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Enhancing academic performance: a shadow curriculum approach for medical and dental student preparation in basic sciences and pre-internship comprehensive exams

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Abstract

Background The shadow curriculum is an emerging concept in curriculum studies that has not yet garnered significant attention in medical education. It includes programs and activities outside formal education to improve students' academic performance in the formal educational system.

Objective In this study, we designed and developed an online course based on the shadow curriculum and evaluated its effect on students' learning and academic performance.

Methods This study represents a form of developmental research, with the study population comprising medical and dental students from universities of medical sciences in Iran. The course was conducted at the Smart University of Medical Sciences, following the ADDIE instructional design approach in three phases. The initial two phases involved designing and implementing the program according to the students' needs and requirements. In the third phase, we evaluated the program using the Kirkpatrick model. In the first level evaluation, the reaction of 70 students in the course was investigated. To assess the impact of the course, pre and post-tests were administered to 30 students. Finally, the effect of the course on students' success in the comprehensive exams for basic medical sciences, dentistry, and pre-internship was analyzed by examining the passing and failing statuses of 83 and 57 students who participated in the September 2023 and February 2024 exams.

Results The results indicated that the students responded positively to the program. The analysis of pre-test and post-test scores showed a significant improvement in the students' academic performance across all the subjects presented in the course, including basic medical sciences, dentistry, and pre-internship ($p < 0.01$, $p < 0.05$). Overall, the descriptive analysis of the program's influence on the students' success in comprehensive exams in basic medical sciences, dentistry, and pre-internship showed that 70 out of 83 participating students passed the September 2023 comprehensive exams. Additionally, 51 out of 57 participants completed the comprehensive exams in February 2024.

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Conclusions In an era where the shadow curriculum is reshaping learning and the educational landscape, the findings presented in this study indicate that this type of curriculum should be given special attention in the theoretical, research, and practical dimensions of the field of medical education.

Keywords Shadow education, Undergraduate medical education, Supplementary course, Differentiated curriculum, Personalized learning, Online education, Program evaluation

Background

Shadow Education emerged in the 1990s through the work of researchers like George [1] and Stevenson & Baker [2], and it has been steadily expanding since then. This growth is fueled by the rising academic competition among students, stemming from the heightened focus on success in standardized assessments. Shadow curriculum refers to programs and educational activities developed and implemented outside formal education. The purpose of these programs is to enhance students' academic performance within the formal education system [3].

Based on three main characteristics of the shadow curriculum (complementary, private, and academic), it is considered a curriculum offered outside the formal education system by private educational institutions to improve students' academic performance in the formal education system [3]. A more comprehensive definition describes the shadow curriculum as "all learning experiences acquired by students through participation in complementary curricula explicitly offered by other private or governmental sectors to improve students' academic performance in the formal education system. These learning experiences also change students' knowledge, behavior, and attitudes" [4]. As stated, the shadow curriculum improves students' academic performance within the educational system or institution; however, the experiences gained in shadow learning environments also shape their beliefs and attitudes.

The concept of the shadow curriculum has been mainly reflected in the writings of two curriculum designers from South Korea in recent years [3]. In practice, shadow education can be conceptualized as a shadow curriculum text [5]. Unlike other types of curricula, such as the formal curriculum (the stated and the intended curriculum, what the school or the teacher says is being taught), hidden curriculum (is an informal and unwritten curriculum and includes lessons, behaviors, norms and values that are learned unconsciously during the learning process), null curriculum (encompasses content, knowledge, and skills that are not included in the formal curriculum, either deliberately or unknowingly), the shadow curriculum is a novel concept which has received minimal attention in medical education and has not been applied in courses. Studies suggest that the shadow curriculum can influence students' academic performance, both directly and indirectly.

There appears to be a correlation between the impressive achievements of the students in East Asian countries like Singapore, Japan, and South Korea in international exams, such as TIMSS and PIRLS, and the investment in the shadow curriculum in these countries [3]. Additionally, research findings indicate that students who receive shadow education outperform their peers academically. Subsequently, students demonstrate increased interest in shadow education as it improves their performance in academic subjects and better equips them for higher-level entrance exams. The primary reason for the continued emphasis on the shadow curriculum is its alignment with each student's abilities, needs, and personal interests, providing a customized curriculum that is highly adaptable and adjusts according to students' requirements [3, 6].

Shadow education, commonly known as private supplementary tutoring [2, 3, 7–10], encompasses various forms. Kim, Gough & Jung [11] have suggested a way to classify different types of shadow education.

