Basismodul i universitetspedagogikk kull 50

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Evaluation of traditional versus case-based lecture satisfaction and learning outcomes in a Pediatrics course

Introduction

Medical doctors traditionally acquire their professional knowledge from a combination of university learning and direct patient experience. This professional knowledge builds on both textbook knowledge and on reflection built on accumulated experience with patient management acquired from both mentors and from their own personal experience with patients. Donald Schøn approaches the learning of a profession in "The Reflective Practitioner – How Professionals think in action" [1]. Here, he points out that real-world problems not only needs training in efficient problem solving, but also training in problem definition. The university teaching of medicine has traditionally focused on aspects of basic science in the first years and patient-oriented/clinical aspects in the last years, although newer study programs at some medical faculties have also focused on clinically oriented aspects from the first years. Traditional teaching in medicine has been lectured-centered for centuries with the use of patients partially integrated as "clinics" where clinical teachers present real-world cases. These cases include patient histories either discussed or illustrated by real patients present in the auditorium. However, the medical curriculum is in most

places taught by traditional lectures, and an editorial in the New England Journal of Medicine in 2011 pointed out that last substantive reform in medical student education followed the Flexner Report, which was written in 1910. Furthermore, this editorial further welcomes the use of online-learning for traditional lectures and the use of class time to challenge students with hands-on exercises [2]. Some years ago (2011), a Canadian group investigated the learning outcomes of traditional teaching versus instruction based on research on instruction in an undergraduate physics class and identified increased student attendance, higher engagement and more than twice the learning using research-based instruction [3]. With the implementation of a new study program at the Medical Faculty at the University of Bergen, Norway from 2015 there has been an emphasis to use more case-based lectures in a group setting and less traditional lectures with the teacher summarizing the main principles of a topic to the class. The main aim is assumedly more efficient learning, although what constitutes real learning of a profession in the long-term is highly complex [1]. As this new study program was planned to be implemented in the Pediatrics course in the Fall 2017, I aimed to compare case-based lectures with traditional lectures, using both satisfaction and learning outcomes as readouts in the Spring 2017 to guide decisions about which topics to prioritize for case-based versus traditional teaching methods.

Methods

I used my lectures in Fluid Therapy and Intoxication to evaluate traditional lecturing ("control") and case based lecturing ("case"), respectively. With traditional lecturing I taught the principles of the chosen topic for 40/45 minutes, followed by a maximum of 5/45 minutes to discuss real world cases. With case-based lecturing I taught the principles of the chosen topic for 5/45 minutes, followed by 40/45 minutes to discuss

real world cases. The total number of students taking the Pediatric course was based on data from the Department showing the number of students taking the Pediatrics Exam (Tore Lillebø, personal communication). The number of students attending the lecture was based on counting heads from a picture of students taken by the lecturer (data not shown). I used the web-based program Kahoot (https://kahoot.it/#/) to assess student responses to the questions. The questions used are presented in Appendix A. In short, I used question of satisfaction both prior to and after each lecture of Fluid therapy and Intoxication, respectively, but with emphasis on traditional lecture for the Fluid Therapy lecture and emphasis on the case-based lecture for the Intoxication lecture. Next, I used two questions, one supposedly easy and one supposedly difficult, to assess the learning outcome both prior to and after the lecture, in the identical format. There was no indication of the correct answer to the students neither prior to nor after the lecture as all answers were incorrectly assigned as "correct" in Kahoot. The rationale for this approach was to reduce the bias introduced by students remembering the correct answer.

Results

Of 96 students taking the Pediatrics exam in the Spring 2017, 45 students met at the subsequently given lectures Fluid Therapy and Intoxication held by the author. None of the students had any prior knowledge that a study was to take place. Of these 45 students, between 19 and 24 students responded to the various questions, giving a participation rate between 42% and 53%. The questions were given both prior to and after each of the two lectures. Figure 1 and 2 outline satisfaction outcomes using traditional and case-based lecture, respectively, showing a lower anticipated satisfaction with traditional lectures vs case-based lectures (0.42 vs 0.64, respectively)

but with similar satisfaction levels after the traditional lectures and case-based lectures (0.73 vs 0.77, respectively).

