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The Effects of an Online Symptom-Based Learning Method Designed to Enhance Clinical Reasoning: A Qualitative Study

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ABSTRACT

Objective: The 'Online Symptom-Based Learning (SBL)' method was developed to support the clinical decision-making processes of students in clinical years, using the Education Management System (EMS) integrated with Zoom. This research aimed to gather the opinions of students and faculty members about the 'Online SBL' method applied during the pandemic.

Materials and Methods: This qualitative study involved 34 faculty members using Online SBL and 267 clinical year students from Karadeniz Technical University Faculty of Medicine. The researchers employed a convenience sampling method and selected volunteers for focus group interviews, including 28 clinical year students and 23 faculty members from different departments and clinical courses.

Results: Analysis revealed five main themes upon which the researchers agreed: educators' previous experiences in clinical reasoning, their experiences with SBL, students' experiences with SBL, the contributions of SBL to education, and suggestions for improving SBL.

Conclusion: The primary findings indicated that SBL improved clinical reasoning skills, positively affected the educational climate during the pandemic, promoted student-centered thinking among educators, and facilitated interdisciplinary collaboration towards common learning objectives. However, challenges included anxiety associated with conducting SBL online, some educators' persistence in educator-oriented thinking, and difficulties in group assessments. The Online SBL method could be beneficial not only online but also in face-to-face undergraduate education across all health professions.

Keywords: Online learning, undergraduate medical education, clinical reasoning.

This study presened as a poster at the XII. National Medical Education Congress 2022 at Samsun, Türkiye.

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INTRODUCTION

Clinical reasoning is defined as the process of diagnosing, treating, and managing follow-up by evaluating clinical symptoms, conditions, or cases based on obtained history, physical examination findings, and laboratory and imaging tests.[1] The 'Dual Theory', which addresses decision-making processes and is often applied in clinical decision-making, suggests that these processes operate through two main systems: fast, spontaneous, non-analytical reasoning in 'System 1', and an analytical system in 'System 2', which generates new hypotheses when encountering unusual phenome-

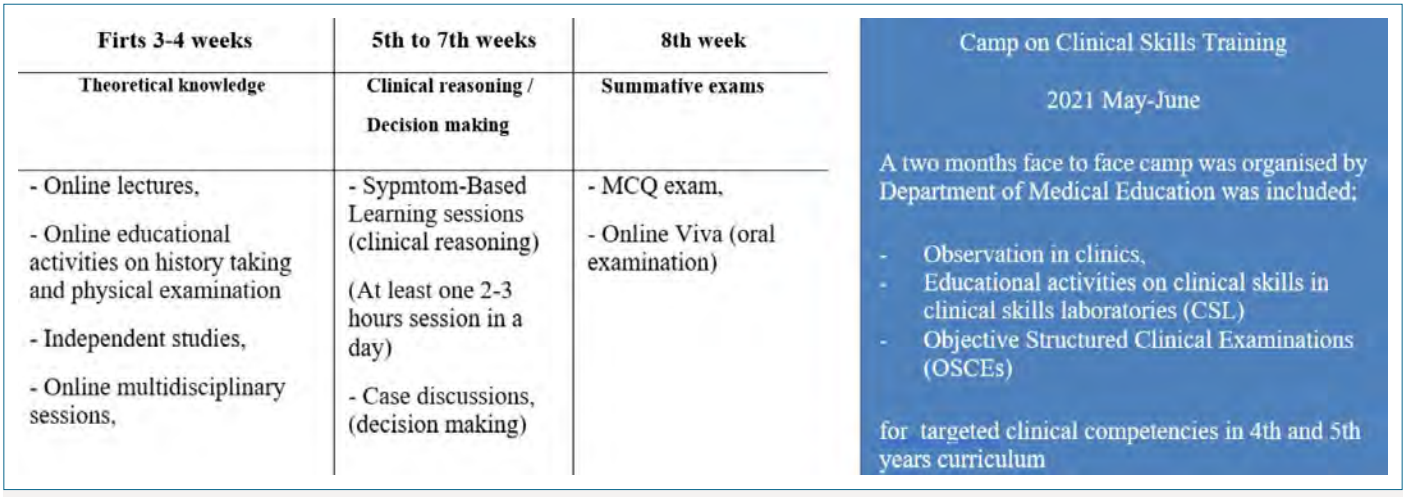

Figure 1. The structure of a 'course' in the 4th and 5th year curriculum during the pandemic.

