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Assessing the clinical reasoning skills of 4th year medical students in Batna

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Abstract

Aim. With the aim of examining the performance, commitment and perception of 4th year medical students in Batna - Algeria with regard to an interactive preparatory tool used in a flipped neuromeningeal infection course and to compare results with other types of teaching including blended as well as distance learning during COVID19.

Methods. we conducted a prospective, evaluative, experimental before-and-after study with comparison maneuvers. Through this study, the success rate of external students 2022-2023 receiving "Reverse Classroom" teaching applied on group A was compared to the success rate of external students of the same year receiving "mixed teaching" applied on group B and to the success rate of external students of the year 2020-2021 (During COVID 19), receiving only "online teaching in downloadable papers" applied on group C consisting of 2 subgroups . All students in group A and B have access to a traditional downloadable paper document coupled with an enhanced e-learning tool including a video. We briefly evaluated this interactive tool during a 01:30-hour lecture in the form of a clinical case, with the same amount of dedicated class time for both subgroups.

Results: Overall, our evaluation showed that the use of the flipped classroom approach is appreciated by students and helps them to learn, understand and retain the essential notions of the course, objectively demonstrated by their response to question 2, 3 and 4, and whose acquisition of the course reached 60% (33.3, 37.1) and 80% (56.0, 49.4) respectively for the A1 and A2 group. The majority asked to adopt it in nearly 67% of cases, which has been reported in studies other. Similarly, our results show the importance of having direct contact with a teacher and feedback during a lecture, and of not exclusively carrying out distance learning without direct contact interaction and feedback.

Conclusion: The flipped classroom defines a blended learning approach in which core content is transferred to students to engage them in active learning exercises during class time.

Keywords: Flipped classroom; Pedagogical continuity; Interactive pedagogy; Distance learning; Medical pedagogy; Interactive response system

1. Introduction

Infectious diseases are the fatal and constant companions of our existence, and still occupy a central place in human medicine. If infectious diseases are diverse, we have known since Pasteur that their diversity results from the diversity of the pathogens that cause them, and from the different ways in which these pathogens are dealt with. Infectious disease teaching is an educational field integrated with the relevant clinical disciplines, supporting the main medical processes of patient diagnosis, describing pathophysiology, epidemiology, clinical aspects, diagnosis, therapeutics and prognosis, taking into account the most recent developments. Such learning objectives would ultimately contribute, through a procedural/methodological approach, to the process of correct diagnosis or appropriate decision-making, to the benefit of the patient. Such learning objectives would ultimately contribute, through a procedural/methodological

approach, to the process of correct diagnosis or appropriate decision-making, to the benefit of the patient. Training and education are essential for future healthcare practitioners. To ensure educational continuity during the COVID-19 epidemic, alternatives had to be quickly put in place due to the closure of many universities. However, conventional distance learning tools, such as videos and downloadable handouts, are not enough to ensure effective teaching. Distance learning requires self-motivation on the part of the student, and does not provide direct access to the teacher. The loss of human contact is a major obstacle to understanding and teaching. In this context, interactive pedagogy tools could be useful for the continuity of medical education by maintaining the necessary human contact [1]. This discipline will never be completed, and must keep abreast of the latest epidemiological news and recommendations, whether national or international. As a result, it will be subject to periodic revisions to adapt it better and better to its mission.

Today's university, situated in a world of challenges and rapid change, is seeking to adapt its academic mission and support it on solid foundations, as part of a quality [2] approach. Pedagogy is an essential concept in education, because it is an important part of what teachers do every day, where they need to understand how students learn, how to make lessons interesting and how to keep them engaged [3].

There are many different pedagogical methods [4] :

- The expositive, transmissive or magisterial method: in which the teacher provides information to the students from the outset, without there being any major interaction.
- The demonstrative method : is used to communicate an idea using visual aids such as flip charts, posters, power point presentations, etc. It involves teaching someone how to make or do something. It involves teaching someone how to make or do something in a step-by-step process.
- The interrogative or maieutic method : this is the theory of reasoning that includes deductive logic as a learning method. It can be argued that the interrogative method is a general theory of reasoning.
- The experiential method : involves learning through experience. This theory was proposed by psychologist David Kolb, who was influenced by the work of other theorists, including John Dewey, Kurt Lewin and Jean Piaget.
- The active or "discovery" method : this is an approach to teaching that involves students actively participating in the course material through discussion, problem-solving, case studies, role-playing and other methods.