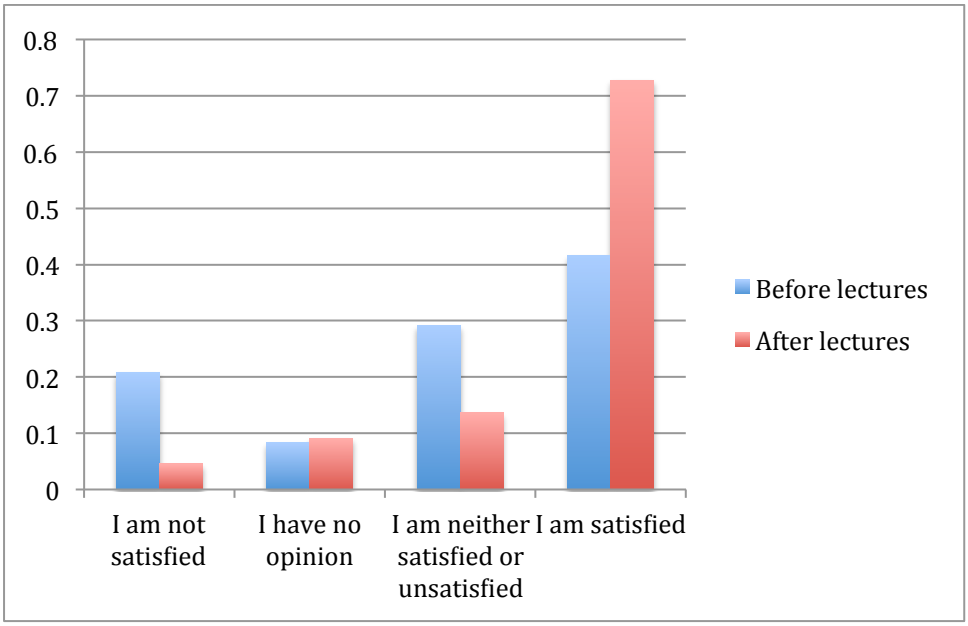

Figure 1. Satisfaction with a traditional lecture (Fluid Therapy) measured as fraction of students in each category to the total number of responding students.

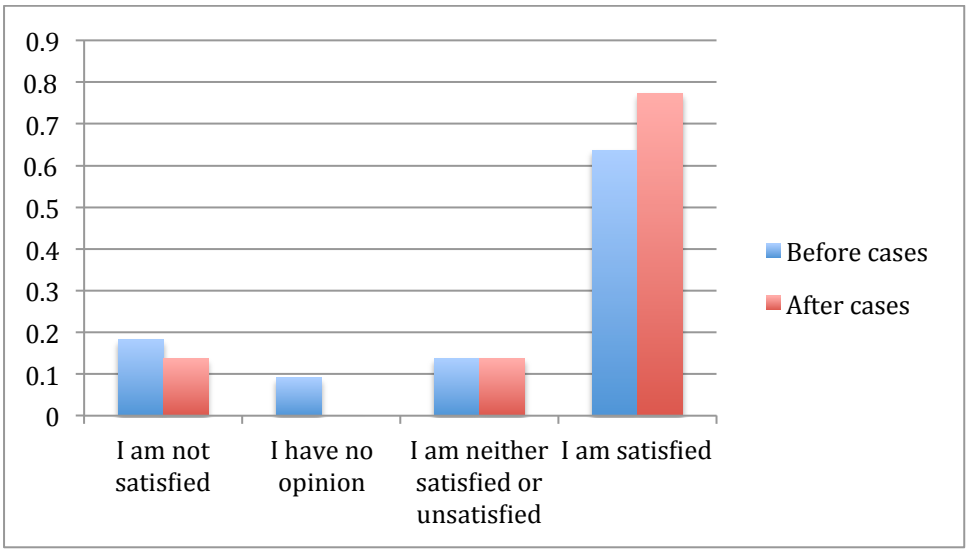

Figure 2. Satisfaction with a case-based lecture (Intoxication), measured as fraction of students in each category to the total number of responding students.

