Abstract:
Evidence based medicine (EBM) is delivered through a didactic, blended learning and mixed models. Students are supposed to construct an answerable question in PICO (patient, intervention, comparison and outcome) framework, acquire evidence through search of literature, appraise evidence, apply it to the clinical case scenario and assess the evidence in relation to clinical context.
Yet these teaching models have limitations especially those related to group work e.g. handling un-cooperative students, students who fail to contribute, students who dominate, students who have personal conflict, their impact upon progress of their groups, and inconsistent individual acquisition of required skills.
At Pediatrics Department, Faculty of Medicine, Cairo University we designed a novel undergraduate pediatric EBM assignment online system to overcome shortcomings of previous didactic method and we aimed to assess its effectiveness by prospective follow up during academic years 2012-2013, and 2013-2014.
The novel web-based online interactive system was tailored to provide sequential single and group assignments for each student. Single assignment addressed a specific case scenario question, while group assignment was teamwork that addressed different questions of same case scenario. Assignment comprised scholar content and skills.
We objectively analyzed students' performance by criterion-based assessment and subjectively by anonymous student questionnaire.
A total of 2879 were enrolled in 5th year Pediatric Courses consecutively, of them 2779 (96.5%) logged in and 2554 (88.7%) submitted their work. They were randomly assigned to 292 groups. 2277 (89.15%) achieved ≥ 80% of total mark (4/5), of them 717 (28.1%) achieved a full mark. 2178 (85.27%) and 2359 (92.36%) made evidence based conclusions and recommendations in single and group assignment respectively (p=0.000). 1102 (43.1%) answered student questionnaire, of them 898 (81.48%) found e-educational experience satisfactory, 175 (15.88%) disagreed, and 29 (2.6%) could not decide. 964 (87.47%) found single assignment educational, 913 (82.84%) found group assignment educational and 794 (72.3%) enjoyed it.
Web-based online interactive undergraduate EBM assignment was found effective in teaching medical students and assured individual student acquisition of concepts and skills of pediatric EMB. It was effective in mass education, in data collection and storage essential for system and student assessment.
Dear Patrick Wall,

Thank you for communicating the editorial decision regarding: RE: MD-D-15-01580, entitled "Pediatric Evidence Based Medicine Assignment Is A Novel Effective Enjoyable Undergraduate Medical Teaching Tool".

Kindly find attached the revised version, table of itemized, point-by-point response to each reviewer.

Reviewer suggested: “For statistical reporting of significance, the use of p=0.000 is misleading. If appropriate, should be reported as p<0.001 throughout.” Suggestion was found acceptable and required changes were made through the manuscript.

Title was changed to:

“Pediatric Online Evidence Based Medicine Assignment Is A Novel Effective Enjoyable Undergraduate Medical Teaching Tool: A SQUIRE Compliant Study”

Thank you,
Magd Ahmed Kotb,
Professor of Pediatrics,
Director of Center of Social & Preventive Medicine,
Cairo University,
Egypt

