Educ Res Med Sci. 2022 June; 11(1):e119522. doi: 10.5812/erms-119522.

Published online 2022 June 8. **Research Article**

Analysis of the Systematic Correlations Between the Influential Factors in Effective Teaching from the Perspective of the Faculty Members of Kermanshah University of Medical Sciences Based on the Graph Theory (2019)

Mostafa Jafari [1], Farshad Nadri [2,*], Soodeh Shahsavari [3] and Mahsa Jafari [4]

[1] School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[2] Assistant Professor of Occupational Health Engineering, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran
[3] Assistant Professor of Biostatistics, School of Nursing, Kermanshah University of Medical Sciences, Kermanshah, Iran
[4] Kermanshah Branch, Islamic Azad University, Kermanshah, Iran

[*] *Corresponding author*: Assistant Professor of Occupational Health Engineering, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: nadrifarshad64@gmail.com

Received 2021 September 13; **Revised** 2022 February 19; **Accepted** 2022 March 12.

Abstract

Background: University professors largely influence achieving established educational goals. Effective teaching plays a pivotal role in enhancing learning and motivation.
Objectives: The present study aimed to evaluate the systematic correlations between the influential factors in effective teaching from the perspective of faculty members based on the graph theory.
Methods: This descriptive-analytical study was conducted on 65 faculty members who were employed in the health and nutrition schools of Kermanshah University of Medical Sciences in 2019. The participants were selected via census sampling, and data were collected using a questionnaire (demographic and effectiveness teaching). Data analysis was performed based on the graph theory in MATLAB software.
Results: Mastery of the subject, providing new and updated content, simplicity and fluency, and the clear transfer of contents were the main influential factors in effective teaching. In addition, mastery of the subject and student evaluation in each session (midterm and end-of-term evaluation) with coordinates of "2.1 and 2.1" and "0.14 and -0.14" were identified as first and last priorities, respectively.
Conclusions: According to the results, the most significant influential factor in effective learning was the mastery of the curriculum by the teacher. Therefore, it is recommended that workshops be conducted on effective teaching in universities.

Keywords: Faculty Members, Effective Teaching, Graph Theory, Lesson Plan

1. Background

Manpower is the most important influential factor in the success and progress of every organization (1). The higher education system in every country plays a key role in their development (2). Empowerment is essential to achieving the goals of sustainable development (3). Innovative and competitive global education and research systems are also critical for the sustainable development of organizations and communities (4). As the most obvious manifestation of manpower investment, universities play a pivotal role in training and providing efficient manpower in society (5). Universities must have faculty members who are capable of providing, training, and strengthening human resources in education (6). Faculty members are the basic assets of a university, and the promotion of their educational capability depends on the capability of the educational system and the training of skilled manpower (7). Based on the systematic education design, the teacher is the most basic factor in achieving the desired success regarding educational goals, and the teacher's performance achieves the highest educational goals and improves the scientific quality of the university (8, 9). Moreover, teachers' awareness of learners' educational needs and the review and use of their opinions to improve educational quality are considered to be facilitators in this context (10).

In the teaching and learning process, the teacher of-

fers learning opportunities to students, and their role in improving education and achieving the educational goals of students is considered prominent (11). Learning is influenced by several factors, such as students' behavior, their motivation to learn, the curriculum content, environmental and physical resources, and effective teaching (12). The study by Abdolmaleki et al. showed six components of effective teaching, including the moral and personality traits of teachers, professional qualities, teaching skills, educational evaluation, psychological action, and the classic leadership of teachers (13). In addition, Franklin and Harrington reported that factors such as the teacher's mastery of the subject, clear expression of educational expectations, leadership and classroom management, and the active participation of students in the teaching process are associated with effective teaching in medical universities (14). On the same note, the findings of Asikainen et al. indicated that the components of lesson plan design and development, presentation and implementation, human relations, personal characteristics, and evaluation are effective teaching criteria in the educational process (15).

Today, the graph theory is used in various branches of sciences. The mathematical definition of a graph network is a set of nodes that are connected to each other through links, thereby forming clusters. Each graph network has a set of criteria for average path length, centrality, and other factors. Using the graph theory for effective teaching analysis has revealed a correlation between various components of the system (16).

