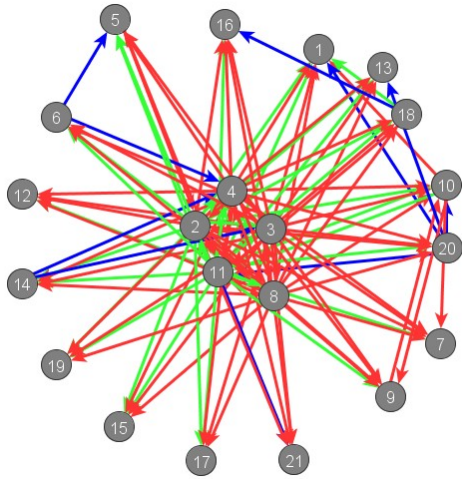
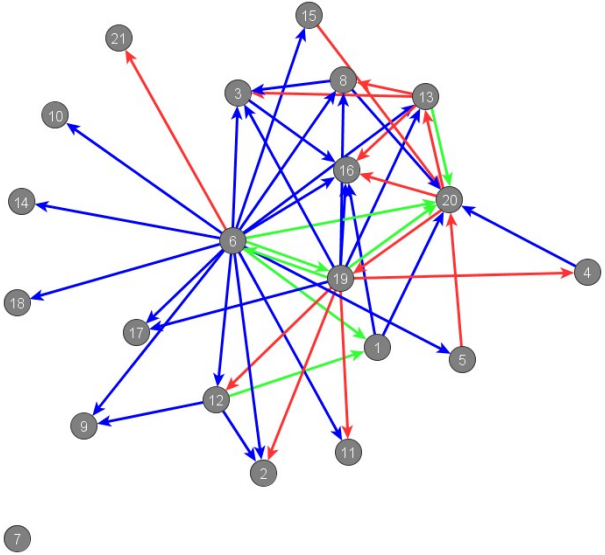


**Figure 1.** Verbal aggressiveness over time (based on mutual and asymmetric dyads).

**Table 4.** Change of verbal aggressiveness network (A and B) over time.

Class A	Class B
	
<p>22 deleted edges (blue) or 84.615% from existing edges at Wave 1</p> <p>4 unchanged edges (green) or 15.384% from existing edges at Wave 1</p> <p>9 added edges (red) or 1.778% from edges of network</p>	<p>35 deleted edges (blue) or 47.945% from existing edges at Wave 1</p> <p>38 unchanged edges (green) or 52.054% from existing edges at Wave 1</p> <p>95 added edges (red) or 18.774% from edges of network</p>

**Table 5.** Change of verbal aggressiveness network (C and D) over time.

Class C	Class D
	
<p>10 deleted edges (blue) or 22.727% from existing edges at Wave 1</p> <p>34 unchanged edges (green) or 77.272% from existing edges at Wave 1</p> <p>73 added edges (red) or 17.381% from edges of network</p>	<p>27 deleted edges (blue) or 79.411% from existing edges at Wave 1</p> <p>7 unchanged edges (green) or 20.588% from existing edges at Wave 1</p> <p>13 added edges (red) or 3.095% from edges of network</p>

In networks A and D, a large amount of the existing edges have been deleted. Also, little new edges have been added. If we consider the density of classes A and D, we could assume that low level density conserves verbal aggressiveness at low level.

In the other two networks (B and C) with higher density, the greatest part of existing verbal aggressiveness has been conserved. Also, a large amount of new relations added to the networks. Thus, it is reasonably assumed that the denser is the network the more aggressive becoming over time.

### 3.5. Triads

A triad in a directed graph is a subgraph which is composed of three nodes and the possible relation between them. The triad census is an especially useful summary of a social network since it makes a large amount of network indicators calculable [48].

In **Table 6**, all triads of transitivity model [48] is being presented. All values are presented in the percentage form.

In **Figure 2**, the triad distribution over time is presented. The null triads constitute the majority of the triads in all networks. Except from triad 003 the most common triads are 021D, 012, 120U, and with lower quantity are the triads 111U, 030T, 102. The other triads have negligible quantity. The four types of the triad (003, 012, 102, 021D) it is usual to occur in a low-density network [59]. Especially the triads 021D with higher rankings can be perceived as containing “source of verbal aggressiveness” (a node attacking to the other two). The triads 111U, 030T, 120U similarly contain “sources of verbal aggressiveness”. These triads are at higher level when the network is denser.

