



Student's attitude towards different teaching methods in pharmacology

Suneel Ishwar Majagi ^{1*} S.S.Torgal ¹, S.V.Hiremath¹

¹ Department of Pharmacology, J.N. Medical College, Nehru Nagar, Belgaum- 590010.Karnataka- India.

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*Corresponding author:

Email : suneelmajagi@yahoo.co.in

Tel : +0831-2473777 Extn : 4095

ABSTRACT

Students' feedback plays a vital role, as suggested by the literature review, in effectively reforming the learning and teaching methods in medical sciences. The present study has been conducted to obtain students' attitude (perception of) towards different teaching and learning methods of pharmacology. The sample consisted of second phase M.B.B.S (n=108) students. Students answered 80 items/questions designed according to Likert's five point (in agreement with items) scale. These items/questions assessed students' attitude (perception of) towards various teaching and learning methods of pharmacology like theory class teaching, tutorial, integrated teaching and clinical/bedside teaching in relation with different constituents of pharmacology subject like classification of drugs, pharmacological actions etc. Similarly students' attitude towards novel teaching methods like CAL, PBL, e-learning etc with regard to understanding, retention, learning clinical applications of pharmacology subject etc has been obtained. Results of the present study indicated the degree to which each teaching and learning method, existing as well as novel methods, helps in understanding different constituents of pharmacology subject as mentioned earlier. Present study indicated the merits and demerits of different teaching and learning methods used in pharmacology. This study will be helpful if any reformations/changes have to be brought into the teaching and learning methods of pharmacology. This study will also be helpful if some of the novel teaching and learning methods, as discussed, have to be introduced into the curriculum.

INTRODUCTION

The undergraduate pharmacology curriculum has always been a topic of intense debate. It has been generally felt that pharmacology course in medical schools has failed to keep pace with the rapid changes and requirements of clinical practice [1]. Only passive learning through didactic lectures is practiced and tutorials are rarely organized [2]. Learning environment should be enriched through incorporation of a variety of teaching and learning strategies and methods (may be newer innovations) [3]. In fact the need of the hour is reformations in the methods of teaching from the same old traditional methods [4]. Transformation of the process of passive learning to active learning in educational pharmacology learning promotes deep learning along with surface learning of the subject [3].

The first and the foremost question that needs to be answered

is 'What aspect(s) of pharmacology should an undergraduate know?'. The nebulous nature of many of the 'new drugs' makes the teachers cautious of teaching the pharmacology of drugs that have been recently introduced into the market[5]. In another study authors have suggested that at the end of three semesters in Pharmacology, an undergraduate medical student should learn about: a) requisite skills to rationally prescribe medicines, b) cost-effective medicine, c) pharmacokinetics & pharmacodynamics of drugs, e) collecting information from information resources f) developing critical appraisal skills by becoming a lifelong learner and practicing self-directed learning, g) communication skills and routes of administration of drugs & h) Use a 'P' list [7]. It has been suggested that the core curriculum should have three broad areas: i) Concepts and Principles, ii) Systemic Pharmacology and iii) Professional Skills [6]. Undergraduate medical students of the All India Institute of Medical Sciences (AIIMS), New Delhi, have recently protested against the outdated curriculum being followed

in their institute [7].

Animal experiments are often labour-intensive and costly [8,9]. Students and teachers in medical colleges in India, overwhelmingly favour replacing the use of animals in undergraduate medical training [10,11,12,13]. Computer-simulated experiments appear to be feasible and effective as a major part of practical lessons of pharmacology [14]. Integrated teaching may be practised for better student learning [15]. At present teaching is compartmentalized and concentrated in particular speciality. Integrated lectures as recommended by WHO should follow the earlier coverage by individual departments [15]. Problem Based Learning (PBL), as compared to traditional learning, should be preferred because it is an approach to learning revolving around a problem [15].