Figures 3 and 4 outline the learning performance during the traditional lecture showing an increase in the proportion with correct answer (from 0.50 to 0.89) and for the difficult and easy question (from 0.91 to 1.00), respectively. Figure 5 and 6 outline the learning performance during the case-based lecture showing an increase in the proportion with correct answer from 0.05 to 0.63 and from 0.87 to 0.91 for the difficult and easy question, respectively.

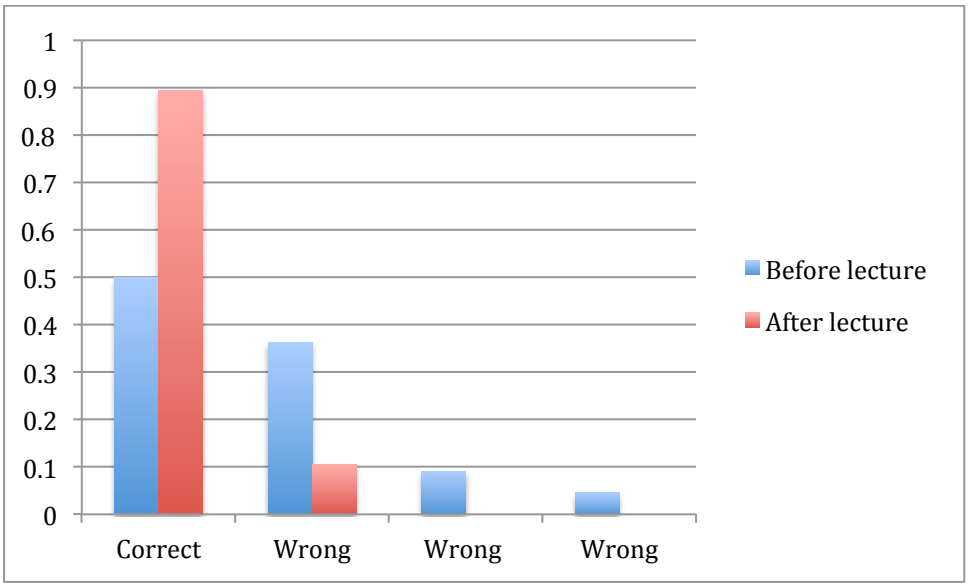

Figure 3. Learning performance of the traditional lecture (Fluid Therapy), difficult question, measured as fraction of students in each category to the total number of responding students.

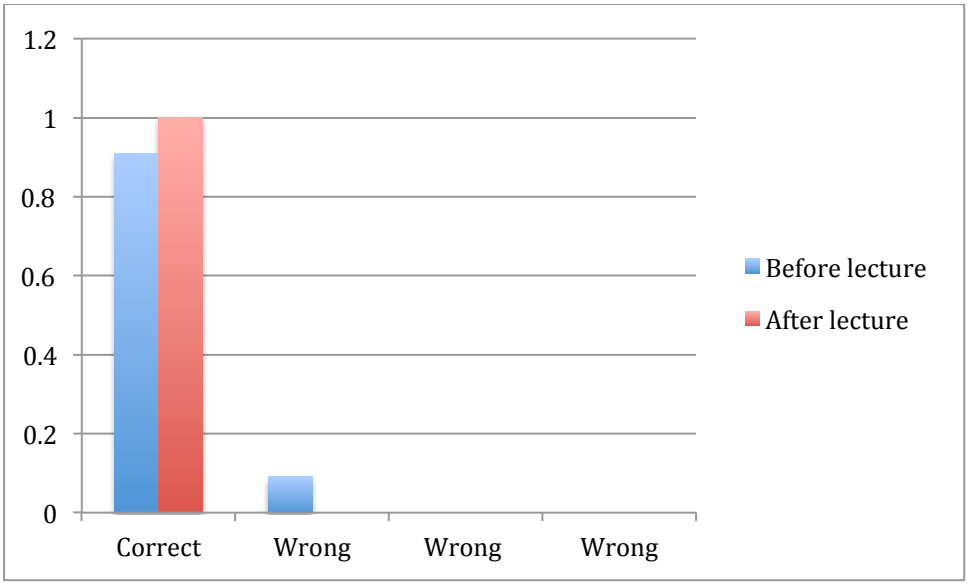

Figure 4. Learning performance of the traditional lecture (Fluid Therapy), easy question, measured as fraction of students in each category to the total number of responding students.