na.[1,2] In the 'Dual Theory', clinical decision-making competence is defined as a process where Systems 1 and 2 are used together in a balanced manner in thinking and discussion processes, ensuring healthy transitions and transformations between systems.[3,4] The clinical decision-making process is inseparable from the underlying knowledge base and does not automatically guarantee successful decision-making.[5] Therefore, this process needs support from methods developed within the 'Dual Theory' framework. This highlights the importance of supporting clinical reasoning through clinical symptoms and cases in medical education, integrating it with both face-to-face and online training in the 21st-century medical education approach.[6,7] Consequently, case-based learning has been defined as a method where, beginning with a symptom, a case is resolved step-by-step, with the educator serving as a facilitator in small groups.[8,9] This case-based learning method is recommended not only in medical education but also in the training of other health professionals for the development of clinical reasoning.[10,11]

However, various problems may be encountered before, during, and after training aimed at acquiring clinical reasoning skills. These problems can arise from educators, learners, or the nature of the case scenarios. Among the problems attributed to educators are insufficient guidance during the process and a tendency to impart knowledge rather than facilitating the steps of clinical reasoning. Problems stemming from learners include an inability to engage in clinical reasoning processes due to their insufficient readiness and a lack of understanding of the teaching method. Issues arising from the case scenarios involve the failure to clearly present problems to learners and poorly structured case scenarios.[12]

During the Coronavirus Disease 2019 (COVID-19) pandemic, many efforts have been made to support students' clinical reasoning skills in undergraduate education across different health professions, including medicine, dentistry, and nursing. The main problems mentioned above have been encountered while using different methods to support clinical reasoning skills.[13,14] Consequently, researchers developed the 'Online Symptom-Based Learning (SBL)' method to support the clinical decision-making processes of clinical year students. This method is aligned with the themes in the Clinical Symptoms/Findings and Situations list from the Undergraduate Medical Education National Core Education Program.[15]

Purpose of the Study

The aim of this study was to gather the opinions of students and faculty members about the 'Online SBL' method implemented during clinical periods in the pandemic at Karadeniz Technical University (KTU) Faculty of Medicine. The objective is to improve the application based on the feedback obtained.

MATERIALS AND METHODS

Participants

Our study was designed following a qualitative approach. The target sample included 34 faculty members using Online SBL in clinical year courses and 267 students who participated in all sessions within the 2020–2021 Academic Year curriculum at KTU Faculty of Medicine. Researchers employed a convenience sampling method and selected volunteers, comprising 28 clinical year students and 23 faculty members from different departments and clinical courses.

Data Collection and Analysis

The Online SBL method, which can take two to three hours per session depending on the case characteristics, follows a 9-step approach to operationalize clinical reasoning processes. This method, developed for potential face-to-face application post-pandemic, was created by faculty members from the

Table 1. The processes of online-symptom based learning (Online SBL)

	Online SBL implementation steps	Instructions for students
Step 1	Determination of Pre-Diagnosis for the Main Symptom	What are your possible pre-diagnoses for this symptom/clinical situation? What questions can be asked of the patient to support your pre-diagnoses? (Socio-demographic information, personal history, characteristics of the main symptom, etc.)
Step 2	Providing Additional Information to Narrow Pre-Diagnosis	With new information, what other symptoms and features associated with the main symptom would you inquire about? (Symptoms and characteristics that may be present in the patient to confirm your possible pre-diagnosis)
Step 3	Sharing Additional Symptoms/ Findings and Situations Regarding the Main Symptom	Review your preliminary diagnoses. What additional physical examination findings do you need for your narrowed pre-diagnoses?
Step 4	Sharing the Patient's Physical Examination (PE) Findings	Review your preliminary diagnoses in light of the physical examination findings. What laboratory tests and imaging methods would you prefer for your narrowed pre-diagnoses?
Step 5	Laboratory Examination and/or Imaging Results of the Patient	Review your preliminary diagnoses in light of laboratory findings and/or imaging results. What additional laboratory tests and/or imaging methods would you need to narrow your pre-diagnoses?
Step 6	Making a Diagnosis Based on Available Information	Do you need additional information to make the patient's diagnosis with the available information? If yes, write it down; otherwise, clarify the diagnosis of the patient.
Step 7	Treatments/Complications/ Follow-Up Procedures/Preventive Medicine Practices	Considering the patient's diagnosis, do you have any suggestions regarding complications, follow-up procedures, or preventive medicine practices? If yes, please explain the details.
Step 8	Thoughts in the Context of Behavioral and Social Sciences	Considering the patient's diagnosis and the information you have obtained, have you identified any behavioral, sociocultural, or environmental relations/factors? If yes, please explain and discuss with the group.
Step 9	Assessment and Feedback Sessions	Conducting a feedback form for students and assessment of group dynamics by educators.

department of medical education, including the researchers. Details of the 'Online SBL' process are presented in Table 1.

