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A Mobile-Based Instruction Application: The Effect of Mobile-Based Concept Instruction on Academic Achievement, Retention and Attitudes of Students

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Abstract
The main purpose of this study was to examine the impact of concept teaching that was designed according to Component Display Theory(CDT) in web environment on the students' academic achievement, retention, and attitudes. Pretest-posttest experimental design was used in the study. Independent variables of the study were mobile-based learning in which component display theory was applied and mobile-based learning in which traditional instruction was applied. Dependent variables were academic achievement, retention and attitudes toward mobile-based instruction.
The study covered 72 students at the faculty of commerce and tourism, the department of office management education. In the study, the statistical significance level was set at 0.05. In data analysis, frequencies, percentages, averages, and standard deviations were calculated and for group comparisons, t-test was used. Experimental and control groups were assigned impartially, as those with smart phones and those without smart phones. According to the study findings, in terms of academic achievement, at the beginning there was not a significant difference between groups but at the end of the treatment, there was a significant difference in favour of treatment groups.
In conclusion, the impact of the instruction based on CDT in mobile environment on the students' achievement, retention and attitudes was supported and proved by the study findings including statistical analyses.
Key Words: m-learning, Component Display Theory, concept teaching, Mobile–Based Instruction,

1. Introduction

It is accepted by all circles that the conventional educational institutions are inadequate in training the ever-increasing World population. This fact became very influential in researching better ways of delivering quality education to wide range of population in an economic manner. One of the ways used in meeting the increasing demand is Web-Based Instruction(Keser, 2000:23;Eryılmaz, 2009:27;Şahan,2005:45). According to Yalın(2008:2) as a synonym to the internet-based instruction, there are also terms and concepts such as internet-based learning, web-based learning, distance learning. Although there could be some slight differences among these terms, these terms could mostly be used in an exchangeable manner(Alkan,2005:56;İşman,2003).
In the literature, studies with a focus on mobile-learning associate mobile-learning with the concept of e-learning. Trifona and Ronchetti(2003) define mobile-learning as a type of e-learning in which the subject matter is presented thorough wi-fi portable communication tools. The literature hosts a number of studies on the design and use of e-learning settings(Kuzu et. al., 2011).
As the rapid growth in mobile technology affects every aspect of our lives, learning settings go on keeping up with the growth in a similar manner(Attewell, 2005; Kim et. al, 2008; Zhang, 2008). Mcconatha, Praul and Lynch(2008) suggest that the first studies on mobile learning started in the early 2000 and there was tremendous increase in the number of the studies as of the early 2000s. Considering the fact that more than half of billion cell phones have running internet Access, it is clear that the interests in the studies(Kukulska-Hulme, 2008a) questioning the merit and the usefulness to the learners will accumulate.
In this present state of mobile learning (hereafter referred to as m-learning), the fact that learners have and use their own devices in m-learning setting(Traxler, 2011) will relocate training and education in a new dimension and space as well as time. The reason for this is that individuals are able to Access the information desired in mobility besides using the e-learning resources even without an Access to computers.
Patten, Sanchez and Tangney(2006) hold that m-learning is a powerful concept to such an extent that it could incorporate individual learning and other learning styles under the same roof. In this way, Access to information, irrespective of time and space, could be possible. Quinn(2001) noted in a similar manner that wi-fi and portable devices could be used anywhere with an aim to learning and underlined that one to one interaction with the device and the owner is of great significance in terms of learning settings.
In the words of Ally(2009:281) "the main obstacle is how the learning materials developed by the instructors are presented on the mobile devices. Learning materials should be developed by making use of manageable learning components and multimedia". In applying the WebSphere Testing Environment to education system, there have been different theories employed, one of which is Component Display Theory(CDT).

2.1. Component Display Theory

CDT was proposed only for the cognitive learning and it is a micro-level strategy investigating the instruction of a principle or process, excluding affective and psycho-motor domains. One of the most important features of the theory is its classification of achievement levels and content type. Merrill, in 1983, put forward the Component Display Theory and divided the theory into two; Descriptive Component Display Theory and Prescriptive Component Display Theory.

CDT could be explained as a theory which deals with cognitive domain of instruction and micro level strategies (concept, principle instruction) and a theory which presents special instruction techniques in order to teach a principle or process. In the development of the theory, inefficiencies in the hierarchical classifications of parts-to whole by Gagne and the approach of zoom-lens guided the way. In-depth studies suggested that classifications proposed by Ausubel, Bruner, Scandura, Merrill, Norman et. Al. Were in harmony with the approach of zoom-lens(Reigeluth, 1987:245).

On the other hand, CDT is a theory composed of the components of instructional deliveries, rather than a method. On the whole, CDT is made up of three stages; two-dimension behaviour-content classification system, types of presentations and the relations between the types of presentations.

Nearly in every concept instruction method, there are elements such as the definition of the concept, examples, presentation of non-examples and exercises related to them. As for the model proposed by Merrill, there are the same elements as well as detailed propositions about the level of instruction of a concept, the array of instruction of the concept in an order.