**Figure 3** shows the existence of verbal aggressiveness based on the triads in four classes. Standard error bars are also presented. One can observe similar results to these of dyads. Thus, triads produce no more particular interactive synergy than dyads.

## 4. Conclusions


















Verbal aggressiveness is presented in all classes, but the structural features are differentiated. Verbal aggressiveness’s network seems to have low density (below 0.5). The differences between network’s densities could be an indicator of the existence of verbal aggressiveness. A future question for research could be if the density of the verbal aggressiveness is correlated with the gender because the network with lower density has more women than men.

Most relations are asymmetric. There are few mutual aggressive ties. This could show that many students don’t choose to respond with the same way, even if they have been attacked verbally. Thus, inequality appears. This behavioural pattern could explain why highly argumentative persons perceive arguing as a mean for lessening conflict.

Triad analysis can disclose elementary “sources of verbal aggressiveness”. This



Table 6. Triads.

Triad	Class	A	A	B	B	C	C	D	D
Wave		1	2	1	2	1	2	1	2
	Real (%)	75.776	85.827	49.407	3.999	63.534	38.485	67.068	78.947
 1 - 008	Real (%)	18.859	12.931	22.417	15.302	16.316	4.773	19.925	15.414
 2 - 012	Real (%)	1.468	0.000	0.678	2.428	0.000	0.379	0.226	2.556
 3 - 102	Real (%)	1.242	0.452	19.932	28.515	14.812	37.955	9.549	0.902
 4 - 021D	Real (%)	0.903	0.565	0.508	0.565	0.376	0.076	0.827	0.301
 5 - 021U	Real (%)	0.734	0.226	0.960	1.129	0.075	0.000	0.226	0.301
 6 - 021C	Real (%)	0.169	0.000	0.226	0.169	0.000	0.000	0.000	0.376
 7 - 111D	Real (%)	0.508	0.000	0.960	5.872	2.857	4.167	0.752	0.977
 8 - 111U	Real (%)	0.169	0.000	3.275	4.065	0.827	0.909	0.977	0.000
 9 - 030T	Real (%)	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000
 10 - 030C	Real (%)	0.000	0.000	0.000	0.113	0.075	0.379	0.000	0.075
 11 - 201	Real (%)	0.056	0.000	0.113	0.452	0.000	0.303	0.000	0.000
 12 - 120D	Real (%)	0.056	0.000	1.468	8.075	0.977	1.758	0.451	0.075
 13 - 120U	Real (%)	0.000	0.000	0.000	0.113	0.000	0.000	0.000	0.000
 14 - 120C	Real (%)	0.056	0.000	0.056	1.242	0.150	0.985	0.000	0.075
 15 - 210	Real (%)	0.000	0.000	0.000	0.903	0.000	0.833	0.000	0.000
 16 - 300	Real (%)	0.000	0.000	0.000	0.903	0.000	0.833	0.000	0.000