To date, several studies have been focused on the subject of effective teaching from students' perspective (17, 18). However, the influential factors in teaching must also be determined from the perspective of teachers. Attention to effective teaching and the influential factors will undoubtedly improve the quality of education. Therefore, extensive research is required in this regard so that the findings could be provided to different professors and educational officials to enhance the current teaching methods and increase the quality of teaching.

2. Objectives

The present study aimed to prioritize the influential factors in effective teaching and determine the systematic correlations between these factors from the perspective of faculty members based on the graph theory.

3. Methods

This descriptive-analytical study was conducted on 65 faculty members who were employed in the schools of health and nutrition of Kermanshah University of Medical Sciences in 2019. In total, 45 faculty members were selected from the School of Health, and 20 faculty members were selected from the School of Nutrition (total: 65). The inclusion criterion for the faculty members was at least one year of teaching experience at the university, which was met by all the participants.

Data were collected using two questionnaires. The demographic questionnaire consisted of seven items regarding age, gender, marital status, academic rank, course history, type of employment, and field of education. The questionnaire of effective teaching factors contained various components, including the mastery of the subject (q_1), presentation of new and updated materials (q_2), eloquent expression/simple and transparent transmission (q_3), creating appropriate contexts for students' participation (q_4), facile access to the faculty members outside of class hours (q_5), intimate and friendly communication with students (q_6), timeliness and timely class attendance (q_7), having a lesson plan and presenting the plan to students (q_8), and student evaluation (before semester, midterm, and end-of-semester) (q_9). Proposals were also classified based on a five-point scale, including absolutely important (score 9), very important (score 7), important (score 5), and slightly important (score 3). The reliability of the questionnaire was confirmed by experts; the validity has been previously confirmed at the Cronbach's alpha coefficient of 91% in the study by Bahadori et al. (19).

According to the graph theory, the process of systematically structuring a set of existing information provides access to an integrated and defined, hierarchically structured model of clear correlations between different factors or components. In the graph theory, R represents the sequence of the factors that strongly influence other factors, and J represents the hierarchy of the influential factors. The actual location of each factor in the final hierarchy is determined by the RJ and R + J columns, with RJ representing the position of a factor along the supply axis; this position is definitely an influence if RJ is positive. J + R represent the total intensity of a factor along the axis of length both in terms of penetrating and being influenced (19).

The researcher initially explained the objective of the study, how to answer the questions, and the confidentiality of personal information. After obtaining informed consent, questionnaires were completed with full satisfaction. Data analysis was performed using the graph theory in MATLAB software.

4. Results

The mean age of the faculty members was 39 $\pm$ 6.4 years; 80% were men, 20% were women, and 41.5% of the

participants had less than five years of professional experience, while 30.8% had ≥ 20 years of professional experience. The demographic characteristics of faculty members are presented (Table 1).

Table 1. Demographic Data of Faculty Members

Variables	No. (%)
Marital status	
Single	16 (24.6)
Married	49 (75.4)
Type of employment	
Official	27 (41.5)
Contractual	14 (21.5)
Tuition	10 (15.4)
Specific commitment (k coefficient)	14 (21.5)
Academic rank	
Instructor	9 (13.8)
Assistant Professor	36 (55.4)
Associate Professor	8 (12.3)
Professor	2 (3.1)
Others	10 (15.4)
Age (y)	
20 - 29	2 (3.1)
30 - 39	35 (53.8)
40 - 49	11 (16.9)
≤ 50	17 (26.2)
Work experience (y)	
< 5	27 (41.5)
5 - 9	10 (15.4)
10 - 19	8 (12.3)
≤ 20	20 (30.8)

The hierarchy of the influential factors in effective teaching from the perspective of the faculty members are shown (Table 2).

The prioritization and the correlation between the influential factors in effective teaching from the perspective of the faculty members are shown (Figure 1). According to the obtained results, q1 with coordinates "2.1 and 2.1" strongly influenced other factors and q9 with coordinates "-0.14 and 0.14" least influenced the other factors.

