Effect of Spaced and Massed Learning Approaches on the Performance of Faculty Members in Medical Education

Rani Ahmad1, Omyayma Hamed2, Reda Jamjoom1, Yoon Soo Park3, Ara Tekian3

Abstract

Introduction. The effectiveness of spaced and massed strategies can be evaluated by examining how educational experts (faculty members) transfer their learning skills to real-life educational contexts, such as with their undergraduate students in Saudi Arabia. It is necessary to consider the respective benefits of these strategies for faculty members to maintain standards and capabilities, fulfilling their learning and development needs.

Aim. This study aimed to compare the effectiveness of spaced and massed practice programs for faculty members in transferring their acquired assessment skills to their students. To achieve this goal, we used a mixed methodological approach, integrating both qualitative and quantitative methods into the study design.

Methods. This study was carried out at the Faculty of Medicine, King Abdul-Aziz University (KAU), Jeddah, Saudi Arabia. Focus group discussions were employed for the qualitative approach, while the paired-sample t-test and Chi-square test of independence were used for the quantitative approach.

Results. The results of the focus group discussion indicated that participants from both groups preferred the spaced learning approach, considering the busy schedules of medical doctors and students. In terms of cost effectivity, both group participants preferred the massed learning technique. Two (25%) participants from the spaced technique group and five (62.5%) participants from the massed technique group succeeded in applying all parts of the assessment cycle without significant help from other experts. Three (37.5%) participants in the spaced groups agreed that the pathway of applying the standards was confusing and entailed extra work requirements, while five (62.5%) participants in the massed group responded that it increased the feeling of being overwhelmed. Furthermore, the statistical results did not provide a clear indication of which program faculty members should adopt to facilitate their students in a better way. The lack of statistically significant differences between the findings of both programs suggests that the results do not confirm the superiority of spaced or massed practice, as is often assumed in medical education.

Conclusions. Both spaced and massed learning strategies were found to be broadly effective in transferring assessment skills, with no significant qualitative and qualitative differences. Their effectiveness depended on the specification of modules.

Keywords

Educational Skills; Massed Practice; Real-Life Practice; Spaced Practice; Transferring Assessment

1Department of Radiology, Faculty of Medicine, King Abdulaziz University, Saudi Arabia
2Armed Forces College of Medicine, Egypt
3Department of Medical Education, Chicago College of Medicine, University of Illinois, Chicago, Illinois, USA
*Corresponding author: rahmad@kau.edu.sa

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Introduction

In medical schools, learning and teaching programs are unfolding as an ever-growing part of scientific knowledge. The impact of knowledge and skills on the professional development of faculty members is fundamental to delivering quality education. Two influential approaches, i.e. spaced and massed practices, in the field of medical education can lead to improvement in procedural skills [1–3]. Spaced practice is a retrieval-based strategy of learning that refers to a circumstance in which learners are provided with many discrete intervals during training programs while massed practice requires learners to do a task with no or few intervals [4]. Previous studies have emphasized educational program requirement for strong evaluation plans to improve professional development [5, 6]. A spaced learning strategy can benefit the learners through spacing effects and testing effects. The spacing effect advocates that retaining knowledge increases when it is confronted continuously across time. Whereas the testing effect emphasizes performance development that originates from diligently arousing memory with the help of testing. In the context of cognitive psychology, the spaced repetition strategy improves the possibility of effective recall in forthcoming and supports the retention of memory [7]. This significant construct of psychology is investigated through medical and higher education [8, 9]. On the other hand, a massed learning strategy is highly accessible and economical, but in this learning approach, the learner could execute their knowledge promptly later by learning since the breakthrough fades subsequently if there is no practice [4]. In short, significant improvement in short-term memory practices suggests massed practice effectivity in terms of correlation between working memory capacity and initial learning. In long-term follow-up practices, spaced learning exhibits significantly greater memory towards spaced-trained stimuli [10, 11].

