

Supplemental Digital Appendix 1

Survey^a Used to Collect Data from Granted Students

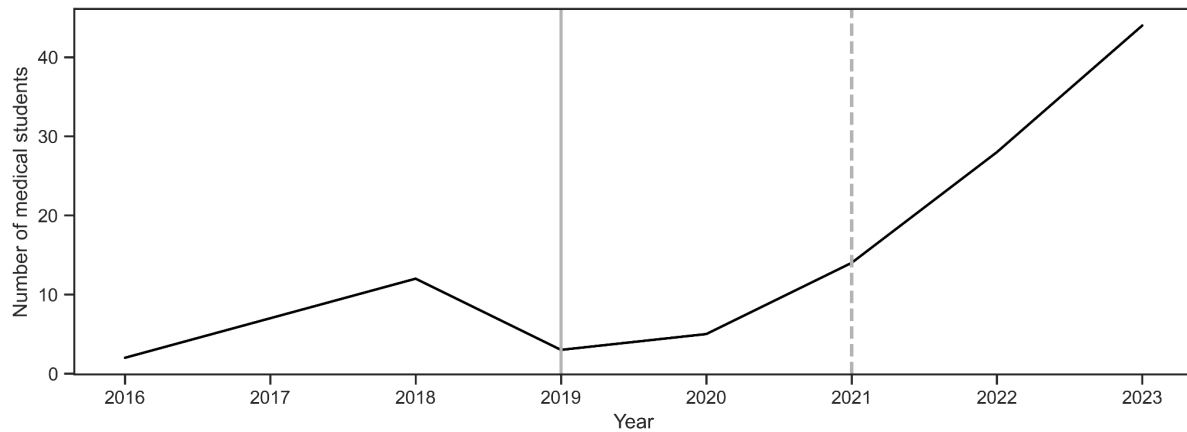
Name-surname																													
Which year are you in?																													
In which academic year were you granted?																													
Please choose fields of interest (check all applied)	☐ Basic science ☐ Clinical research ☐ Translational research ☐ Medical education research ☐ Trans-disciplinary research ☐ Health policy & systems research																												
[Student] How often do you seek advice from [each person] about your research project? Rating in 5-Likert scale N/A: not applicable (never seek advice in research) 1: Less than once a month 2: Once a month 3: Several times a month 4: Once a week 5: Several times a week	<table> <tr> <td>Student 1^b</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>N/A</td> </tr> <tr> <td>Student 2</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>N/A</td> </tr> <tr> <td>Student 3</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>N/A</td> </tr> <tr> <td>...</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Student 1 ^b	1	2	3	4	5	N/A	Student 2	1	2	3	4	5	N/A	Student 3	1	2	3	4	5	N/A	...						
Student 1 ^b	1	2	3	4	5	N/A																							
Student 2	1	2	3	4	5	N/A																							
Student 3	1	2	3	4	5	N/A																							
...																													
[Advisor] Please list your advisor name(s) and the corresponding Likert-scale.	Participants would fill this part as “Prof. A (n), Prof. B (n),...” n was the measure of frequency of advice-seeking behavior as mentioned above.																												
[Others] Please list your advisor name(s) and the corresponding Likert-scale.	Participants would fill this part as “Person A (n), Person B (n),...” n was the measure of frequency of advice-seeking behavior as mentioned above. In this study, others included other students who did not receive awards or people other than undergraduates and advisors.																												

^a In this study, the surveys were collected separately in each year.

^b A list of students in this part included the granted students in each year separately.

Supplemental Digital Appendix 2

Numbers of Students Who Received Presentation and Publication Grants



Graph displays numbers of medical students who received research presentation grants before and after the mandatory research coursework. While the gray straight line (—) refers to the coursework implementation in 2019, the gray dash line (---) refers to the first medical student who enrolled in the coursework received the presentation grant in 2021 indicating the delayed effect of the renewed curriculum.

Demographics for the Ramathibodi Undergraduate Research Presentation and Publication Grants, Academic Year 2016-2023

Characteristics	2016	2017	2018	2019	2020	2021	2022	2023
Number of successful student	2	7	12	3	5	14	28	44
Percentage of female	0%	42.86%	41.67%	66.67%	20%	47.06%	42.86%	56.82%
Percentage of preclinical student	100%	42.86%	58.33%	0%	0%	50%	28.57%	22.73%
Median of students number per project (IQR)	2 (0)	1 (0)	1 (0)	1 (0)	1 (1)	1 (1)	1 (1)	2 (1.25)
Median of advisors number (IQR)	3 (0)	3 (2.75)	2 (2)	4 (2)	6 (1.5)	1 (1)	1.5 (1.75)	1 (1)