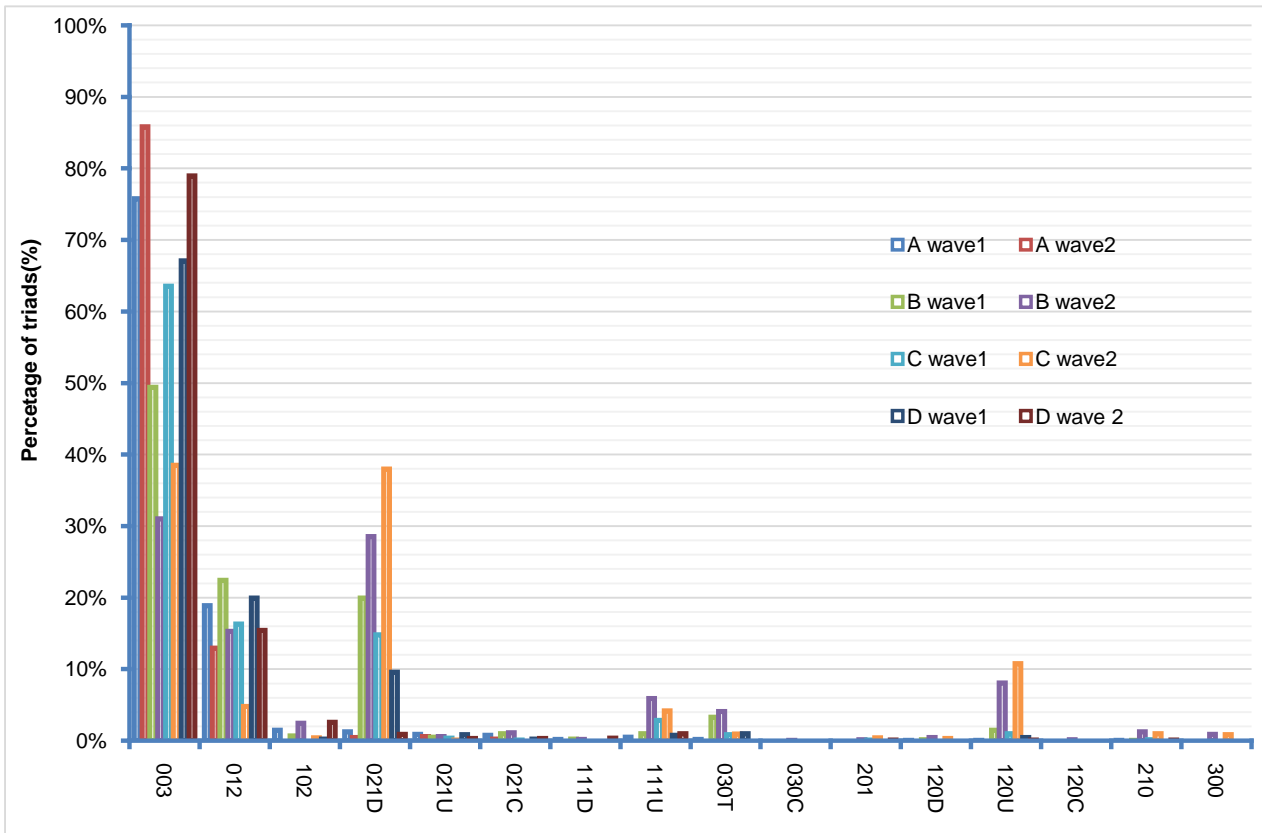


Figure 2. Triad number distribution.