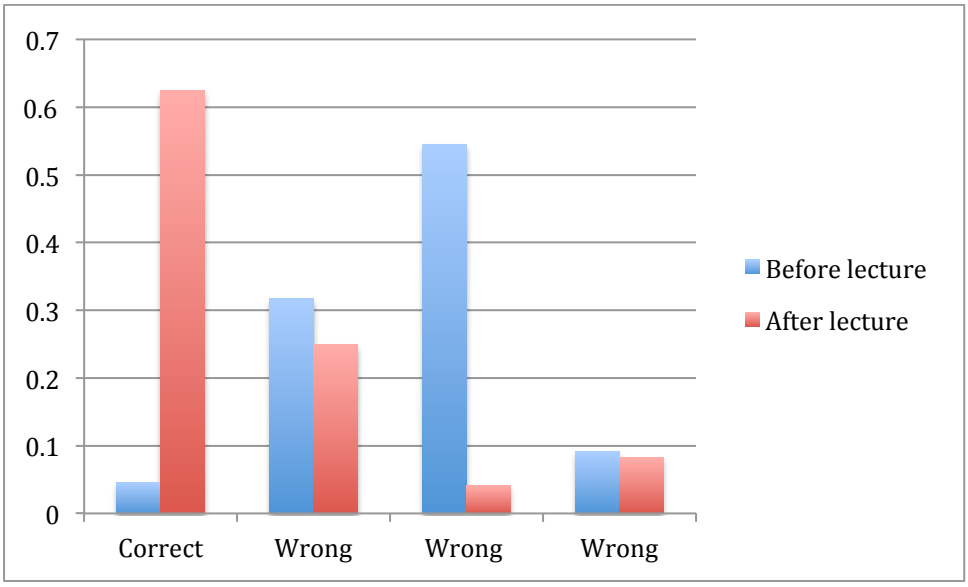

Figure 5. Learning performance of a case based lecture (Intoxication), difficult question, measured as fraction of students in each category to the total number of responding students.

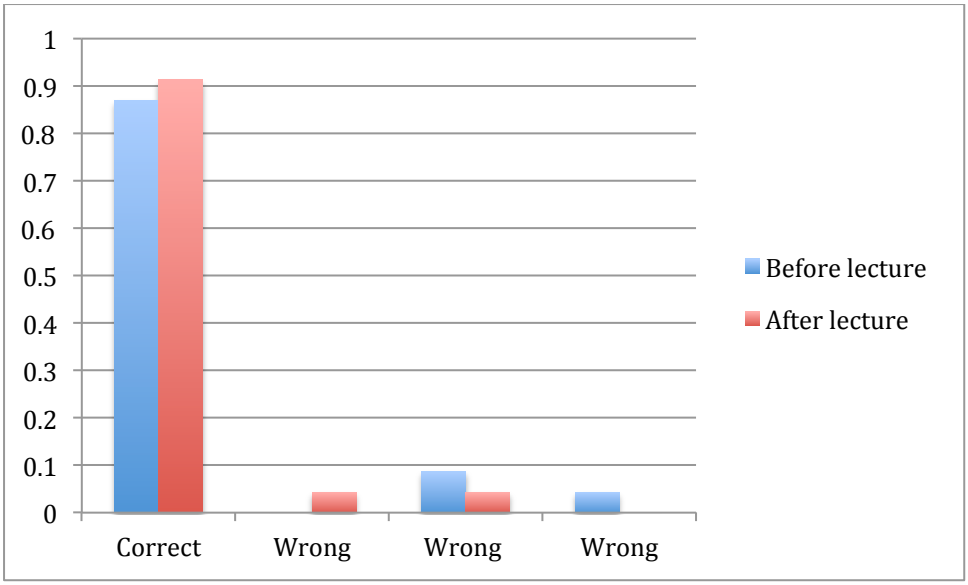

Figure 6. Learning performance of a case based lecture (Intoxication), easy question measured as fraction of students in each category to the total number of responding students.