5. Discussion

Effective teaching has features that set it apart from many other professions. Teachers often find many components to be of importance for teaching (19). In the current research, factors such as mastering the subject, creating suitable grounds for students' participation, eloquence, simple expression, and transparent transmission, presenting new and updated materials, facile access to the teacher outside the classroom, intimate communication and friendly with students and punctuality/timely class attendance were definitely influential in effective teaching (cause group). Other factors such as having a lesson plan and presenting it to students and periodical student evaluation were among the influential factors (also cause group).

In a similar study conducted by Bahadori et al. (19) to assess effective teaching based on the graph theory from students' perspective, mastering the subject, presenting new and updated materials, eloquent expression, simple, and transparent transitions in a different order were such influential factors; regardless of their order, they were consistent with the views of the professors. On the other hand, creating a suitable context for students' participation, facile access to the teacher outside class hours, intimate and friendly communication with students, and punctuality/timely attendance in class were not among the consistent findings with the present study. Furthermore, factors such as having a lesson plan and presenting it to students and periodical student evaluation in our study were consistent with the mentioned study.

Our findings indicated that the mastery of the subject had the highest coefficient, and evaluation had the lowest coefficient. Bieg et al. also reported that a teacher's skills, area of knowledge, and educational content are the most important factors involved in effective teaching (20). Also, Torkzadeh and Keshavarzi claimed that effective and strategic teaching is achieved when professors, with their creative methods, are able to respond to students' conditions, needs, and requirements, creating a strategic environment that meets the needs of all the stakeholders in terms of different components (21). Such examples are the personality traits of professors, students' readiness and abilities, the quality of teaching and teaching performance, teaching achievements, and the educational environment (21).

In a study on the "Evaluating effective teaching in college level economics using student ratings of instruction: a factor analytic approach", Agbetsiafa examined the factors that affect students' evaluation of economics education (22). Factor analysis was used to determine the validity and reliability of the evaluation tools for teacher evaluation or course effectiveness. The obtained results showed a positive correlation between students' perception of teaching effectiveness, learning facilitation, effective communication, clarity of the course elements, and

Table 2. Hierarchy of Influential Factors in Effective Teaching from Perspective of Faculty Members

Components	q1	q2	q3	q4	q5	q6	q7	q8	q9	R	J	R+J	R-J
q1	0.000	0.320	0.192	0.307	0.175	0.446	0.122	0.188	0.3434	2.0950	0.0000	2.10	2.10
q2	0.000	0.000	0.265	0.372	0.020	0.144	0.283	0.249	0.1891	1.525	0.0356	1.56	1.49
q3	0.000	0.000	0.000	0.441	0.341	0.382	0.343	0.272	0.0098	1.7904	0.0508	1.84	1.74
q4	0.000	0.000	0.000	0.000	0.373	0.484	0.461	0.271	0.2350	1.8263	0.1246	1.95	1.70
q5	0.000	0.000	0.000	0.000	0.000	0.450	0.375	0.262	0.0919	1.1795	0.1012	1.28	1.08
q6	0.000	0.000	0.000	0.000	0.000	0.000	0.430	0.185	0.2156	0.8316	0.2120	1.04	0.62
q7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.431	0.0720	0.5033	0.2240	0.73	0.28
q8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1384	0.1384	0.2068	0.35	-0.07
q9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.1439	0.14	-0.14

