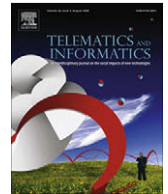




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Future's learning environments in health education: The effects of smart classrooms on the academic achievements of the students at health college

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ABSTRACT

The aim of this study is to determine the effectiveness of smart classrooms on the academic achievement of the nursing students. The sample of the research included 66 Health College students in Elazığ. The sampling group was randomly chosen from second year students of Nursing and Midwife Education. The research was carried out with experimental approach. The experimental group included nursing students and the control group, midwife students. Pre-test and post-test including questions regarding "internal diseases" course were applied to both groups. *t*-Test, percentage and frequency were used as statistical procedures for data analysis. The findings showed that lectures given through smart classroom significantly increases the academic achievements of the students. It is, therefore, reasonable to state that smart classroom applications are effective environments that can be used as an alternative and a supplement to face to face educational environments in the institutions where health education is given.

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1. Introduction

Recently distance education applications reap a great success among the current educational systems. Especially 21st century laid the groundwork for the constitution of distance education as an alternative and also a supplement to traditional educational systems. Among the distance education applications, smart classrooms can be said to be one of the cutting edge technology. Moreover, smart classrooms are advantageous with zero faults in the simultaneous distance education environments.

Stokes et al. (2008) conducted a study for the purpose of assessing the state of readiness for online and web-based learning of future health professionals at the University of Sheffield by electronically distributed survey prior to the establishment of a National Web-based Inter-professional Learning Network (WILEN). In this study, 191 valid responses were received. The survey results showed that only 62% of medical faculty students have access to an internet at home. Most of students (95.8%) check their e-mail every other day or more, and slightly less of them (82.8%) use the web frequently. Technologies identified as providing the technology for future on-line learning environments were generally not used: Internet Relay Chat (62.3% never use it), Message Forums (50.3% never use it) and Video-conferencing (94.2% never use it). However, encouragingly, 66% of students had used Computer Aided Learning packages. To sum up, most students do not have sufficient experience of on-line learning environments and future use of Continuing Professional Education material in this environment is, therefore, likely to be limited.

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Wijngaert and Bouwman (2009) in a study they conducted, described the case of wireless grids, as an emerging technology that enables ad hoc sharing of resources (such as screen, signal and microphone) on edge devices (such as PDA's, laptops and mobile phones). In smart classrooms all the sources and devices that Wijngaert and Bouwman mentioned in their study can be used. In the study they investigated the circumstances under which people are willing to share the resources on their edge devices using a technology with which they are not yet familiar. They collected data from students at a University in the North-eastern USA ($N = 284$) through a policy capturing design (also known as factorial design or conjoint measurement), and analyzed the information via multilevel regression analysis. This approach allowed us to explore factors that explain the use of emerging peer-to-peer technologies among consumers as well as context-related characteristics. Context-related characteristics, in particular trust in communication partners, explain the willingness to share and, consequently, the use of wireless grids.

There is a data system installed on today's education applications, from classical educational understandings to technology assisted educational understanding. Among these systems, distance education applications have been changing positively with every successive day. In distance education based nursing education applications, web based distance education applications and hybrid education applications were used. However; its lacking parts is still being discussed. In this study, it was aimed to remove these lacking parts experienced in the other distance education applications and to constitute the most effective classroom environments similar to the traditional classroom environments. It is believed that the smart classroom environments constituted in this way should have a structure that can share data immediately, can make it flexible and a structure in which equipmental problems can be eliminated. Teaching environments in health education with this aim were described as smart classrooms.

Smart classrooms were initially used in the fields of social and applied sciences in the world. In the field of health education, distance education studies were started as internet based but simultaneous smart classroom applications were not planned. It became an unavoidable educational approach from undergraduate level to the post graduate level in the field of health education, especially in the field of nursing and midwife.

One of the important reasons for making this research is that the concept of smart classroom in (health education) Turkey and in the world cannot be explained precisely. That is to say, the effects of them on students cannot be expressed clearly. For this reason, the study investigated the academic achievement of health college students' in smart classrooms in order to determine the effects of smart classroom on students.