The theory specifies that instruction is more effective to the extent that it contains all necessary primary and secondary forms. Thus, a complete lesson would consist of objective followed by some combination of rules, examples, recall, practice, feedback, helps and mnemonics appropriate to the subject matter and learning task. Indeed, the theory suggests that for a given objective and learner, there is a unique combination of presentation forms that results in the most effective learning experience(Merrill, 1994:163-175). The rules used in the prepared course materials for the web and mobile environment and about the concept teaching are given in the course material part.

Compared to other concept instruction methods, the level of the concept instruction, the content elements to be delivered, their order, and the points to consider in the presentation, evaluation (behavioural) of the content are elaborated in a detailed manner. In studies on this model of instruction, conducted by Eryılmaz(2009), Dede(2004) and Karataş(1999), it has been revealed that the instructional strategies developed by Merrill are effective.

In a study by Shih, Li and Hung (2007), they used cell phones to view the instructional materials. The result of the study suggested that there occurred some problems such as limited viewing area, slow processing and limited storage capacity. According to Mcconatha, Praul and Lynch(2008), limited accessory equipment and software problems are the major factors in the failure of the m-learning environment. Wagner(2005), in a similar way, concluded that the most important obstacle in the widespread use of mobile learning is the equipment problem.

2.2. Mobile Learning

Mobile learning is both a new concept and one that has some familiar connotations. It is certainly concerned with learner mobility, in the sense that learners should be able to engage in educational activities without the constraints of having to do so in a tightly delimited physical location. To a certain extent, learning outside a classroom or in various locations requires nothing more than the motivation to do so wherever the opportunity arises-from books, electronic resources, places and people. What is new in “mobile learning” comes from the possibilities opened up by portable, lightweight devices that are sometimes small enough to fit in a pocket or in the palm of one’s hand. Typical examples are mobile phones smartphones, palmtops and handheld computers(Personal Digital Assistants / PDA), tablet computers, laptop computers and personal media players can also fall within its scope. These devices can be carried around with relative ease and used for communication and collaboration, and for teaching and learning activities that are different from what is possible with other media(Kukulska-Hulme, 2005).

The growing popularity of the term “mobile learning” brings with it a shift in focus that may impact on educators and trainers: it is mainly learners who carry the mobile devices and move around with them, whilst the term mobile teaching is hardly used at all. Much of the current work with mobile technologies, especially in schools, is in fact on personal connected learning. It takes place in the classroom and exploits the synergy between active whiteboards, data projectors, personal digital assistants, and networked desktop PCs, so is not strictly mobile learning(Kukulska-Hulme & Traxler, 2005).

Mobile learning must exploit the potential of different technologies to support different learning activities differently, from attracting, engaging, attending, delivery, assessment, all the way to revision. Clearly, the usability constraints of most mobile devices play to the bite-sized character of some revision and the spontaneity informality of mobile devices is useful in the attracting phase. Designers and developers of mobile learning must,

however, also exploit the spontaneous and opportunistic nature of learning on the move, alongside the more structured and premeditated approaches to learning the mobile learners may adopt.
Given the variety and uncertainty of work on learning styles, any learning material needs to be accessible by a number of routes in a number of ways, and possibly, for a number of purposes; learning material must be designed redundantly. Once the specifics of designing and navigating mobile web pages are better understood, there may be the chance to look at richer ways of accessing content, where perhaps its organization and navigation could match the diversity of its users.
Learning through mobile devices has some disadvantages because of small screens and keypads. If an educational material is text-intensive, due to the necessity of scrolling on a small screen, a learner's performance, satisfaction and effectiveness may be negatively affected(Jones, Buchanan & Thimbleby, 2003). Therefore, learning content designed for mobile devices should include less text than what is used for other types of material. To compensate for the reduction in text, more audio can be used to support learning. Moreover, graphics, animations and videos also can be used to develop learning materials for mobile devices. It is clear that further research is needed to illuminate the advantages and limitations of using mobile devices for appropriate learning pedagogies.
This paper focuses on the learning environment, and the use of mobile devices in the programming lectures from the viewpoint of instructors.
The main objective of the study is to investigate the effect the instruction of concept designed according to the CDT in mobile environment on academic achievement, attitudes and retention of students. To reach the mentioned objective, the sub-objectives given below have been planned:
1. To test whether there is statistically significant difference between the academic achievement of the students in the control group, who were delivered mobile based education by CDT and experiment group, who were delivered web-based instruction.
2. To test whether there is statistically significant difference between the retention scores of the students in the control group, who was delivered mobile based education by CDT and experiment group, who were delivered web-based instruction.
3. To test whether there is statistically significant difference between the attitudes of the students in the control group, who was delivered mobile based education by CDT and experiment group, who were delivered web-based instruction.