Across various paradigms of knowledge and skill recognition, spaced practice has been broadly shown to provide more benefits than massed practice in terms of enhanced memory and retention [12]. According to Weinstein et al. [13], spaced practice often leads to a better retention rate, allowing for better consolidation of facts and ideas. Similarly, Kang [2] also claimed that spaced practice enhanced the diverse learning form, including problem-solving and memory retention. However, the recovery of complex ideas can be difficult in spaced practices since retrieval depends upon the repetition of elements. Massed teaching practices often employ competent resource strategies, but expensive human stimulators and manikins might not be available on a regular, full-day basis, that is necessary for teaching and learning purposes. However, spaced practice enables self-evaluation of knowledge and cognitive processing where complex concepts are difficult to understand [14] and, additionally, provides enough time for concentration [15]. The two strategies have benefits depending upon the situational conditions, and these can be intensified to promote better results [16, 17].

A study by Shail [18] states that learning through the cramming (massed) approach can be stored as short-term memory and it is reduced as time passes if it is not used repeatedly. However, the massed learning strategy may be the choice of students over the spaced repetition approach for several reasons. Foremost, the massed doctrine gives an outstanding illustration for instant memory and retention processes, thereby decreasing the endeavor of transient memorial recovery. Furthermore, the massed learning approach may provide strength to dynamic momentary recovery, that is beneficial for instant examining, and it can help students immediately pay attention to their examination with their linked test scores [18]. Contradictory to the temporary advantage of massed learning practice, electroencephalography (EEG) was employed by Zhao et al. [19], which revealed that lexical education of long-term retention recovery can be hindered under massed priming circumstances. This result advocates that teachers and learners can encounter the benefits of the massed learning approach for instant memorial evaluation but overlook its possible damage to long-term memory [19].

On the other hand, the merits of spaced repetition are emerging as progressively obvious in research. However, its practical worth has been overlooked. This paradox might be evaluated at the systematic and individual levels. A study by Kelley and Whatson [20] advocates that the usage of the spaced repetition approach permits study courses to transmit conceptions and ideas at an exceptional pace and expand learning efficacy beyond compromise on the concentration of students and their analytical abilities [20]. This can be attained by conducting several concise and brief lessons interspersed with breaks that include physical activities. Such course design can imperatively enhance students’ long-term memory of concepts and better recognize their learning capabilities. Furthermore, one of the derivative principles of spaced learning practice is microlearning (technology-based learning): appropriate interactive priming and skills in technology-based education could provide productive outcomes related to learning [21]. The spaced learning approach can provide benefit to undergraduate and postgraduate medical students as it develops learning particularly to the topics that raise their scores on tests [22].

The significance of these two strategies of learning made it necessary to consider the respective benefits of these strategies for faculty members in maintaining standards and capabilities and fulfilling their learning and development needs. However, the effectiveness of these strategies can be evaluated by measuring how educational experts transfer their learning skills to real-life educational contexts, such as with their students [23]. Currently, there is a gap in the literature regarding which method is more effective in transferring educational assessment skills acquired in medical universities to real-life educational practice. The rationale for conducting this study was also the scarcity of data in our region.

The objective of the study was to evaluate the efficiency of spaced and massed approaches for medical faculty members in Saudi Arabia, aiming to determine which strategy is more effective in assessing their educational skills. Furthermore, this study contributed to the literature by examining...
Effect of Spaced and Massed Learning Approaches on the Performance of Faculty Members in Medical Education

The impact of spaced and massed learning practices on teaching performance, aiming to identify the more beneficial strategy for teachers to use their potential educational skills in effectively transferring knowledge to their students.

Materials and Methods

Research Design
A mixed method study design was incorporated to analyze the outcomes of spaced and massed strategy courses in developing the assessment skills of faculty members, conducted between January 2018 and January 2019. The mixed approach of study design included both qualitative and quantitative approaches to analyze the data (Fig. 1).