They categorize shadow education into five primary forms: private tutoring institutes, home-visit private tutoring, subscribed learning programs, academic after-school programs, and internet-based tutoring [4]. Among these forms, internet-based private tutoring is rapidly growing to help students manage time and location constraints in accessing private education [11]. The shadow curriculum can be delivered in various formats, including asynchronous learning, synchronous learning, or a blended approach. In this study, we designed and implemented a course centered on the shadow curriculum, evaluating its impact on student learning and academic success. The current course and program have been designed as internet-based supplementary education, offering both synchronous and asynchronous online learning. As a response to the needs of students, the education deputy of the Ministry of Health and Medical Education (MOHME) developed supplementary courses to prepare them for comprehensive exams in basic medical sciences, dentistry, and pre-internship. As a result, the current program was designed, implemented, and evaluated online, both synchronously and asynchronously, for doctoral students in general medicine and dentistry nationwide. We conducted this program considering the analysis of the students' performance in previous courses and the needs expressed by universities/medical faculties nationwide.

Methods and materials

Setting and program description

The current course at the Smart University of Medical Sciences was designed and implemented in two paths: basic sciences (including anatomy, physiology, clinical biochemistry, bacteriology, mycology, and parasitology) and pre-clinical studies (covering cardiovascular, pediatrics, lung, gynecology, and obstetrics, rheumatology, psychiatry, skin, neurology, surgery, and nephrology). This program served students from medical sciences universities nationwide (Fig. 1). The program was evaluated at the Smart University of Medical Sciences.

Instructional design of the course

Design, development, and implementation of the program

We planned and presented this program using the ADDIE approach (Analyze, Design, Develop, Implement, and Evaluate), a valid model for instructional design consisting of steps of analysis, design, development, implementation, and evaluation (Table 1). The target population of this program was doctoral students in general medicine and dentistry nationwide. The Smart University of Medical Sciences developed and implemented this course in response to a request from the Education deputy of the MOHME. The aim was to address students' needs to strengthen their scientific knowledge and prepare for comprehensive exams in basic medical sciences, dentistry, and pre-internship.

The course addressed the issue of underperformance in exams based on a comprehensive needs analysis conducted across medical universities nationwide by identifying the subjects where students faced some challenges. The program lasted 109 instructional hours, with 64 h allocated to fundamental sciences (equivalent to 3.7 credits) and 45 h to pre-internship training (equivalent to 2.6 credits). As a supplementary educational initiative, the course aimed to strengthen students' understanding of these critical areas, ultimately enabling them to excel in their comprehensive exams. The course was delivered through synchronous and asynchronous online learning using the Learning Management System (LMS) and Adobe Connect application. We aimed to underscore the significance of diverse educational opportunities in medical education by introducing the shadow curriculum,