2. Method

Data were analyzed using computer program of SPSS for Windows (Statistical Packages for Social Science). Data were encoded as available to objectives and arranged to statistical analysis.
Achievement test (AT) and Attitude Scale (AS) were used in the measurements in experimental group and control group at the start of the study and at the end of the study. AT scale was used to measure the academic achievement of students in measures of the pretest and posttest and the permanence of learning in retention test; AS was used to measure the students' attitude toward Mobile-Based Instruction(MBI). In data analysis;

- Frequency (f) and percentage (%) in statistics about demographic characteristics of students in experimental and control groups,
- Frequency (f), percentage (%), standard deviation (S) and arithmetic mean ($\overline{X}$) in statistics about the scores of pretest, posttest and retention tests of students in experimental and control groups,
- Student t-Test to compare the differences of achievement and attitude scores of all students in pretest and to determine whether the difference among averages is a significant,
- Single factor analysis of covariance (One Factor ANCOVA) to compare the achievement scores of all students in posttest and to test the significance of difference among scores of posttest. In all statistical analysis the significance level is based on 0.05.

The first factor of the pattern of this study, whose purpose is to examine the impact of teaching about the academic achievement, retention of learning and attitudes of students according to mobile-based CDT, is "to be in different groups (experimental group – control group)" and the second factor of the pattern of this study is "measurements about dependent variables (attitude, achievement and retention)" (Büyüköztürk, 2001). In the field of education the experimental studies generally investigate which method could give better results between two or more methods, which were used for a specific purpose (Kerlinger, 1986:370).
The study was designed by "experimental type with pretest-posttest control group". Dependent variables of this study are academic achievement, retention and attitude; and independent variables of this study are teaching environments, which were prepared by web and mobile-based CDT.
The experimental group and control group were created by taking note of impartiality rule for carrying out the research. The experimental group consists of the students in lesson, which was prepared by CDT in units of "Arrays" and "Sub Procedure" in the course of "Programming Language - I"; the control group consist of

student who aren't in lesson, which was prepared by CDT in units of "Arrays" and "Sub Procedure" in Lesson of "Programming Language - I". The students of control group participate to normal education in web environment. Pattern about research model is given in Table 1:

Table 1. The Pattern of Research's Model

Group	Appoint	Pretest	Application Process	Posttest	Retention
Experimental Group	R	$PREA_1$ $PREE_1$	MBI+CDT	$PSTA_2$ $PSTE_2$	$PRER_1$
Control Group	R	$PREC_1$	WBI+TT	$PSTC_2$	$PSTR_2$

R : Impartial Appoint
MBI : Mobile – Based Instruction
WBI : Web – Based Instruction
CDT : Component Display Theory
TT : Traditional Teaching
$PREE_1$: Pretest of Experimental Group's Achievement
$PSTE_2$: Posttest of Experimental Group's Achievement
$PREC_1$: Pretest of Control Group's Achievement
$PSTC_2$: Posttest of Control Group's Achievement
$PREA_1$: Pretest of Mobile-Based Instruction Attitude Scale (MBI-AS) of Experimental Group
$PSTA_2$: Posttest of Mobile-Based Instruction Attitude Scale (MBI-AS) of Experimental Group
$PRER_1$: Retention Test of Experimental Group
$PSTR_2$: Retention Test of Control Group
Achievement : Level of Achievement in end of the teaching
Attitude: Level of Attitude about mobile/web-based instruction
Retention: Level of Achievement after 2 weeks from end of the teaching

3. Participants

Participants of this research are students who are sophomore in Lesson of "Programming Language - I" in Department of Office Management Education in The Faculty of Commerce and Tourism Education Faculty at Gazi University, in the educational terms of 2011-2012. In total this class has got 72 students. All of students attend the course of "Programming Language - I" and they were separated randomly and impartially by the criterion whether they own a smart phone or not. Participants consists of experimental group (38 students) and control group (34 students) and pre-test was conducted on these groups.

Those who participated in the lessons using mobile based instruction represent experimental group and those who did not represent (Web-Based Instruction) control group. The experimental study lasted four weeks.

Cohen suggested that in experimental works should cover minimum 34 participants at 0.05 of significance level for each group(Cohen, 1988:313). In this study experimental group consisted of 38 students; and control group consisted of 34 students, too. In addition, significance scale was 0.05. In other words, the number of students in each two groups is enough for the experimental study.

3.1. Materials and Design

In this study that was prepared to determine the effect about achievement of students, attitude of students and retention of teaching in the course of "Programming Language - I", the content was prepared separately for mobile and web environment. The instructors administered a questionnaire to find out in which units the students had difficulty and for which concepts. And hence, Array and Sub-procedure units were selected, since it was found out that these two were the subjects students had difficulty with. ,

Flash, Ajax, VB.NET and Mobile programming languages were used for preparing the content of teaching. The students in the experimental group had overwhelmingly smart phones with Iphone OS or Android OS, for which course content for mobile devices were prepared. The software of Distance Learning Management System (Enocta v5.30) that was used in Vocational School of Distance Education in Gazi University was used in experimental group and control group.

In the teaching of the concepts, students were presented with the definition of the concept, the defining character of the concept, the relations between the features of the concept, and the samples of the concept under consideration. Within the scope of concept instruction, it has been argued which of these will provide the most effective and efficient delivery of instruction(Karataş; 1999:92).