<table>
<thead>
<tr>
<th>Page/line number</th>
<th>Text before revision</th>
<th>Text after revision</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviewer #1: There are several grammatical errors that should be fixed. For example, there are several statements that are incomplete sentence fragments:</td>
<td></td>
<td></td>
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<tr>
<td>5:15</td>
<td>PEMBA spans 7 weeks.</td>
<td>PEMBA spanned 7 weeks.</td>
<td>Tense of verb was corrected</td>
</tr>
<tr>
<td>6:18</td>
<td>To assure individual acquisition of skills, students go through a login screen, fill personal profile page followed by multiple screens to access tutorials.</td>
<td>To assure individual acquisition of skills, students accessed through a login screen, filled personal profile page that was followed by multiple</td>
<td>Tense of verbs were corrected</td>
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<tr>
<td>Line</td>
<td>Original Text</td>
<td>Corrected Text</td>
<td>Notes</td>
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<tr>
<td>6:20</td>
<td>Tutorials can be accessed without log in as well.</td>
<td>Tutorials were accessible without log in as well.</td>
<td>Tense of verb was corrected</td>
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<tr>
<td>6:last line</td>
<td>Each student is expected to submit a single assignment comprising a structured….</td>
<td>Each student was expected to submit a single assignment comprising a structured…</td>
<td>Tense of verb was corrected</td>
</tr>
<tr>
<td>7:3</td>
<td>After deadline for submission of the single assignment is met, students are made familiar with their group members i.e. the others who answered the other questions in a same case scenario. Students are made familiar with their achievement in the single assignment often with feed back from demonstrators/facilitators.</td>
<td>After deadline for submission of the single assignment is met, students were made familiar with their group members i.e. the others who answered the other questions in a same case scenario. Students were made familiar with their achievement in the single assignment often with feed back from demonstrators/facilitators.</td>
<td>Tense of verbs were corrected</td>
</tr>
<tr>
<td>7:7</td>
<td>Group has to nominate a leader and work together to prepare a structured summary.</td>
<td>Group members had to nominate a leader and work together to prepare a structured summary.</td>
<td>“members” was added.</td>
</tr>
<tr>
<td>7:8</td>
<td>Only leader submits, but all had to submit their contribution in a discussion platform that is visualized by demonstrator</td>
<td>Only leader was allowed to submit group assignment on behalf of the group members, and all had to submit their contribution in a discussion platform that was visualized by demonstrator.</td>
<td>Structure was corrected</td>
</tr>
<tr>
<td>7:9</td>
<td>Students are expected to work in groups and submit written referenced structured summary of</td>
<td>Students were expected to work in groups and submit written referenced structured summary of</td>
<td>Tense of verb was corrected</td>
</tr>
<tr>
<td>8:17</td>
<td>Coordinator of PEBMA is the admin of the e-system.&quot; -- grammatically incorrect and also requires more explanation of this role</td>
<td>The Professor of Pediatrics in charge of coordinating the PEMBA during the Pediatrics Round is the admin of the e-system.</td>
<td>Structure was corrected</td>
</tr>
<tr>
<td>9:1</td>
<td>In the methods section, the outline-approach of &quot;Main Outcomes&quot; is inappropriate. This could be presented as a separate table if the authors like, otherwise the methods should be spelled out in sentences for readers to be able to understand them.</td>
<td>Thank you for the comment. We prefer itemization of the outcome measures, because they were discussed in introduction.</td>
<td></td>
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<tr>
<td>10:24</td>
<td>A major issue with the analysis is that &quot;Inter-rater reliability was not studied in</td>
<td>Inter-rater reliability is out of scope of this study. It is currently being assessed.</td>
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<td>11:3</td>
<td>Anonymous questionnaire screen appears after complete submission of work and assessment of work to assure lack of bias or intimidation of students.</td>
<td>12:18</td>
<td>Structure was corrected For a total of 5 marks divided as 2.5 for single and 2.5 for group assignment 20 (0.78%) students of those who submitted their work failed to achieve a total of 2.5/5 (50%).</td>
</tr>
<tr>
<td>12:20</td>
<td>Students were requested to acquire specific skills that had to be answered in the sequential screens. There was no pre- post test. Evidence based Medicine is a concept and not a scholar content. We believe that online PEMBA was about fostering the concept, again this is an open book exam, and they were allowed optional hands on, and interaction with their demonstrators was afforded. It has to be remembered that students tend to lose these skills unless re-enforced.</td>
<td></td>
<td>Structure was corrected It allowed students to construct new knowledge, assured individual active participation and acquisition of skills, allowed participation in groups, enforced a code of moral conduct, and enabled confident decision-making.</td>
</tr>
<tr>
<td>14:7</td>
<td>It allowed students to constructs new knowledge, assured individual active participation and acquisition of skills, allowed participation in groups, enforced a code of moral conduct, and enabled confident decision-making.</td>
<td></td>
<td>It allowed students to construct new knowledge, assured individual active participation and acquisition of skills, allowed participation in group work, enforced a code of moral conduct, and enabled confident decision-making.</td>
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</tbody>
</table>
Pediatric Online Evidence Based Medicine Assignment Is A Novel Effective Enjoyable Undergraduate Medical Teaching Tool: A SQUIRE Compliant Study

By

Magd Ahmed Kotb, Hesham Nabeh Elmahdy, Nour El Deen Mahmoud Khalifa, Mohamed Hamed Nasr El-Deen, Mohamed Amr N. Lotfi

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Corresponding Author: Magd A. Kotb, Professor of Pediatrics, Cairo University, PO Box: 85, El Mokatam, 11571 Cairo, Egypt. Phone: 002 010 1420 831; E-mail: magdkotb@kasralainy.edu.eg.

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Financial Disclosure: Authors have no financial relationships relevant to this article to disclose.

Conflict of Interest: Professor Magd A. Kotb is the Coordinator of 5th undergraduate year Pediatric Evidence based Medicine Assignment, Department of Pediatrics, Cairo University, otherwise= None.

Contributor’s Statement:
Professor Magd A. Kotb conceptualized and designed the study, designed functions of novel website, carried out initial analyses, shared in drafting the initial manuscript. Professor Hesham N. El-Mahady designed work, shared in designing the main functions and structure of designed portal, reviewed and revised the manuscript. Dr. Nour El-Deen Mahmoud and Dr. Mohamed Hamed designed work, shared in designing the main functions and structure of designed portal, built the database for the portal, coordinated and supervised data collection, revised literature, and shared in drafting initial manuscript. Professor Mohamed Amr Lotfi shared in designing student anonymous questionnaire. All critically reviewed and approved final manuscript.

Counts: Abstract=345, text= 2731, Tables= 2 and Figure= 1.

Abbreviations: EBM: Evidence based medicine; PEBMA: Pediatrics Evidence Based Medicine Assignment
Abstract
Evidence based medicine (EBM) is delivered through a didactic, blended learning and mixed models. Students are supposed to construct an answerable question in PICO (patient, intervention, comparison and outcome) framework, acquire evidence through search of literature, appraise evidence, apply it to the clinical case scenario and assess the evidence in relation to clinical context.

Yet these teaching models have limitations especially those related to group work e.g. handling un-cooperative students, students who fail to contribute, students who domineer, students who have personal conflict, their impact upon progress of their groups, and inconsistent individual acquisition of required skills.