Study Participants and Sampling
A total of 20 participants were initially enrolled in the study using a purposive sampling technique. Finally, sixteen participants consented to participate with an 80% response rate, and the remaining 4 responses of participants were left because of response biases. The sample size was small as we considered the Faculty of Medicine only at King Abdul-Aziz University (KAU) in Saudi Arabia and only 16 faculty members of the university cooperated to conduct focus group discussions (FGDs) due to their busy schedule. The study included faculty members based on their skills, educational backgrounds, experience, and knowledge. A total of 8 undergraduate modules from the MBBS curriculum were included in the study, each supervised by a single faculty member. The modules we included in our study were as follows: Medical Pharmacology (year II), Cardiovascular System and Nutrition & Metabolism (year III), Clinical Skills and Laboratory Medicine (year IV), Family Medicine and Pediatrics (year V), and Patient Safety (year VI). The study excluded inexperienced faculty members who had not previously attended any form of medical education or workshops and were unwilling to provide informed consent to ensure a fair comparison between teaching strategies. The selected 16 faculty members were randomly divided into two groups, spaced (Group I) and massed practice (Group II), with each group comprising 8 members.

Study Procedure
The study included FGDs conducted at two different levels: the first level involved examining faculty members’ predictions on the best strategies and development programs, where they selected their preferences for spaced or massed practice; the second level assessed teaching strategies through an appraisal of their measurable outcomes in real-life practice, i.e. the impact on student results. A brief pre-program questionnaire was provided to participants to attain baseline demographic data. Additionally, post-program review forms and questionnaires were provided, encompassing self-assessment questions and information on the perceived success rate of the course. The appropriate response to item analysis was determined by assessing the participants’ level of satisfaction in transferring educational skills to medical students. Furthermore, the success rate of modules was based on faculty members’ satisfaction, which was evaluated through the performance of students in each group.

Faculty members from both groups (spaced and massed) were evaluated separately over a specific period. The most expedient methods to evaluate the implementation procedures of workshops are routine meetings of trainers, feedback sessions of large groups, and FGDs. In a study by Alfaris et al. [24], a post-workshop questionnaire was used to assess the satisfaction of participants and a quasi-experimental pretest-posttest design was used to evaluate the learning effect. In the spaced group, workshops lasting less than two weeks were considered the least helpful; it was suggested that the duration should be extended to more than a month. In Group I, the spaced technique program spanned nine months, comprising seven workshops (with a duration of 3-4 hours for each session) attended by faculty members at intervals of three weeks. In Group II, faculty members spent five full days attending seven workshops, each running from 9 a.m. to 5 p.m. daily for the entire five-day period. After a three-month retention period, a final assessment was conducted for both groups, encompassing the information given to participants during the specific training program.

Data Analysis
The data were analyzed using a Statistical Package for the Social Sciences (SPSS) version 20.0. Qualitative data were analyzed through content analysis, including open-ended semi-structured questions regarding the positive and negative outcomes of educational programs, the realization of intended or unintended outcomes, short-term and long-term implications, overall impact and sustainability, and the adoption of program elements, focusing on the three themes formulated: input, process, and product. Quantitative analysis was conducted through the paired-sample t-test to compute the difference between spaced-group and massed-group approaches and examine the success rates of modules delivered by faculty members through either spaced-type or massed-type educational programs, assessed through the students’ performance in each group.
Moreover, the Chi-square test of independence was employed to determine possible relationships between the dependent and independent variables in the measurable outcomes of the workshops attended in the spaced and massed groups. However, the statistically significant level was set at p < 0.05.

## Results

This section presents the results of the mixed method approach, involving both qualitative and quantitative data analyses. Furthermore, the qualitative approach incorporated an open-ended semi-structured survey (in-depth interview), and the quantitative approach utilized a paired-sample t-test and Chi-square test. Moreover, this study illustrated the results within three themes: Theme 1 focused on input (FGD), Theme 2 covered the process, and Theme 3 addressed the product.

The demographic profile of the participants is provided in Table 1. Table 2 demonstrates the response of both spaced and massed group participants to FGD Theme 1 (Input). The results related to the feasibility of strategies to achieve necessary assessment skills showed that participants from both groups favored the spaced learning approach, particularly considering the busy schedules of medical doctors and students. In terms of cost-effectiveness, both group participants preferred massed learning techniques.