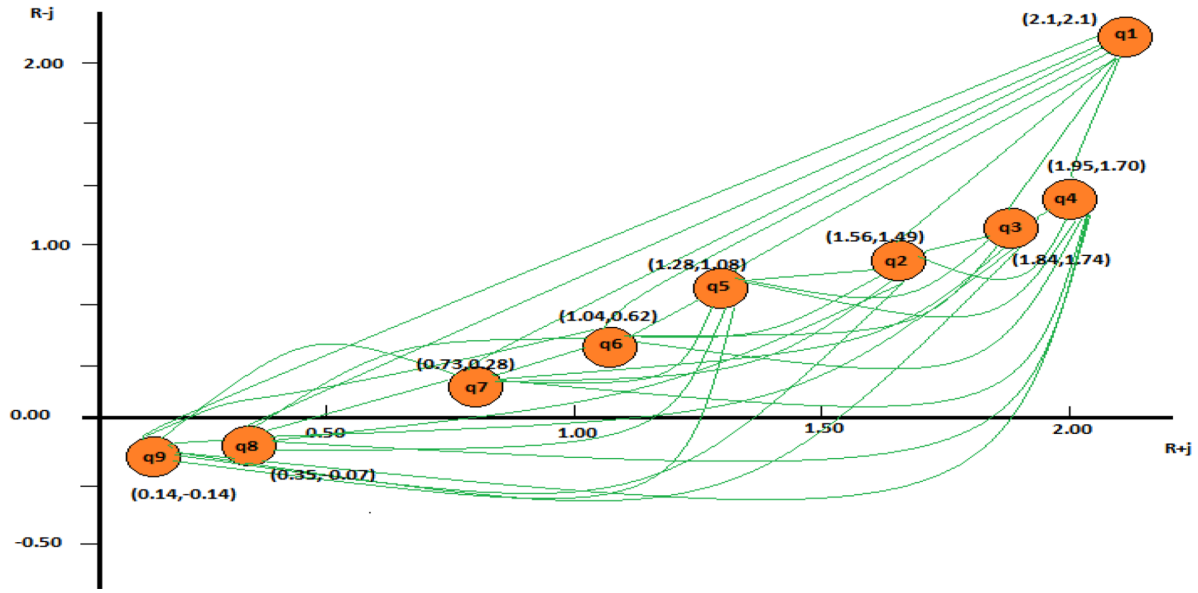

Figure 1. The prioritization and the correlation between the influential factors in effective teaching from the perspective of the faculty members

evaluation and feedback on the course (22). The findings of Molway also indicated that teachers value subject-specific survey feedback for professional learning (23).

5.1. Conclusions

According to the results, teacher's mastery of the subject matter was the most significant factor affecting proper teaching. Therefore, attention should be paid to the quality of effective teaching to improve the current situation. It is suggested that various educational workshops be held to bring professors' views closer to students, provide an active environment for effective teaching, and use new educational technologies in the agenda of education policymakers at the ministry of health and universities (Medical Education Studies and Development Center). It is also recommended that scholars review the effectiveness of teaching in faculty members, and the views of learners should be considered to develop a comprehensive package for effective teaching.

Acknowledgments

The authors express their gratitude to the professors of the two schools of Health and Nutrition Sciences and Nutrition Industries who participated in this study.

Footnotes

Authors' Contribution: Mostafa Jafari participated in different levels of the study. Farshad Nadri manuscript editing. Soodeh Shahsavari did Data was analyzed. Mahsa Jafari did search and quality review.

Conflict of Interests: There is not conflicts of interests.

Data Reproducibility: It was not declared by the authors.

Funding/Support: None.