Researchers conducted a 4-hour online training session via Zoom, which included implementation based on examples of Online SBL for faculty members involved in clinical education (Terms 4 and 5) and practical training for clinical term students on the application process of the Online SBL method.[16] Online SBL applications were first implemented in the 2020–2021 Academic Year, during Terms 4 and 5, by voluntary departments at KTU Faculty of Medicine. Students and teachers accessed Online SBL one to two times per week during the last five to six weeks of their clinical courses (Fig. 1). The unit of our faculty that coordinates the organization and management of student education and processes on the Education Management System (EMS) integrated with Zoom are illustrated in Figure 2.

Semi-structured focus group interviews with students and in-depth interviews with educators were conducted between April 2021 and June 2021. Online focus group interviews, utilizing the Online SBL applications, were held via Zoom in four different groups with six to eight students in each. These interviews were moderated by two researchers, with the sessions for the four groups scheduled at separate times. Information about the study was disseminated through the 'Education Management System' used by the KTU Faculty of Medicine, and focus groups were formed from those who voluntarily agreed to participate in the study.

For in-depth and focus group interviews, the researchers sent the Zoom link to participants' email addresses at least one hour before the interviews. Faculty members and students were informed that the online Zoom meetings would be recorded. Those who refused were excluded from the study, and pre-selected students were invited as substitutes. Online semi-structured in-depth interviews lasting 30 minutes were conducted with faculty members via Zoom, facilitated separately by two researchers.