### Table 1. Demographic profile of study participants.

<table>
<thead>
<tr>
<th>Item</th>
<th>Measure</th>
<th>Between 28–40 years old n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>12 (80)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Experience</td>
<td>0-5 years</td>
<td>5 (24)</td>
</tr>
<tr>
<td></td>
<td>&gt;5 years</td>
<td>11 (76)</td>
</tr>
<tr>
<td></td>
<td>Lecturer</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Designation</td>
<td>Assistant professor</td>
<td>5 (14)</td>
</tr>
<tr>
<td></td>
<td>Associate professor</td>
<td>9 (76)</td>
</tr>
<tr>
<td>Workshop attended</td>
<td>Yes</td>
<td>12 (88)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>3 (12)</td>
</tr>
</tbody>
</table>

Table 3 displays the participants’ response to Theme 2 (Process). Two (25%) participants from the spaced learning technique group and five (62.5%) participants from the massed technique group succeeded in applying all parts of the assessment cycle without significant help from other experts. Three (37.5%) participants from the spaced group and seven (87.5%) members of the massed group succeeded in providing a complete annual report that fulfilled all elements. On the other hand, five (62.5%) participants from the spaced group failed to apply for the assessment cycle, with or without significant help from experts, whereas in the massed group, only one (12.5%) participant failed to apply the planned program.

Participants’ response to Theme 3 (product) is presented in Table 4. Six (75%) participants from both spaced and massed groups identified all elements of the assessment cycle and provided a positive response regarding improved retention of acquired knowledge and better skill implementation in the field observed. Three (37.5%) participants in the spaced groups agreed that the pathway of applying the standards was confusing and entailed additional work requirements. In contrast, five (62.5%) participants in the massed group responded that it increased the feeling of being overwhelmed. Considering the long-term implication of program outcomes, six (75%) participants in the spaced group and five (62.5%) participants in the massed group concurred on the importance of enhancing the assessment environment to meet national standards. The negative outcome for the spaced group was reported by three (37.5%) out of 8 participants stating that the faculty administration is adding extra work to faculty members to get accreditation. In contrast, the massed group received a positive outcome from 6 (75%) out of 8 members. The response to the sustainability of the intended and positive program outcomes was found the same (87.5%) in both groups. Moreover, the study is limited due to its small sample size as only 16 faculty members managed to cooperate due to their busy scheduling and response biases.

### Discussion

The study assessed the faculty members’ ability to transfer the assessment knowledge gained in educational programs to their real-life educational practices through a comparison of spaced and massed learning strategies. From the outset, it might seem that faculty members would prefer longer spacing between sessions, especially when encountering challenging subjects or concepts. Accordingly, spaced faculty development programs may be thought to ensure the transfer of educational skills to real-life practice. The present study examined the effectiveness of spaced and massed techniques in transferring their knowledge of assessment of educational skills in undergraduate teaching.

The results of Theme 1 revealed that, as per the feasibility of the program, both spaced and massed group strategies were effective in achieving the necessary assessment skills; however, in terms of cost-effectiveness, most participants favoured the massed group strategy because it required fewer advertisement and administrative measures. Terenyi et al. [25] and Smolen et al. [26] indicated that spaced retrieval was more consistent than massed practice in reinforcing memory. In spaced practice, each learning session provided an opportunity to retrieve memory by incorporating previous learning sessions, whereas massed activities failed to provide chances for memory reinforcement. The findings of Theme 2 indicated that the response rate of implementing the spaced group program was very low (only 25%) as compared to the response rate of the massed group program (62.5%). These findings...
Table 2. Results of participant responses to Theme 1: Input.

<table>
<thead>
<tr>
<th>Item</th>
<th>Spaced Group</th>
<th>Massed Group</th>
<th>Methods Employed for Information Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>How feasible is spacing compared to the massed strategy to achieve the necessary assessment skills?</td>
<td>Spacing is more convenient to fulfill the busy schedules of medical doctors.</td>
<td>Everyone agreed that spacing met the needs of all faculties, given its ease of scheduling with breaks. However, a lot of participants found the massed strategy feasible as well because it required some exemption from duty and a one-time rescheduling of patients.</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>How cost-effective is spacing compared to the massed strategy to achieve the necessary assessment skills?</td>
<td>The spaced learning approach could be cost-effective because priming through spaced repetition is more suitable and lasts for a similar duration and this can accompany future savings by spending less time revising the lesson that has been forgotten.</td>
<td>The university provided full financial assistance. The participants found the massed strategy to be more cost-effective, requiring fewer advertisement materials, secretary duties, and canceling clinics.</td>
<td>Qualitative: FGD. The total teaching hours were equal for the two groups.</td>
</tr>
</tbody>
</table>

Table 3. Results of participant responses to Theme 2: Process.