During the instruction of concept based on CDT, as well as primary presentations, secondary presentation types such as prerequisite behaviour, feedback, representation, memory support and help were used in the content of the lesson. Besides, in the process of instruction in the experimental group, secondary presentation types were used.

The course contents prepared in a manner that will last 10 and 12 minutes. Students were asked to follow the

course material through their smart phones three times for ten minutes in each lesson during the four weeks. On the other hand, the students in the control group were asked the course content prepared in web environment through their computers during the four weeks.

4. Procedure

4.1. Implementation of the Experiment

Content in experimental group was prepared by CDT; and macro and micro strategies were used by presentation type of this concept. The methods were clarified to prepare the contents of lesson.

1. Content was determined to design the contents of lesson by CDT and to realize the general purposes of lesson. Lesson of "Introduction to Programming has got the procedural content type(Patten, Chao and Reigeluth, 1986:446). In this way content was prepared as procedural structure and the steps were determined to teach the concepts from easy to difficult and from simple to complex(Reigeluth, 1987:249).

Before teaching process the basic principles, which are in prepared documents, theory was presented to two experts in this field. These experts investigated the prepared documents and then proofreading about content was performed.

Merrill, subsequent to indicating the primary presentation types based on the behavioural levels, clarified what sort of information will be presented within the scope of GA, ÖrA, ÖrB and GB primary presentation types. Considering this, there are four types of presentations(Table 2).

1. Expository Generality (EG-GA),
2. Expository Instance (Eeg-ÖrA),
3. Inquisitory Instance (Leg-ÖrB),
4. Inquisitory Generality (IG-GB).

Table 2. Content-primary Presentation Type consistency

	Primary presentation			
CONCEPT	GA Generalization	ÖrA Sample	ÖrB Sample exercise	GB Generalization exercise
	Definition	sample	classification	Creating definition
	.name . high-order features . relations	.name .object, event, symbol .showing features	. new object, event, symbol .showing features .representation ?(name)	.name .transformation or recitation ? (definition)

In the presentation of GA, there is information with the definition of the concept. The concept to be taught, name, high-order concept, features and the relations between the features should be delivered to students.

In the presentation of ÖrA, there is information on the sample of the concept. Presented the The name of the concept, its example as object or event, the features based on the new sample, students should show the features of the concept and asked to classify them.

In ÖrB exercise, there is the performance of the concept sample. Students are presented a new sample of the concept and they should be asked to show the new features of the concept over the new example or classify the new samples.

In GB exercise, there are exercises on the definite of the concept. The name of the concept should be given as it is or stated differently and then students should be asked to differentiate these or give the definition of the concept. Besides, Merrill, within the framework of CDT, developed some proposals on what secondary presentation types could be used with the primary presentation types.

2. Related processes, concepts and principles were presented as generalization during training. While in courses usually the expository approach was used, inquisitor approach was used to solve especially the problem about units of "Arrays" (Merrill, 1994:121). Presentation of knowledge was based on expository approach; practice and assessment were based on inquisitive approach. Then Primary Presentation Forms, which were used about related purposes, degree of content (difficulty degree – simplicity degree), characteristics of students and interaction of course for each generalization, and Secondary Presentation Forms, which were used to facilitate the understanding of contents for students, were used (Merrill, 1983:312). As mentioned earlier in micro level education the teaching of any content's unit (anyone of concept, principle or process) consisted of three of PPTs. There are generalization, sample and practice (Merrill, 1994:215; Köymen, 1996:38). In addition the instructions that were proposed by Merrill (1994:215) and are given below were considered.

These;

a. Practice is the better than one example,
b. Practice is the better than one rule,
c. One rule and example assist in teaching uniformly,

d. Two or more presentations are the better than only one presentation,
e. Generalization + sample + practice are the better than the combination of only two presentations.

Order forms of these elements were valid in teaching of content's unit and at the end of the teaching the learning levels may be differentiated by ranging in different ways of these three items (Patten, Chao and Reigeluth, 1986:445). For example, while generalization + sample are used for outcomes in "use" level, sample + generalization are used for outcomes in "find" level. Different sorting of PPTs were in this study. Secondary Presentation Forms consisted of;

- Expository Generality information (EGi-GA'i),
- Expository Generality prerequisites(EGp-GA'öd),
- Expository Generality mnemonic (EGm-GA'bd) ,
- Expository Generality representation(EGr-GA'tem),
- Expository Generality attention help (EGh-GA'y)

In this content elaboration of example was used; examples were carried out by colorization, arrows, drawings and multiple forms of presentation (ÖrA'y ve ÖrA'tem). Students were encouraged to find sample and generalization. In relation to them;

- Students show the generality on a specific sample (GB'y),
- Presentations which consist of precondition knowledge about generality are wanted by students (GB'i),
- Students plot the illustration about generality (GB'tem),
- Student find the sample (ÖrB'y),
- Students present the sample in different ways (ÖrB'tem) and different teaching strategies were used with all of content.