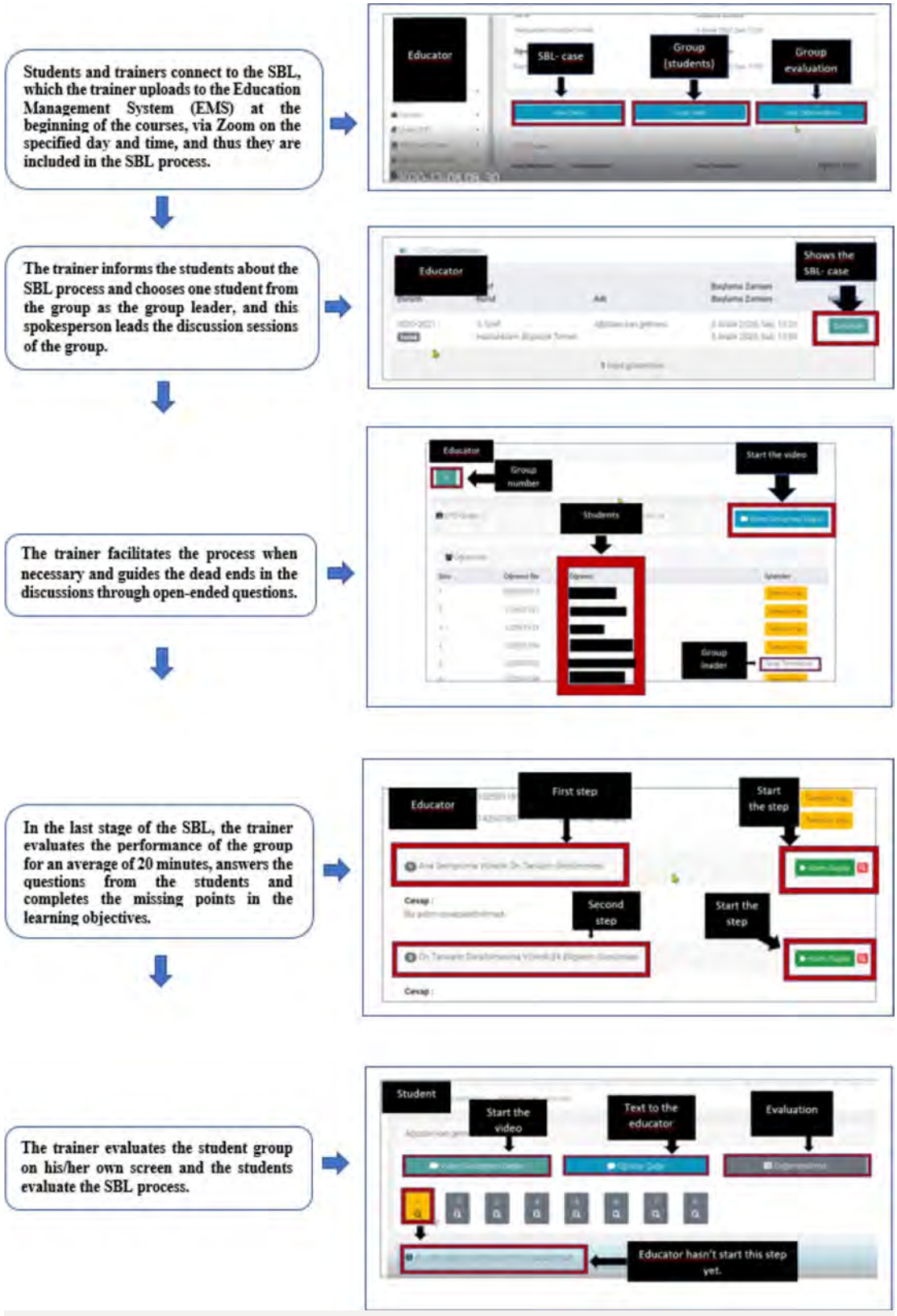

Figure 2. The details of online SBL processes on EMS.

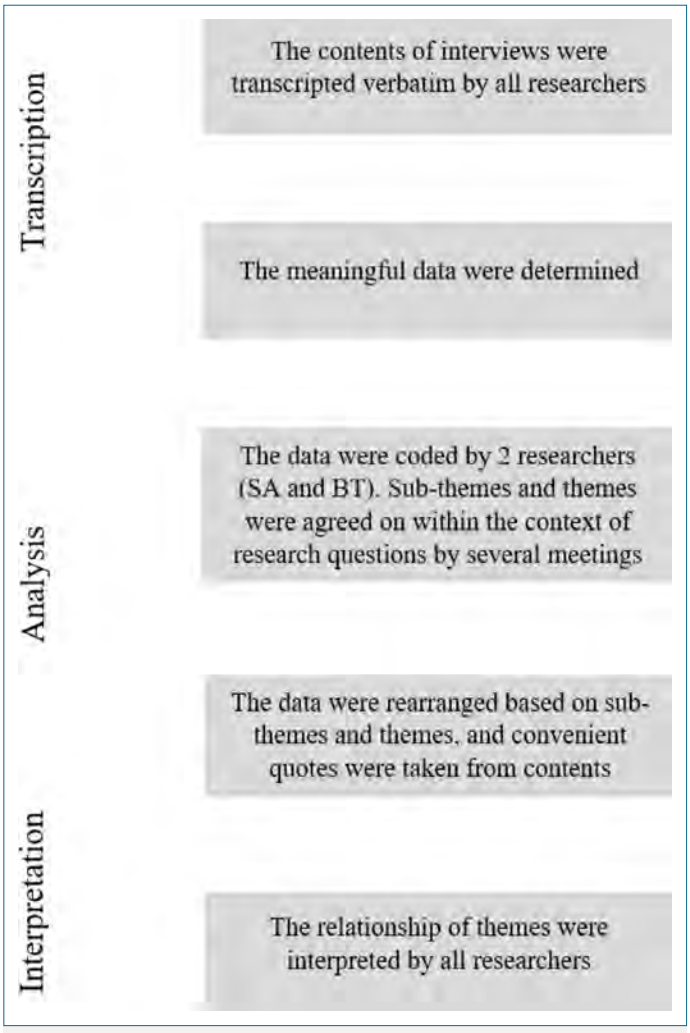

Figure 3. The qualitative analysis processes.

The 'Qualitative Interview Questions for In-depth Interviews' for faculty members and the 'Qualitative Interview Questions for Focus Group Interviews' for students were prepared by the researchers. The video recording from the pilot in-depth interview was reviewed by the researchers, leading to the revision and finalization of the interview questions (Appendix 1).

The content derived from the qualitative interviews were transcribed by the researchers, and a content analysis was performed on the texts. Details of the qualitative analysis process are shown in Figure 3.

Ethical Approval

Ethics committee approval for our study was obtained from the Scientific Research Ethics Committee of KTU Faculty of Medicine (document number: 2020/337, date: 21.12.2020).

RESULTS

The analyses revealed five main themes upon which the researchers agreed: the educators' previous experiences with clinical reasoning, their experiences with online SBL, the students' experiences with online SBL, the effects of online SBL on education, and suggestions for improving online SBL.