The investigation of the applications used in smart classrooms for health education is important since, in the field of health education, distance education studies (web based, online, offline) provided efficiency in theoretical courses whereas it was deficient in application and experimental studies. This experimental study on smart classrooms, probably the learning environment of the future, was conducted to remove this deficiency and to investigate simultaneous health education applications. In this experimental study, the effects of smart classrooms on the academic achievements of the students in nursing education were particularly examined. The remaining part of this paper has five sections:

- The first section presents the literature review of research.
- The second section provides the methodology of research.
- The third section presents the findings and comments of research.
- The fourth section presents the Conclusion and Discussion of research.
- The final section outlines some suggestions for the effective use of smart classroom in distance education.

2. Review of literature

This section has three parts. The notion of "what is smart classroom?" is designed in the first section. Then the equipments of smart classrooms are discussed in the second section. In the final part, possible ways for teaching effectively in smart classrooms are represented.

2.1. What is smart classroom?

Rapid developments in internet-based platforms have added a new dimension to the concept of distance education. The cutting edge of this new dimension is the smart classroom environments which also consist of face to face communication. By integrating video conference applications, smart classroom environments form a new platform. Smart classroom is, therefore, a distance education application. In the light of the results of the research conducted, it is found that distance education applications developed depending on the smart classrooms give successful results when compared to the traditional educational systems. The concept of smart classroom has appeared in the distance education literature as a result of internet based education applications. However, how we have come to this degree on distance education applications is an important stage for us. It is seen that applications in distance education has been in eight steps since its beginnings. These are:

- Application of taking somebody to an examination from outside.
- To be based on written communication.
- To be based on radio and television.

- To be based on mass media.
- To be based on computer and multi-environment.
- Integration of individual and mass processes.
- Organization that is based on the integration of formal and mass educational institutions.
- Making the system of distance education global (Alkan, 1996).

The most important step among the ones listed above is global structuring. It is that, in this global structuring, new organizational schemas have appeared. Lastly, the concept which emerged along with internet based education systems has been expressed as smart classrooms.

The greatest difference between smart classrooms and the traditional ones is that all the things which happen in the smart classroom environment can be recorded and examined later. This process has been identified with the term smart. However, according to recent researches, smart classrooms, used in the distance education system, is described as the system which will raise the human computer interaction to the top level at many points for the instructors (Shi et al., 2002).

Concluding from the mentioned, smart classroom, in a general sense, is a new constitution which integrates electronic areas and human interface as well as technology and traditional teaching methods to form an innovative, advanced, flexible learning environment. Smart classroom gives great opportunity to share learning environment in the information age in which basic learning skills become much more important than the former training systems. Furthermore, it is the best configuration which makes distance points near and makes learning wide. In this configuration, it is seen that human computer interaction occurs at a high level (Ren and Xu, 2002) (see Fig. 1).

Smart classes environments are not only used in solely education environments but frequently in all kinds of meetings, museums and libraries and their applications as well. For example in Wang's study named as "Smart spaces: creating new instructional space with smart classroom technology", smart libraries were built by using smart Technologies. In this study, virtual teaching programmes were arranged and students were provided to meet with the library in a virtual environment (Wang, 2008). In another study conducted by Bryan Carter and Tim Linder named as Collaborative Learning Environments: Developing Smart Classrooms in Theory and in Practice, relationship between smart classes and cooperative learning was established and it also used in museology (Carter and Linder, 2006). Tulio Tiburcio and Edward F. Finch in their study named as "The impact of an intelligent classroom on pupils' interactive behavior" analyzed the effects of smart classes, a new learning environment, on the behaviors of primary school students. In their study, by using two new classrooms designed by INTEGER (Intelligent and Green) in two different UK schools, they investigated whether intelligent buildings (learning environments) can enhance learning experiences. Several factors were observed in the learning environments: mobility, flexibility, use of technology, interactions. Relationships among them were found indicating that new environments have positive impact on pupils' behavior (Tiburcio and Finch, 2005).

Taking into consideration the studies pre-mentioned, it can be concluded that smart classrooms are multi-purposed environments beneficial to several usage areas. However, a conceptual ambiguity can also be the issue since intelligent as well as smart was used interchangeably. Depending on our understanding smart is a term having more flexibility and more comprehensive equipmental infrastructure. Therefore, we chose to use smart term rather than intelligent in this study.