Merrill clarified that using of three presentation types in the same time (rule + sample + practice) result is the best than the other usages (1994:169). In this study while the concept was taught, presentations of sample and practice was used. Teaching levels of concepts and presentation types of concepts were shown in the following list. In this study the concept teaching;

Rule 2:
Performance level : Remember Instance
Content type : Concept
Primary Presentation Forms : Eeg + leg + leg
Rule 3:
Performance level : Remember Instance
Content type : Procedure
Primary Presentation Forms : Eeg + leg + leg
Rule 5:
Performance level : Remember Generality
Content type : Concept
Primary Presentation Forms: EG + Eeg + IG.p + IG.p
Rule 6:
Performance level : Remember Generality
Content type : Procedure
Primary Presentation Forms : EG + Eeg + IG.p + IG.p
Rule 9:
Performance level : Use
Content type : Procedure
Primary Presentation Forms : EG + Eegs + Iegs.N + Iegs.N
Rule 11:
Performance level : Find
Content type : Concept
Primary Presentation Forms : Iegs.N + IG.N + Iegs.N + IG.N Primary Presentation Forms were examined as the list. In presentation of content the following points were considered to practice and assessment (Merrill, 1994:153-157).

Divergence : Divergence means that the critical characteristic of subsequent instances should be as different from each other as possible.

Range Of Difficulty : For almost any concept, procedure or principle some of the instances are more easily classified, executed or explained than others. If a student is presented all typical examples, there is a tendency to undergeneralize, and thus to fail to adequately perform when difficult instances are presented.

Matching : Matching means that the nonexample should be selected in such a way that it enhances the student's ability to discriminate among characteristics that are relevant and those that are not relevant. Matching takes

different forms for the different types of content. For a concept, matching exists when all of the irrelevant or variable characteristics of the example and the matched nonexample are as similar as possible.
Isolation : Primary and secondary presentation forms have been identified for the purpose of analyzing and describing instructional presentations.
Fading : Fading indicates that information added to the instruction to facilitate learning during the early stages of instruction should be gradually replaced by directions to the student to increase their own level of mental processing.
Chunking : Learners have limitations on short term processing. It has been demonstrated that a learner can adequately process seven or fewer discrete pieces of information at a given time.
Random order : Random order means that on subsequent presentations, the order of the items is changed according to a random pattern to eliminate such extraneous but irrelevant cues to learning.
Sequence : When learning a large number of steps in a procedure or events in a process, it is difficult for a learner to acquire all of these elements at one time.
Criterion : Criterion refers to the accuracy of a learner's responses in practice or testing.
Response Delay : How soon a learner responds in a given situation also varies with the type of learning involved.
Learner Control : Learner control determines whether the instructional system (and hence the instructor) or the learner makes decisions about the learning. Learner control can be applied to a number of learning parameters.
Number of Items : More complex information requires more instances in order for a learner to acquire an adequate mental representation of the information to be learned.
Presentations' rules that were defined in new CDT are given in Table 2. In the new CDT rules are Rule-2, Rule-3, Rule-5, Rule-6, Rule-9 and Rule-11 and these are written bold in Table 3. (Merrill, 1994:162-176).
Table 3. The rules in content of experimental group

Find		**Rule-11**	Rule-12	Rule-13
Use		Rule-8	**Rule-9**	Rule-10
Remember Generality		**Rule-5**	**Rule-6**	Rule-7
Remember Instance	Rule-1	**Rule-2**	**Rule-3**	Rule-4
	Fact	**Concept**	**Procedure**	**Principle**

3. The visions of students about when the strategies are used and how the strategies are used are taken into consideration (supervision of students). One of the most important opportunities that provide to pass from simple structure to complex structure is to take into account the views of students for focusing on details in content of lesson (zoom in), for recalling knowledge in contents of past lessons (zoom out) (Reigeluth, 1983:363). In the study, this strategy was used at a level that will not affect the aims of program.
4. All courses were in computer laboratories in experimental group and control group. Students were registered in the database of distance education management system at Gazi University. Students followed the contents of courses by guiding the educator in the laboratory.
Primary and Secondary Presentation Forms in CDT were used. Literature about computer-based monitor design was reviewed in the preparation of content (Yalın, 1999:128,129) and proposed design principles and recommendations were taken into consideration. Generally the writing types were used as "Helvetica", "Times" and "Verdana"; the appropriate line spacing were preferred to provide readability and the simplicity and easiness; and in different colours fonts, images, shapes and flow charts were used.
Contents of course in experimental group were prepared by CDT. Contents of course in control group were transformed to the same environment with experimental group. Descriptions about process of courses in control group are given below:

4.2. Procedure in The Control Group

In control group contents of course that were prepared by using traditional methods were carried out on the web. In this study lecture method was implied as traditional method. Lecture method is a traditional method that teacher teach the subjects by sitting and passively to students (Küçükahmet, 2002:73). In this study content of course was prepared in accordance with requirements of lecture method and was transformed on the web. Web-based teaching was prepared was carried out in control group as given below:
1. In the first section concepts of "Description of the Arrays" and "Define Array" was taught for 2 hours of courses within the framework of sample course plan.
2. In the introductory chapter of course the activities, which are about attention, motivation, notification of goals and process (review), were carried out; and then started to the development chapter.
3. In the development chapter the content, which was precondition of teaching for unit by providing the necessary feedback, correction and enhancement for comparing the correct answers with answers of students about questions of "What is array?", "Why is variable of array defined?" was presented.
4. Classifications in arrays were explained by examples.
5. After each part of classification short summary was made.