<table>
<thead>
<tr>
<th>Item</th>
<th>Spaced Group</th>
<th>Massed Group</th>
<th>Methods Employed for Information Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent was the program implemented compared to the plan?</td>
<td>Two (25%) out of eight participants succeeded in applying all parts of the assessment cycle without significant help from other experts. One (12.5%) member succeeded with significant help from the quality unit, while the remaining 5 (62.5%) members failed to apply for the assessment cycle, with or without significant help from other experts.</td>
<td>Of the eight members, five (62.5%) succeeded in applying all parts of the assessment cycle without significant help from other experts. Two (25%) members succeeded with significant help from the quality unit. Only one (12.5%) member failed to apply for the planned program.</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>How was the program implementation documented?</td>
<td>Of the eight modules, three (37.5%) generated an annual course report that met all criteria, including results from student and faculty surveys, success rate, samples from exam items, evidence of using exam blueprinting, the location of formative assessment, and the incorporation of constructive feedback.</td>
<td>Seven (87.5%) out of eight modules succeeded in providing a complete annual report that fulfilled all elements.</td>
<td>Quantitative: document review.</td>
</tr>
</tbody>
</table>

are in line with a study by Hughes and Lee [27], according to which massed practice provides better outcomes for higher or complex mental tasks, better implementation of the program, and improves proficiency in using these activities. Additionally, as per Hattie and Donoghue [28], strategy effectiveness is a product of how well the content and concepts are embedded into the course. The results of Theme 3 revealed that 75% of participants from both groups recognized positive outcomes of the programs. In the spaced group, participants identified long-term retention and better skills implementation as the positive outcomes of the spaced program, while educational standards increasing the significant confidence, as indicated by structured presentation, were identified as positive outcomes of the massed program. However, time-consuming practice and more theoretical use of the content taught to students were identified as the negative outcomes of spaced groups with a 37.5% response rate. The massed group reported a negative outcome with a relatively high response rate (62.5%), citing extensive curriculum changes needed to meet the standards. Furthermore, the sustainability of the massed program was higher as compared to the spaced group with response rates of 62.5% and 50%, respectively. In short, the qualitative data results showed a preference for a spaced or massed approach to teaching educational skills depending on the feasibility of the faculty member to teach the medical module. For instance, faculty members chose the massed learning approach to teach pharmacological demonstrations because it provided skillful resource planning and appeared to be more cost-effective; however, the basis of medical genetics required small sessions with spaces for long-term retention and improved knowledge skills. Previous research has supported both programs of learning. A study by Molloy et al. [29] showed that a short time between sessions was effective as a strategy because it enabled the emergence of latent learning and
### Table 4. Results of participant responses to Theme 3: Product.

