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A Comparative Case Study on the Social Networking of Final Year Undergraduate and Postgraduate Mathematics Students of The M.D.T. Hindu College, Tirunelveli, Tamil Nadu, India

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ABSTRACT

In this experimental case study, the social relationship of individual final year under graduate and postgraduate mathematics students of The M.D.T Hindu College, Tirunelveli is compared using sociometry.

Keywords: Case study, reciprocity, social network, sociometry, postgraduate mathematics students

1. INTRODUCTION

A case study is an in-depth study of a person or a group especially as a model of medical, psychiatric, psychological or social phenomena. Social network theory in the social sciences began with the field of sociometry, a quantitative method for measuring social relationships. It is the practice of expanding the number of one's business and / or social contacts by making connections through individuals. It is a map of the relationships between

the individuals, indicating the ways in which they are connected through various social familiarities ranging from casual acquaintance to close familial bonds. It views social relationships in terms of nodes and ties. Nodes are individual actors and ties are the relationships between the actors. There can be many kinds of ties between the nodes, depending on the relationships being studied.

2. EXPERIMENTAL STUDY

In this experimental case study, the social relationship of individual final year undergraduate and post graduate Mathematics students of The M.D.T Hindu College, Tirunelveli is compared using sociometry.

2. 1. Network data

The population of this social study consists of 30 under graduate students and 20 post graduate students of final year Mathematics of The M.D.T Hindu College, Tirunelveli. Both the under graduate class and the post graduate class were co educated. There were 19 girls and 11 boys in the UG class and 14 girls and 6 boys in the PG class. The population is heterogeneous.

2. 2. About the College

The M.D.T Hindu College was incepted in 1878. In 1997, the College extended its service by establishing unaided courses. It celebrated its Centenary in 1979 and Post-Centenary Silver Jubilee in 2004. The B.Sc. degree course and the M.Sc. degree course in Mathematics were started in the years 1957 and 1980 respectively. In 2006, the College was approved as a Research Centre in Mathematics by the Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India.

2. 3. Method of study

Data were collected from the population using a printed questionnaire. Instructions regarding the questionnaire were given in advance. The questionnaire consisted of two sections. The first section consisted of the personal data and the second section consisted of questions on social network. In the personal data, the name of the student, sex, age & date of birth and class of study were asked. A provision for allotting the confidential number for each student was also provided in that section. In the second section, five questions each consisting of two parts were asked. In the first part, the student was asked to answer   Yes / No. If the response was yes, then he / she was asked to write the name of the student in the second part.

In the first question they have asked if they have a close friend in their class. In the second, they have asked if they approach anybody in their class to clear their doubts. Whether they approach anybody in their class for monetary help is the third question. In the fourth question, they have asked if they approach anybody in their class for advice and in the last they have asked if they approach anybody in their class for companionship to spend their leisure time. The 10 questions were numbered as 1(a), 1(b), 2(a), 2(b), 3(a), 3(b), 4(a), 4(b), 5(a) and 5(b).

The students were given a copy of the questionnaire each and provided accommodation & sufficient time to fill in the personal data and to answer the questions.

Their responses were collected and then the 11 under graduate male students were labeled with the confidential numbers 1, 2,…, 11 and the 19 under graduate female students were labeled with the confidential numbers 12, 13,…30. The 6 post graduate male students were labeled with the confidential numbers 1, 2, …, 6 and the 14 post graduate female students were labeled with the confidential numbers 7, 8,…, 20 in random order by the investigators. Their responses were recorded and tabulated separately.

Directed graphs were drawn based on the responses given. The vertices denote the confidential numbers and the directed arcs for each response show the relationship between two confidential numbers. x approaches y is denoted by x ⟶ y.

Table (1) shows the response of the individuals for the questions from 1(a) to 5(a).

Table 1. Individual responses.