Students are able to reflect both on what and how they are learning [16]. For any meaningful progress in the learning process there has to be mutual respect for the teacher and the student [6]. The views of the students should not and cannot be casually dismissed [6]. Most of the institutions in the world do have one or more students' representatives in their academic/curriculum committees [6]. Attitudes have a very strong influence on the behaviour of a person [17]. They form the middle link between knowledge and practice [18,19]. A study has indicated that implementation of suggestions obtained from the students resulted in improvement in their performance [20]. Frequent feedbacks may help teachers plan the curriculum and improve upon the teaching and assessment methods. Hence, it is very essential to synchronize teaching methods with special requirements of medical students. Currently, student's feedback represents the primary means used by most programs to assess their methodology [21,22]. Undertaking educational research to find out the success of new interventions will provide a great help in improving the education system [2]. This study is planned to know the merits and demerits of each teaching and learning method used in pharmacology which can be used to bring positive reforms. The present study is also planned to analyse the feasibility of novel methods of teaching and learning. Review of literature suggests the need to obtain the students feedback which will help to bring effective reforms in teaching and learning methods. Therefore the present study is planned to obtain students' attitude towards different teaching and learning methods in pharmacology.

The present study was carried out to obtain

1) Students' attitude (perception of) towards the teaching and learning methods of pharmacology at the Department of Pharmacology, J.N.M.C.

2) Students' attitude (perception of) towards the newer

methods of teaching and learning of pharmacology.

MATERIALS AND METHODS

This is an experimental study. Sample consisted of second phase/year M.B.B.S (n=108) students. Different topics of pharmacology subject have been taught/covered through different teaching methods throughout one-and-a-half-year during second phase M.B.B.S. Before the final examinations students' assessment of retaining, recalling and reproducing skills of different teaching and learning methods in pharmacology has been obtained by using different questionnaires with 5 point scale designed according to Likert's scale [23]. The respondents are required to indicate their agreement or otherwise with each item by ticking one of the five alternatives viz., strongly agree, agree, neither agree or disagree, disagree and strongly disagree. Forty questions/items have been formed for different teaching and learning methods in pharmacology viz., Theory class, Tutorials, Integrated teaching and Bedside clinical teaching. Questions (items) pertaining to each teaching method that have been mentioned above will help in understanding/ learning different constituents of the pharmacology subject viz., General introduction, Patho-physiology of the disease, Classification of drugs, Pharmacological actions, Mechanism of Action, Preparations of the drugs, Adverse drug reactions, Resistance development in case of AMA (Antimicrobial agents) or Antibiotics, Contraindications, Precautions, Interactions and Therapeutic uses. Similarly another forty questions/ items have been designed to know the attitude of students on novel teaching and learning methods like Use of virtual teacher through your/students computer (audio visual aid/videos of pre-recorded lectures), Use of audio tapes (recorded lectures), Use of web based teaching/assignments (e-learning), Use of regular mobile tips (regular sms by the teachers or subject experts), Use of mobile for interactions (conversations) with teachers, Problem Based Learning (PBL), Computer Assisted Learning (CAL) and Use of animals in practicals (this item is involved to know whether animals in practicals can be replaced by recorded videos or CAL). Details about these novel methods have been explained to the students. Each student is required to answer the items in an answer paper (response sheet) provided to them. The answer papers have been corrected by the chief investigator.

Ethics: Voluntary consent from each student to participate in the study was taken. Ethical clearance from the Institutional Ethics Committee for Human Subjects was taken.

The data were collected after correcting the answer papers (response sheets) of the students (respondents). This data were summarised and the results were analyzed by using standard statistical tests. $P < 0.05$ was considered as significant.

FEEDBACK FORM (Open ended questions)