Discussion

My study demonstrated that the there was a lower anticipated satisfaction with traditional lectures compared to case-based lectures prior to the lectures, and that satisfaction with both types of lectures rose to almost equal levels after the lectures. Furthermore, learning outcome readouts seemed to increase with a slightly higher proportion (although not statistically tested) for the case-based lectures (please compare the increase in proportion for the difficult questions from 0,50-0,89, i.e. 0.39 for the traditional lecture and the increase in proportion from 0.05-0.63, i.e. 0.58 for the case-based lecture). Hence, learning outcome could be probably slightly better with case-based lectures and, if confirmed by follow-up studies, should be preferred for the topics that are most important for students in Pediatric courses. There are however several limitations with the performed studies. First, only one teacher was evaluated. As teachers differ in their pedagogical qualities, assessing several teachers

would probably increase the variation, both in the satisfaction and learning outcomes. Second, the studies lack a crossover design, which could be implemented by repeating the lectures to the next course but switching topics for the traditional and case-based lectures (i.e. Intoxication as the traditional lecture and Fluid therapy as the case-based lecture). However, this approach would potentially be biased by variation introduced by a different cohort of students. Third, the evaluator (H.R.) was not blinded to the questions used to assess the students introducing observer bias to the studies. A double-blind design where the teacher do not know the hypothesis of the evaluator would probably reduced the observer bias. Forth, the number of students tested and the number of questions used is small and there is no long-term follow up of learning outcomes. Fifth, the design includes a variation of topic assessed (i.e. Fluid Therapy or Intoxication) and of method (traditional vs case-based) simultaneously, obscuring the ability to interpret and assign effects of the question asked and of the method used. Sixth, the question of satisfaction is not addressing the primary objective of the studies (more efficient learning) and would probably be better addressed using a question of how much traditional vs case-based lectures contributes to learning. In conclusion, case-based lectures indicated a tendency towards more efficient in increasing learning, but follow-up studies are clearly needed to more robustly address this question. Gender differences in learning could also be further studied. In general, there is much unexplored territory related to the long term efficacy of different teaching methods. In addition to testing students for incremental theoretical knowledge, the field would also benefit from innovative new readouts/exam methods to guide what is efficient teaching of the medical profession, addressing different aspects of the quality of clinical judgement of the responding students. As pointed out by Schøn [1], what constitutes real learning of a profession in the long-term is highly

complex. Hence, future readouts/exams to assess teaching efficacy should include not only assessment of the student´ws ability of problem solving, but also assess the ability to define the clinical problem. A well-developed instrumentarium of robustly validated readouts tailored to the particular profession assessed would probably stimulate the progress in the field of teaching methodology.

Appendix A

Multiple choice questions (MCQ) given for each lecture including the defined objectives prior to the lecture for the learning outcome questions

FLUID THERAPY

Satisfaction:
How satisfied are you in general with lectures using presentation of powerpoint slides.
a. I am not satisfied
b. I have no opinion
c. I am neither satisfied nor satisfied.
d. I am satisfied

Learning outcomes:
Defined objective prior to lecture:
To understand and apply principles of pediatric fluid and electrolyte replacement therapy.

Replacement strategy in detail:
I. Rescucitate: if necessary (severe/schock): 20 ml isotonic Saline or Ringer/kg/5-30 min.Evalute urine, vital signs for need of more. Consider shock treatment (blood, albumin, vasoactive).
II. Replace:
A: determine iv (shock, moderate to severe, third room losses, intolerance to oral, reduce consciousness) vs po (works well in most cases).
B. determine type/need/speed of volume + electrolytes as above (maintenance + deficit + ongoing losses).
po
B1. type: Oral rehydration solutions (usually glucose:sodium = 2:1)
B2. Need: 5- 10 ml every 5-10 min/resume breast milk (pre and post nursing weight). Correct maintenance + deficit (50/30 ml/kg ORS for mild and 100/60 ml/kg ORS for moderate) + ongoing losses (10 ml/kg pr diarrheal stool, 2ml/kg pr vomit).
B3. Speed: Ensure that you replace usually over 4 h.