Today, it is difficult to give a precise description of what active pedagogy is. In fact, it's a dynamic set of pedagogical practices centered on the student, enabling them to develop their existing knowledge and skills by interacting (with the teacher and their peers) on a contextualized subject, while taking an analytical, reflective and critical look at it [5].

Active pedagogy reverses the problem by putting learners in situations where they are confronted with information, and acquire it at their own pace [6]. Active pedagogy encompasses a range of methods that have one thing in common: learning by doing. It's a constructivist approach, based on the theory of learning conceptualized by Piaget as early as 1923, according to which the subject's activity is indispensable for constructing a representation of the reality that surrounds him or her[7]. Unlike the traditional method, which begins with theory and ends with practice, this pedagogy begins with practice and progresses towards theory. Learners are plunged into real-life situations of research and investigation, where they must grasp and master the resources made available to them by the teacher. These approaches were formalized throughout the 20th century

In the 21st century, we know from brain scans that active behavior puts the brain more to work: the act of thinking largely puts the brain into activity, thus promoting learning. The seven principles of active teaching :

- The inductive experimental approach: trial and error, experimentation, discovery; this is why active methods should be favored,
- Information passes from working memory to permanent memory if it is logical and seen in 3 different ways,
- Varied learning methods: Howard Gardner, one of the world's leading experts in describing forms of intelligence, lists 8: each person will recognize his or her own preferred way of learning, so we need to vary teaching methods to serve as many intelligences as possible,
- Respect for rhythms: George MILLER explains that a normal human being can integrate between 5 and 9 units of meaning at any one time. This means that there's no point in pushing too many stimuli onto a learner, if he or she can't process them. Active teaching therefore reverses the problem by putting the learner in a situation where he or she is confronted with information, and acquires it at his or her own pace [8].
- Predominance of the visual: it has to be said that sight is a highly developed sense in human beings. Pedagogy should take this dimension into account by favoring highly visual aids [9].

- Social-cognitive conflict: if we say to someone at their workstation "that's not the way to work, I'll show you", it's highly likely that their mental representations won't budge an inch. Why? Because we're triggering a socio-cognitive conflict: active pedagogy doesn't go against this conflict, but rather encourages it, by creating the right conditions[10].
- Active pedagogy must provide meaning and pleasure to facilitate learning.

Active pedagogy confers a greater degree of responsibility on the learner than passive approaches such as lectures, but the instructor's guidance remains crucial in an active learning classroom. Active learning activities can last from a few minutes to entire class sessions, or take place over several class sessions.

Objectives

The aim of this study was to examine 4th year medical students' performance, engagement and perception of an interactive preparatory tool used in a flipped neuromeningeal infection course and to compare results with blended teaching as well as distance learning during COVID19 (using conventional traditional teaching).

2. Materials and methods

With a view to improving the conditions under which infectious diseases are taught, in order to ensure qualitative pedagogical continuity, We conducted a prospective, evaluative, experimental before-and-after study with comparison maneuvers. We therefore evaluated these interactive tools from a flipped classroom approach (a blended learning approach in which core content is transferred to students to learn on their own turf) : On group A 2022-2023 made up of 2 sub-groups : Group A1 with 18/ 108 students; Group A2 with 89/ 105 students.

Then the results were compared to group B of the same year, receiving only blended learning (traditional teaching with downloadable paper documents coupled with an enhanced online learning tool, notably a video). This group B is composed of 2 subgroups: Group B1 with 98 students; Group B2 with 100 students.

All students had access to a traditional downloadable paper document coupled with an enhanced e-learning tool including a video. We briefly evaluated this interactive tool during a 01h30 hour lecture in the form of a clinical case to highlight the specific tasks, skills and aptitudes required to optimize the students' learning abilities. The dedicated lecture time was identical for both subgroups A and was videotaped (Appendices). After the lecture, a short 7-question online survey based on the objectives of our study was submitted to the students.

Sex: Male Female

- Would you like to take part in this quiz ?

  Yes ☐   No ☐

- Do you agree that we should all join forces to solve the problem ?