I. What factors facilitate your learning: 1.....2.....3.....

II. What factors hinder your learning: 1.....2.....3.....

III. Suggestions for improvements in future: 1.....2.....3.....

Student's signature

RESULTS AND DISCUSSION

The degree to which various teaching and learning methods viz., theory classes, tutorial, integrated teaching and clinical/bedside teaching help to elicit different constituents of pharmacology subject have been revealed by the results. The attitude tests revealed that theory class teaching, tutorial, clinical/bedside teaching and integrated teaching, in the descending order, help better in understanding of general introduction (history etc) [Table 1], classification of drugs {significant ($p<0.01$) difference is noted between different teaching methods} [Table 3], pharmacological actions of the drugs (significant difference, $p<0.01$) [Table 4], therapeutic uses of the drugs [Table 10]. Tutorial, theory class teaching, clinical/bedside teaching and integrated teaching, in the descending order, help better in learning the mechanism of action of drugs (significant difference, $p<0.05$) [Table 5]. Theory class teaching, clinical/bedside teaching, tutorials and integrated teaching in the descending order help in better understanding the patho-physiology of the diseases (significant difference, $p<0.001$) [Table 2], adverse drug reactions (significant difference, $p<0.01$) [Table 7], contraindications/precautions/interactions of the drugs [Table 9]. Clinical/bedside teaching, tutorial, theory class teaching and integrated teaching in the descending order help better in learning the preparations of different drugs [Table 6], resistance development in case of antimicrobial drugs [Table 8]. Integrated teaching and OSPE are newly introduced in our department [24,25]. It has been mentioned that an inbuilt deficiency of integrated teaching across the medical course may also interfere in the achievement of desired objectives [2]. Integrated teaching (horizontal or vertical) may be practised for better student learning [15].

Another set of attitude tests on novel methods of teaching and learning revealed that CAL, PBL, Internet/Web based teaching/assignment, Mobile interactions with teachers, Use of virtual teacher through computers, Use of animals in practicals, Mobile tips/sms and Use of audio tapes, in the descending order, will help in better *understanding* of pharmacology subject {significant difference ($p<0.01$) is noted between different teaching and learning methods} [Table 11]. CAL is preferred first and MCI has given an option of replacing the use of live animals in medical-course experiments with sophisticated non-animal training methods, such as computer-aided education [14].

Recently, there is a huge demand for and increasing interest in introducing CAL techniques in pharmacology [14]. In our department there is lacunae of CAL and other computer-aided education therefore it will be an innovative effort if we use these methods for teaching and evaluation. CD containing CAL software for teaching animal experiments is becoming a revolution in pharmacological teaching [27]. PBL has been ranked next and it is in agreement with an earlier study which has mentioned improvement in students' attitude towards pharmacology after introducing PBL [28,29]. PBL is gaining ground in medical education [30]. Clinical application can be elicited if evaluation is done through PBL. PBL has been shown to improve both the cognition of and motivation towards medical education [31].

Mobile tips/sms, Use of virtual teacher through computers, Use of audio tapes, Mobile interactions with teachers, CAL, Web based teaching/assignment, Use of animals in practicals and PBL, in the descending order, help (significant difference, $p<0.001$) in the *retention* of pharmacology subject [Table 12]. Whereas Use of audio tapes, Use of virtual teacher through computers, Use of animals in practicals, Web based teaching/assignment, Mobile tips/sms, CAL, Mobile interactions with teachers and PBL, in the descending order, will be helpful to *pass the examinations* (significant difference $p<0.001$) [Table 13]. *Clinical applications* of pharmacology knowledge, in the descending order, can be learnt better by the following methods viz., Use of audio tapes, Use of virtual teacher through computers, Mobile interactions with teachers, Web based teaching/assignment, Mobile tips/sms, PBL, CAL and Use of animals in practicals [Table 14]. Use of animals in practical, Use of virtual teacher through computers, Mobile tips/sms, Use of audio tapes, Web based teaching/assignment, CAL, Mobile interactions with teachers and PBL, in the descending order, will be *useful in the long run* (significant difference $p<0.001$) [Table 15].

Analysis of open ended questions (Feedback forms) indicated that the use of black board and power point (though less preferred than the former [24]) in theory teaching, revision and interactive sessions involved in the tutorials facilitated the learning of pharmacology. Integrated teaching was generally not preferred because it involves few students at a time and more time has to be spent towards the preparation of the presentation. Some students pointed out the demerits of power point as it strains the eyes and

Table 1. Following teaching method helps to understand general introduction (history etc) of pharmacology.