6. At the end of the subject abstract was made.
7. Placements of arrays were provided to index of array by students for reinforcing the learning in subject of arrays and accuracy of these was checked. Re-motivation activity was made.
8. General information about arrays was given.
9. Search abstracts were made after each level of knowledge.
10. Given definitions of logic array were done by students.
11. At the end of the subject summary was made to last.
12. At the end of the session practices about arrays were done.

Processing of course about control group was continued by using same method in the other units, too.

4.3. Data Collection Techniques

4.3.1. Achievement Test (PreTest, PostTest and Retention Test)

In creation of achievement tests, the test preparation process, planning, preparation and editing were made in the mentioned order. The item difficulty is 0.59, which indicates that the test has moderate difficulty (Özgüven, 1994:110;Akgül,2003:34) The discriminating degree of the test was between 0.21 and 0.53. In other words, there is no item with discriminating power less than 0.20. The first job in preparation the test is the planning for achieving objectives of assessment. Assessment activities are started by the plan. This plan is called as test plan (Özçelik, 1998:146). In this study achievement test included a plan.

KR-20 reliability was determined as 0.67 as a result of second application, which suggests that the reliability coefficient has a moderate value (Baykul, 2002:57; Eryılmaz, 2009:89)

In this study retention test was used to measure the permanence of students' learning in experimental group and control group; and this test was carried out after 15 days from achievement test (final test). This test was used through printed materials in experimental group and control group.

4.3.2. Attitude Scale About Mobile-Based Instruction (MBI-AS)

The scale that was used to determine students' attitude towards WBE by utilizing from literature and expert opinions was presented by Erdoğan; and this scale was composed of 26 questions (5 Likert Type). 5-grading are as completely agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1). In this study attitude scale of Erdoğan (2005) was used.

Considering the contents of the items the dimensions were named. The items in the first dimension focused on "educational and instructional efficiency". Considering the such items as " MBE is as effective as lecture", "MBE is an alternative to educational problems", and MBE ensures life-long education", the first dimension is named as " the effectiveness of mobile-based education"

The negative opinions are indicated in the second phase. To illustrate, items like "I think mobile learning is boring", "the technical problems encountered make me angry" and " Mobile based education weakens my social side", they all focus on the negative aspects. Drawing on these, the second dimension is called "resistance to mobile based education"

5. Findings and Results

In this study, the effect of mobile-based concept instruction, designed with respect to CDT, on academic achievement, retention and attitudes of students has been examined. In this chapter the statistical analyses of data, which were obtained from this study, and the conclusions about these have been given. Findings and conclusions are presented.

5.1. Results and Findings about academic achievement

5.1.1. Findings of the pretest scores of academic achievement between the groups

Before starting of learning process achievement levels of students of the effects of the teaching process were determined by scores of posttest. Before the start of training the pretest was carried out to all students (in experimental group and in control group). In experimental and control groups the academic achievements, arithmetic mean of pretest scores and standard deviation values were given in Table 4.

Table 4. Pretest Scores of Academic Achievement In Experimental and Control Groups

Groups	N	$\bar{x}$	sd	t	p
Experimental	38	12,0000	4,47891	0,29	,589
Control	34	10,7632	3,91418		

As shown in Table 4, when the mean of pretest scores was examined, the mean of experimental group, which is $\bar{x}$ = 12.00, and the mean of control group, which is $\bar{x}$ = 10.76, and values of mean, which is different a little, were shown. "Students t test" analysis was carried out for finding whether the difference about average scores of each two groups was statistically significant. The result of the t test suggests that there is no statistically significant difference between the control and experiment group. This is an expected situation and it could be said that since the students have no prior experience, they have similar readiness level, which is why there is statistically significant result revealed.

5.1.2. Findings of the posttest scores of academic achievement between the groups

The effects of the teaching process "that was prepared by CDT, which is the independent variable of study, and carried out on web" and the effects of normal teaching process "that was prepared on web" were determined by scores of posttest. After the training process the posttests were carried out to two groups.

Table 5. Achievement post-test scores of the control and experiment groups

Groups	N	$\bar{x}$	Adjusted $\bar{x}$	sd
Experimental	38	17,50	17,74	3,66
Control	34	18,41	18,14	3,21

As shown in Table 5 although the significant differences weren't among mean of pretest achievement scores of these groups, the means of posttest achievement score were compared with each other for checking the effect of achievement scores' mean; and the achievement scores of pretest was used as same variable (covariate) in experimental and control groups. To determine whether the significant differences is in posttest achievement scores of groups firstly means of achievement scores were calculated by correcting with the pretest; and then the One Factor ANCOVA was carried out and given in Table 6.