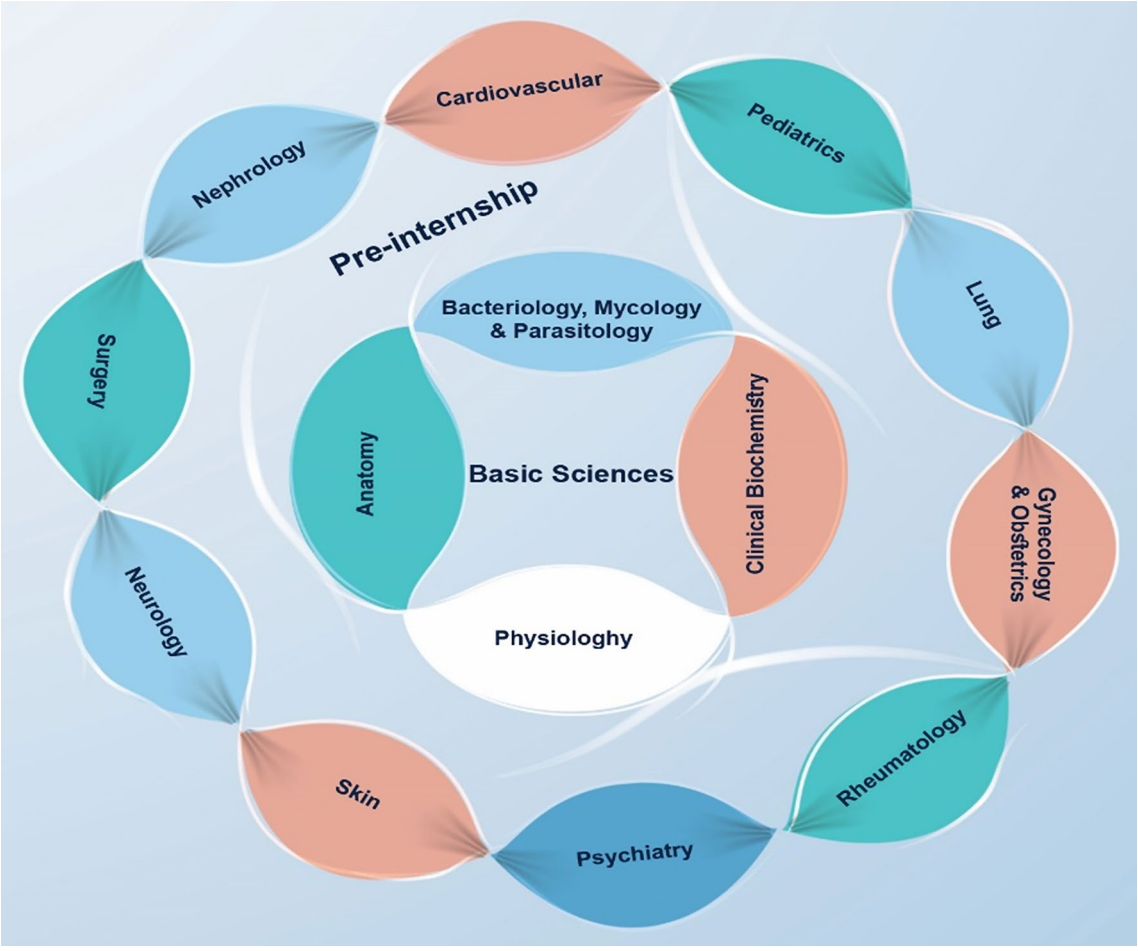

Fig. 1 The presented courses in the program according to the basic and pre-clinical sciences

Table 1 Outline of the design, implementation, and evaluation of the program and steps performed based on the ADDIE model

N	The phases of designing, implementing, and evaluating the program	Steps and actions
1	Condition analysis phase	- Analysis of conditions, characteristics of learners and program - Receiving permission and necessary correspondence with the Deputy of Education (MOHME) - Creating the scientific-educational and executive team of the course - Forming a content developing team and course managers
2	Program design phase	- Choosing an educational strategy to achieve the learning outcomes of the course - Developing course plans, materials and content, educational environment, and implementation method
3	Program development phase	- Development of the content of the first course based on Mayer's multimedia principles - Revising some of the content of the first course and developing new content for the second course
4	Implementation phase	- Preparing and announcing the call to universities and the target group in the first and second course - Academic calendar of the course and registration of students in the first and second course - Uploading the developed content in the LMS system - Holding synchronous online classes - Course monitoring by the director of Student Affairs and educational and technical personnel
5	Evaluation phase	- Reaction evaluation (satisfaction of learners) - Learning evaluation - Impact evaluation of the course

Table 2 Course name, hours, and credits

Basic sciences				
N	**Course Name**	**Hours**	**Equivalent of Credits**	**The number of developed content**
1	Anatomy	50	3.7 Credits	43
2	Physiology	5		6
3	Clinical biochemistry	4		2 online sessions
4	Bacteriology, mycology and parasitology	5		19
Pre-internship				
5	Cardiovascular	5	2.6 Credits	2 online sessions
6	Pediatrics	5		2
7	Lung	5		2
8	Gynecology and obstetrics	4		2
9	Rheumatology	3		7
10	Psychiatry	5		20
11	Skin	3		21
12	Neurology	5		4
13	Surgery	5		2
14	Nephrology	5		4

designed to enhance the scientific capabilities of students through supplementary learning experiences. The next phase involved forming a scientific and executive team, which included the university president, deputy for academic affairs, student affairs manager, faculty members, and some experts, to analyze conditions. Course coordinators for basic and pre-clinical sciences were appointed, followed by scientific teams and networks of university faculty members with relevant expertise to develop content for the specified topics.

In this program, we implemented the educational strategy of electives and student-selected components, determining courses and materials based on statistical analysis of universities and student needs. The team developed the materials to address students' academic and functional weaknesses. Through this approach, the supplementary course encourages students to delve deeper into the selected subjects and enhance their performance in basic medical sciences, dentistry, and pre-internship exams. Moreover, decisions were made during the design phase regarding the content, class hours, and unit equivalents for basic sciences and pre-internship, as detailed in Table 2.

Teams delivered the courses in two forms: synchronous and asynchronous online learning. Asynchronous classes were conducted through the Learning Management System (LMS) and synchronous classes via Adobe Connect.

During the development phase, faculty members were familiarized with the necessary skills to develop course content, including standards for producing electronic content and utilizing the LMS in asynchronous training. Instructors also received a comprehensive briefing on the course's nature, target population, objectives, and features. Additionally, educational content for the course was developed, comprising a total of 132 instructional materials (68 for basic sciences and 64 for pre-internship) organized by course hours. The teaching approach involved interactive lectures and slides, integrating virtual reality (VR) in certain instructional materials. In addition to the instructional content, two online sessions, two hours each, were conducted for basic sciences and two sessions of two and a half hours each for pre-internship.

Following the development of our program, we moved into the exciting phase of implementing the training course. During this stage, we crafted vital elements,

including a compelling call-to-action message, essential information for prospective registrants, course titles and duration, a streamlined registration process, necessary documents for enrollment, course fees, an educational calendar, and an engaging electronic poster. This vital information was then communicated to all medical universities in the country, ensuring that all potential participants were well-informed and ready to take the next step. After registration, the enrolled students were grouped and defined in the LMS, and their training began.