Q. No	UG		PG	
	YES	NO	YES	NO
1(a)	90%	10%	70%	30%
2(a)	70%	30%	70%	30%
3(a)	70%	30%	50%	50%
4(a)	60%	40%	45%	55%
5(a)	87%	13%	70%	30%

In the UG class, the percentage of students having a friend in their class is more when compared with the PG class. Surprisingly, in both the classes, the percentage of students approaching other students to clear their doubts is the same.

The percentage of students approaching for monetary help, advice and companionship to spend their leisure time is considerably more in UG class when compared with the PG class.

2. 4. Reciprocity in the network

A measure of reciprocity is a number which gives the extent to which support is both given and received in a relationship. Reciprocity in social psychology refers to responding to a positive action with another positive action. It is considered as a strong determining factor of human behavior. Let U_i and P_i denote the graph of directed arcs of UG and PG respectively for the question i(b), $1 \leq i \leq 5$.

The following table shows the details of reciprocity under various networks for both UG and PG classes.

Table 2. Reciprocity.

Network	Reciprocity	
	UG	**PG**
1(b)	9	3
2(b)	3	1
3(b)	1	1
4(b)	1	1
5(b)	5	3

In the U_1 and P_1 networks, representing their close friends in their class, there are nine and three reciprocal ties respectively.

In the U_2 and P_2 networks, representing their approach to clear their doubts in the subject, there are three and one reciprocal ties respectively.

In the U_3 and P_3 networks, representing their approach for monetary help and in the U_4 and P_4 networks, representing their approach for advice, it is seen that there is only one reciprocal tie in both the classes.

In the U_5 and P_5 networks representing their companionship during leisure time in the UG class there are 5 reciprocal ties and in the PG class the number of reciprocal ties is three.

In the networks 1(b), 2(b) and 5(b) the percentage of reciprocity is more in the UG class than the PG class. But in 3(b) and 4(b), the percentage of reciprocity is more in PG than in UG class.

In a directed network, the in-degree (id) of a vertex is defined to be the number of arrows directed to the vertex and the out-degree (od) of a vertex is the number of arrows which arise from the vertex. In this study, a respondent can approach only one person, in all the networks. Hence the maximum out-degree of any vertex will be only one.

The following table shows the details of maximum in- degree and the number of vertices with maximum in-degree for all the five networks.

Table 3. Details of maximum in-degree.

Network	Max. in-degree		No. of vertices	
	UG	**PG**	**UG**	**PG**
1(b)	2	2	6	2
2(b)	4	4	2	1
3(b)	4	3	3	1

4(b)	3	1	1	9
5(b)	2	2	5	2

In the network 1(b), it is found that in the UG class, the boys with confidential numbers 7 and 9 and the girls with confidential numbers 19, 24, 25 and 27 have the maximum in-degree 2. In the PG class, the boy with the confidential number 2 and the girl with the confidential number 16 have the maximum in- degree. They are the friends for two students each. It is to be noted that, friendship exists only between the same sexes in both the classes.

It is observed that in the UG class, the girls with the confidential numbers 16 and 29 have the maximum in- degree in the network 2(b). They are approached for clearing the doubts by more students. It is to be noted that only girls are approached to clear the doubts. Another interesting thing to be noted is that the girl with confidential number 16 is approached by a boy and three girls and the girl with confidential number 29 is approached by four girls to clear their doubts. It is found that reciprocity exists between those two maximum in-degree confidential numbers. In the PG class, the girl with the confidential number 10 has the maximum in-degree. She is approached by a boy and three girls and she in turn approaches the boy with the confidential number 1 to clear her doubts.

In the UG class, the boys with the confidential numbers 4, 6 and 10 have the maximum in degree in the network 3(b). The boy with the confidential number 10 is approached for monetary help only by the boys where as it is not found in the confidential numbers 4 and 6. In the PG class, the girl with the confidential number 15 is approached for monetary help only by girls.