Main Theme (MT)-1: The Educators' Previous Experiences with Clinical Reasoning

'Bedside training' and 'case discussion in the classroom setting' emerged as two sub-themes from the educators' opinions. This indicates that educators employed various methods in bedside training and case discussions sessions in classroom settings to support students' clinical reasoning skills. Some quotes related to this theme are as follows:

> *"I give anamnesis training… Then, the students prepare a case and apply examination methods, and then I listen to them taking anamnesis."* E3

> *"I would hold discussion sessions with students about a symptom; for example, I would talk about the approach to chest pain, but we did not have a structured process like SBL."* E6

MT-2: The Educators' Experiences with Online SBL

Three sub-themes emerged from educators' opinions are: experiences in the preparatory phase; differences in practice; and challenges in the evaluation of sessions. Educators had different styles of preparation before online SBL. Additionally, educators displayed different facilitation and management approaches during online SBL. Some educators highlighted challenges in evaluating groups in online SBL. Some quotes related to this theme are as follows:

> *"We prepared and conducted the SBL scenario together with the X department. I can say that this was our first time providing such education. We realized we had many common goals and could increase the number of online SBL sessions..."* E11

> *"I intervened when they were stuck, of course, these were interventions that would facilitate clinical reasoning processes, but I still need to improve my role as a facilitator ...I was anxious due to my insufficient facilitation skills..."* E10

MT-3: Students' Experiences with the SBL

Three sub-themes emerged from students' opinion are: readiness before the SBL; fulfilling duties and responsibilities in online SBL processes; and emotions and thoughts. Students expressed their opinions on readiness before attending sessions

and the impact of the online SBL structure on their ability to perform roles during sessions. In addition, some emotions and thoughts about the effects of online SBL on their education were revealed. Some quotes related to the theme are as follows:

> "*We received training on how online SBL functions before…it was not difficult; the process was fast, and the pre-prepared online system guides students very well.*" S4

> "*...we can easily discuss and talk with our friends in SBL.*" S2

> "*...after studying the subjects taught in the classes, I learned what I really need to know through SBL, namely, how to use this information.*" S8

MT-4: Effects of Online SBL on Education

The following sub-themes emerged from the interviews: effects on clinical reasoning, contributions to the learning climate, impact on learners' roles in education, impact on the educator's role, and learners' professional attitudes and behaviors. The online SBL method improved students' clinical reasoning skills and enhanced interaction and discussion between educators and students. It also motivated students to perform their roles voluntarily. Educators found support in the online SBL method for facilitating and managing the clinical reasoning process. Some quotes related to the theme are as follows:

> "*We have basic knowledge to make a good discussion within the first three to four weeks of clinical courses, so the timeframe of online SBL is suitable for us...*" S6

> "*The steps of online SBL were established so similarly to real-life clinical cases. This method makes students feel competent in clinical reasoning...*" E9

> "*We sometimes go into too many details in theoretical lectures. With SBL, we prepare scenarios focusing on the answers to questions like 'What kind of path should they follow (in terms of clinical reasoning)?' and 'What information do they need?'...*" E20

MT-5: Suggestions for the Improvement of SBL

Three sub-themes emerged: suggestions for pre-training preparation, suggestions for the implementation process, and suggestions for the evaluation of the online SBL process. Educators emphasized that some symptoms should be prepared using a multidisciplinary approach. They shared many opinions on the needs that should be met by a coordination unit. Participants expressed a desire for easy connectivity when encountering issues during online SBL. Additionally, faculty members demonstrated some educator-centered attitudes, which were not aligned with the objectives of online SBL. Thus, educators suggested receiving training at regular intervals and desired feedback on their performance in online SBL. Students also offered suggestions on evaluating the online SBL process, such as having educators summarize and evaluate all steps at the end of the session. Some quotes related to the theme are as follows:

> "*Technically, it is necessary to establish and maintain a technical support unit where we can get help when uploading scenarios to the education management system...*" E7

> "*The number of students in groups should not exceed 15; it is very difficult to manage them online...*" E12

> "*The SBL session takes an average of 2.5 hours, and it can be very tiring for students, especially when they are online and in front of a screen; it is even more exhausting...*" E22

DISCUSSION

The Online SBL model contributed to the improvement of clinical reasoning skills on online platforms in undergraduate medical education. The main findings about SBL applied during the clinical period indicate that SBL enhanced clinical reasoning, had positive effects on the educational climate during the pandemic, encouraged educators to adopt a student-centered approach, and facilitated collaboration among educators from different disciplines towards shared learning goals. However, some of the main drawbacks identified in SBL were anxiety caused by conducting SBL online, some educators' persistence in educator-oriented thinking, difficulties experienced in group assessments, and a lack of experience in process assessments among educators. During the pandemic period, there were various examples of educational activities to support clinical reasoning worldwide. At Harvard University School of Medicine, which implements one of the more prominent practices, case discussions are carried out in small group studies.[17] In another study, researchers designed a workshop that included a red-eye clinical reasoning case for 1st-year preclinical medical students, incorporating virtual small- and large-group discussions in a clinical ophthalmology rotation. At the end of these workshops, students achieved the targeted knowledge gains and skills for clinical reasoning.[18] Isaac KS Ng et al.[19] highlighted that online platforms such as Zoom facilitated case-based tutorials, supporting medical students' clinical reasoning in history-taking, physical examination, differential diagnoses, and investigation/management plans during the COVID-19 pandemic. However, the study lacked detail on