2.2. Smart classrooms and the equipment

As hardware and software, smart classrooms let the notes written during the live lesson automatically and slides, videos and audios captured automatically. For a change needed for better teaching and learning environments technologically, computer engineers, training specialist, professors, and students should gang together in the process of development (Winer and Cooperstock, 2002).



Fig. 1. Ideal classroom model that was developed for smart classroom environments (Numerus, 2006).

While many scientists who focus on innovative applications in the field of distance education discuss web applications in high education, the main agenda is application of mixed mode. These applications of mixed mode are some kind of integration of traditional face to face education model with tele-learning devices. The smart classroom project is relevant to three basic learning and teaching points listed below:

- (1) Professors' using different presentation modes to control the environment by forming a transparent interface.
- (2) Students' views about the content of the course, being able to criticize the materials and their synchronized interaction with the professors.
- (3) To evaluate the students with certain alternatives (Winer and Cooperstock, 2002).

In the chronological structure of smart classroom equipment, video conference applications take an important place. Smart classrooms are based on video conference applications. One of the first tries of video conference applications was held between two different geographies in the laboratory of Bell. This system was used to transmit an analogue TV channel which was full duplex. There were three cameras which saw the speaker in every conference room. There was an audio switching system which transmitted the output of the camera to other rooms. In the other room in which no one spoke, the image of all the participants was transmitted with the output of a fourth camera with a wide view.

Video conference systems based on digital transmission has come after this analogue type of studies. The Bell Company from Canada benefited from 45 Mbit/s of fiber lines between Montreal and Toronto in video conference system based on digital transmission. 2 Mbit/s of commercial video conference service opened in 1976, in France. In today's Europe, video conference systems has been designed and standardized by nearly ten countries. In two situations mentioned above, a structuring composed over satellite is a point at issue. However, the most important element which constitutes today's smart classroom environments is protocol of H.323, which is a kind of protocol that is IP based internet protocol over ISDN lines. Thanks to this protocol, there is no loss of data in the quality of audio–visual. Furthermore, the most important feature of this system is the usage of dynamic IP inside the local network. However to use a clearly static IP for distance access points in different geographies is a must. According to the education standards which were implemented as live broadcast which has been developed in the last 30 years (Cora, 1996). Another alternative hardware structuring classification is indicated in the Table 1 below by Middle East Technical University (METU) in Turkey. Classification of smart classrooms in four different ways at METU is a point at issue.

Type A: Well found smart classrooms. (A smart classroom in which joint meeting can be held over the video conference system, which provides live broadcast over internet and in which the courses that require internet and computer can be conducted.) This classroom is available at METU now.

Type B: Room of video conference (classes in which joint meetings can be hold over the video conference system).

Type C: A smart classroom which can do live broadcast (classrooms which provide live broadcast and in which infrastructure of wireless internet connection can be installed anytime if required).

Type D: Training classrooms with technological support (technologically supported classrooms in which curricular courses which require internet and computer can be given). The devices which are in smart classrooms that are classified in this way are shown in the table below (Kurşun and Karakuş, 2005).

2.3. How a lesson is given in a smart classroom?

In a smart classroom, a lesson is given in direct proportion with the need of appropriate hardware and software's being met. In this context, the instructor uses an electronic board in a smart classroom of which all the need is met. All the notes the instruc-

Table 1
Table of equipment category.

	A	B	C	D
Video conference device	X	X		
Live broadcast device	X		X	
Switch (Internet infrastructure)	X	X	X	X
Internet lines inside the classroom	X			X
Computer	X			X
Screen	X	X	X	X
Projection	X	X	X	X
Camera	X	X	X	
Video mixer	X		X	
Document camera (for printed document)		X		
White board	X	X	X	
Sound system	X	X	X	
UPS (electrical infrastructure)	X	X	X	X

Source: Kurşun and Karakuş (2005).

tor writes on this board are reflected to the students' computers and the students save these notes by means of word processing package programs to their computers or flash discs that they carry with them. The students can revise the topic anywhere outside the classroom by saving audio visual frames besides text contented data with these discs. The instructor can see the applications of the students on his/her own computer while distributing the notes to the students' computers and he will provide information about interaction between the students and applications also let the students interact with each other. In such training, no matter what high technology is used between the instructor and the students, the environment of classroom in face to face education will be supported in a way. We call such classroom applications smart classrooms with the instructor.