In the network 4(b), it is found that in the UG class, the girl with the confidential number 24 has the maximum in-degree. She is approached by the girls 13, 30 and by the boy 6 for advice. In the PG class, 9 students have the maximum in degree 1.

In the network 5(b), it is again to be noted that in the UG class, the boys with the confidential numbers 3,8,10 and the girls with confidential numbers 18 and 22 are approached by more than one for spending leisure time where as in the PG class, the boy with the confidential number 5 and the girl with the confidential number 11 are approached by more than one for the same.

In the UG class, the confidential numbers 10 and 24 have the maximum in-degree in two networks. The confidential number 10 has the maximum in-degree in 3(b) and 5(b). 24 has the maximum in degree in the networks 1(b) and 4(b). In the UG class, the confidential numbers 3, 4, 6, 7, 8, 9, 16, 18, 19, 22, 25, 27 and 29 have the maximum in-degree in only one network. The other confidential numbers1, 2, 5, 11, 12, 13, 14, 15, 17, 20, 21, 23, 26, 28 and 30 don't have the maximum in-degree in any of the networks.

In the PG class, the confidential numbers 5 and 16 have the maximum in-degree in two networks. The confidential number 5 has the maximum in-degree in the networks 4(b) and 5(b).The confidential number 16 has the maximum in-degree in the networks 1(b) and 4(b). The confidential numbers 1, 2, 3, 7, 10, 11, 12, 14, 15 and 20 have the maximum in-degree in only one network. The other confidential numbers 4, 6, 8, 9, 13, 17, 18 and 19 don't have the maximum in-degree in any of the networks.

2. 5. Definition [2]

Let D = (V, A) be a directed graph. A vertex v ∈ V is called

(i)   An isolated vertex if od(v) = id(v) = 0
(ii) A transmitter if od(v) > 0 and id(v) = 0
(iii) A receiver if od(v) = 0 and id(v) > 0
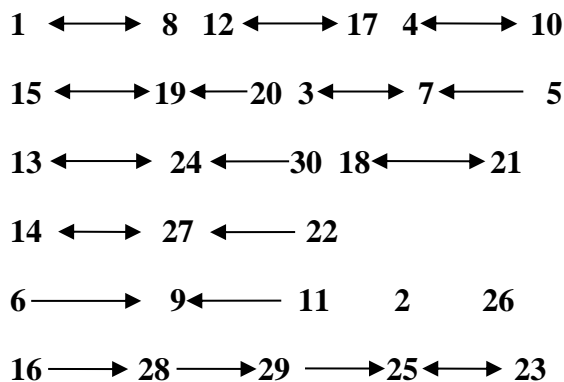(iv) A carrier if od(v) > 0 and id(v) > 0

A directed walk in a graph is an alternating sequence of points and arcs, v_0, $x_1, v_1, \ldots x_n, v_n$ in which each arc x_i is $v_{i-1} v_i$. The length of such a walk is n, the number of occurrences of arcs in it. A closed walk has the same first and last points. A path is a walk in which all points are distinct. A cycle is a nontrivial closed walk with all points distinct (except the first and last).

A digraph is unilaterally connected, or unilateral, if for any two points at least one is reachable from the other. A unilateral component is a maximal unilateral subgraph.

A receiver is one who receives from other persons where as a transmitter is one who tends to provide help without expecting anything in return. A carrier is one who receives and transmits.