  No Little Yes Entirely

- What do you think of this method ? Tick the answers that seem right to you.
  - Ensures the participation of all students ☐
  - Help students express their requests, ☐
  - Help students express their ideas ☐
  - Helps students formulate hypotheses ☐
  - Redresses design errors ☐
- Do you think this method will guarantee the quality of your reasoning in the future ?

No	Little	Yes	Entirely

- Do you think this method excludes students who are frustrated or shy about taking part in the dialogue ?

Yes ☐ No ☐

If yes, what do you propose ? .....

- Course acquisition has reached
  - 20% :
  - 40% :
  - 60% :
  - 80% :
- Do you think this method can be applied :
  - Tutorials & Courses
  - Tutorials
  - Course

Survey results are presented in Table 2 and were analyzed by percentage, while exam results were analyzed by mean +/- standard deviation.

Through this study, the success rate of external students 2022-2023 receiving "Reverse Classroom" teaching applied on group A was compared to the success rate of external students of the same year receiving "mixed teaching" applied on group B and to the success rate of external students of the year 2020-2021 (During COVID 19),receiving only "online teaching in downloadable papers" applied on group C consisting of 2 subgroups: Group C1 with 136 students; Group C2 with 137 students.

For statistical analysis, responses to the quiz were compared. An independent factor analysis was also performed.

3. Results

3.1. Epidemiological characteristics

During the academic year 2022-2023, we were able to collate 107 students in 4th year, 1st and 2nd rotation of infectiology, from the Batna Faculty of Medicine, and after subtracting 90 and 16 students from group A1 and A2 respectively; We found, after analyzing their responses to our questionnaire, that the average age was almost the same for the two groups A1 and A2 respectively: 21.44 and 21.69, with the most obvious age bracket being 22 years. Gender distribution was predominantly female, with a sex ratio of : 0.2 and 0.3 respectively. (Table N°1)

Table 1 Epidemiological characteristics

Parameters / groups		GROUP A1 N =18 (%)	GROUP A2 N = 89 (%)
Average age	Standard deviation +/-	21.44+/-0.511	21.69 +/-0.82
	Male	3 (17)	20 (22.5)
	Female	15(83.3)	69 (77.5)

3.2. Student survey, results and significance of the different scales used

To achieve our objectives, we used a questionnaire containing a series of 7 questions designed to evaluate and obtain feedback on the application of innovative pedagogy with students accustomed to being more passive. The results are illustrated in Table 2 :

Table 2 Student survey, results and significance of the different scales used

Parameters / groups		GROUP A1 N =18 (%)	GROUP A2 N = 89 (%)
Would you like to take part in this quiz ?	Yes	18 (100)	88(99)
	No	0	1(1.1)
Do you agree that we should all join forces to solve the problem ?	No	0	0
	Little	0	9(10.1)
	Yes	6 (33.3)	42(47.2)
	Absolutely	3 (17)	15(17)
	Entirely	9 (50)	23(26)
What do you think of this method ?	Ensures the participation of all student	14 (78)	38(43)
	Helps students express their needs	14 (78)	
	Helps students express their ideas	12 (67)	
	Helps students to formulate their hypotheses	14 (78)	
	Redresses design errors	16 (90)	
Do you think this method will guarantee the quality of your reasoning in the future ?	No	0	0
	Little	0	7(8)
	Yes	4 (22.2)	45(51)
	Absolutely	6 (33.3)	17(19.1)
	Entirely	8 (44.4)	20(22.5)
Do you think this method excludes students who are frustrated or shy about taking part in the dialogue ?	Yes	4 (22.2)	46(52)
	No	14 (78)	43(48.3)
	20%	0	2(2.2)
	40%	2 (11.1)	10(11.2)
Course acquisition has reached :	60%	6(33.3)	33(37.1)
	80%	10(56)	44(49.4)
Do you think this method can be applied :	Tutorals & Courses	12(67)	60(67.4)
	Tutorals	6(33.3)	26(29.2)
	Courses	0	3(3.4)

3.3. Comparison of exam results for the 3 groups A (1.2), B (1.2), C (1.2)

The comparison of the results obtained following a quiz with the examination results was imperative to consolidate our flipped classroom approach, which have been reported in Table 3.