Educational intervention evaluation

To assess students' perceptions of the course, we used a 15-item satisfaction questionnaire by Akbari Farmad and Yousefian [12]. Participants rated their satisfaction on a five-point Likert scale from 5 (Very high) to 1 (Very low), with 3 indicating moderate satisfaction. The questionnaire was created using Porsline, and the link was distributed to participants. We conducted pre-tests and post-tests to evaluate learning (the second level). Additionally, to measure the course's impact on students' success in comprehensive exams for basic medical sciences, dentistry, and pre-internships, we collaborated with the Medical Education Assessment Center (MEAC) to review passing and failing rates from the September 2023 and February 2024 exams. Figure 2 illustrates the evaluation levels and tools used.

Population, participants and sampling

The students participating in the course were from universities of medical sciences nationwide and affiliated hospitals (including Lorestan, Ahvaz Jundishapur, Iran, Shahid Beheshti, Zahedan, Zanjan, Tehran, North Khorasan, Tabriz, Shahroud, Kashan, Gilan, Yazd, Jahrom, Kermanshah, Kerman, Larestan, Shiraz, Mazandaran, Yasuj, Fasa, Mashhad, Isfahan, Sabzevar, Alborz, Shahrekord, Babol, Urmia, Shahed, Golestan and Arak). The total number of students participating in the course was 115 people: basic medical sciences with 64 students (35 female and 29 male), Basic dental sciences with 19 students (7 female and 12 male), pre-internship, 32 students (17 female and 15 male).

We determined the sample size for the first level evaluation (reaction) based on Cochran's formula, and we collected data from 70 participating students at this level. For the second level evaluation (learning), we gathered data from 30 participants, with 10 each from basic medical sciences, dentistry, and pre-internship programs. For this level, we utilized pre-tests and post-tests. Stratified random sampling was used to collect data at both levels (reaction and learning), and students participating in the study were selected using the RANDBETWEEN function in Excel software. Ultimately, in collaboration with the MEAC, we evaluated the impact of the course on the students' success in these comprehensive exams by analyzing the passing and failing rates of students who took the exams of September 2023 and February 2024.

Data analysis

The collected data were analyzed through quantitative-descriptive methods (frequency, percentage, mean, and standard deviation) and inferential methods (paired t-test).

Results

Reaction evaluation (satisfaction of learners)

The students' responses to the course satisfaction questionnaire are presented in Table 3.

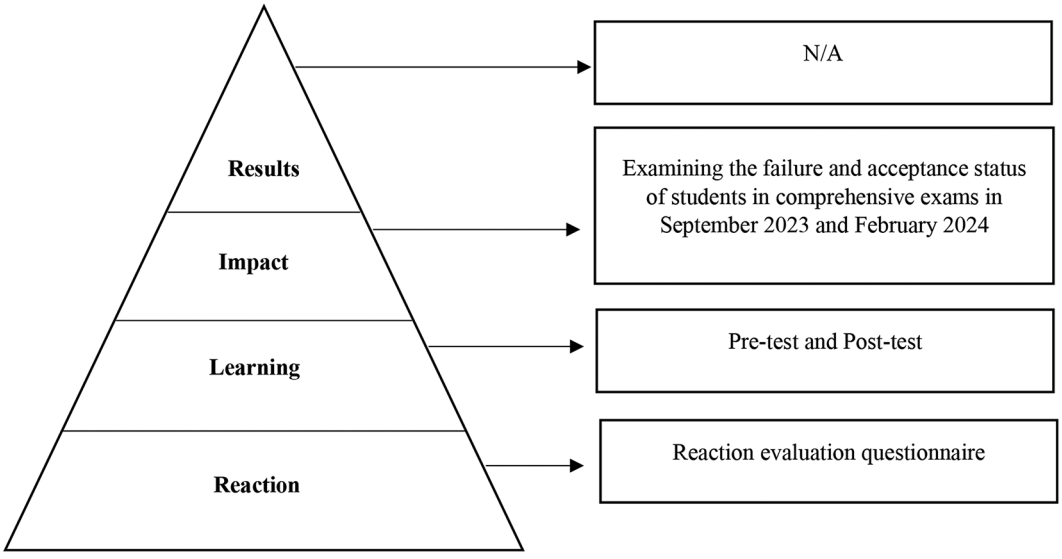

Fig. 2 Program evaluation levels based on the Kirkpatrick model and the tools used

Table 3 Reaction evaluation results (students' satisfaction with the course)