the methods of learning activities for clinical reasoning. In a different study, an online interactive module was designed with three sections: a demonstration of the components of the respiratory physical exam via video conferencing software, a telemedicine encounter with a standardized patient, and a case discussion and clinical reasoning component via video conferencing software. Most medical students stated that this course helped improve their development of differential diagnosis.[20] The "Clinical Case Discussions" (CCDs) elective course was structured to allow students to work on real-life medical cases through a well-structured approach, aimed at strengthening clinical year students' clinical reasoning competence.[21] However, in this study, CCD sessions consisted of three parts where the process leading to diagnosis was operated, but it was noted that the cases were not discussed in terms of behavioral, social, and humanities aspects. Virtual rounds (VR) were used by Sukumar S et al.,[22] where educators conducted VR for third-year medical students, including online didactics, case discussions, students' presentations, and simulations, and it was reported that VR improved medical students' clinical reasoning skills during the pandemic. Although there have been many examples of the case-based learning approach in undergraduate medical education, these approaches often fall short in conducting a holistic analysis and running all steps of clinical reasoning. One of the key strengths of our model is its widespread use and experience across various departments and different clinical courses. Moreover, our model can be applied during the clinical years of all health professions education because it encompasses all steps of clinical reasoning. Additionally, our SBL model includes a behavioral-social-humanities component, which strengthens its holistic approach.

The clinical reasoning process mostly occurs in clinical education.[19] However, when viewed as a skill, it is emphasized that the curriculum should include how to operate the process from the early stages, starting in the first year, even if theoretical knowledge is lacking.[23,24] The clinical reasoning process needs support through case presentation, interpretation, and interaction. The importance of context is underscored when developing clinical reasoning skills.[25] After the theoretical lessons provided in the first third of each course at our institution, we proposed constructing SBLs to support clinical reasoning for clinical symptoms, spread over the remaining two-thirds of the course and tailored to that course's context. In line with our suggestions, educators also revised their courses as necessary. Our SBL model presents a method in which the phenomenon progresses gradually with clues and allows students to interact and interpret on an online platform (education management system) supported by Zoom. Students' remarkable insights regarding the method we recommended showed that it increased their motivation to learn, made them feel valued, contributed positively to clinical reasoning skills and the educational climate, offered an opportunity to apply theoretical knowledge specifically to clinical symptoms, enabled active participation in their learning, and facilitated interaction with peers.

One of the fundamental roles of educators is to provide feedback to students during the clinical reasoning process.[26] In our model, an educator led at most two groups, actively followed the groups both with the responses processed through the training management system and in the video session, facilitated the groups, and then provided feedback. Feedback was given both verbally at the end of the session and through a structured evaluation form. Some educators reported no issues in managing two groups simultaneously, while others preferred managing a single group due difficulties in following the students and facilitating when necessary. Our study revealed that students expect the educator to summarize the subject at the end of the session, especially in SBLs where scenarios cannot be fully resolved. Factors such as traditional teaching habits, scenarios not prepared in line with the clinical reasoning process, educators not acting as appropriate facilitators, and insufficient student readiness can be among the reasons.

Supporting the development of clinical reasoning has traditionally been deferred to clinical courses in undergraduate medical education. However, these courses often involve limited, undefined frameworks and practices that vary based on educators' competencies in this field. Medical faculties should implement methods supporting clinical reasoning from the preclinical period, so students are better prepared for clinical reasoning in the clinical period. The primary goal of medical educators, and thus of undergraduate medical education, is to foster the development of clinical reasoning skills in students. Educators should encourage students to actively participate in the evaluation and management of patients and to reflect critically on their performance. Moreover, clinician educators must assist in clearly teaching clinical reasoning concepts.[27]

A systematic review suggests that training in clinical reasoning varies across two dimensions. The first relates to how case information is presented, either in a 'serial clues' approach or a 'whole case' format, where the case is gradually presented to students. The second dimension is related to the purpose of education and aims to support students in acquiring and/or applying knowledge, enabling them to develop a way of thinking. The most common approach is the 'serial clue' approach, as it attempts to directly simulate the diagnostic processes of clinical symptoms or conditions that may be encountered in real life.[28] Students emphasized that case-based online modules were more productive in small groups than in face-to-face settings, significantly contributing to the discussion of history, physical examination, and diagnosis processes.[20] In our online SBL meth-

od, we used the 'serial clue' approach and took advantage of the pandemic conditions to integrate small group interactions and training activities for clinical reasoning, striving to improve education on online platforms. Our method begins with a symptom for clinical students and progresses gradually with the introduction of new information. Unlike others, our method, after making a differential diagnosis, addresses treatment planning, complications, and follow-up processes with a learner-centered approach. Additionally, topics of behavioral, social, and humanities are discussed in the context of symptoms and related clinical situations, on a case-by-case basis, which is considered one of the strongest aspects of our method.

