

# FROM A PERSONAL TO A MORE SOCIAL VIEW OF STUDENTS' ACADEMIC PERFORMANCE: THE IMPORTANCE OF PEER SELECTION AT UNIVERSITY

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## Abstract

Students' academic performance has traditionally been linked to aspects centred on their personal abilities, such as cognitive skills, hours spent studying or personal motivation. However, in recent years, some research in the literature have begun to highlight the role that students' social interactions play in their performance. These interactions create informal trust-based networks that facilitate knowledge exchange between students and enhance their learning.

A number of contributions have recently found a direct relationship between students' position in these knowledge networks and their academic performance. On the other hand, this position has also been linked to opportunities to obtain new knowledge from external sources and to creative skills. However, in this paper, far from this static vision, we delve deeper into the dynamic view of knowledge networks among students in order to understand the academic influence exerted in university environments by students on their peers. Specifically, this paper aims to answer the following research question: do the peers of higher-achieving students improve their performance over time?

To answer this question, this paper applies a stochastic actor-oriented model (SAOM) to a sample of 50 students of the Business Administration and Management bachelor's degree at the Campus of Alcoy of the Universitat Politècnica de València in Spain.

The results obtained corroborate that the average grades of students who academically support focal students significantly affect the focal students' grades. Thus, lower-achieving students perform better over time as they increase their academic relationships with higher-achieving students. These results highlight the importance for universities of attracting higher-achieving students, as well as mixing students into heterogeneous work groups in terms of academic performance. This would make it easier to improve the performance of less proficient students, thus preventing them from dropping out of the university. Therefore, these findings may have relevant implications for both university policy and classroom learning management.

Keywords: Academic performance; student relationships; student networks; classmate selection; University studies.

## 1 INTRODUCTION

The study of academic performance has received significant attention in the literature for decades. Initially linked to aspects focused on students' personal abilities, such as cognitive skills, study hours or personal motivation, in recent years scholars have shifted their focus and started to highlight the role that students' social interactions play in their performance [1,2,3]. These bonds allow building informal academic networks between students that facilitate knowledge sharing and enhance their learning [4].

Recent contributions have stressed the presence of a direct relationship between students' position in these academic networks and their grades [5,6,7]. In the same vein, other contributions have linked this position with opportunities to obtain novel knowledge from external sources and develop creative skills [8,9]. However, in this paper, far from this static vision, we delve into the dynamic view of knowledge networks among students in order to understand the academic influence exerted in university environments by students on their peers. In particular, this paper aims to explore the influence of academic support relationships on the academic performance of university students by answering the following research question: do the peers of higher-achieving students improve their academic performance over time?

To answer the research question, this study applies a stochastic actor-oriented model (SAOM) to a sample of 50 students of the 2017-2021 cohort of the Business Administration and Management bachelor's degree at the Campus of Alcoy of the Universitat Politècnica de València in Spain.

After running the simulation model, the results allow us to confirm the positive influence of different endogenous effects on academic links formation. Furthermore, they also corroborate that the average grades of students who academically support focal students significantly affect the focal students' grades. Thus, lower-achieving students perform better over time as they receive more supporting links from higher-achieving students. Similarly, higher-achieving students may lower their grades if they receive more support over time from lower-achieving students. These findings may have relevant implications for both university policy and classroom learning management.

The rest of the paper is organised as follows. The next section presents the object of study, the data collection process and the analytical approach on which the work is based. This is followed by a description of the results obtained after the application of the stochastic actor-oriented model. Finally, the conclusions of the paper are presented.

## 2 METHODOLOGY

As we have mentioned above, our sample is composed of students of the Business Administration and Management bachelor's degree at the Campus of Alcoy of the Universitat Politècnica de València in Spain. This bachelor's degree is a four-year full-time program requiring the completion of 240 ECTS credits.

We have focused on students who have completed their first three years at university (2017-2021 cohort) because these have been able to extensively develop their relationships in this context after this period. Furthermore, in the fourth year, a large part of the students decides to carry out part of their studies in foreign universities mainly thanks to the scholarships of the European Erasmus+ Programme or to carry out internships in companies, which prevents them from adequately developing their relations in the university environment.