Supplemental Digital Appendix 3

Network parameters with mathematical formula

Parameter	Mathematical Formula	Interpretation in the Context of Advice-Seeking Behavior
Node Level Analysis		
Out-degree Centrality	$C_{D_{out}}(i) = \frac{E_{out}(i)}{N-1}$ $C_{D_{out}}(i)$ is the out-degree centrality of node i $E_{out}(i)$ is number of outgoing edges from node i N is number of nodes in the network Code	Indicates students who actively seek advice from others
In-degree Centrality	$C_{D_{in}}(i) = \frac{E_{in}(i)}{N-1}$ $C_{D_{in}}(i)$ is the in-degree centrality of node i $E_{in}(i)$ is number of incoming edges to node i N is number of nodes in the network Code	Indicates the students who provide advice to others
Betweenness Centrality	$C_B(i) = \sum \frac{g_{jk}(i)}{g_{jk}}$ $C_B(i)$ is the betweenness centrality of node i $g_{jk}(i)$ is the total number of shortest paths between nodes j and k that pass through node i g_{jk} is the total number of shortest paths between nodes j and k Code	Indicates the students who act as ‘bridges’ between separate groups
Closeness Centrality	$C_c(i) = \frac{1}{\sum d(i,j)}$ $C_c(i)$ is the closeness centrality of node i $d(i,j)$ is the shortest path distance between nodes i and j Code	Indicate the students who are centrally located; therefore, well-positioned to disseminate information to others

Network Level Analysis		
Maximum distance	The longest shortest path length between any pair of nodes in the network Code	Measures the maximum number of intermediary students needed for advice to flow between any two students.
Assortativity	The tendency of nodes with similar characteristics to connect with each other Code	Measures whether students with similar levels of advice-seeking activity tend to connect with each other
Homophily	The tendency of nodes to connect with others based on specific characteristics, such as gender, ethnicity, or interests Code	Measures the tendency of students to connect with others based on specific characteristics (e.g. genders)
Reciprocity	$R = \frac{E_r}{E}$ R is the reciprocity of the network E_r is the total number of reciprocated edges in the network E is the total number of edges in the network Code	Measures the likelihood of mutual advice exchange between students
Density	$D = \frac{E}{N(N-1)}$ D is the density of the network N is the total number of nodes in the network E is the total number of edges in the network Code	Measures the overall connectedness within the network
Modularity	$Q = \frac{1}{2E} \sum_{i,j} [A_{ij} - \frac{E(i)E(j)}{2E}] \delta(c_i, c_j)$ Q is the modularity of the network A_{ij} is the element of the adjacency matrix (1 if advice connection between i and j, 0 otherwise) $E(i)$ is the degrees of nodes i $E(j)$ is the degree of node j E is the total number of edges in the network	Measures the strength of division of a network into clusters; high modularity means students tend to seek or provide advice within their own cluster

	$\delta(c_i, c_j) = \text{Kronecker delta function (1 if nodes are in the same cluster, 0 otherwise)}$ Code	
Clustering Coefficient	$C(i) = \frac{2 t(i)}{E(i)(E(i)-1)}$ $C(i)$ is the clustering coefficient of node i $t(i)$ is number of close triangles formed by edges that node i participates in $E(i)$ is the number of edges connected to node i (degree of node i) Code	Measures the tendency for ‘friends of friends’ to form advice-seeking connections
Small-worldness	Calculated by comparing clustering coefficient and average path length to those of a comparable random network Code	Measures if research advice can be obtained through relatively few connections.

Supplemental Digital Appendix 4

Social Network Parameters Result Table

	Academic Years							
	2016	2017	2018	2019	2020	2021	2022	2023
Mean degree centrality	0.667	0.267	0.167	0.000	0.667	0.363	0.267	0.121
Top degree centrality	1.000	0.400	0.375	0.000	1.000	0.615	0.704	0.302
Mean betweenness centrality (0,1)	0.000	0.000	0.002	0.000	0.000	0.015	0.020	0.007
Top betweenness centrality	0.000	0.000	0.018	0.000	0.000	0.064	0.133	0.043
Mean closeness centrality (0,1)	0.333	0.133	0.088	0.000	0.333	0.224	0.232	0.095
Top closeness centrality	0.500	0.200	0.167	0.000	0.667	0.621	0.578	0.337
Average advice seeking distance (weighted)	1.000	1.000	1.143	0.000	1.000	1.559	2.129	2.380
Maximum distance	1	1	2	0	1	3	5	7
Advice seeking student-to-student per student-to-advisor	1.500	0.875	0.667	0.000	0.667	1.091	1.982	2.365
Density	0.333	0.133	0.045	0.000	0.333	0.181	0.134	0.060
Modularity (-1,1)	0.000	0.444	0.594	0.000	0.000	0.373	0.451	0.691
Clustering coefficient	0.000	0.000	0.000	0.000	0.500	0.373	0.345	0.329
Small-worldness coefficient	Nan ^a	Nan ^a	Nan ^a	Nan ^a	Nan ^a	1.321	1.113	2.919
Assortativity (-1,1)	Nan ^a	Nan ^a	Nan ^a	Nan ^a	Nan ^a	0.110	-0.142	0.115
Reciprocity	1.000	0.500	0.333	0.000	0.500	0.545	0.356	0.614