(n=108)	Strongly disagree (SD)	Disagree (D)	Neither agree or disagree (NA or D)	Agree (A)	Strongly agree (SA)
Theory lectures	2.78%(3)	7.41%(8)	30.56%(33)	35.19%(38)	24.07%(26)
Tutorial	3.70%(4)	11.11%(12)	34.26%(37)	29.63%(32)	21.30%(23)
Integrated teaching	9.26%(10)	21.30%(23)	29.63%(32)	25.00%(27)	14.81%(16)
Clinical/Bedside teaching	5.56%(6)	14.81%(16)	31.48%(34)	27.78%(30)	20.37%(22)
Chi-square: 18.198, df: 12, $p > 0.05$					

Table 2. Following teaching method helps in understanding patho-physiology of the diseases.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	1.85%(2)	8.33%(9)	32.41%(35)	45.37%(49)	12.04%(13)
Tutorial	0.00%(0)	9.26%(10)	43.52%(47)	34.26%(37)	12.96%(14)
Integrated teaching	13.89%(15)	17.59%(19)	30.56%(33)	26.85%(29)	11.11%(12)
Clinical/Bedside teaching	1.85%(2)	16.67%(18)	26.85%(29)	39.81%(43)	14.81%(16)
Chi-square: 47.09, df:12, ***p < 0.001					

Table 3. Following teaching method helps to learn the classification of drugs.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	0.00%(0)	11.11%(12)	27.78%(30)	37.96%(41)	23.15%(25)
Tutorial	0.93%(1)	13.89%(15)	34.26%(37)	31.48%(34)	19.44%(21)
Integrated teaching	10.19%(11)	19.44%(21)	32.41%(35)	20.37%(22)	17.59%(19)
Clinical/Bedside teaching	3.70%(4)	18.52%(20)	35.19%(38)	26.85%(29)	15.74%(17)
Chi-square:30.596, df:12, **p < 0.01					

Table 4. Following teaching method helps to understand pharmacological actions of the drugs.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	1.85%(2)	12.96%(14)	29.63%(32)	40.74%(44)	14.81%(16)
Tutorial	3.70%(4)	10.19%(11)	33.33%(36)	37.96%(41)	14.81%(16)
Integrated teaching	13.89%(15)	20.37%(22)	29.63%(32)	24.07%(26)	12.04%(13)
Clinical/Bedside teaching	3.70%(4)	12.96%(14)	31.48%(34)	37.96%(41)	13.89%(15)
Chi-square:27.076, df:12, **p < 0.01					

Table 5. Following teaching method helps to learn the mechanism of action of drugs.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	7.41%(8)	9.26%(10)	29.63%(32)	33.33%(36)	20.37%(22)
Tutorial	6.48%(7)	9.26%(10)	26.85%(29)	34.26%(37)	23.15%(25)
Integrated teaching	12.96%(14)	22.22%(24)	32.41%(35)	20.37%(22)	12.04%(13)
Clinical/Bedside teaching	9.26%(10)	16.67%(18)	29.63%(32)	27.78%(30)	16.67%(18)
Chi-square:21.201, df:12, *p < 0.05					

Table 6. Following teaching method helps to learn the preparations of drugs.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	8.33%(9)	8.33%(9)	37.04%(40)	24.07%(26)	22.22%(24)
Tutorial	4.63%(5)	20.37%(22)	25.93%(28)	29.63%(32)	19.44%(21)
Integrated teaching	8.33%(9)	20.37%(22)	31.48%(34)	24.07%(26)	15.74%(17)
Clinical/Bedside teaching	5.56%(6)	12.04%(13)	27.78%(30)	32.41%(35)	22.22%(24)
Chi-square:15.699,df:12, p>0.05					

Table 7. Following teaching method helps to understand adverse drug reactions.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	1.85%(2)	7.41%(8)	26.85%(29)	49.07%(53)	14.81%(16)
Tutorial	3.70%(4)	11.11%(12)	29.63%(32)	36.11%(39)	19.44%(21)
Integrated teaching	7.41%(8)	18.52%(20)	37.04%(40)	28.70%(31)	8.33%(9)
Clinical/Bedside teaching	0.00%(0)	14.81%(16)	25.00%(27)	43.52%(47)	16.67%(18)
Chi-square:30.122, df:12, **p < 0.01					

Table 8. Following teaching method helps to understand resistance development in case of antimicrobial agents.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	5.56%(6)	15.74%(17)	37.04%(40)	26.85%(29)	14.81%(16)
Tutorial	2.78%(3)	12.04%(13)	42.59%(46)	32.41%(35)	10.19%(11)
Integrated teaching	6.48%(7)	22.22%(24)	34.26%(37)	23.51%(25)	13.89%(15)
Clinical/Bedside teaching	5.56%(6)	17.59%(19)	31.48%(34)	30.56%(33)	14.81%(16)
Chi-square:10.188, df: 12, p> 0.05					