The total number of students considered in this bachelor's degree was 50. However, this number was smaller in the first year, since four full-time new students enrolled in the bachelor's degree in the second year. Apart from this change, the composition of the students' cohort has been the same for the three years analysed.

Concerning data collection, the information provided by the students of the 2017-2021 cohort during their first three years at the university was the main data source of this research. This was carried out by using a "roster recall" method [10], which involves presenting to the interviewees a full list of the students in the cohort who were then asked about their academic relationships with each of them. Specifically, students were asked at the end of each academic year about the students that they had helped that year in the bachelor's degree to develop projects, exercises and joint classroom activities, as well as to prepare for exams. If student  $i$  had nominated student  $j$  in year  $k$ , we assigned a value of 1 to  $x_{ijk}$  (i.e. knowledge transfer from student  $i$  to student  $j$  in year  $k$ ), zero otherwise. This information allowed us to build three academic relationship networks, one for each academic year. Additionally, students were also asked every year about different personal and academic aspects such as academic performance and interests. At the end of the data collection procedure, we had 50 valid responses which represent the whole population of the students' cohort addressed.

Finally, with the purpose of analysing the research questions proposed, a SAOM for network dynamics was applied [11,12,13]. We used Siena (Simulation Investigation for Empirical Network Analysis) [14], a software to statistically estimate models for network evolution. More specifically, we used RSiena, a contributed package to the statistical software environment R.

## 3 RESULTS

This section presents the empirical results obtained from the SAOM implemented in the RSiena package and attempts to answer the research question proposed in the previous sections.

Table 1 shows the results of the RSiena analysis, including both the influence of the analysed effects on the evolution of the academic network and the influence of the analysed mechanisms on students' performance, proxied by their Grade Point Average (GPA), during the period analysed. For this SAOM analysis, parameters estimation was based on 2,322 iterations. Basic rate parameters as well as convergence diagnostics, covariance and derivative matrices were based on 1,000 iterations. Model convergence was good (t-ratios were lower than 0.07 for all coefficients) and no important problems of multicollinearity were observed. On the other hand, the rate of change parameters of selection and

influence processes were positive and significant, thus indicating a remarkable change in the formation of new ties and performance level over the years.

Table 1. Results of the co-evolution academic model in RSiena.

Effects	Effect Description	Estimate	Std. Error	t-value
<b>Selection mechanisms</b>				
Rate parameter (period 1)	Probability of a student to establish new ties between the first and second academic year as a measure of network change [11].	6,018	0,552	10,902***
Rate parameter (period 2)	Probability of a student to establish new ties between the second and third academic year as a measure of network change [11].	3,692	0,340	10,859***
<i>Endogenous network effects</i>				
Outdegree (density)	Tendency of students not to establish academic links with just any other student on the network [15].	-1,425	0,083	-17,169***
Reciprocity	A positive and significant reciprocity effect means that there is a tendency for new links to be formed by reciprocating pre-existing links between pairs of students.	0,968	0,135	7,170***
Transitive triplets	A positive and significant transitive triplets effect means that linkages tend to form by closing triads of students who were connected by two connections in the previous period.	0,170	0,015	11,333***
Cyclicity	A positive and significant cyclicity effect means that there is a tendency to form triads where knowledge circulates in cycles between students.	-0,149	0,027	-5,519***
<i>Exogenous network effects</i>				
Performance (alter)	A positive and significant coefficient will imply a tendency for the indegrees of higher-achieving students to increase more rapidly.	-0,023	0,035	-0,657
Performance (ego)	A positive and significant coefficient will imply a tendency for higher-achieving students to increase their outdegrees more rapidly.	-0,045	0,037	-1,216
<b>Influence mechanisms on performance</b>				
Rate period performance (period 1)	The rate of change in students' performance (proxied by their GPA) between the first and second academic year.	2,858	0,652	4,383***
Rate period performance (period 2)	The rate of change in students' performance (proxied by their GPA) between the second and third academic year.	2,299	0,538	4,273***
Linear shape	Intercept (mean performance).	0,131	0,285	0,460
Quadratic shape	Dispersion of performance.	-0,098	0,034	-2,882**
Indegree performance	The higher the number of incoming connections, the higher the level of performance.	0,023	0,031	0,742
Average performance in-alter	Effect of average grades of the students who support the focal student on the grades of the focal student; over time the performance level of the focal student becomes more similar to that of the students from whom he/she received support.	0,508	0,259	1,961*
Reciprocated degree	When students have reciprocal relationships, these are more likely to influence grades.	-0,000	0,035	-0,000