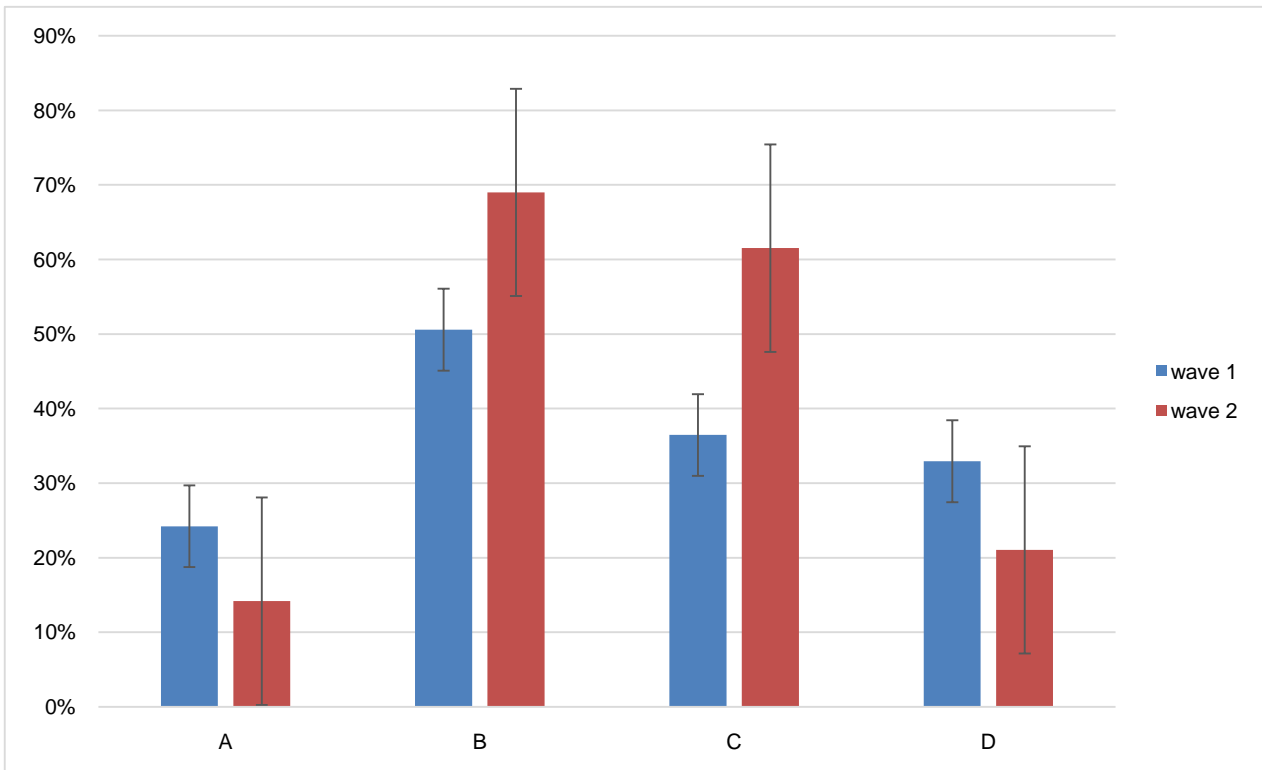


Figure 3. Verbal aggressiveness over time (based on triads).

can be interpreted that if someone is verbal aggressive, he/she probably will direct it to multiple targets. Also, correlation revealed that verbally aggressive students probably tend to use as many verbal aggressiveness forms as possible to harm the self-concepts of other students. However, one can distinguish between cohesive and not cohesive core of verbal aggressiveness dimensions.

Over time analysis showed the way of proliferation and reduction of verbal aggression. If verbal aggressiveness becomes denser, one can observe a greater amount of new verbal attacks added to the networks and only a small amount of the existing relation deleted. "Violence begets violence". On the contrary, the diminution of the existing verbal aggressiveness without adding new entries seems to decrease verbal aggressiveness.