Limitations

Some senior educators faced adaptation challenges with distance learning, thereby encountering difficulties using the Online SBL method via EMS. Furthermore, internet access issues among students affected a few online SBL sessions.

CONCLUSION

Our SBL model contributed to the improvement of clinical reasoning skills on online platforms in undergraduate medical education. This method might be utilized not only online but also in face-to-face education across all health professions. The main findings indicated that online SBL had positive effects on the educational climate during the pandemic, encouraged educators to adopt a student-centered approach, and led to collaborative efforts among educators from different disciplines. However, some identified drawbacks of SBL included anxiety caused by conducting SBL online, some educators' persistence in educator-oriented thinking, difficulties in group assessments, and a lack of experience in process assessments among educators.

For further research, we suggest investigating the effects of online SBL methods on the self-regulated learning skills of students.

Peer-review: Externally peer-reviewed.

Ethics Committee Approval: The Karadeniz Technical University Faculty of Medicine Scientific Research Ethics Committee granted approval for this study (date: 21.12.2020, number: 2020/337).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Author Contributions: Concept – SA; Design – SA; Supervision – SA; Resource – SA, BD, ADD; Data Collection and/or Processing – SA, BD, ADD; Analysis and/or Interpretation – SA, BD, ADD; Literature Search – SA, BD, ADD; Writing – SA, BD, ADD; Critical Reviews – SA, BD, ADD.

Conflict of Interest: The authors have no conflict of interest to declare.

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REFERENCES

1. Audétat MC, Laurin S, Dory V, Charlin B, Nendaz MR. Diagnosis and management of clinical reasoning difficulties: Part I. Clinical reasoning supervision and educational diagnosis. Med Teach 2017; 39(8): 792–6. [CrossRef]
2. Demirören M, Palaoğlu Ö. The teaching and evaluation of clinical reasoning models. Tıp Eğitimi Dünyası 2011; 29(29): 1–10.
3. Kahneman D. Thinking Fast and Slow. 1st edition. New York: Farrar, Straus and Groux; 2011.
4. Ark TK, Brooks LR, Eva KW. Giving learners the best of both worlds: do clinical teachers need to guard against teaching pattern recognition to novices?. Acad Med 2006; 81(4): 405–9. [CrossRef]
5. Norman GR, Monteiro SD, Sherbino J, Ilgen JS, Schmidt HG, Mamede S. The causes of errors in clinical reasoning: cognitive biases, knowledge deficits, and dual process thinking. Acad Med 2017; 92(1): 23–30. [CrossRef]
6. Hassoulas A, Forty E, Hoskins M, Walters J, Riley S. A case-based medical curriculum for the 21st century: The use of innovative approaches in designing and developing a case on mental health. Med Teach 2017; 39(5): 505–11.
7. Gauthier G, Lajoie SP. Do expert clinical teachers have a shared understanding of what constitutes a competent reasoning performance in case-based teaching? Instr Sci 2014; 42(4): 579–94. [CrossRef]
8. Kassirer JP. Teaching clinical reasoning: case-based and coached. Acad Med 2010; 85(7): 1118–24. [CrossRef]
9. Turk B, Ertl S, Wong G, Wadowski PP, Löffler-Stastka H. Does case-based blended-learning expedite the transfer of declarative knowledge to procedural knowledge in practice?. BMC Med Educ 2019; 19(1): 447. [CrossRef]
10. Ahmad FA, Karimi AA, Alboloushi NA, Al-Omari QD, Al-Sairafi FJ, Qudeimat MA. Stress level of dental and medical students: comparison of effects of a subject-based curriculum versus a case-based integrated curriculum. J Dent Educ 2017; 81(5): 534–44. [CrossRef]
11. Khatami S, MacEntee MI, Pratt DD, Collins JB. Clinical reasoning in dentistry: a conceptual framework for dental education. J Dent Educ 2012; 76(9): 1116–28. [CrossRef]
12. Audétat MC, Laurin S, Dory V, Charlin B, Nendaz MR. Diagnosis and management of clinical reasoning difficulties: Part II. Clinical reasoning difficulties: Management and remediation strategies. Med Teach 2017; 39(8): 797–801.
13. Tomeh H, Bay RC, Lovell K, Hong M. Self-motivation and self-direction in team-based and case-based learning. J Dent Educ 2021; 85(Suppl 3): 2007–8. [CrossRef]
14. Liu L, Li M, Zheng Q, Jiang H. The effects of case-based

teaching in nursing skill education: cases do matter. Inquiry 2020; 57: 46958020964421. [CrossRef]