Table 6. The results of One Factor Covariance Analysis About Differences in Posttest's Achievement Score, which was adjusted by Pretest's Scores

Source of Variance	Sum of Squares	SD	Mean Squares	F	P
Achievement (Pre-test)	385,24	1	209,588	23,096	,000
Group (main)	2,822	1	2,822	0,311	,579
Error	626,147	69	9,07		
Total	23999,00	72			

As shown in Table 6 achievement scores' mean of posttest of groups has a significant difference by correcting ($F=0,311$, $p>0.05$). For teaching of concepts in experimental group while teaching of concepts was made, besides the primary presentation the precondition behaviors, feedback, representation, memory support, symbolic help were used, too.

When the findings of this study are compared with the finding of the studies, which was made by Karataş (1999) and Dede (2001), it has been shown that the regulation of content by CDT is effective in mobile-based instruction and this method can be used in the teaching of concept. Studies related to CDT in the teaching of the single unit of content, have shown that the achievement of teaching is increased by only editing of content without making any changes in the strategies of communication and management (Merrill, 1994:168). The obtained findings support this knowledge.

5.2. Findings and Conclusions on Retention

5.2.1. Findings of the pre-test scores of retention between the groups

In order to measure the retention level of the mobile learning, achievement test was re-administered. The retention test was carried out to two groups after 2 weeks from end of the teaching process. The obtained data are given in Table 7.

Table 7. The Average and Standard Deviation Values of Retention Pretest Scores of Experimental and Control Groups

Groups	N	$\bar{x}$	sd	t	p
Experimental	38	13,60	2,97	,015	.903
Control	34	14,11	3,17		

As shown in Table 7 when the averages of scores of groups in pretest are examined, the average of experimental group is $\bar{x}$ = 13,60, the average of control group is $\bar{x}$ =14,11, and the difference in averages are observed.

5.3. Findings and Conclusions about Scores of Groups in Posttest

The effects of the teaching process "that was prepared by CDT, which is the independent variable of study, and carried out on mobile" and the effects of normal teaching process "that was prepared on web" about students in permanence level were determined by the scores of posttest.

Table 8. Adjusted Averages of Post-test Retention Scores of the Groups

Groups	N	$\bar{x}$	SD	Adjusted $\bar{x}$
Control	34	14,11	3,17	13,814
Experiment	38	13,61	2,97	13,877

As shown in Table 8 while the retention scores were compared to control the effect of observed difference in the permanence scores of groups in posttest measurements, the achievement scores of posttest were used as common variable (covariate). Therefore the averages of the retention scores, which was adjusted by posttest scores, were calculated to determine whether the significant difference is in the scores of permanence test of groups; and then the only factor covariance analysis was made; this was shown in Table 9.

Table 9. The Results of One Factor Covariance Analysis, which was adjusted by posttest scores of groups

Source of Variance	Sum of Squares	SD	Mean Squares	F	P
Retention(post-test)	333,39	1	333,39	70,303	,000
Group(Main)	0,71	2	0,71	0,15	,903
Error	327,215	69	4,74		
Total	14471,00	72			

As shown in Table 9, the no significant difference was found by the results of the one factor covariance analysis in the average of permanence scores in posttest of groups (F=0,15 p>0.05). The teaching process, which was prepared and carried out by CDT on mobile settings, was caused to increase the permanence score of students statistically in comparison to control group (normal teaching process, which was prepared on web).

5.4. Findings and Conclusions on MBI Attitude Scale

The effects of the teaching process "that was prepared by CDT, which is the independent variable of study, and carried out on mobile" and the effects of normal teaching process "that was prepared on web" about students' attitudes towards MBI were determined by the scores of pretest.

The attitude; is an emotional tendency about a person, an institution or a situation (İnceoğlu, 1993) and is fed from experience of past (Özgüven, 1994). To limit the achievement of web-based instruction (with only scientific achievements of students) isn't correct.

5.4.1. Findings and Conclusions about the Scores of Posttest of Resistance Level of MBI of Groups

Statistical findings about resistance level, which is sub-dimension of MBI-AS have shown that the scores of pretest ($\bar{X}$=2,77) is higher than the posttest scores ($\bar{X}$=2,91)

Table 10. The Scores of Pre-test and Post-test of Resistance Dimension

Groups	N	$\bar{X}$	ss	t	p
Pre-test	38	2,7747	,55514	-1,002	,320
Post-test	38	2,9095	,61679		

"Students t test" was used in order to test whether there is statistically significant difference between the test scores. This result revealed that there is no statistically significant result between the scores (t = -1,002, p = 0,320). It could be said that the resistance is not towards the course of the total teaching and Educational activities. Parallel to this, it could be projected that this resistance will no change towards MBE. Hence, there is no difference expected in MBE, as well. The only difference that is likely to arise may occur when the groups are compared one another in the form of pre-test and post-test. In this case, inter-group resistance scores might differ in favour of pre-test scores.