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## Appendix

Spearman correlation of verbal aggressiveness (degree).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. insulting behaviour/wave 1	1.000	<b>0.704**</b>	<b>0.545**</b>	<b>0.612**</b>	<b>0.510**</b>	<b>0.642**</b>	<b>0.396**</b>	<b>0.544**</b>	<b>0.386**</b>	0.083	<b>0.259*</b>	<b>0.228*</b>	<b>0.406**</b>	0.168	<b>0.257*</b>	<b>0.210*</b>
2. underestimated attitude/wave 1	<b>0.704**</b>	1.000	<b>0.563**</b>	<b>0.576**</b>	<b>0.487**</b>	<b>0.742**</b>	<b>0.254*</b>	<b>0.725**</b>	<b>0.310**</b>	0.197	0.183	0.138	<b>0.246*</b>	<b>0.217*</b>	<b>0.278**</b>	0.170
3. underestimating intelligence/wave 1	<b>0.545**</b>	<b>0.563**</b>	1.000	<b>0.458**</b>	<b>0.386**</b>	<b>0.487**</b>	<b>0.349**</b>	<b>0.620**</b>	<b>0.253*</b>	0.007	0.159	0.083	<b>0.215*</b>	0.131	0.135	0.047
4. ironic comments/wave 1	<b>0.612**</b>	<b>0.576**</b>	<b>0.458**</b>	1.000	<b>0.637**</b>	<b>0.503**</b>	<b>0.382**</b>	<b>0.434**</b>	<b>0.340**</b>	0.018	<b>0.234*</b>	<b>0.280**</b>	<b>0.318**</b>	<b>0.232*</b>	<b>0.349**</b>	0.184
5. rude behaviour/wave 1	<b>0.510**</b>	<b>0.487**</b>	<b>0.386**</b>	<b>0.637**</b>	1.000	<b>0.518**</b>	<b>0.377**</b>	<b>0.351**</b>	<b>0.271*</b>	0.066	<b>0.285**</b>	<b>0.314**</b>	<b>0.264*</b>	<b>0.225*</b>	0.204	0.146
6. lessening behaviour/wave 1	<b>0.642**</b>	<b>0.742**</b>	<b>0.487**</b>	<b>0.503**</b>	<b>0.518**</b>	1.000	<b>0.247*</b>	<b>0.549**</b>	<b>0.227*</b>	0.152	0.165	0.123	0.194	<b>0.235*</b>	<b>0.273*</b>	0.181
7. causing bad feelings/wave 1	<b>0.396**</b>	<b>0.254*</b>	<b>0.349**</b>	<b>0.382**</b>	<b>0.377**</b>	<b>0.247*</b>	1.000	<b>0.502**</b>	<b>0.229*</b>	0.023	0.077	0.195	<b>0.310**</b>	<b>0.210*</b>	0.148	0.004
8. mocking behaviour/wave 1	<b>0.544**</b>	<b>0.725**</b>	<b>0.620**</b>	<b>0.434**</b>	<b>0.351**</b>	<b>0.549**</b>	<b>0.502**</b>	1.000	<b>0.232*</b>	0.077	0.069	0.033	0.197	0.153	0.126	0.020
9. insulting behaviour/wave 2	<b>0.386**</b>	<b>0.310**</b>	<b>0.253*</b>	<b>0.340**</b>	<b>0.271*</b>	<b>0.227*</b>	<b>0.229*</b>	<b>0.232*</b>	1.000	<b>0.508**</b>	<b>0.578**</b>	<b>0.537**</b>	<b>0.526**</b>	<b>0.509**</b>	<b>0.495**</b>	<b>0.463**</b>
10. underestimated attitudes/wave 2	0.083	0.197	0.007	0.018	0.066	0.152	0.023	0.077	<b>0.508**</b>	1.000	<b>0.447**</b>	<b>0.406**</b>	<b>0.333**</b>	<b>0.378**</b>	<b>0.343**</b>	<b>0.488**</b>
11. underestimating intelligence/wave 2	<b>0.259*</b>	0.183	0.159	<b>0.234*</b>	<b>0.285**</b>	0.165	0.077	0.069	<b>0.578**</b>	<b>0.447**</b>	1.000	<b>0.578**</b>	<b>0.589**</b>	<b>0.555**</b>	<b>0.512**</b>	<b>0.683**</b>
12. ironic comments/wave 2	<b>0.228*</b>	0.138	0.083	<b>0.280**</b>	<b>0.314**</b>	0.123	0.195	0.033	<b>0.537**</b>	<b>0.406**</b>	<b>0.578**</b>	1.000	<b>0.620**</b>	<b>0.448**</b>	<b>0.356**</b>	<b>0.533**</b>
13. rude behaviour/wave 2	<b>0.406**</b>	<b>0.246*</b>	<b>0.215*</b>	<b>0.318**</b>	<b>0.264*</b>	0.194	<b>0.310**</b>	0.197	<b>0.526**</b>	<b>0.333**</b>	<b>0.589**</b>	<b>0.620**</b>	1.000	<b>0.446**</b>	<b>0.313**</b>	<b>0.415**</b>
14. lessening behaviour/wave 2	0.168	<b>0.217*</b>	0.131	<b>0.232*</b>	<b>0.225*</b>	<b>0.235*</b>	<b>0.210*</b>	0.153	<b>0.509**</b>	<b>0.378**</b>	<b>0.555**</b>	<b>0.448**</b>	<b>0.446**</b>	1.000	<b>0.673**</b>	<b>0.609**</b>
15. causing bad feelings/wave 2	<b>0.257*</b>	<b>0.278**</b>	0.135	<b>0.349**</b>	0.204	<b>0.273*</b>	0.148	0.126	<b>0.495**</b>	<b>0.343**</b>	<b>0.512**</b>	<b>0.356**</b>	<b>0.313**</b>	<b>0.673**</b>	1.000	0.685**
16. mocking behaviour/wave 2	<b>0.210*</b>	0.170	0.047	0.184	0.146	0.181	0.004	0.020	<b>0.463**</b>	<b>0.488**</b>	<b>0.683**</b>	<b>0.533**</b>	<b>0.415**</b>	<b>0.609**</b>	<b>0.685**</b>	1.000
	0.049	0.114	0.664	0.087	0.174	0.091	0.974	0.852	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	.