N	Questions	Very low		Low		Moderate		High		Very high	
		N	%	*N*	%	*N*	%	*N*	%	*N*	%
1	How much has your knowledge improved through participating in this course?	0	0	7	10%	7	10%	10	15%	46	65%
2	How challenging was the course?	3	5%	7	10%	3	5%	8	10%	49	70%
3	How satisfied were you with the teacher's methods?	3	5%	7	10%	3	5%	11	15%	46	65%
4	How well were the objectives achieved during the course?	3	5%	3	5%	11	15%	11	15%	42	60%
5	How well were your expectations addressed in this course?	0	0	7	10%	10	15%	7	10%	46	65%
6	How good were the forum discussions?	3	5%	7	10%	11	15%	14	20%	35	50%
7	How good were group activities?	7	10%	3	5%	10	15%	18	25%	32	45%
8	How related was the course to your educational needs?	3	5%	7	10%	4	5%	14	20%	42	60%
9	How aligned were the educational materials with the course objectives?	3	5%	7	10%	3	5%	18	25%	39	55%
10	How did you find the overall quality of the materials and educational activities?	7	10%	3	5%	7	10%	18	25%	35	50%
11	How satisfied are you with the teacher's guidance and control over the course?	3	5%	7	10%	4	5%	14	20%	42	60%
12	How satisfied are you with the quality of the feedback provided in the course?	7	10%	7	10%	7	10%	17	25%	32	45%
13	How much did the teacher encourage the learners to engage in the course?	7	10%	3	5%	3	5%	18	25%	39	55%
14	How clear were the teacher's explanations?	3	5%	3	5%	7	10%	11	15%	46	65%
15	How effective did you find the course overall?	3	5%	7	10%	11	15%	14	20%	35	50%

It is evident from the data in this table that students held a highly favorable opinion of the course

Learning evaluation

To evaluate students' comprehension levels, pre-tests and post-tests were carried out for those in basic medical sciences and dentistry, separately for subjects like anatomy, physiology, clinical biochemistry, bacteriology, parasitology, and mycology. The evaluations were also done distinctively for pre-internship medical students for subjects such as cardiology, pediatrics, pulmonology, obstetrics and gynecology, rheumatology, psychiatry, dermatology, neurology, surgery, and nephrology, with the results of pre-tests and post-tests for each subject presented in Table 4.

We conducted a paired t-test to analyze and compare participants' pre-test and post-test scores in the comprehensive basic sciences examinations for medicine, dentistry, and pre-internship. Table 4 indicates that post-test mean scores significantly increased across all courses ($p<0.01$; $p<0.05$).

Impact evaluation

We contacted the MEAC to get access to the scores of the students who took part in the comprehensive examinations in September 2023 and February 2024. The passing and failing rates of those students were analyzed to evaluate the influence of the course on their success in the exams. According to the data provided by the MEAC, 83 students participated in the comprehensive basic sciences and pre-internship examinations in September 2023, while 57 students took part in the February 2024 examinations. The passing and failing rates of these students are presented in detail in Table 5.

The statistical analysis of pass and fail rates of students in the September 2023 exams shows the effectiveness of the course (approximately 85% pass rate). Similarly, the analysis of the February 2024 exams indicates a high pass rate of around 90%, highlighting the effectiveness of the course.

Discussion

Findings and their relation to the existing literature

Shadow education originated in East Asian countries and has since spread globally, gaining importance [5, 7, 8, 11, 13, 14]. Research from South Korea, the United States, Japan, Bangladesh, Sri Lanka, India, and Canada underscores the significant role of the shadow curriculum in student learning [5, 15]. While well-established in general education, the concept has been explored less in higher education, in medical education in particular, and remains largely unrecognized, both theoretically and practically. An online course was developed, implemented, and evaluated in this study within the context of the shadow curriculum to fill the mentioned gap in the literature.

The findings of this study indicate that students reacted positively to the program, with data analysis revealing significant improvements in grades across all courses offered. Additionally, the course substantially increased the success rate in comprehensive exams for basic medical sciences, dentistry, and pre-internship.

However, there are occasional inconsistent findings regarding the shadow curriculum's effect on academic achievement [3]. Nevertheless, many researchers have identified a positive influence of shadow education on students' learning and academic success [8, 16–20].

In this regard, the findings of our study are consistent with the results of some studies [2, 5, 8, 15, 21, 22]; however, they are inconsistent with a limited number of studies [10, 23]. However, many scholars believe that more

Table 4 Paired t-test regarding the difference between pre-test and post-test scores of the participants by tests