The following networks explain the responses of UG and PG students for the question 1(b)

1(b) UG

1 ⟷ 8   12 ⟷ 17   4 ⟷ 10

15 ⟷ 19 ← 20   3 ⟷ 7 ← 5

13 ⟷ 24 ← 30   18 ⟷ 21

14 ⟷ 27 ← 22

6 ⟶ 9 ← 11   2   26

16 ⟶ 28 ⟶ 29 ⟶ 25 ⟷ 23

1(b) PG

1 ⟷ 2 ← 6   8 ⟷ 12

17 ⟷ 18   15 ⟶ 14 ⟶ 9
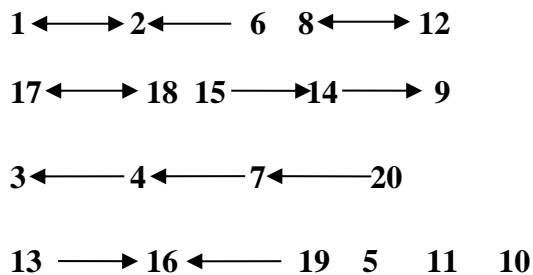
3 ← 4 ← 7 ← 20

13 ⟶ 16 ← 19   5   11   10

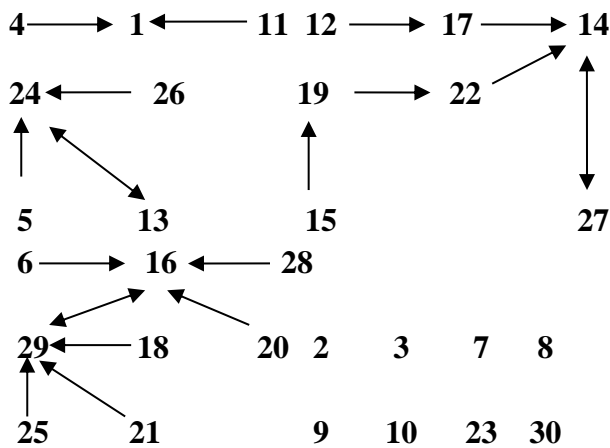**Figure 1.** Network for question 1(b).

The following table shows the distribution of respondents under various categories in the network 1(b)

Table 4. Distribution of respondents under various categories in network 1(b).

Net work	Isolated		Receiver		Transmitter		Carrier	
	UG	PG	UG	PG	UG	PG	UG	PG
1(b)	2	3	1	3	7	5	20	9

There are 2 and 3 isolates in the network 1(b). Comparatively, a larger percentage of respondents in the PG class are isolated than in the UG class. The percentage of receivers in UG is low when compared with PG class. The percentage of transmitters is almost equal in both the classes where as the percentage of carriers is more in the PG class. The number of unilateral components in the UG class is 10 and in the PG class is 6.The length of the longest path in UG is 4 and in PG is 3. The following networks explain the responses of UG and PG students for the question 2(b).
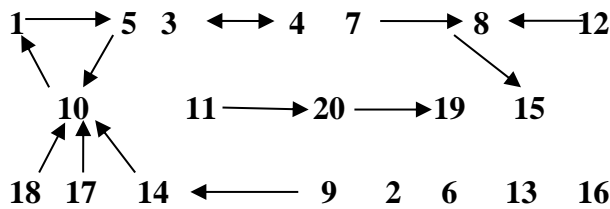
2(b) UG

2(b) PG

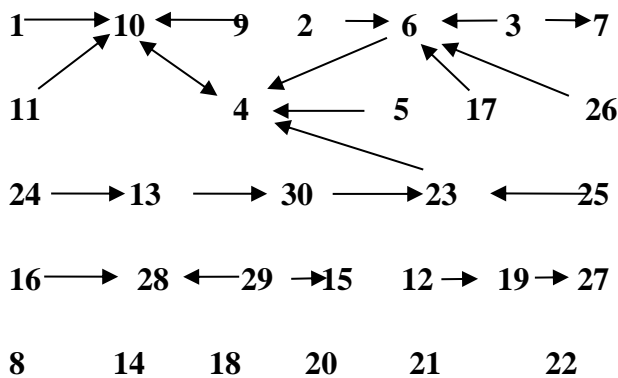**Figure 2.** Network for question 2(b).

The following table shows the distribution of respondents under various categories in network 2(b).

Table 5. Distribution of respondents under various categories in network 2(b).