^a A few numbers of individuals led to a few connections causing the parameters to be incalculable.

Supplemental Digital Appendix 5

Permutation Test Results Table

	Clinic-vs-Non Clinic		Male-vs-Female		Publish-vs-Non Publish		Previous-vs-Current curriculum	
	Difference	P-value	Difference	P-value	Difference	P-value	Difference	P-value
Fields Of Interest								
Basic Science	-0.2073	0.0181	0.0843	0.3838	-0.1389	0.4503	0.0389	0.6624
Clinical Research	0.1174	0.2994	0.0598	0.5622	0.2927	0.149	0.1613	0.0824
Translational Research	0.0345	0.8061	-0.0038	1.0000	0.2521	0.0954	0.2671	0.0006
Health Policy and Systems Research	0.0441	0.6845	0.1353	0.1657	-0.1432	0.4862	0.0314	0.8491
Medical Education Research	-0.0128	1.0000	-0.0085	1.0000	-0.3985	0.0335	-0.4187	0.0000
Transdisciplinary Research	0.1031	0.1793	0.0150	1.0000	0.078	0.6229	0.0311	0.7885
Network Parameter								
Degree Centrality	-0.1042	0.0837	0.1163	0.0376	-0.0844	0.4044	0.1122	0.0454
In-Degree Centrality	-0.0222	0.5423	0.0886	0.0027	-0.0152	0.8127	0.0893	0.001
Out-Degree Centrality	-0.082	0.0131	0.0278	0.3988	-0.0692	0.22	0.0229	0.4903
Betweenness Centrality	0.0085	0.0411	0.0062	0.1283	-0.0017	0.8289	0.0033	0.4238
Closeness Centrality	-0.0002	0.9957	0.1121	0.0006	-0.0431	0.5273	0.0869	0.0128
Clustering Coefficient	-0.0164	0.801	-0.0792	0.189	-0.2076	0.0571	-0.2361	0.0001

Supplemental Digital Appendix 6

Path Analysis Results Table

Mediators	Path Coefficient (Standard Error)	95% confidence interval	P-value
^a Number of the students (Total Effect)	0.98 (0.09)	(0.76, 1.19)	<0.01
Mean degree centrality			
Direct effect	0.04 (0.16)	(-0.03, 0.38)	0.22
Indirect effect	0.93 (0.09)	(0.70, 1.17)	<0.01
Mean Betweenness Centrality			
Direct effect	0.92 (0.11)	(0.64, 1.20)	<0.01
Indirect effect	0.05 (0.49)	(-0.31, 2.95)	0.63
Mean Closeness Centrality			
Direct effect	0.96 (0.09)	(0.73, 1.19)	<0.01
Indirect effect	0.02 (0.54)	(-0.07, 0.27)	0.49
Average Advice Seeking			
Direct effect	0.95 (0.20)	(0.44, 1.46)	<0.01
Indirect effect	0.03 (0.43)	(-0.64, 0.59)	0.87
Network Density			
Direct effect	0.93 (0.08)	(0.72, 1.13)	<0.01
Indirect effect	0.05 (0.16)	(-0.02, 0.42)	0.24
Clustering Coefficient			
Direct effect	1.00 (0.10)	(0.74, 1.27)	<0.01
Indirect effect	-0.03 (0.20)	(-0.75, 0.15)	0.54
Reciprocity			
Direct effect	0.98 (0.08)	(0.76, 1.20)	<0.01
Indirect effect	-0.00 (0.13)	(-0.90, 0.07)	0.80

Mediators	Path Coefficient (Standard Error)	95% confidence interval	P-value
Peer-to-Peer to Peer-to-Advisor Advice-seeking Ratio			
Direct effect	1.10 (0.15)	(0.72, 1.48)	<0.01
Indirect effect	-0.12 (0.56)	(-0.78, 0.19)	0.39
Modularity			
Direct effect	0.77 (0.08)	(0.56, 0.99)	<0.01
Indirect effect	0.20 (0.26)	(0.01, 0.58)	0.04