N	Phase and field (basic and pre-clinical sciences)	Blocks	Stage	*N*	Mean	SD	T	*P*-value
1	Basic Sciences (Medical)	Anatomy	Pre-test	10	5.10	0.87	-3.54	0.006**
			Post-test	10	6.40	0.51		
2		Physiology	Pre-test	10	5.20	1.22	-3.28	0.010**
			Post-test	10	6.60	0.84		
3		Clinical Biochemistry	Pre-test	10	4.60	1.26	-2.90	0.017*
			Post-test	10	5.70	0.94		
4		Bacteriology, Mycology and Parasitology	Pre-test	10	4.30	0.94	-7.06	0.000**
			Post-test	10	6.70	1.49		
1	Basic Sciences (Dentistry)	Anatomy	Pre-test	10	5.20	1.13	-5.28	0.001**
			Post-test	10	7.40	1.17		
2		Physiology	Pre-test	10	4.30	0.94	-7.06	0.000**
			Post-test	10	6.70	1.15		
3		Clinical Biochemistry	Pre-test	10	4.70	1.33	-2.80	0.021*
			Post-test	10	6.10	1.44		
4		Bacteriology, Mycology and Parasitology	Pre-test	10	5.50	1.08	-14.69	0.000**
			Post-test	10	7.90	1.44		
1	Pre-Internship (Medical)	Cardiovascular	Pre-test	10	4.60	0.96	-11.69	0.000**
			Post-test	10	6.70	0.94		
2		Pediatrics	Pre-test	10	4.30	1.15	-3.16	0.021*
			Post-test	10	6.30	1.33		
3		Lung	Pre-test	10	4.60	1.07	-3.43	0.008**
			Post-test	10	6.30	1.05		
4		Gynecology and Obstetrics	Pre-test	10	5.10	0.99	-4.07	0.003**
			Post-test	10	6.90	1.19		
5		Rheumatology	Pre-test	10	4.20	0.63	-4.38	0.002**
			Post-test	10	6.10	1.28		
6		Psychiatry	Pre-test	10	5.30	1.15	-4.14	0.002**
			Post-test	10	7.20	0.91		
7		Skin	Pre-test	10	5.10	0.99	-5.46	0.000**
			Post-test	10	7.00	1.15		
8		Neurology	Pre-test	10	5.10	1.10	-7.58	0.000**
			Post-test	10	7.20	0.91		
9		Surgery	Pre-test	10	4.90	1.10	-2.68	0.025*
			Post-test	10	6.30	1.63		
10		Nephrology	Pre-test	10	5.00	1.05	-5.01	0.001**
			Post-test	10	6.90	1.10		

**Significant at the 0.01 level *Significant at the 0.05 level

research is needed to understand the contexts and factors in which shadow education has had little effect on academic achievement [21, 24].

Overall, the higher education system in healthcare and medical universities/faculties in any given country and setting strives to educate competent graduates and physicians, thereby using a variety of educational opportunities, experiences, and diverse curricula, including shadow curriculum, which are crucial to achieving this goal. One key feature of the shadow curriculum is personalized learning. According to Bray, private tutoring exemplifies personalized learning as it caters to learners' individual needs, enabling them to customize their learning by selecting subject areas, course levels, preferred mentors, course content, learning pace, and the location and time of their learning [25].

One critique in the literature concerning the shadow curriculum results from its implication that the primary goal of education is to attain high grades and excel in competitive exams, potentially discouraging students from grasping the intrinsic value of learning. However, this criticism may not be entirely valid, as learning and assessment are two sides of the same coin, and a notable advancement in medical education assessment has been the shift away from artificial distinctions between formative and summative assessment toward the concept of assessment for learning [26] and newer paradigms like assessment as learning [27]. Essentially, in medical education, assessment should ultimately contribute to enhancing learning. Hence, one of the motivations for students engaging in shadow education is its focus on improving learning, enhancing academic performance, and professional development [2, 5, 8].

Table 5 Statistical status of acceptance and failure of students participating in comprehensive exams in September 2023 and February 2024

Comprehensive exams in September 2023				
N	**Type of comprehensive exam**	**The number of acceptances**	**The number of failures**	**Absent**
1	Comprehensive exam of basic sciences (Medical)	33	8	1
2	Comprehensive exam of basic sciences (dentistry)	11	0	0
3	Comprehensive pre-internship Exam (Medical)	26	4	0
4	**Total**	**70**	**12**	**1**
Comprehensive exams in February 2024				
1	Comprehensive exam of basic sciences (Medical)	21	3	1
2	Comprehensive exam of basic sciences (dentistry)	4	0	0
3	Comprehensive pre-internship Exam (Medical)	26	1	1
4	**Total**	**51**	**4**	**2**

On the other hand, in response to this critique, we can argue that while the shadow curriculum operates outside formal education and is integrated into the mainstream educational system to enhance students' performance, learners acquire practical knowledge in the shadow learning environment that shapes their beliefs and attitudes. Huhn and his colleagues [28] conducted a study to assess the effectiveness of a voluntary peer-led preparatory course for first-year international medical students in preparing them for exams. They found various significant benefits of the course regarding exam preparation, such as gaining technical and educational insights and social learning experiences. Moreover, other research in general education points out that socioeconomic factors significantly influence the investment in shadow education. Wealthy families can afford to prioritize this education for their children, leading to better academic performance and widening social, educational, and cultural disparities [3, 6, 29, 30]. While a correlation exists between the two, it does not necessarily mean the perpetuation of social and educational inequalities [5].

Additionally, the current program welcomes students from medical universities throughout Iran to benefit from the course. As a result, contrary to the related literature, these outcomes will not jeopardize the course. Finally, in the current millennium and ever-changing world, learning extends beyond traditional classroom settings, making investment in the shadow curriculum crucial for enriching medical education and improving students' academic performance.

The strengths and limitations of the study

The shadow curriculum in medical education has mainly been overlooked nationally and internationally. This project represents a groundbreaking study aimed at investing in the shadow curriculum in medical education. Furthermore, the study encourages educational planners and mentors to prioritize the development of this curriculum and to design educational interventions based on it. One of the strengths of this study is that the course has been designed and developed entirely based on the needs and demands of students, emphasizing personalized education and highlighting a differentiated curriculum in medical education more than ever before. Our study also faced specific limitations. As mentioned, the concept of the shadow curriculum is well-known, neither in theoretical nor practical aspects of medical education, and has limited related literature. Therefore, designing and implementing this course was challenging for researchers. Therefore, designing and implementing this course was challenging for researchers.