15. National Core Curriculum of Undergraduate Medical Education- (NCCP-2020). Available from: URL: https://www.yok.gov.tr/Documents/Kurumsal/egitim_ogretim_dairesi/Ulusal-cekirdek-egitimi-programlari/mezuniyet-oncesi-tip-egitimi-cekirdek-egitimi-programi.pdf Accessed May 1, 2023.
16. KTU. The news of training of the trainers on Online SBL 2020. Available from: URL: https://www.ktu.edu.tr/med-duyuru30895. Accessed Feb 1, 2022.
17. Krupat E, Richards JB, Sullivan AM, Fleenor TJ Jr, Schwartzstein RM. Assessing the effectiveness of case-based collaborative learning via randomized controlled trial. Acad Med 2016; 91(5): 723–9. [CrossRef]
18. Chadha N, Fredrick D, Malbari A, Hojsak J. A virtual clinical reasoning case for medical students using an ophthalmology model: a case of red eye. MedEdPORTAL 2021; 17: 11117. [CrossRef]
19. Ng IK, Zhang VRY, Tseng FS, Tay DSH, Lee SS, Lau TC. Learning during the pandemic: Perspectives of medical students in Singapore. Ann Acad Med Singap 2021; 50(8): 638–42. [CrossRef]
20. Afonso N, Kelekar A, Alangaden A. "I Have a Cough": an ınteractive virtual respiratory case-based module. MedEdPORTAL 2020; 16: 11058. [CrossRef]
21. Koenemann N, Lenzer B, Zottmann JM, Fischer MR, Weidenbusch M. Clinical Case Discussions - a novel, supervised peer-teaching format to promote clinical reasoning in medical students. GMS J Med Educ 2020; 37(5): Doc48.
22. Sukumar S, Zakaria A, Lai CJ, Sakumoto M, Khanna R, Choi N. Designing and implementing a novel virtual rounds curriculum for medical students' ınternal medicine clerkship during the COVID-19 Pandemic. MedEdPORTAL 2021; 17: 11106. [CrossRef]
23. Kelekar A, Afonso N. Evaluation of the effect of a new clinical reasoning curriculum in a pre-clerkship clinical skills course. Perspect Med Educ 2020; 9(2): 123–7. [CrossRef]
24. Amey L, Donald KJ, Teodorczuk A. Teaching clinical reasoning to medical students. Br J Hosp Med (Lond) 2017; 78(7): 399–401. [CrossRef]
25. Koufidis C, Manninen K, Nieminen J, Wohlin M, Silén C. Representation, interaction and interpretation. Making sense of the context in clinical reasoning. Med Educ 2022; 56(1): 98–109. [CrossRef]
26. Singh M, Collins L, Farrington R, Jones M, Thampy H, Watson P, et al. From principles to practice: embedding clinical reasoning as a longitudinal curriculum theme in a medical school programme. Diagnosis (Berl) 2021; 9(2): 184–94.
27. Rencic J. Twelve tips for teaching expertise in clinical reasoning. Med Teach 2011; 33(11): 887–92. [CrossRef]
28. Schmidt HG, Mamede S. How to improve the teaching of clinical reasoning: a narrative review and a proposal. Med Educ 2015; 49(10): 961–73. [CrossRef]

Appendix 1.

Semi-structured qualitative interview questions for in-depth interviews with faculty members

1. What kind of training activities did you organize for clinical decision-making processes before the online SBL application? Please explain.
2. Could you share your experiences regarding the preparation process for the online SBL application?
3. Could you share your experiences regarding the online SBL application process?
4. Could you share your thoughts on the effects of the online SBL application on students?
5. Could you share your thoughts on the effects of the online SBL application on your own teaching role?
6. Could you explain the aspects that you think should be improved for the online SBL application?

Semi-structured qualitative interview questions for focus group interviews for students

1. What kind of activities did you participate in your case or symptom-based education activities before the online SBL application?
2. Could you share your experiences regarding the preparation process for the online SBL application?
3. Could you share your experiences regarding the online SBL application process?
4. Could you share your thoughts on the effects on the role of trainers in the online SBL implementation process?
5. Could you share your thoughts on the effects of the online SBL application on your own learning?
6. Could you explain the aspects that you think should be improved for the online SBL application?