<table>
<thead>
<tr>
<th>Item</th>
<th>Spaced Group</th>
<th>Massed Group</th>
<th>Methods Employed for Information Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>What positive outcomes of the program can be identified?</td>
<td>Six (75%) participants identified all elements of the assessment cycle; were familiar with the national standards and knew how the implementation process could be carried out. Overall, participants showed positive responses, indicating improved retention of acquired knowledge and better skill implementation in the field.</td>
<td>Six (75%) participants identified all elements of the assessment cycle, showcasing a clear understanding of educational standards among faculty members. Furthermore, there was a significant increase in confidence when applying these standards and making any necessary decisions. The confidence among the participants was evident through the structured presentation of the questions and the positive outcomes of the program. Moreover, participants’ positive responses to the questions facilitated the researcher in measuring confidence.</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>What negative outcomes of the program can be identified?</td>
<td>Three (37.5%) members agreed that the pathway of applying the standards was confusing. They developed a feeling that the taught practice is time-consuming and cannot be handled by some participants. Additionally, there was a perception that what was taught had more of a theoretical application rather than practical use.</td>
<td>Five (62.5%) participants reported an increased feeling of being overwhelmed. They expressed a need for more extensive changes to the curriculum to meet standards. Furthermore, there was a sentiment that students became more empowered without a tangible increase in their academic levels.</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>Were the intended outcomes of the program realized?</td>
<td>Yes</td>
<td>Yes</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>Were the unintended outcomes positive or negative?</td>
<td>The faculty administration is adding extra work to faculty members to get accreditation (negative outcome reported by 3 (37.5%) out of 8 members).</td>
<td>Increased collaboration between faculty members and supporting bodies, including the medical education department, quality, and assessment unit, was reported as a positive outcome by 6 (75%) out of 8 members.</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>What are the long-term implications of program outcomes?</td>
<td>Six (75%) members concurred on the importance of enhancing the assessment environment to meet national standards.</td>
<td>Five (62.5%) agreed to improve the assessment environment to meet the national standards.</td>
<td>Qualitative: FGD.</td>
</tr>
<tr>
<td>How sustainable is the program?</td>
<td>Four (50%) participants agreed that the sustainability of the program might be contingent on providing additional sessions accompanied by clearer guidelines or by reducing the spacing or time intervals between sessions.</td>
<td>Five (62.5%) faculty members expressed the view that the program sustainability could be achieved through repetition and scheduling at appropriate times.</td>
<td>Qualitative FGD.</td>
</tr>
<tr>
<td>How sustainable are the intended and positive program outcomes?</td>
<td>Seven (87.5%) respondents agreed that program outcomes would be sustainable if all coordinators attended the courses before being assigned to their roles.</td>
<td>Seven (87.5%) respondents agreed that program outcomes would be sustainable if all coordinators attended the courses before being assigned to their roles.</td>
<td>Qualitative FGD.</td>
</tr>
<tr>
<td>How easily can the program elements be adopted by other educators with similar needs?</td>
<td>Recruiting other faculty members for the program is challenging, as current participants perceive an additional burden when implementing elements of the program.</td>
<td>Recruiting other faculty members is much easier in a massed program, as the adoption of the idea becomes straightforward once other educators understand it.</td>
<td>Qualitative FGD.</td>
</tr>
</tbody>
</table>
post-training learning. Additionally, evidence from Ahmadvand et al. [30] suggested that massed practice was useful in promoting learning between individuals, aside from direct transfer from the faculty member, which may have been an important factor in the research.

The analysis also examined the success rate of modules supervised by faculty members in spaced and massed group strategies and both groups showed almost similar success rates in each module, with means of 97.2% and 96.1%, respectively, p > 0.05. Moreover, Table 5 demonstrated the results of empirical estimations, and we found no statistically significant difference between all constructs of spaced group and massed group approaches for faculty members in transferring their educational skills to undergraduate students, as their p-values were greater than 0.05. In other words, this indicates that the results do not confirm the superiority of spaced or massed practice, as is often assumed in the medical education literature. It should be noted that the use of blueprints in space and massed groups tends to be significant (0.059 and 0.066).

Table 5. Review document - spaced group (SG) and massed group (MG).

<table>
<thead>
<tr>
<th>Module</th>
<th>Using blueprint</th>
<th>Blueprint structured as per evidence-based recommendation</th>
<th>Flaws in the sample of exam items</th>
<th>Structured planned formative assessment</th>
<th>Constructive feedback</th>
<th>Item analysis</th>
<th>Appropriate response to the item analysis</th>
<th>Success rate of modules (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG</td>
<td>Yes</td>
<td>Yes</td>
<td>No flaws</td>
<td>Not done</td>
<td>Done</td>
<td>Yes</td>
<td>Yes</td>
<td>99</td>
</tr>
<tr>
<td>MG</td>
<td>Yes</td>
<td>Yes</td>
<td>Few flaws</td>
<td>Done</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>96</td>
</tr>
<tr>
<td>SG</td>
<td>No</td>
<td>Yes</td>
<td>No flaws</td>
<td>Done</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>97</td>
</tr>
<tr>
<td>MG</td>
<td>No</td>
<td>Yes</td>
<td>No flaws</td>
<td>Done</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>94</td>
</tr>
<tr>
<td>SG</td>
<td>No</td>
<td>No</td>
<td>No flaws</td>
<td>Done</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>99</td>
</tr>
<tr>
<td>MG</td>
<td>No</td>
<td>No</td>
<td>Few flaws</td>
<td>Done</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>95</td>
</tr>
<tr>
<td>SG</td>
<td>No</td>
<td>No</td>
<td>Many flaws</td>
<td>Done</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>95</td>
</tr>
<tr>
<td>MG</td>
<td>No</td>
<td>No</td>
<td>Few flaws</td>
<td>Done</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>95</td>
</tr>
</tbody>
</table>