5.4.2. Findings and Conclusions about the Scores of Posttest of Attitude Scale of Effectiveness Level of Mobile-Based Instruction of Group

Statistical findings about effectiveness level, which is sub-dimension of MBI-AS, have shown that the scores of pretest of experimental group($\bar{X}$ = 2,77) is higher than the post-test score ($\bar{X}$ = 2,91).

Table 11. The Scores of Pre-test and Post-test of Effectiveness Dimension.

Groups	N	$\bar{X}$	ss	t	p
Pre-test	38	2,8860	,47527	-4,783	,000
Post-test	38	3,4591	,56548		

As seen in table 11, there is statistically significant difference between the groups (t=4,783, p=,000). The effectiveness attitudes of the students (mobile-based process) are towards the course.

6. Discussion

In their study "internet based learning system for students", Maderia, Sousa, Pires, Esteves and Dias (2009) used a learning system with two modules, in which the same educational content could be viewed differently from computer and mobile devices. According to the researchers, the presentation of the internet based module that can be accessed from a computer with a module that can be accessed from mobile devices support individual learning.

In their study on 270 graduate and post-graduate students, Kukulska-Hulme, Petit, Brandley, Carvalho, Herrington, Kennedy and Walker (2009) investigated the habit of mobile phone use in their Daily lives. The results of the study suggest that economic and social levels and existing knowledge level of the students has an impact on the use of cell phones.

Al-Fahad (2009) conducted a study in order to determine the attitudes and the views of the students on mobile learning and the study covered 186 female students with 18-26 years of age at King Saud University. The views of the students were collected through a 5-point Likert scale and the data obtained were descriptively analysed.

The results of the study revealed that all of the students owned a cell phone, many students adopted the idea of mobile learning, and the majority of the students were of the opinion that wi-fi networks made the Access to learning materials easier and paved the way for self-study. Besides, students expressed that learning through mobile devices cost higher.

Rismark, Solvberg, Stromme and Hokstad(2007) conducted a study with an aim to put forward the opinions of the students with cell phone's on mobile learning as a part of the biology course. Students were provided with the opportunity to watch the videos from cell phones before the course. As a result of the observations and the interviews, the achievement level of the students was higher compared to those who did not watch any videos. The common view of the students was that they were content with the use of cell phones as they liked.

In their study which tested whether the digital learning materials affected the reading strategies of the students, Waycott and Kukulska-Hulme(2003) delivered instruction using mobile devices in classroom. The study covered 65 graduate students at UK Open University. Students were presented with both printed and digital materials and it was up to the students to use whether the printed or the digital materials. The results of the study indicated that although the limited screen sizes, and the obstacles in text input and net surfing, students preferred mobile devices rather than course books and they were content with the advantages electronic resources provided for them.

Korkmaz (2010) in his study titled "the effect of problem-based mobile learning on the academic achievement of the students" examined the mobile learning approach and face-to-face problem-based approach and compared them by the academic achievement of the students. The study tool 4 weeks to complete and covered 32 students at high school level. İn learning environment dealing with an unstructured problem, instruction was delivered face-to-face, while for the mobile group the learning environment was supported by Black Board Learning System, Facebook social network, instant communication programs (msn) and SMS services. In evaluating the problem solving skills of the students, a performance appraisal scale was used. The results of the study suggested that the achievement scores of those in the mobile group were higher and there was statistically significant difference among the groups in achievement scores.

In his study titled "A study into the awareness level of graduate students and faculty staff towards mobile learning" examined the awareness level of the graduate students and faculty staff on mobile learning in the department of computer education and instructional technology. The data collection was performed using semi-structured interviews and the study covered 20 individuals selected from the faculty staff and the graduate students. It was found out that the theoretical awareness level of the participants were high towards mobile learning. It was observed that those who conducted a study on mobile learning were knowledgeable about the applications mentioned in the literature, while those with no study at hand were theoretically aware of the mobile learning applications. Having conducted studies on mobile learning is a factor increasing the awareness of mobile learning applications.

A prominent factor in studies on mobile learning is that it is technology-focused (Muyinda, Mugisa and Lynch, 2006;Herrington and Herrington, 2007), however with the developments in the field, it is seen that the pedagogical and instructional aspects are coming to the fore. According to the researchers, unless the theories in the field of mobile learning are based on sound grounds, pedagogical problems and deficiencies in the presentation and the development of mobile learning will remain.

As seen in the studies into mobile learning, it could be said that there has been positive awareness towards mobile learning. Mobile learning is now among the blended instructional methods. It has been found out that Mobile learning is adopted by a majority of students. The result of this study suggest that the attitudes of students showed a significant increase in mobile learning and mobile learning-based instruction has no negative effect on academic achievement and permanence.

7. Conclusion

Based on the result of this study and the related studies in the literature, the attitudes of the students on mobile learning have changed in a positive manner. We are of the opinion that there should be more emphasis on instructional theory and strategies in studies into mobile learning in terms of making more use of mobile devices. The significance of mobile environments at instructional stages has increased in that it paves the way for individual learning irrespective of time and space constraints. It is of great value and significance that in comprehensive technology-focused projects such as FATİH, which is in the process of implementation, there should be a stress on mobile-based instructional environments.

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