At Pediatrics Department, Faculty of Medicine, Cairo University we designed a novel undergraduate pediatric EBM assignment online system to overcome shortcomings of previous didactic method and we aimed to assess its effectiveness by prospective follow up during academic years 2012-2013, and 2013-2014.

The novel web-based online interactive system was tailored to provide sequential single and group assignments for each student. Single assignment addressed a specific case scenario question, while group assignment was teamwork that addressed different questions of same case scenario. Assignment comprised scholar content and skills.

We objectively analyzed students’ performance by criterion-based assessment and subjectively by anonymous student questionnaire.

A total of 2879 were enrolled in 5th year Pediatric Courses consecutively, of them 2779 (96.5%) logged in and 2554 (88.7%) submitted their work. They were randomly assigned to 292 groups. 2277 (89.15%) achieved ≥ 80% of total mark (4/5), of them 717 (28.1%) achieved a full mark. 2178 (85.27%) and 2359 (92.36%) made evidence
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Web-based online interactive undergraduate EBM assignment was found effective in teaching medical students and assured individual student acquisition of concepts and skills of pediatric EMB. It was effective in mass education, in data collection and storage essential for system and student assessment.

Keywords: Evidence Based Medicine; EBM; Pediatrics; Medical education; web-based; online;
Introduction:

Evidence based medicine (EBM) is defined as the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.\(^1\)\(^2\) The lag between the development of medical sciences and practice spans several years.\(^3\) It was found essential to incorporate EBM in curricula of medical schools, with stressing upon decision analysis.\(^4\)\(^5\) EBM is delivered through a didactic, blended learning and mixed models. Students are supposed to construct an answerable question in PICO (patient, intervention, comparison and outcome) framework, acquire evidence through search of literature, appraise evidence, apply it to the clinical case scenario and assess the evidence in relation to clinical context.\(^6\)

Faculty of Medicine, Cairo University is challenged by the massive number of students enrolled in its undergraduate years, with a total of 9664 – 8687 undergraduate students across its six undergraduate years in the academic year 2004-2005, and 2010-2011 respectively.\(^7\)

Pediatrics Evidence Based Medicine Assignment (PEBMA) was delivered didactically by competent pediatrics staff members trained in EBM teaching in Department of Pediatrics, Faculty of Medicine, Cairo University until 2011-2012 academic year. Students worked in 10-15 student groups, yet group work has its limitations in handling un-cooperative students, their impact upon progress of their groups, students who fail to contribute, students who domineer, students who have personal conflict, and inconsistent individual acquisition of required skills.\(^8\)

We developed a web-based online system to allow undergraduate medical student individual acquisition of PEBMA skills, allow work in-group and overcome limitations of group work.\(^9\) This study aimed at assessing the effectiveness of the
newly developed online system as an educational tool of EBM skills among 5th year students of Pediatrics Course, Cairo University.

**Material and Methods**

**Design, Setting and Participants**

PEBMA is part of curriculum of Pediatrics Course delivered in 5th undergraduate year. Shift from PEBMA didactic model to website was approved by Department of Pediatrics July 2012 Staff- Council. We followed this educational intervention prospectively in Pediatrics Department Cairo University during the academic years 2012-2013, and 2013-2014 to assess effectiveness of PEBMA website as a tool for EBM education for 5th year Pediatrics Course students.

Participants of this study were undergraduate medical students of 5th year Pediatrics Course.

In a given academic year, students are divided in 2 independent groups to join November or March semesters. Participants of this study were 2897 students.

PEMBA spanned 7 weeks.

**Interventions**

**Structural**

We developed an interactive E-medical assignment portal that is a web-based information system that uses Internet web technologies to deliver information, services and statistics to the system stakeholders (students, demonstrators/facilitators and system administrator). The power of the system resides in the lack of need to install software to navigate the system. It functions by a web browser and an Internet connection which exist already in all contemporary computers and smart devices.9
The portal consisted of three different layers; the first layer is the database layer, which contains all related information about the system that includes the medical case scenarios, questions and information about stakeholders and their transactions using Open Source Database Technology (MYSQL). The second layer is the interface design using web technology (HTML and CSS), this technology was used to build the portal interface screens for system stakeholders. The third layer was the system workflow transactions using Open Source Development Language (PHP), this layer contains the brain of the system to guide and interact with system stakeholder to accomplish their tasks throughout the system.

**Functional**

Students received a 2 hour orientation lecture of EBM of website and its functions. Optional hands-on training involving system navigation and expected tasks were offered.

Students log in by their identification card number as a username and password to be changed by student as wished. Difficulty to login was responded to by an automatic message to admin requesting username and password to be sent to an email address. PEMBA comprises acquisition of knowledge and skills that undergo criterion-based assessment. To assure individual acquisition of skills, students accessed through a login screen, filled personal profile page that was followed by multiple screens to access tutorials. Tutorials were accessible without log in as well.

Students found an external link to PICO question tutorial and model answers of single and group assignments. Screens were designed to provide scholar knowledge of EBM, i.e. describe concept of EBM, how to formulate a search question (PICO question), search literature, define the results of search in terms of level of evidence. Each student was expected to submit a single assignment comprising a structured
referred summary of maximum 400 words that contains her/his argument substantiating her/his decision.