Furthermore, there has been significant confusion in distinguishing this curriculum from others, such as hidden or informal curricula. This ambiguity poses a challenge for researchers attempting to convey a clear understanding of the concept to policymakers, planners, and medical mentors. Given that education and learning in medical training are intricate processes influenced by the context, caution should be exercised when applying the findings of this study to other countries.

Lessons learned and implications for policymakers and future researchers

Since shadow education is crucial for many students, understanding it is vital for a comprehensive grasp of the teaching landscape. More importantly, the growth and development of students cannot be ignored by those who show interest in today's education and learning. The current research can have implications for practitioners, policymakers, and medical educators, such as:

- Emphasizing shadow education (the shadow curriculum) to boost students' academic performance and subsequently enhance their future professional success in healthcare fields;
- Paying attention to and addressing previous failures in the comprehensive basic sciences exams of medicine, dentistry, and pre-internship;
- Enhancing the scientific groundwork and improving students' performance in the comprehensive basic sciences exams of medicine, dentistry, and pre-internship;
- Reducing the retention rate of general medicine and dental students in the course to avoid unnecessary time and costs in the healthcare education system;

- Facilitating a smooth transition for medical and dental students into the workforce and developing them to embrace their future professional roles without delays.

Overall, in an era where shadow curriculum is reshaping student learning and the educational landscape in many countries worldwide, the findings presented in this study suggest that shadow education, especially the shadow curriculum, should be recognized as a new research area in curriculum studies and gradually develop. The current course aims to prepare students for basic medical sciences, dentistry, and pre-internship exams. Therefore, we suggest that future researchers develop, implement, and evaluate curriculum shadow-based courses to develop students in other areas.

Conclusion

In this study, an online course was designed, implemented, and evaluated within the framework of the shadow curriculum to improve learning and academic success in comprehensive examinations of basic medical sciences, dentistry, and pre-internship. The results showed that the shadow curriculum can improve learning and enhance students' academic performance, especially in high-stakes tests. Therefore, it is recommended that policymakers, educational planners, and medical educators invest in the shadow curriculum.

Abbreviations

MEAC	Medical Education Assessment Center is one of the subsidiary organizations of Education Deputy of the Ministry of Health and Medical Education. The Medical Education Assessment Center is officially responsible for conducting various exams, such as master's degree, Ph.D., medical assistantship, comprehensive basic sciences, and pre-internship, of the Ministry of Health and Medical Education
MOHME	Ministry of Health and Medical Education

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Author contributions

This research was conceptualized and designed by B.S. and H.Kh. All planning and preparations leading up to the course implementation were expertly crafted and executed by B.S. and H.Kh. and A.H. H.Kh. and A.H. and R.A. were engaged in the course implementation. B.S. was the leader of the research and project team. H.Kh. supervised the implementation of the course. H.Kh., A.H., and M.K. participated in evaluating the program and collected, analyzed, and interpreted the data. R.A. was responsible for providing students' tuition and administrative support. H.Kh. and S.K.Kh. collaborated on drafting the manuscript. B.S., A.H., and M.K. critically studied and appraised the first draft. H.Kh. and S.K.Kh. revised and developed the first draft based on a critical appraisal of their colleagues. Finally, all authors have read and approved the final article.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This research has received ethics approval with the number IR.SMUMS.REC.1403.011 on 2024-06-08 from the Research Ethics Committee of Smart University of Medical Sciences. The Iranian Registry of Clinical Trials (IRCT) informed us that the evaluation data of this study would not need a trial register. All participants were informed of the research objectives when collecting data. Data confidentiality and anonymity of participants were guaranteed in the study. Finally, we obtained informed consent from all the participants involved in the study. All methods were conducted following the ethical principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. George C. Time to come out of the shadows. Straits Times. 1992;4:28.
2. Stevenson DL, Baker DP. Shadow education and allocation in formal schooling: transition to university in Japan. Am J Sociol. 1992;97(6):1639–57. https://doi.org/10.1086/229942
3. Kim YC, Jung JH. Shadow education as worldwide curriculum studies. Cham: Springer International Publishing; 2019a. https://doi.org/10.1007/978-3-030-03982-0
4. Nouri A. Shadow curriculum. Iranian encyclopedia of curriculum. 2021.
5. Kim YC, Jung JH. Conceptualizing shadow curriculum: definition, features and the changing landscapes of learning cultures. J Curric Stud. 2019b;51(2):141–61. https://doi.org/10.1080/00220272.2019.1568583
6. Entrich SR. Shadow education and social inequalities in Japan: evolving patterns and conceptual implications. Springer; 2017. https://doi.org/10.1007/978-3-319-69119-0
7. Bray M, Kwo O. Regulating private tutoring for public good. Policy options for supplementary education in Asia. UNESCO Bangkok. 2014. https://unesdoc.unesco.org/ark:/48223/pf0000227026
8. Kim YC. Shadow education, curriculum and culture of schooling in South Korea. Palgrave Macmillan US; 2016. https://doi.org/10.1057/978-1-137-51324-3
9. De Silva WA, Gunawardane C, Jayaweera S et al. Extra-school instruction, social equity and educational quality (Sri Lanka). Report prepared for the International Development Research Centre, Singapore.
10. Bray M. The shadow education system: private tutoring and its implications for planners. UNESCO International Institute for Educational Planning.; 1999. https://unesdoc.unesco.org/ark:/48223/pf0000118486