Net work	Isolated		Receiver		Transmitter		Carrier	
	UG	PG	UG	PG	UG	PG	UG	PG
2(b)	8	4	1	2	12	7	9	7

In the network 2(b), there are 8 and 4 isolates respectively in the UG and PG classes. The percentage of receivers is low in UG. The percentage of transmitters and carriers in both the classes is almost equal. The number of unilateral components in UG is 4 and in PG is 4. The length of the longest path in UG and PG is 4. It is interesting to see that a cycle of length 3 is formed by the respondents 1, 5 and 10 in PG. In the UG class the boys with confidential numbers 5 and 6 approach the girls with confidential numbers 24 and 16 respectively to clear their doubts. In the PG class the boy with confidential number 5 approaches the girl with confidential number 10 and she in turn approaches the boy with confidential number 1 to clear their doubts, though they are not friends. The following networks explain the responses of UG and PG students for the question 3(b)

3(b) UG

3(b) PG

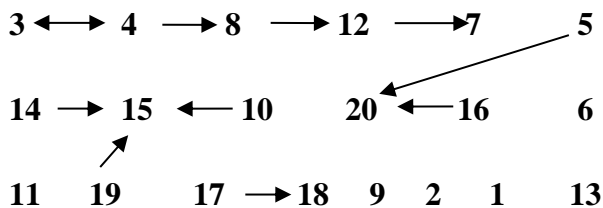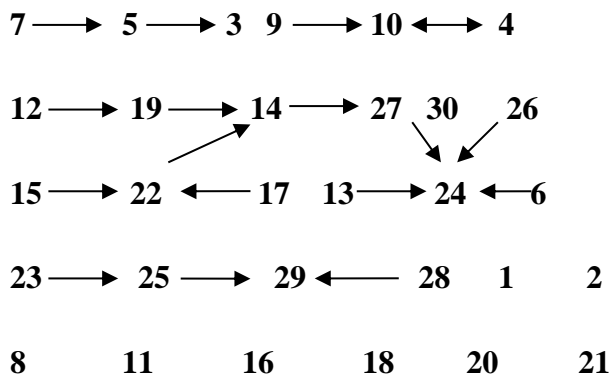**Figure 3.** Network for question 3(b).

The following table shows the distribution of respondents under various categories in network 3(b).

Table 6. Distribution of respondents under various categories in network 3(b).

Net work	Isolated		Receiver		Transmitter		Carrier	
	UG	PG	UG	PG	UG	PG	UG	PG
3(b)	6	7	3	3	13	6	8	4

In the network 3(b), there are 6 and 7 isolates in UG and PG class respectively. In this network also the percentage of receivers is low in UG where as the percentage of transmitters and carriers were more in UG. The length of the longest path in UG is 5 and in PG is 3. The number of unilateral components in UG and PG are 3 and 4 respectively. It is special to note that in the entire study a unilateral component with a maximum number of 17 respondents is seen in this network. In the UG class the boys with the confidential numbers 4 and 10 are approached by 4 students each for monetary help. Here also the girl with confidential number 23 approaches the boy with confidential number 4 for monetary help. In the PG class no such opposite gender pair exists. The following networks explain the responses of UG and PG students for the question 4(b)

4(b) UG

$7 \longrightarrow 5 \longrightarrow 3 \quad 9 \longrightarrow 10 \longleftrightarrow 4$

$12 \longrightarrow 19 \longrightarrow 14 \longrightarrow 27 \quad 30 \quad 26$

$15 \longrightarrow 22 \longleftarrow 17 \quad 13 \longrightarrow 24 \longleftarrow 6$

$23 \longrightarrow 25 \longrightarrow 29 \longleftarrow 28 \quad 1 \quad 2$

$8 \qquad 11 \qquad 16 \qquad 18 \qquad 20 \qquad 21$

4(b) PG

$3 \longleftarrow 1 \longleftarrow 4 \quad 5 \longleftarrow 10 \quad 8 \longrightarrow 12$