After deadline for submission of the single assignment is met, students were made familiar with their group members i.e. the others who answered the other questions in a same case scenario. Students were made familiar with their achievement in the single assignment often with feed back from demonstrators/facilitators. Groups were assigned randomly by E-system. Group members had to nominate a leader and work together to prepare a structured summary. Only leader was allowed to submit group assignment on behalf of the group members, and all had to submit their contribution in a discussion platform that was visualized by demonstrator. Students were expected to work in groups and submit written referenced structured summary of maximum 800 words, design and describe a plan for future research relevant to their case scenario subject. The EBM should foster (1) moral based choices, and students were encouraged to check their work for plagiarism, (2) individualized choices to suit the patient care in the specific scenario within a given time limit, (3) weighed decision making by comparing evidence and benefits, and (4) self confidence by supporting decision by argument. Students put their contribution in the discussion panel to allow delineate those who shared and annul effect of uncooperative students. The total assignment duration was divided into a single assignment and a group assignment. Case scenario questions had 3 types of answers, positive with evidence to support, negative with evidence against, or evidence was not enough. The system accumulated 180 case scenarios with a total of 1804 questions. Case scenarios were added twice yearly. For every case scenario there are a group of questions related to clinical picture, management and prognosis. The system allows the student to login, read instructions and read a specific case scenario. Each student
has to answer a single question which is computer generated. The student finds links
to databases,¹⁰⁻¹³ and can submit the PICO question that identifies patient
population/problem (P), intervention (I), comparison parameter (C) and measurable
outcome (O), referenced summary, make changes and save them. A student can get
help through the get help box, where the student can compose the questions and
receive answers. Students were encouraged to comment or make suggestions to
improve the system and/or the assignment.
Students were allowed to engage in conversations in the group assignment through
“discussion platform” online function. In group assignment; students have to describe
their contribution in discussion platform in group assignment to get the mark in the
group assignment.
The system allowed demonstrators/facilitators to login. For each of the 4 pediatrics
courses 24 demonstrators were assigned to PEBMA. Each demonstrator had a group
of computer assigned students. Demonstrators coached and facilitated through the get
help box, met students upon request from students, corrected the submitted single and
group assignments through a criterion-based system.
The Professor of Pediatrics in charge of coordinating the PEMBA during the
Pediatrics Round is the admin of the e-system. Admin screens provide reports and
links to all transactions on web including number of visits of all, demonstrators’ time
to correct single and group assignments, comments report, final mark list, and allows
search for individual specific student results, change password and/or username upon
student request, view in box messages and responses. Students were invited to seek
help from admin through admin e-mail address.

Main Outcomes And Measures

Main Outcomes
I. Students acquisition of the following EBM skills:

I. a. Understanding concept of EBM.

I. b. Formulating the relevant question in the PICO (patient, intervention, comparison, outcome) framework.

I. c. Searching literature for evidence systematically and efficiently.

I. d. Appraising the evidence.

I. e. Applying the evidence to the specific clinical scenario.

I. f. Decision making and providing argument to support decision.

II. Students acquisition of the following presentation skills:

II. a. Structuring answer and argument in abstract form abiding by word count (400 word abstract for single assignment and 800 words for group assignment), putting a title to work, formulating an introduction, describing their search methodology, describing results, making an evidence based recommendation and conclusion.

II. b. Citing references.

II. c. Abiding by instructions.

III. Building an E-system that:

III. a. Suits average student and delivers the intended learning outcomes.

III. b. Delivers 24hours/7day synchronized consecutive functions.

III. c. Effective in mass education.


III. e. Delivers assessment feedback to students.

III. f. Delivers timely reports and statistical data.

III. g. Delivers students’ comments and anonymous questionnaire.

Measures
We assessed the system through the students’ grades, number of engagements online, and students’ end of assignment feedback questionnaire. Students’ performance in single and group assignments were subjected to analysis. For single assignment (total 2.5 marks) 0.5 marks were assigned for each of the following:

1- Student formulated a PICO Question and defined the PICO elements correctly.

2- Student answered his/her relevant question

3- Student followed instructions in preparing the 400 words abstract

4- References content is congruent with results and cited in Vancouver style

5- Conclusion and student recommendation tailored to case scenario are evidence based.

For group assignment (total 2.5 marks) 0.5 marks were assigned for each of the following:

1- Students answered their relevant question

2- Students followed instructions in preparing the 800 words abstract

3- References content is congruent with results and cited in Vancouver style

4- Conclusion and recommendation tailored to case scenario are evidence based.

5- Students forwarded a future research plan with defined patient population, intervention, comparison and measurable outcome.

Students received a total of 5 marks divided as 2.5 for single and 2.5 for group assignment. Students were warned against plagiarism and instructed that they get a zero in case of plagiarism irrespectively. Our assessment meets reported validation properties\(^{14}\) i.e., content validity, internal reliability, item difficulty, item discrimination, and construct validity. Inter-rater reliability was not studied in PEBMA and is part of future work.
Students were encouraged to answer an assignment anonymous feedback questionnaire by end of pediatrics course regarding website navigation, log in, single, group assignment and the subjective impressions left upon the students. The screen of feedback anonymous questionnaire appeared only after students’ completely submitted their work and it was assessed to assure lack of bias or intimidation of students.