Table 9. Following teaching method helps to understand contraindications/precautions/ interactions

(n=108)	SD	D	NA or D	A	SA
Theory lectures	3.70%(4)	17.59%(19)	20.37%(22)	41.67%(45)	16.67%(18)
Tutorial	2.78%(3)	17.59%(19)	33.33%(36)	33.33%(36)	12.96%(14)
Integrated teaching	8.33%(9)	19.44%(21)	32.41%(35)	26.85%(29)	12.96%(14)
Clinical/Bedside teaching	5.56%(6)	14.81%(16)	28.70%(31)	33.33%(36)	17.59%(19)
Chi-square:13.245, df: 12, p > 0.05					

Table 10. Following teaching method helps to learn therapeutic uses of the drugs.

(n=108)	SD	D	NA or D	A	SA
Theory lectures	0.93%(1)	8.33%(9)	28.70%(31)	33.33%(36)	28.70%(31)
Tutorial	2.78%(3)	7.41%(8)	28.70%(31)	37.96%(41)	23.15%(25)
Integrated teaching	8.33%(9)	12.96%(14)	30.56%(33)	30.56%(33)	17.59%(19)
Clinical/Bedside teaching	2.78%(3)	6.48%(7)	35.19%(38)	32.41%(35)	23.15%(25)
Chi-square:16.876, df: 12, p> 0.05					

Table 11. Following novel teaching method helps in understanding the subject.

(n=108)	SD	D	NA or D	A	SA
Use of virtual teacher through computers	3.70%(4)	9.26%(10)	26.85%(29)	40.74%(44)	19.44%(21)
Use of audio tapes	8.33%(9)	12.04%(13)	35.19%(38)	24.07%(26)	20.37%(22)
Web based teaching/assignments	0.93%(1)	12.04%(13)	25.00%(27)	37.96%(41)	24.07%(26)
Use of regular mobile tips	4.63%(5)	14.81%(16)	33.33%(36)	28.70%(31)	18.52%(20)
Mobile interactions with teacher	5.56%(6)	9.26%(10)	25.00%(27)	37.04%(40)	23.15%(25)
Problem Based Learning	3.70%(4)	9.26%(10)	21.30%(23)	36.11%(39)	29.63%(32)
Use of animals in practicals	7.41%(8)	7.41%(8)	31.48%(34)	27.78%(30)	25.93%(28)
Computer Assisted Learning	0.93%(1)	1.85%(2)	27.78%(30)	33.33%(36)	36.11%(39)
Chi-square:48.67, df:28, **p< 0.01					

Table 12. Following novel teaching method helps in retention of the subject.

(n=108)	SD	D	NA or D	A	SA
Use of virtual teacher through computers	1.85%(2)	10.19%(11)	41.67%(45)	28.70%(31)	17.59%(19)
Use of audio tapes	5.56%(6)	13.89%(15)	30.56%(33)	35.19%(38)	14.81%(16)
Web based teaching/assignments	0.93%(1)	15.74%(17)	26.85%(29)	42.59%(46)	13.89%(15)
Use of regular mobile tips	1.85%(2)	19.44%(21)	36.11%(39)	22.22%(24)	20.37%(22)
Mobile interactions with teacher	2.78%(3)	13.89%(15)	32.41%(35)	28.70%(31)	22.22%(24)
Problem Based Learning	3.70%(4)	7.41%(8)	22.22%(24)	40.74%(44)	25.93%(28)
Use of animals in practicals	6.48%(7)	6.48%(7)	24.07%(26)	45.37%(49)	17.59%(19)
Computer Assisted Learning	0.00%(0)	5.56%(6)	32.41%(35)	32.41%(35)	22.22%(24)
Chi-square:59.08, df:28, ***p< 0.001					

Table 13. Following novel teaching method helps to pass the examination.