11. Kim YC, Gough N, Jung JH. Shadow education as an emerging focus in worldwide curriculum studies. Curriculum Matters. 2018;14:8–30. https://doi.org/10.18296/cm.0027
12. Farmad SA, Yousefian F. Evaluation of the effectiveness of virtual CPR training in midwives of Shahid Hasheminezhad Hospital in Mashhad. MEDEDJ. 2022;10(2). https://doi.org/10.22088/mededj.10.2.7
13. Sun M, Braeye S. Comparing supplementary ethnic schools and the academic achievement of Chinese immigrant students in Quebec and Flanders. Diversité Urbaine. 2012;12(1):105–24. https://doi.org/10.7202/1019214ar
14. Zhou M, Kim S. Community forces, social capital, and educational achievement: the case of supplementary education in the Chinese and Korean immigrant communities. Harv Educ Rev. 2006;76(1):1–29. https://doi.org/10.17763/haer.76.1.u08t548554882477
15. Park H, Buchmann C, Choi J, Merry JJ. Learning beyond the school walls: Trends and implications. Annu Rev Sociol. 2016;42(1):231–52. https://doi.org/10.1146/annurev-soc-081715-074341
16. Carr D, Wang LC. The effect of after-school classes on private tuition, mental health and academic outcomes: evidence from Korea. Sociology. 2018;52(5):877–97. https://doi.org/10.1177/0038038516677219
17. Entrich SR. German and Japanese education in the Shadow–Do out-of-School lessons really contribute to Class Reproduction? IAFOR J Educ. 2014;2(2):17–53. https://doi.org/10.22492/ije.2.2.01
18. Lee J. Two worlds of private tutoring: the prevalence and causes of after-school mathematics tutoring in Korea and the United States. Teachers Coll Record. 2007;109(5):1207–34. https://doi.org/10.1177/016146810710900507
19. Nath SR. Private supplementary tutoring among primary students in Bangladesh. Educational Stud. 2008;34(1):55–72. https://doi.org/10.1080/03055690701785285
20. Ozaki M. A juku childhood: Children's experiences in juku attendance and its relation to their well-being in Japan (Unpublished doctoral disserta- tion). 2015. University of Bath, Claverton Down, UK. https://core.ac.uk/download/pdf/161920843.pdf
21. Bray M, Lykins C. Shadow education: private supplementary tutoring and its implications for policy makers in Asia. Volume 1. Asian Development Bank; 2012.
22. Buchmann C, Condron DJ, Roscigno VJ. Shadow education, American style: test preparation, the SAT and college enrollment. Soc Forces. 2010;89(2):435–61. https://doi.org/10.1353/sof.2010.0105
23. Baker D, LeTendre GK. National differences, global similarities: World culture and the future of schooling. Stanford University Press; 2005. https://doi.org/10.1515/9781503624870
24. Smyth E. The more, the better? Intensity of involvement in private tuition and examination performance. Educ Res Eval. 2008;14(5):465–76. https://doi.org/10.1080/13803610802246395
25. Javadi Y, Kazemirad F. Worldwide shadow education epidemic and its move toward shadow curriculum. JLTR. 2020;11(2):212–20. https://doi.org/10.17507/jltr.1102.09
26. Walsh K. Online assessment in medical education-current trends and future directions. MMJ. 2015;27(2):71–2. https://doi.org/10.4314/mmj.v27i2.8
27. Brunton J, Brown M, Costello E, Farrell O. Enhancing programme approaches to assessment and feedback in Irish higher education: case studies, commentaries and tools. InNational Forum for the enhancement of teaching and learning. Teach Learn ie. 2017. https://doi.org/10.6084/m9.figshare.5113939
28. Huhn D, Eckart W, Karimian-Jazi K, et al. Voluntary peer-led exam preparation course for international first year students: Tutees' perceptions. BMC Med Educ. 2015;15:106. https://doi.org/10.1186/s12909-015-0391-5
29. Bray M. Private supplementary tutoring: comparative perspectives on patterns and implications. Compare. 2006;36(4):515–30. https://doi.org/10.1080/03057920601024974
30. Bray M. Shadow education in Europe: growing prevalence, underlying forces, and policy implications. ECNU Rev Educ. 2021;4(3):442–75. https://doi.org/10.1177/2096531119890142

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