Furthermore, at McGill University, in Canada, in the smart classroom, digital notes written on the board can be presented online on internet synchronized with the audio–visual recordings of the instructor by means of cameras. Designs and developments of smart classrooms at McGill University started in 1999 fall semester and this application amazed everyone. First of all, a room in McConnell engineering building was equipped with audio–visual electronic board which can be recorded by a computer, VCR and digital pencils. The system was fixed perfectly in every lecturer's rooms and the lecturers could make presentations in their rooms by means of computers. Two things were achieved in this way (Winer and Cooperstock, 2002). First, transparent interface emerged for multi-class environments, which the lecturers want. Next, students save all types of presentations, slides and lecture notes on internet automatically.

In a few studies conducted about smart classroom, the required equipments, the use of these equipments, how the lectures are presented, and the comparison of smart classrooms were investigated. In this study, for the first time, the issues of how smart classrooms affect the academic achievement of students and how the classroom environments of the future will be arranged are dealt with.

3. Methodology

3.1. The aim of the study

The main aim of this study is to determine the degree of the effectiveness of smart classrooms on the academic achievement of the nursing students. To this end, the answers to the following questions will be investigated. Is there a difference between the academic achievement of the students who receive training in smart classrooms (Experimental group) and those in traditional ones (Control group)?

An experimental and a control group were formed as the essential of experimental research model. While forming the experimental and control group, great care was given to include students having similar features in the experimental and control group. In the formation process of these groups, the average scores of four semesters and the average scores of the third year students in Health College of Elazığ, Nursing and Midwife in the course 'internal disease' (Analysis of Cluster) were taken into consideration. Internal disease course took four weeks. The course was given by experienced lecturer who had been teaching this course for 9 years in the smart classroom in The Informatics Lab of Firat University.

3.2. Sample of the study

Students of Health College of Elazığ (80 students) constitute the sample of the research. The sampling group included 66 students chosen from students in the second year of Nursing and Midwife Education. The study started with 80 students studying in Health College of Elazığ. Fourteen students were excluded from the study due to their financial problems.

After excluding those students not having taken both pre- and post-tests, and those not attended to the course regularly the study was completed with 66 students (see Table 2).

After determining the research sample, the equipments used in smart classroom environments were installed in two informatics laboratory different from each other in terms of node. Video conference devices, microphones, overhead cameras, background cameras were placed in these laboratories. After the classes were prepared, in one classroom lectures were given under teacher supervision while in the other classroom lectures were given only with image transfer. In both classrooms, no problems were experienced in terms of co-operation, presentation of the lectures, sound pollution and the speed of image transfer. Dynamic internet protocol (IP) was used in this study since it was a in-campus application.

3.3. Data collection tools and data collection

In order to collect data, academic achievement test was used to evaluate the students' academic achievement in the course named "internal diseases". The academic achievement scale used in the study initially consisted of 37 items. The

Table 2
Determining the system and sampling groups.

System/sampling	System	Sampling	Experimental	Control group
Nursing Class 2	42	33	33	33
Health officers Class 2	38	33		
Total	80	66		

items were related to issues covered in internal disease course (see Appendix for some exemplary items). The scale was applied to 84 students who took the internal disease course before for reliability and validity check. After this process, 7 items were removed. The test (scale) was found to be average strong, at the level 0.54, and determined to be an ideal measurement tool. As a result of the calculations, reliability factor of the measurement tool was considered to be a tool having a reliability factor as high as KR-20 = 0.90.

The academic achievement scale was applied to students twice as pre-test and post-test in 2005–2006 years fall semester. The pre-test was applied at the beginning of the course and the post-test after four weeks of instruction given to both groups.

3.4. Data analysis

In the data analysis section, the operations below were completed. Data obtained from pre-applications and post-applications were processed with computer based statistical package programme. When there were two variables in processing data relating to the academic achievement of the subjects, *t*-test of dependent groups and independent groups was applied. Percentage and frequency statistics was performed to determine the opinions concerning the attitudes.

4. Findings and comments

4.1. Findings and comments concerning the first sub-aim

In the findings chapter concerning the aim, the relation between the experimental and control groups will be evaluated in terms of the differences between pre-test and post-test scores belonging to the experimental and control groups and access scores. So, the academic achievement scale between the smart classroom environments and traditional classroom environments will be revealed.