(n=108)	SD	D	NA or D	A	SA
Use of virtual teacher through computers	6.48%(7)	10.19%(11)	39.81%(43)	25.00%(27)	18.52%(20)
Use of audio tapes	10.19%(11)	13.89%(15)	37.04%(40)	29.63%(32)	9.26%(10)
Web based teaching/assignments	4.63%(5)	10.19%(11)	37.96%(41)	28.70%(31)	18.52%(20)
Use of regular mobile tips	3.70%(4)	14.81%(16)	31.41%(35)	28.70%(31)	20.37%(22)
Mobile interactions with teacher	3.70%(4)	10.19%(11)	32.41%(35)	24.07%(26)	29.63%(32)
Problem Based Learning	2.78%(3)	10.19%(11)	33.33%(36)	22.22%(24)	31.48%(34)
Use of animals in practicals	4.63%(5)	17.59%(19)	30.56%(33)	33.33%(36)	13.89%(15)
Computer Assisted Learning	0.00%(0)	4.63%(5)	44.44%(48)	23.15%(25)	27.78%(30)
Chi-square:55.43, df:28, ***p<0.001					

Table 14. Following novel teaching method helps in learning clinical applications of pharmacology.

(n=108)	SD	D	NA or D	A	SA
Use of virtual teacher through computers	2.78%(3)	5.56%(6)	43.52%(47)	30.56%(33)	17.59%(19)
Use of audio tapes	6.48%(7)	15.74%(17)	29.63%(32)	33.33%(36)	14.81%(16)
Web based teaching/assignments	1.85%(2)	9.26%(10)	35.19%(38)	34.26%(37)	19.44%(21)
Use of regular mobile tips	1.85%(2)	9.26%(10)	35.19%(38)	27.78%(30)	25.93%(28)
Mobile interactions with teacher	2.78%(3)	9.26%(10)	36.11%(39)	29.63%(32)	22.22%(24)
Problem Based Learning	0.93%(1)	10.19%(11)	34.26%(37)	32.41%(35)	22.22%(24)
Use of animals in practicals	6.48%(7)	10.19%(11)	25.00%(27)	43.52%(47)	14.81%(16)
Computer Assisted Learning	1.85%(2)	9.26%(10)	34.26%(37)	29.63%(32)	25.00%(27)
Chi-square:35.94, df:28, p > 0.05					

Table 15. Following novel teaching method helps in the long run.

(n=108)	SD	D	NA or D	A	SA
Use of virtual teacher through computers	3.70%(4)	15.74%(17)	34.26%(37)	22.22%(24)	24.07%(26)
Use of audio tapes	6.48%(7)	14.81%(16)	25.93%(28)	36.11%(39)	16.67%(18)
Web based teaching/assignments	2.78%(3)	12.04%(13)	29.63%(32)	28.70%(31)	26.85%(29)
Use of regular mobile tips	5.56%(6)	18.52%(20)	26.85%(29)	21.30%(23)	27.78%(30)
Mobile interactions with teacher	6.48%(7)	7.41%(8)	26.85%(29)	30.56%(33)	28.70%(31)
Problem Based Learning	4.63%(5)	9.26%(10)	25.93%(28)	29.63%(32)	30.56%(33)
Use of animals in practicals	14.81%(16)	9.26%(10)	29.63%(32)	32.41%(35)	13.89%(15)
Computer Assisted Learning	5.56%(6)	2.78%(3)	33.33%(36)	25.93%(28)	32.41%(35)
Chi-square:56.52, df:28, ***p < 0.001					

too many contents in the slides make it difficult to grasp. Didactic long lectures and involvement of more number of drugs hinders the learning.

Suggestions for improvement of teaching and learning of pharmacology in future include: introducing of Web/E-learning in the curriculum, increasing clinical pharmacology or bedside teaching of pharmacology, shifting from passive teaching (didactic lectures) to active teaching and learning, involving shorter classes (duration) and using audio-visual aids like animations depicting mechanism of action drug etc.

Present study indicated the merits and demerits of different teaching and learning methods used in pharmacology. This study will be helpful if any reformations/changes have to be brought into the teaching and learning methods of pharmacology. The use of electronic media has become common in medical colleges, as in other colleges and universities [32]. This study will also be helpful if some of the novel teaching and learning methods, as discussed, have to be introduced into the curriculum.

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