**Statistical Analysis:**

All the statistical analyses in this study were conducted using Statistical Package for Social Sciences version 16 (SPSS, Chicago, Ill). Descriptive analysis was used for data summarization. The parametric quantitative data were expressed as mean ± standard deviation (SD).

The simple frequency and cross-tabulation were employed for the qualitative data.

Suitable tests of significance (t test for parametric data and Chi square χ² tests for nonparametric numbers N5) were used as indicated. Comparisons were carried upon number of students in single and group assignment.
Results
A total of 2879 were enrolled in 4 Pediatric courses during 2012-2013 and 2013-2014 academic years. Of them 2779 (96.5%) logged in and only 2554 (88.7%) submitted their work. They were randomly assigned by system to 292 groups. 49 demonstrators participated in PEBMA across both academic years.

Students’ performance in single and group assignments:
Total number of log in of students was 55886 (mean ± standard deviation SD= 38.8±15 per student), total number of demonstrators log in was 374 (mean per demonstrator= 15 ± 6.9) and admin was 622. Students and demonstrators engaged in 1880 online conversations, of them 1023 (54.4%) were composed messages by students, and 857 (45.58%) replies by demonstrators. Students requested log in information (username/password) and emailed 4349 email messages to admin on the admin announced email address. Admin responded to all, but only 3783 (86.98%) were communicated while admin failed to communicate response to 566 (13%) messages requesting username and password to login, as student correspondence email address was not valid. Table (1) shows various numbers of e-system transactions.

Assignment marks comprised a total of 5 marks divided as 2.5 for single and 2.5 for group assignment. Only 20 (0.78%) students of those who submitted their work failed to achieve a total of 2.5/5 (50%), while 2277 (89.15%) achieved 80% or more of total mark (4/5), of them 717 (28.1%) achieved a full mark. Table (2) presents assessed single and group assignment parameters. Mean ± SD of single assignment was= 2.16±0.49 and of group assignment was 2.38±0.23 (p<0.001). The individual activity of the students reflected by number of student log in, correlated positively with all the 5 single assignment parameters (p<0.001), their total grade (p<0.001). On the contrary
frequency of log in did not correlate with group assignment parameters except grade for answering relevant questions (p=0.049). 225 students did not submit their work and got a zero.

*Students' responses to anonymous questionnaire*

Students who responded to invitation to answer questionnaire were 1102 (43.1%). 898 (81.48%) the E-educational experience satisfactory, 175 (15.88%) disagreed, and 29 (2.6%) could not decide. Figure (1) describes the various responses of student’s. It is interesting that 794 (72.3%) found the overall experience enjoyable and 707 (72.2%) found the website links to databases enough.
Discussion

The novel interactive electronic system is invaluable in teaching EBM in 5th year Pediatrics Course, Faculty of Medicine, Cairo University.

It assured that each student understood, practiced and applied the knowledge and skills of EBM, presentation skills, and worked in group. The PEBMA capitalized on “the need to know”, fostered information acquisition, decision making, developed presentation skills and supported arguments abiding by limits of instructions. It allowed students to construct new knowledge, assured individual active participation and acquisition of skills, allowed participation in group work, enforced a code of moral conduct, and enabled confident decision-making. PEBMA targeted the average student and was efficient in mass education without compromising quality of education. It allowed continuous surveillance, and monitoring affording prompt intervention. It accommodated a large bank of questions that did not allow duplication of scenarios, giving each student a different task, stores student responses, provided future research plans bank and allowed students to participate with their comments and feed back. The sequence of tasks allowed students group-work to follow mastering skills by individual student.

The newly devised e-system exploited the advantages afforded by the accurate, accessible, and continually updated sources of evidence such as the Cochrane Library and Clinical Evidence\textsuperscript{15}, of Pub Med database and others that contains all types of reports, even those containing contradictory evidence that augment students’ power to appraise and of EBM e-learning sites.\textsuperscript{15-19}

It is interesting to note that frequency of students log in correlated with single assignment parameters, which highlights the engagement of students in self acquisition of concept, search, appraisal, application, assessment and presentation of
EBM assignment. PEBMA challenged a minority of students (14.7%) who were inclined to resistance to precision and tended to ambiguity in tailoring their conclusions and recommendation for their specific case scenario.

Students’ higher marks in group assignment might be attributed to group effect education, learning from mistakes in single assignment and gaining more insight by practice.

The newly designed e-system is technically demanding, requires space, effort, maintenance, feeding of question bank twice annually and needs continuous surveillance for server malfunction, bugs, password losses and student personal information inaccuracy. It demands too much work of the PEBMA staff team when they are overloaded by other teaching and training duties for both under and postgraduates. It pressurized students to shift from didactic into interactive and mostly self-education. The PEBMA team had to face students’ uprising frustrations and resistance at initial implementation that faded by time.

It is rewarding that 794 (72.3%) students found the novel e-system enjoyable.

Sustainability of PEMBA remains a great challenge, and impact of PEMBA upon personal attitudes of students in their postgraduate practice remains to be known and cannot be foreseen. Reinforcement by subsequent practice remains the barrier against loss of acquired skills, i.e. workshops, seminars, journal clubs (or any combination), standalone and integrated methods, to improve knowledge, improve skills, attitudes, and behavior, and on-the-job EBM training.