4.1.1. Is there a difference between the scores of the experimental group's pre-test and post-test?

In order to show whether our experimental study have an effect on the academic achievement scores of students in the experimental group, *t*-test was performed to see the difference between the scores of paired groups in the tests given at the beginning and at the end of the lesson (Table 3).

As seen in the Table 3, there is a meaningful difference between the scores of the experimental group students' pre-test ($\bar{X} = 56.69$) and post-test ($\bar{X} = 81.42$). Furthermore, according to the results of the *t*-test (*t*: 12.56) a meaningful difference at the level of $p < .05$ was obtained between the average scores of pre-test and post-test of the experimental group. This result shows that smart classes are effective on the student's academic achievement.

4.1.2. Is there a difference between the pre-test and post-test scores of the control group?

In order to show whether our experimental study have an effect on the academic achievement scores of students in the control group, *t*-test was performed to see the difference between the scores of paired groups in the tests given at the beginning and at the end of the lesson (Table 4).

As seen in the Table 4, there is a meaningful difference between the scores of the control group students' pre-test ($\bar{X} = 45.21$) and post-test ($\bar{X} = 70.24$). Moreover, according to the results of the *t*-test (*t*: 12.13), there is a meaningful difference at the level of $p < .05$ between average scores of pre-test and post-test of the control group. This result shows that there is also an increase in the academic achievement scores of the students in the traditional classrooms; however, this increase is not as much as the one in smart classrooms.

Table 3

Academic achievement score averages of the experimental group's pre-test and post-test and the results of *t*-Test.

	<i>N</i>	\bar{X}	Sd	df	<i>t</i>	Significance level*
Pre-test	33	56.69	11.95	32	12.56	.016
Post-test	33	81.42	8.06			

* $p < 0.05$.

Table 4

Academic achievement score averages of the control group's pre-test and post-test and the results of *t*-test.

	<i>N</i>	\bar{X}	Sd	df	<i>t</i>	Significance level*
Pre-test	33	45.21	11.51	32	12.13	.006
Post-test	33	70.24	11.42			

* $p < 0.05$.

Table 5Academic achievement score averages of the experimental and control groups' post-tests and the results of the *t*-test.

Groups	N	\bar{X}	Sd	df	<i>t</i>	Significance level*
Experimental	33	81.42	8.06	64	4.59	.000
Control	33	70.24	11.42			

* $p < 0.05$.**Table 6**

Summary table of the academic achievement scores.

	Pre-test \bar{X}	Post-test \bar{X}	<i>t</i> -Test	<i>P</i>
Experimental	56.69	81.42	12.56	0.016
Control	45.21	70.24	12.13	0.006
<i>t</i> -Test	3.97	4.59		
<i>P</i>		0.000		

4.1.3. Is there a difference between the post-tests of the experimental and control groups?

t-Test of independent groups was performed in order to determine whether or not there is a difference between the post-tests of the experimental and control groups. Data relating to this section is given in the Table 5.

It is clear from the table above that there is a difference of 11.18 points in terms of in arithmetic mean between the experimental and control groups concerning the academic achievement of the experimental group ($\bar{X} = 81.42$) and the control group ($\bar{X} = 70.24$). It is also clear that there is a meaningful difference at a level of $p < .05$ ($p: .000$) concerning whether there is a difference statistically ($t: 4.59$).

According to the results shown in Table 6 below, there are significant differences between the scores of post-tests. These results are the indicator of model smart classrooms' giving similar results with model traditional classrooms on the effect of academic achievement. At the same time, the teaching environments belonging to these two groups can be considered as equal. This result is considered to be an adequate result to form a meaningful difference. The summary concerning the results of the analysis about academic achievement scores is given in the Table 6.

According to Table 6, there are meaningful differences within the groups between traditional classes (control group) and smart classes (experimental group) in terms of averages scores of academic achievement. Such a difference indicates that smart classes are important in increasing the academic achievement. It can be concluded that such an increase in the academic achievement results from smart classes being motivating, and striking during the lesson.

5. Discussion–conclusion

5.1. Discussion

This study has investigated the concept of smart classroom and what it is like. Given that previous studies are mainly related to a pure description of what kinds of hardware and software that a smart classroom has, this study has further contributed to our understanding of how a lesson can be taught in such a classroom. This study is different from those studies conducted on this subject in terms of the importance it gives to the academic achievement of students in these classrooms.