$13 \longrightarrow 16 \longrightarrow 19 \quad 14 \longleftarrow 15 \quad 7 \longleftrightarrow 20$
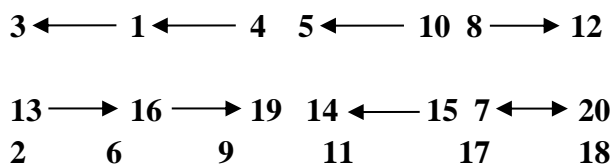$2 \qquad 6 \qquad 9 \qquad 11 \qquad 17 \qquad 18$

Figure 4. Network for question 4(b)

The following table shows the distribution of respondents under various categories in network 4(b).

Table 7. Distribution of respondents under various categories in network 4(b).

Net work	Isolated		Receiver		Transmitter		Carrier	
	UG	PG	UG	PG	UG	PG	UG	PG
4(b)	8	6	4	5	10	5	8	4

In the network 4(b), there are 8 and 6 isolates respectively in the UG and PG class. The level of percentage of receivers, transmitters and carriers is the same as the network 3(b). The length of the longest path in UG is 3 and in PG is 2. The number of unilateral components in UG and PG are 5 and 6 respectively. In the UG class the girl with confidential number 26 approaches the boy with confidential number 6 and he in turn approaches the girl with confidential number 24 for advice. In the PG class the girl with confidential number 10 approaches the boy with confidential number 5 for advice. Hence in the UG class a boy approaches a girl and vice versa. But in the PG class only one way approach is found. The following networks explain the responses of UG and PG students for the question 5(b)

5(b) UG

5(b) PG

Figure 5. Network for question 5(b).

The following table shows the distribution of respondents under various categories in network 5(b).

Table 8. Distribution of respondents under various categories in network 5(b).

Net work	Isolated		Receiver		Transmitter		Carrier	
	UG	PG	UG	PG	UG	PG	UG	PG
5(b)	Nil	3	4	3	9	5	17	9

In the network 5(b), there are no isolates in UG whereas there are 3 isolates in PG. The level of percentage of receivers, transmitters and carriers is the same as in the network 3(b). The length of the longest path in UG is 6 and in PG is 3. The number of unilateral components in both UG and PG are 9 and 6 respectively.

2. 6. Other Findings

In this case study, the following observations were made.

➢ In the UG class the boy with the confidential number 2 appears to be an isolate in the networks 1(b), 2(b) and 4(b). In the PG class the boy with the confidential number 6 appears to be an isolate in the networks 2(b), 3(b), 4(b) and 5(b).

➢ The confidential number 27 in the UG class and the confidential numbers 5, 14, 15 and 20 in the PG class appear as receivers in two different networks.

➢ The confidential numbers 5 and 11 in the UG class and the confidential numbers 15 and 19 in the PG class appear as transmitters in three different networks.

➢ The confidential number pair (13, 24) in the UG class has reciprocity in the networks 1(b), 2(b) and 5(b). This is the only pair with a maximum number of reciprocity. In the PG class, the confidential number pairs (3, 4) and (8, 12) have a maximum number of reciprocity. (3, 4) has reciprocity in the networks 2(b) and 3(b) whereas (8, 12) has reciprocity in the networks 1(b) and 5(b).

3. CONCLUSION

This study gives an outline of the behavior of students in various networks. The major roles played by some individuals in both the classes are exhibited. It is to be noted that in the networks 1(b) and 5(b), there are relationships existing only between the same genders. Some individuals found to be isolates in many networks. Reciprocity is low in some networks. The number of unilateral components is high in some networks. As a follow-up action, proper guidance and counseling may be given to reduce the number of unilateral components and isolates. Efforts may be taken to increase the reciprocity. Further studies can be made on their approaches outside their classes.

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