In conclusion we found PEMBA website effective in teaching undergraduate medical students. It assures individual student acquisition of concepts and skills of pediatric EBM especially in courses enrolling large number of students.
Acknowledgment

We acknowledge advice of Professor Mona El Lawindi, Professor of Public Health and Biostatistics, Faculty of Medicine, Cairo University, and late Professor Ahmed Kotb, Professor of Paediatrics, Faculty of Medicine, Cairo University. We acknowledge efforts of co-founder of Pediatrics EBM discipline Professor Ghada Anwar, Professor of Pediatrics, Pediatric Diabetes and Endocrinology, Cairo University, she is awarded Diploma in Health Profession Education, and is an International certified trainer, an Associate Editor in Egyptian Pediatric Association Gazette, and Member of European Society for Pediatric Endocrinology (ESPE) American Heart Association Instructor for Pediatric Advanced Life Support (PALS).

We acknowledge Pediatric Evidence Based Medicine Assignment Team of demonstrators in alphabetical order:


Professor Magd A. Kotb is the Coordinator of 5th undergraduate year Pediatric Evidence based Medicine Assignment, Department of Pediatrics, Cairo University.

Otherwise there are no conflicts of interest, and there was no funding source, or
financial support. All authors searched literature. Professor Magd A. Kotb conceptualized and designed the study, designed functions of portal, carried out the initial analyses, shared in drafting the initial manuscript. Professor Hesham N. El-Mahdy designed work, shared in designing the main functions and structure of designed portal, reviewed and revised the manuscript. Dr. Nour El-Deen Mahmood and Dr. Mohamed Hamed designed work, shared in designing the main functions and structure of designed portal, built the database for the portal, coordinated and supervised data collection, revised literature, and shared in drafting initial manuscript. Professor Mohamed Amr Lotfi shared in designing student anonymous questionnaire. All critically reviewed the final manuscript, and approved the final manuscript as submitted. Leader Author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.
References


7- El Feky N. International Students at Faculty of Medicine-Cairo University 2006-2011.


9- Faculty of Medicine Pediatric Department. Pediatric evidence based medicine assignment project. [http://medical.i-sciences.com/](http://medical.i-sciences.com/) Accessed September 9,


Tables and Figures

Table (1): System recorded transactions during the academic years 2012-2013 and 2013-2014.

Table (2): Students in single and group assignments assessed parameters.

Figure (1): Student’s responses to end of assignment feedback questionnaire
Table (1) System recorded transactions during the academic years 2012-2013 and 2013-2014.

<table>
<thead>
<tr>
<th>Activity type</th>
<th>Total Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students log in</td>
<td>55886</td>
</tr>
<tr>
<td>Visits of system</td>
<td>584194</td>
</tr>
<tr>
<td>Visits to home page</td>
<td>137102</td>
</tr>
<tr>
<td>Visits to personal profile page</td>
<td>39162</td>
</tr>
<tr>
<td>Visits to Instructions Page of Single assignment</td>
<td>36048</td>
</tr>
<tr>
<td>Visits to Instructions Page of group assignment</td>
<td>38372</td>
</tr>
<tr>
<td>Unique views*</td>
<td>314708</td>
</tr>
<tr>
<td>Composed messages by students</td>
<td>1023</td>
</tr>
<tr>
<td>Visits to results of single assignment</td>
<td>24072</td>
</tr>
<tr>
<td>Reply by demonstrators</td>
<td>857</td>
</tr>
<tr>
<td>Messages through the system between Students and Demonstrators</td>
<td>1880</td>
</tr>
<tr>
<td>Case Discussion between Students</td>
<td>2543</td>
</tr>
<tr>
<td>Feedback comments by students</td>
<td>362</td>
</tr>
<tr>
<td>Demonstrators log in</td>
<td>374</td>
</tr>
<tr>
<td>Admin log in</td>
<td>622</td>
</tr>
</tbody>
</table>

* Student may view the page more than once per day, it is calculated as one view for unique view concept.
Table (2) Students in single and group assignments assessed parameters:

<table>
<thead>
<tr>
<th></th>
<th>Students in Single Assignment N=2554</th>
<th>Students in Group Assignment N=2554</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence based conclusion and recommendation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2178 85.28</td>
<td>2359 92.36</td>
<td>0.000</td>
</tr>
<tr>
<td>Lacked recommendation</td>
<td>215 8.42</td>
<td>181 7.09</td>
<td></td>
</tr>
<tr>
<td>Contradicts Evidence</td>
<td>161 6.30</td>
<td>14 0.55</td>
<td></td>
</tr>
<tr>
<td>Following Instructions &amp; Presentation skills acquisition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answered relevant question</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2261 88.53</td>
<td>2431 95.18</td>
<td>0.000</td>
</tr>
<tr>
<td>No</td>
<td>293 11.47</td>
<td>123 4.82</td>
<td></td>
</tr>
<tr>
<td>Structured Abstract</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2152 84.26</td>
<td>2442 95.61</td>
<td>0.000</td>
</tr>
<tr>
<td>Confused in 2 requirements</td>
<td>186 7.28</td>
<td>59 2.31</td>
<td></td>
</tr>
<tr>
<td>Failed to meet requirements</td>
<td>216 8.46</td>
<td>53 2.08</td>
<td></td>
</tr>
<tr>
<td>Cited references</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2118 82.93</td>
<td>2337 91.50</td>
<td>0.000</td>
</tr>
<tr>
<td>Not all</td>
<td>264 10.34</td>
<td>184 7.20</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td>172 6.73</td>
<td>33 1.29</td>
<td></td>
</tr>
<tr>
<td>Single Assignment formulated a PICO question/Group designed a future research question</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>1713 67.07</td>
<td>2355 92.21</td>
<td>0.000</td>
</tr>
<tr>
<td>Two Element confusion</td>
<td>220 8.61</td>
<td>88 3.45</td>
<td></td>
</tr>
<tr>
<td>Failed</td>
<td>621 24.31</td>
<td>111 4.35</td>
<td></td>
</tr>
<tr>
<td>Detected Plagiarism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2520 98.67</td>
<td>2548 99.77</td>
<td>0.000</td>
</tr>
<tr>
<td>Detected</td>
<td>34 1.33</td>
<td>6 0.23</td>
<td></td>
</tr>
</tbody>
</table>

Structured Abstract comprised title, introduction, aim of work, methods, results and conclusion. Students were instructed to cite references in Vancouver style and demonstrators were responsible to check context and congruence of cited reference to relevant case scenario.
Figure (1): Student’s responses to end of assignment feedback questionnaire
These guidelines provide a framework for reporting formal, planned studies designed to assess the nature and effectiveness of interventions to improve the quality and safety of care.

It may not be possible to include information about every numbered guideline item in reports of original formal studies, but authors should at least consider every item in writing their reports.

Although each major section (i.e., Introduction, Methods, Results, and Discussion) of a published original study generally contains some information about the numbered items within that section, information about items from one section (for example, the Introduction) is often also needed in other sections (for example, the Discussion).

<table>
<thead>
<tr>
<th>Text section; Item number and name</th>
<th>Section or Item Description</th>
<th>Reported on Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title and Abstract</td>
<td><em>Did you provide clear and accurate information for finding, indexing, and scanning your paper?</em></td>
<td>2-3</td>
</tr>
</tbody>
</table>
| 1. Title                          | a. Indicates the article concerns the improvement of quality (broadly defined to include the safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity of care)  
   b. States the specific aim of the intervention  
   c. Specifies the study method used (for example, “A qualitative study,” or “A randomized cluster trial”) | 1               |
| 2. Abstract                       | Summarizes precisely all key information from various sections of the text using the abstract format of the intended publication | 2-3             |
| Introduction                      | *Why did you start?* | | |
| 3. Background knowledge           | Provides a brief, non-selective summary of current knowledge of the care problem being addressed, and characteristics of organizations in which it occurs | 4               |
| 4. Local problem                  | Describes the nature and severity of the specific local problem or system dysfunction that was addressed | 4               |
| 5. Intended improvement           | a. Describes the specific aim (changes/improvements in care processes and patient outcomes) of the proposed intervention  
   b. Specifies who (champions, supporters) and what (events, observations) triggered the decision to make changes, and why now (timing) | 4-5             |
<p>| 6. Study Question                 | States precisely the primary improvement-related question and any secondary questions that the study of the intervention was designed to answer | 4-5             |
| Methods                           | <em>What did you do?</em> | | |
| 7. Ethical Issues                 | Describes ethical aspects of implementing and studying the improvement, such as privacy concerns, protection of participants’ physical well-being, and potential author conflicts of interest, and how ethical concerns were addressed | 5               |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Setting</td>
<td>Specifies how elements of the local care environment considered most likely to influence change/improvement in the involved site or sites were identified and characterized</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
| 9. Planning the intervention | a. Describes the intervention and its component parts in sufficient detail that others could reproduce it  
   b. Indicates main factors that contributed to choice of the specific intervention (for example, analysis of causes of dysfunction; matching relevant improvement experience of others with the local situation)  
   c. Outlines initial plans for how the intervention was to be implemented: e.g., what was to be done (initial steps; functions to be accomplished by those steps; how tests of change would be used to modify intervention), and by whom (intended roles, qualifications, and training of staff) | 5-8 |
| 10. Planning the study of the intervention | a. Outlines plans for assessing how well the intervention was implemented (dose or intensity of exposure)  
   b. Describes mechanisms by which intervention components were expected to cause changes, and plans for testing whether those mechanisms were effective  
   c. Identifies the study design (for example, observational, quasiexperimental, experimental) chosen for measuring impact of the intervention on primary and secondary outcomes, if applicable  
   d. Explains plans for implementing essential aspects of the chosen study design, as described in publication guidelines for specific designs, if applicable (see, for example, www.equator-network.org)  
   e. Describes aspects of the study design that specifically concerned internal validity (integrity of the data) and external validity (generalizability) | 5-8 |
| 11. Methods of evaluation | a. Describes instruments and procedures (qualitative, quantitative, or mixed) used to assess a) the effectiveness of implementation, b) the contributions of intervention components and context factors to effectiveness of the intervention, and c) primary and secondary outcomes  
   b. Reports efforts to validate and test reliability of assessment instruments  
   c. Explains methods used to assure data quality and adequacy (for example, blinding; repeating measurements and data extraction; training in data collection; collection of sufficient baseline measurements) | 8-10 |
| 12. Analysis | a. Provides details of qualitative and quantitative (statistical) methods used to draw inferences from the data  
   b. Aligns unit of analysis with level at which the intervention was implemented, if applicable  
   c. Specifies degree of variability expected in implementation, change expected in primary outcome (effect size), and ability of study design (including size) to detect such effects  
   d. Describes analytic methods used to demonstrate effects of time as a variable (for example, statistical process control) | 11 |
| Results | What did you find? |   |
### 13. Outcomes