Smart classrooms are superior to traditional classrooms since it has a more motivating effect on students. Because students are lectured in a new and innovative environment, smart classrooms help to arouse students' interest and motivation to the lectures. It is clear that increase in the motivation and interest of the students to the lectures will help to improve the academic achievement of the students.

This study focused on the academic achievement of the students lectured in smart classes in contrast to other studies which especially focused on the equipments used in these classrooms. This study, therefore, helps to gain insight into the students' achievements. Moreover, it also shed light on how the lessons should be presented in order to be more effective.

5.2. Conclusion

In recent years, the uses of distance education systems in all kinds of education have been increasing. One of the tools for distance education system is probably smart classrooms, simultaneous classroom environments. It is, therefore, important to increase the effectiveness of smart classroom to enhance the learning environment in distance education. In many previous studies conducted, smart classroom assisted distance education systems show success similar to those of traditional ones. The pre- and post-test results of academic achievement tests of our study clearly prove what is stated above. However, the use of smart classrooms in health education is limited. It is, therefore, important to increase the use of smart classroom systems in the health education for training qualified students in the fields of nursing and midwife.

In the view of the results of this study, it is clear that academic achievement averages of the students who received training in smart classroom environments increased doubly compared with those who received training in the traditional educational environments. Such an increase in the academic achievement scores will certainly be a motivating factor for the students of nursing since success is one of the indispensable part that has a motivating effect on students. Therefore, it is wise to integrate smart classrooms, one of the important components of distance education systems, into the health education to improve the motivation of students in this field.

In conclusion, this study which was conducted as technology-based in the field of health gave positive results about the use of smart classrooms in the fields of nursing and midwife when they used with effective teaching strategies and methods. This means that smart classrooms, an essential part of distance education, will not be as useful as desired when it is merely perceived as a technological development. Instead, the technological aspect of smart classrooms should be accompanied by effective teaching strategies and methods. A combination of all of these will certainly be more effective in health education to train more qualified students in the fields of nursing and midwife.

6. Suggestions

The suggestions expressed below in the result of this study emphasize the integration of the students receiving training in the field health education with information technology:

- Smart classroom environments provide standard constitution and improvements in the development of global health applications in the field of health education.
- Smart classrooms should be used as an effective tool in order to provide a quick globalization in the field of health education throughout the world.
- Smart classes should be equipped flexibly depending on the type of the training to be given in the field of health education.
- Smart classroom environments should be integrated with appropriate teaching design models and goals of health education.
- Smart classrooms should not be confused with video conference classrooms conceptually from the view of efficiency in the learning and teaching environments.
- Smart classrooms should show parallelism with artificial intelligence applications.
- Other teaching strategies should be used effectively with the equipment used in the smart classroom.
- In order to increase the effectiveness in learning, smart classroom environments should be used flexibly.

Appendix A. I. Scales of academic achievement

1. In which illness, kidneys can't discard body's metabolic wastes and loses its capacity of arranging liquid electrolyte equilibrium irreversibly?

- (A) Nephrotic syndrome
- (B) Glomerulonephritis
- (C) Nephrosis
- (D) Chronic kidney insufficiency
- (E) Acute kidney insufficiency

2. To which organ do proximal and distal tubes belong?

Proximal tube	Distal tube
(A) Kidney	Urinary bladder
(B) Ureter	Urethra
(C) Urethra	Kidney
(D) Kidney	Kidney
(E) Urinary bladder	Urethra

29. What does happen if the speed of glomerular filtration becomes 20–25 ml. per second?

- (A) Kidney insufficiency doesn't make a symptom.
- (B) Uremic symptoms appear.
- (C) Last period kidney insufficiency develops.
- (D) Anemia develops.
- (E) None of the above.

30. In which item, is the formation order of urine given correctly?

- (A) Tubular secretion – glomerular filtration – reabsorption.
- (B) Glomerular filtration – reabsorption – tubular secretion.
- (C) Glomerular filtration – tubular secretion – reabsorption.
- (D) Reabsorption – glomerular filtration – tubular secretion.
- (E) Reabsorption – tubular secretion – glomerular filtration.

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