iv:
B1. type: usually isotonic fluids (if isotonic dehydration): NaCl 9 mg/ml (=0.9%) or Ringer or Glucose 50 mg/ml with added electrolytes
but if:
hypotonic dehydration + symptoms: hypertonic NaCl 0.5 mmol/ml (= 3%).
if hypertonic dehydration: Glucose 50 mg/ml with added electrolytes
B2. Need: Subtract rescusitation fluid. Correct
maintenance
+deficit (Holiday Segar for volume -100/50/20 and for electrolytes - 30/20/20)
...for volume: 100/60 ml/kg for moderate and 150/90 ml/kg for severe
...for electrolytes: by titration or Na-deficit=(135-sNa)*0.6*BW)
+ ongoing losses (10 ml/kg pr diarrheal stool, 2ml/kg pr vomit, or losses as they occur or use tables, sum up every 6-8 h).
B3. Speed: Usually 24 h or less, but 48 h if hypertonic. Avvoid >4 ml/m2/24h and Na-correction >10-15 mM since this may precipitate cerebral edema (hypertonic dehydration) or pontine myelinolysis (hypotonic dehydration)

MCQ-difficult question:. 6 yrs boy, diarrhea/4 days, 9% dehydration, Na 166 mmol/L (N<145). Diagnosis and treatment?
a. Severe hypertonic. Iv isotonic fluid over 48 hours. (Correct answer)
b. Moderate hypertonic. Oral isotonic fluid over 24 hours (Wrong answer)
c. Moderate hypotonic. Iv hypertonic fluid over 24 hours (Wrong answer)
d. Severe isotonic. Oral isotonic fluid over 48 hours (Wrong answer)

MCQ-easy question:. 12 h after rehydration, Na normalized to 144 mmol/L (from 166 mmol/L). Considerations?
a. *Rehydration too quickly, risk of cerebral edema.*
b. *Correct speed, and no additional intervention needed (Wrong answer)*
c. Too slowly, more volume needed to avoid hypo-perfusion (Wrong answer)
d. Na-levels are irrelevant, prior calculations determine (Wrong answer)

INTOXICATION
1. How satisfied are you in general with lectures based on case discussions?
a. I am not satisfied
b. I have no opinion
c. I am neither satisfied nor unsatisfied.
d. I am satisfied

2. Defined objectives prior to lecture:
To understand and apply principles of pediatric intoxication management.
Details of management principles
A - ABC and assess Glasgow Coma Scale

B- Prevent uptake (1-2 h window; aspiration risk: avoid if corrosives or petroleum products)

B1- Induction of vomiting (spatulae, ipecac syryp)

B2- Gastric lavage (gastric tube)

B3- Activated charcoal (fluid installation after gastric lavage. No metals, alcohol ineffective)

C- Antidote (N-acectyl cystein)

D- Forced elimination (forced alkali diuresis, renal dialysis, intestinal lavage)

E- Symptomatic treatment

F- Treatment of crisis

MCQ-difficult question: 4 yrs girl, ethylene glycol ingestion 1h ago. Intake >> toxic dose. Management in hospital?

a. Induced vomiting, gastric lavage, antidote, symptoms tx (Correct answer)
b. Gastric lavage, charcoal, symptoms tx, forced alkali diuresis (Wrong answer)
c. Provide milk/cream/ice cream to dilute, symptoms tx (Wrong answer)
d. Induced vomiting, intestinal lavage, anti-venome (Wrong answer)

MCQ-easy question: 4 yrs girl, ethylene glycol ingestion 3h ago. Intake >> toxic dose. Tx in general practice?

a. Induced vomiting, gastric lavage, antidote, symptoms tx. (Correct answer)
b. Induced vomiting, ambulance ASAP to hospital. (Wrong answer)
c. Provide milk/cream/ice cream to dilute, send home (Wrong answer)
d. Ambulance ASAP to hospital with GCS monitoring (Wrong answer)

References

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2. Prober, C.G. and C. Heath, *Lecture halls without lectures--a proposal for medical education.* N Engl J Med, 2012. **366**(18): p. 1657-9.
3. Deslauriers, L., E. Schelew, and C. Wieman, *Improved learning in a large-enrollment physics class.* Science, 2011. **332**(6031): p. 862-4.