<table>
<thead>
<tr>
<th>a)</th>
<th>Nature of setting and improvement intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Characterizes relevant elements of setting or settings (for example, geography, physical resources, organizational culture, history of change efforts), and structures and patterns of care (for example, staffing, leadership) that provided context for the intervention</td>
</tr>
<tr>
<td>ii)</td>
<td>Explains the actual course of the intervention (for example, sequence of steps, events or phases; type and number of participants at key points), preferably using a time-line diagram or flow chart</td>
</tr>
<tr>
<td>iii)</td>
<td>Documents degree of success in implementing intervention components</td>
</tr>
<tr>
<td>iv)</td>
<td>Describes how and why the initial plan evolved, and the most important lessons learned from that evolution, particularly the effects of internal feedback from tests of change (reflexiveness)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b)</th>
<th>Changes in processes of care and patient outcomes associated with the intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Presents data on changes observed in the care delivery process</td>
</tr>
<tr>
<td>ii)</td>
<td>Presents data on changes observed in measures of patient outcome (for example, morbidity, mortality, function, patient/staff satisfaction, service utilization, cost, care disparities)</td>
</tr>
<tr>
<td>iii)</td>
<td>Considers benefits, harms, unexpected results, problems, failures</td>
</tr>
<tr>
<td>iv)</td>
<td>Presents evidence regarding the strength of association between observed changes/improvements and intervention components/context factors</td>
</tr>
<tr>
<td>v)</td>
<td>Includes summary of missing data for intervention and outcomes</td>
</tr>
</tbody>
</table>

### Discussion

**What do the findings mean?**

### 14. Summary

<table>
<thead>
<tr>
<th>a.</th>
<th>Summarizes the most important successes and difficulties in implementing intervention components, and main changes observed in care delivery and clinical outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>b.</td>
<td>Highlights the study’s particular strengths</td>
</tr>
</tbody>
</table>

### 15. Relation to other evidence

Compares and contrasts study results with relevant findings of others, drawing on broad review of the literature; use of a summary table may be helpful in building on existing evidence
<table>
<thead>
<tr>
<th></th>
<th><strong>16. Limitations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Considers possible sources of confounding, bias, or imprecision in design, measurement, and analysis that might have affected study outcomes (internal validity)</td>
</tr>
<tr>
<td>b.</td>
<td>Explores factors that could affect generalizability (external validity), for example: representativeness of participants; effectiveness of implementation; dose-response effects; features of local care setting</td>
</tr>
<tr>
<td>c.</td>
<td>Addresses likelihood that observed gains may weaken over time, and describes plans, if any, for monitoring and maintaining improvement; explicitly states if such planning was not done</td>
</tr>
<tr>
<td>d.</td>
<td>Reviews efforts made to minimize and adjust for study limitations</td>
</tr>
<tr>
<td>e.</td>
<td>Assesses the effect of study limitations on interpretation and application of results</td>
</tr>
<tr>
<td></td>
<td><strong>17. Interpretation</strong></td>
</tr>
<tr>
<td>a.</td>
<td>Explores possible reasons for differences between observed and expected outcomes</td>
</tr>
<tr>
<td>b.</td>
<td>Draws inferences consistent with the strength of the data about causal mechanisms and size of observed changes, paying particular attention to components of the intervention and context factors that helped determine the intervention’s effectiveness (or lack thereof), and types of settings in which this intervention is most likely to be effective</td>
</tr>
<tr>
<td>c.</td>
<td>Suggests steps that might be modified to improve future performance</td>
</tr>
<tr>
<td>d.</td>
<td>Reviews issues of opportunity cost and actual financial cost of the intervention</td>
</tr>
<tr>
<td></td>
<td><strong>18. Conclusions</strong></td>
</tr>
<tr>
<td>a.</td>
<td>Considers overall practical usefulness of the intervention</td>
</tr>
<tr>
<td>b.</td>
<td>Suggests implications of this report for further studies of improvement interventions</td>
</tr>
<tr>
<td></td>
<td><strong>Other information</strong></td>
</tr>
<tr>
<td></td>
<td><em>Were other factors relevant to conduct and interpretation of the study?</em></td>
</tr>
<tr>
<td></td>
<td><strong>19. Funding</strong></td>
</tr>
<tr>
<td></td>
<td>Describes funding sources, if any, and role of funding organization in design, implementation, interpretation, and publication of study</td>
</tr>
</tbody>
</table>
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