Table 3 Comparison of examination results for the 3 groups A (1,2), B (1.2), C (1.2)

Results / groups	Average results	Standard deviation +/-
GROUP A1 (N =18) (%)	17.96	+/- 0.7
GROUP A2 (N =89) (%)	17.47	+/- 1.3
GROUP B (N= 198) (%)	16.43	+/- 1.2
GROUP C (N= 213) (%)	14.38	+/- 1.8

4. Discussion

In recent years, a growing number of educators have explored the use of instructional technology to improve student outcomes. Continued advances in pedagogical technology have fostered "blended" learning environments that combine the use of e-learning with traditional classroom learning. What is new is the flipped classroom, defined as a blended learning approach in which core content is transferred to students to engage them in active learning exercises during class time. This approach shifts the focus from teaching and teacher orientation to learning and student orientation, promoting self-regulated learning and intrinsic motivation as well as effective transfer [12].

From our perspective, a vaccinated adult population with an average age of A1 and A2 groups of 21.44 +/- 0.511, 21.69 +/-0.82 with a clear predominance of females, course participation was clearly reduced for the A1 group, whose sanction prompted a considerable number to participate in the A2 group compared to the A1 group.

Through our knowledge study. Group A2 and the 18 students in group A1 reported improved exam performance and increased engagement in a flipped medical course concordant with what was brought by Pierce and Fox who found improved performance and perceptions in a flipped renal pharmacotherapy module, also widely reported in dentistry, nursing and medicine. As the literature [13] demonstrates, this will enable the teacher to identify relevant concepts and organize the transferred content, while the students control the learning environment by going through the content at their own pace, guiding themselves to additional resources and assessing their own learning achievements. What's more, students have the opportunity to fully prepare for courses that focus on higher-order thinking, problem-solving and critical analysis rather than content delivery.[12,13].

The answer to question 2 (Table 2), demonstrated the students' motivation expressed positively in different ways to solve the problem, which reached 90% for group A2 and 100% for group A1. The benefits of this flipped classroom approach were clearly expressed by the response to question 3 (Table 2) in helping students to better express their requests, expose their ideas, formulate hypotheses and correct design errors, which ranged from 67-90%. This demonstrated the effectiveness of the flipped classroom reported by research that suggested that in addition to improving students' learning and problem-solving skills, it can also foster their engagement and motivation to learn.[12,13.]

The improvement in student results in the context of the flipped classroom can be explained in part by "connectivism", a theory of learning in the digital age that demonstrates the growing influence of new technologies and emphasizes the process of connecting information sources, maintaining continuous and current knowledge acquisition and developing decision-making, by engaging students in active learning that integrates and applies this content, students develop the ability to identify links between different sources and recognize meaningful patterns, and enable them to quickly and efficiently navigate through diverse sources of information and further identify new sources among distributed sets of information.[12,13.]

Overall, our evaluation showed that the use of the flipped classroom approach is appreciated by the students and helps them to learn, understand and retain the essential notions of the course, objectively demonstrated by their response to question 4 with a rate varying between 92. 1% and 100% for the 2 A groups, and whose acquisition of the course reached 60% (33.3,37.1) and 80% (56. 49.4) respectively for the A1 and A2 groups, and whose majority asked to adopt it for the course and TD in nearly 67%, which has been reported in the studies. [12,13].

In our modest study and by comparing the results obtained after an exam, where the A1 and A2 group received flipped classroom learning (17.96 and 17.47) with the B1 and B2 group receiving traditional teaching with downloadable paper documents coupled with an enhanced e-learning tool notably a video (16. 43), and group C1 and C2 receiving only

downloadable paper-based e-learning (14.38), the flipped classroom approach was found to be highly effective in optimizing students' learning abilities.[14] .

Similarly, our results show the importance of having direct contact with a teacher and feedback during a lecture, and of not exclusively carrying out distance learning without direct contact interaction and feedback, which is detrimental to pedagogy. That's why, in today's context, we encourage teachers to use this type of tool to maintain direct interaction with students to ensure qualitative pedagogical continuity.[13] Because traditional distance learning tools, such as videos and downloadable handouts, are not enough to ensure effective teaching, and distance learning requires self-motivation on the part of the student and does not give direct access to the teacher.[13].

5. Conclusion

Flipped classroom teaching is a highly mutual teaching domain where reciprocal collaboration can effectively address students' learning needs and is able to significantly contribute to facilitating learning, and that the degree, frequency and time of access to the online learning tool are positively related to academic performance.

The results of this study suggest that engagement with a highly interactive online preparatory tool is positively related to students' learning in each of their subject areas.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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