Note: Parameters estimation in the objective function are approximately normally distributed, which means that the parameters can be tested by referring the t-value (parameter estimate divided by the standard error) to a standard normal distribution [13]. Therefore, we consider t-values greater than 1.96 as significant at the 0.05 level (\*), t-values greater than 2.58 as significant at the 0.01 level (\*\*) and t-values greater than 3.30 as significant at the 0.001 level (\*\*\*).

Concerning the endogenous network effects, the density parameter of the model was negative and significant which is generally the case for social networks, except for contexts with extreme high densities [16]. As for the remaining three endogenous effects, reciprocity, transitivity and cyclicity all showed significant results. In this way, our sample studied showed a more balanced structure of knowledge flows and a more stable context of collaboration over time thanks to the tendency to reciprocity in the new established links, that is, to the inclination of those students who have received academic advice to reciprocate the favour. In other words, students were more likely to provide support to those students from whom they have received support in the past. On the other hand, our results also corroborated the presence of transitivity in the students' network throughout the three years analysed, thus confirming the tendency of students to establish new academic linkages with partners of partners within the class. Finally, our results showed a negative and significant impact of cyclicity, which together with a positive transitive triplets effect, can be interpreted as a tendency toward local hierarchy [14]. Thus, the academic knowledge does not circulate in cycles through groups of students, but one of the students is more likely to control the triad and provide knowledge to the other two.

Turning to exogenous effects, none of the effects studied had a significant influence on the sample analysed.

Finally, the table presents the results for the influence mechanisms on performance. The linear shape effect was not significant which implies that we do not find evidence for a certain tendency in the changes in the overall mean (trend). Yet, the negative significance of the quadratic shape effect suggests a tendency in the changes toward a normative behaviour, that is, there is a tendency over time for students to have grades closer to the mean. On the other hand, we do not find evidence for students' performance to depend on the number of incoming academic links. Furthermore, it seems that students with more reciprocated academic relationships do not differ in terms of their grades from those with less reciprocated bonds. Our results also allow corroborating that the average grades of students who academically support focal students significantly affect the focal students' grades. Therefore, we can answer the research question proposed in this study in the affirmative.

## 4 CONCLUSIONS

This paper has focused particularly on exploring the influence of academic support relationships on the academic performance of university students.

The results obtained have firstly allowed us to confirm the importance of endogenous effects and the relevance of social proximity for the formation of academic links between students in line with different past contributions [17,18,19,20].

Furthermore, our results did not allow us to confirm the influence of the indegree effect on students' academic performance, suggesting a priori that the accumulation of a high number of academic support links by students is of little relevance to this performance indicator. Nevertheless, the results do confirm that receiving academic support from higher-achieving students improves the grades of the students receiving the support. Therefore, based on these premises, the key is not to have more academic support links in general but to have more support links from higher-achieving students. It is a question of quality versus quantity. Hence the importance of peer selection is key in the university context.

On the other hand, these results highlight the importance for universities of attracting higher-achieving students, as well as mixing students into heterogeneous work groups in terms of academic performance. This would make it easier to improve the performance of less proficient students, thus preventing them from dropping out of the university.

In short, this work confirms the relevance of academic relationships among students in explaining their academic performance, paving the way for new studies to further explore this influence, as well as the impact of academic networks on other aspects linked to students' habits such as smoking, drinking, sport or the development of certain attitudes or behaviours.

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