Mean Values (SG) 97.2
Mean Values (MG) 96.1
p value 0.059* 0.066* 0.435* 0.285* 0.500* 0.100* 0.157* 0.489*

Notes: * Chi-square test of the mean difference between the categorical data of Group I and Group II.
+ paired-sample t-test of the mean difference between the continuous data of Group I and Group II.

Comparing results of the massed and spaced techniques, while Molloy et al. [29] argued that longer gaps between sessions facilitate optimal learning, noting that the effectiveness of each technique depended on the specific context, and neither method proved consistently more effective than the other.

Limitations

This study has a few limitations. Firstly, its small sample size may limit transferability as it relies on the assessment of only one faculty in a single institution. Secondly, the study does not involve all possible courses in undergraduate education; rather, it focuses on selected courses available in the given settings. Furthermore, this study lacks diversity in faculties as it solely considers the Faculty of Medicine.

Conclusions

Both spaced and massed learning strategies were found to be broadly effective in transferring assessment skills. The findings of the qualitative data emphasized the massed learning approach as more cost-effective compared to the spaced repetition approach, requiring fewer administrative measures for implementation. Furthermore, the sustainability of the massed program was higher as compared to the spaced group program. In addition, the implementation of the massed practice program was found to be higher in educational institutions when compared to the implementation of the spaced group program. However, spaced group programs also identified positive outcomes, including long-term retention and better skills implementation. Consequently, the knowledge skills were found to be the same in both groups, whereas the massed group was associated with short-term memory retention, and the spaced group facilitated long-term memory retention. The results of
the quantitative data revealed no statistical difference between the success rate of the spaced group and the massed group, with a p-value of 0.48 > 0.05. These results indicated that there was no difference between the statistical significance for faculty members in choosing between the spaced group or massed group approach to transfer their educational skills in assessing undergraduate students. Thus, it indicated that the preference to choose between the spaced or massed group depended on the specification of modules taught by the faculty member. In summary, the results concluded that contrary to common beliefs in some previously discussed studies, massed practice could be as successful as spaced practice and more cost-effective if used under appropriate conditions. In contrast, the expected general increased effectiveness of the spaced strategy in helping learners perform tasks and memory of long-term difficult targets was evident as well. Nevertheless, the current results serve as a stimulating starting point for a broader examination of the transference of educational skills to real-life practice.

**Recommendations & Future Directions**

This study provides a baseline foundation for educational experts and planners in Saudi Arabia to promote both mass and spaced learning strategies in medical and healthcare faculties, based on specific requirements, possibly resulting in more economical curricular expenditure. Indeed, these strategies tend to be more advantageous when applied in a structured way, enabling consistency to be achieved in terms of course organization, structure, and content. Faculty members should consistently review course topics over time as each successive reiteration enhances the depth of knowledge and allows new perspectives to develop. The practical implications of the spaced learning approach are evident in applications utilizing flash cards, which effectively enhance the retention of medical students regarding course content. Both surgical and medical residents use spaced practice (flash cards) to prepare themselves for in-service examinations to secure better scores in exams. However, spaced practice does not facilitate psychiatry students. A more extensive study involving different medical faculties should be conducted in the future to establish the effectiveness of mass learning and spaced learning approaches to prompt a possible reconsideration of teaching practices in the university and explore more effective utilization of limited resources. Moreover, future research should consider numerous behavioral and socio-political factors to evaluate their efficiency on retention and learning. Additionally, further research is required for spaced learning practice to explore personalized approaches, such as adaptive schedules.

**Ethical Statement**

This study was approved by the Ethical Review Committee and conducted in accordance with the Declaration of Helsinki.

**References**


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