References

1. Mortazavi Oskouei SK, Sayadi S, Salajeghe S, Sheikhi A, Fatehi Rad N. Explaining And Designing Of Manpower Productivity Manifestation Model At Saderat Bank Of Iran: Case Study Of Central Staffs. *Int Trans J Eng Manag Appl Sci Technol*. 2020;**11**(3):11A03C: 1–8.
2. Kaliisa R, Palmer E, Miller J. Mobile learning in higher education: A comparative analysis of developed and developing country contexts. *Br J Educ Technol*. 2019;**50**(2):546–61. doi: 10.1111/bjet.12583.
3. Hussain S, Jullandhry S. Are urban women empowered in Pakistan? A study from a metropolitan city. *Women's Studies International Forum*. 2020;**82**. doi: 10.1016/j.wsif.2020.102390.
4. Nafukho FM, Wekullo CS, Muyia MH. Examining research productivity of faculty in selected leading public universities in Kenya. *Int J Educ Dev*. 2019;**66**:44–51. doi: 10.1016/j.ijedudev.2019.01.005.
5. Fayyaz R, Shah Talebi B, Ebrahimzadeh R. Developing a Model for Empowerment of Faculty Members in Islamic Azad University: A Qualitative Study. *Strides in Development of Medical Education*. 2020;**17**(1). doi: 10.22062/sdme.2020.91549.
6. Romiani U, Abili K, Pourkaremi J, Farahbakhsh S. Designing a talent-based model for recruiting faculty members at Iranian regional comprehensive universities. *International Journal of Educational Management*. 2021;**35**(3):668–83. doi: 10.1108/ijem-03-2020-0129.
7. Karimian Z, Abolghasemi M. Comparison between the Viewpoints of Faculty Members Regarding the Share of Scholarship Functions in Different Disciplines. *Journal of Medical Education Development*. 2018;**11**(29):63–76. doi: 10.29252/edcj.11.29.63.
8. Bal-Taştan S, Mousavi Davoudi SM, Masalimova AR, Bersanov AS, Kurbanov RA, Boiarchuk AV, et al. The Impacts of Teacher's Efficacy and Motivation on Student's Academic Achievement in Science Education among Secondary and High School Students. *EURASIA Journal of Mathematics, Science and Technology Education*. 2018;**14**(6). doi: 10.29333/ejmste/89579.
9. Voelkel RH, Chrispeels JH. Understanding the link between professional learning communities and teacher collective efficacy. *Sch Eff Sch Improv*. 2017;**28**(4):505–26. doi: 10.1080/09243453.2017.1299015.
10. Orland-Barak L, Wang J. Teacher Mentoring in Service of Preservice Teachers' Learning to Teach: Conceptual Bases, Characteristics, and Challenges for Teacher Education Reform. *J Teach Educ*. 2020;**72**(1):86–99. doi: 10.1177/0022487119894230.
11. Marlina E, Tjahjadi B, Ningsih S. Factors affecting student performance in e-learning: a case study of higher educational institutions in Indonesia. *The Journal of Asian Finance, Economics and Business*. 2021;**8**(4):993–1001.
12. Sims S, Fletcher-Wood H. Identifying the characteristics of effective teacher professional development: a critical review. *Sch Eff Sch Improv*. 2020;**32**(1):47–63. doi: 10.1080/09243453.2020.1772841.
13. Abdolmaleki S, Maleki H, Farjadmand L. Effective components on effective teaching of teachers (Case study: fifth grade primary school teachers in Tehran). *Journal of Training & Learning Researches*. 2019;**16**(1):123–35.
14. Franklin H, Harrington I. A Review into Effective Classroom Management and Strategies for Student Engagement: Teacher and Student Roles in Today's Classrooms. *Journal of Education and Training Studies*. 2019;**7**(12). doi: 10.11114/jets.v7i12.4491.
15. Asikainen H, Blomster J, Virtanen V. From functioning communality to hostile behaviour: students' and teachers' experiences of the teacher–student relationship in the academic community. *Journal of Further and Higher Education*. 2017;**42**(5):633–48. doi: 10.1080/0309877x.2017.1302566.
16. Nekouei MA, Rudbari S, Zahedianpour M. Vulnerability analysis of water supply network by graph theory method. *Scientific-Research Journal of Safe City*. 2019;**2**(5):1–19.
17. Hill LH. Graduate Students' Perspectives on Effective Teaching. *Adult Learning*. 2014;**25**(2):57–65. doi: 10.1177/1045159514522433.
18. Schiefele U. Classroom management and mastery-oriented instruction as mediators of the effects of teacher motivation on student motivation. *Teach Teach Educ*. 2017;**64**:115–26. doi: 10.1016/j.tate.2017.02.004.
19. Bahadori MK, Rajabi Vasokolaee G, Raadabadi M, Yaghoubi M. Analysis of the Systematic Relationships between Influencing Factors on Effective Teaching from the Perspective of Graduate Students Using Graph Theory. *Educational Development of Jundishapur*. 2013;**5**(1):28–36.
20. Bieg S, Backes S, Mittag W. The role of intrinsic motivation for teaching, teachers' care and autonomy support in students' self-determined motivation. *Journal for educational research online*. 2011;**3**(1):122–40.
21. Torkzadeh J, Keshavarzi F. Identifying the effective components on effective teaching with a strategic approach in higher education courses. *Education in Law Enforcement Sciences*. 2020;**25**:43–63.
22. Agbetsiafa D. Evaluating effective teaching in college level economics using student ratings of instruction: A factor analytic approach. *J Coll Teach Learn*. 2010;**7**(5):57.
23. Molway L. Measuring effective teaching: Student perceptions of their modern languages lessons in England. *System*. 2021;**97**. doi: 10.1016/j.system.2020.102440.