

Content Analysis of Research Trends in Instructional Design Models: 1999-2014

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Abstract

This study examines studies on instructional design models by applying content analysis. It covers 113 papers published in 44 international Social Science Citation Index (SSCI) and Science Citation Index (SCI) journals. Studies on instructional design models are explored in terms of journal of publication, preferred model, country where the study was conducted, research method, data collection tool, data analysis method, sampling interval, and field in which the model was applied. Studies are also examined in terms of variables, focusing on connections with model used, relevant results, and orientation of the model (e.g., system-oriented, class-oriented, or product-oriented). Results identified the most preferred models as ADDIE, ARCS, Gagne and Briggs, 4C-ID, and Dick and Carey. System-based instructional design models were most common. These results show recent trends in instructional design models and will contribute to both researchers and instructional designers.

Keywords

instructional design, instructional design model, ADDIE, content analysis

Introduction

Elaborate planning and arrangement of instruction is important for ensuring quality in education, which is its main goal. Instructional design leads the way in accomplishing this goal through better, more effective teaching. Instructional design, which gained more and more importance during the second half of the 20th Century, has led to the development of many models to improve teaching as a result of technological advancements. According to Şimşek (2011), instructional design first appeared as a system in the 1950s via studies on instructional design models.

Instructional design has acquired various dimensions and been defined in different ways as a result

of developing instructional technologies. For example, to Seels and Richey (1994), instructional design referred to the evaluation of processes and resources for facilitating the conceptualisation, development, implementation and management of learning. Valiathan (2010) observed how instructional design is affected by learning and motivation theories and highlighted certain elements for effective teaching. According to Reigeluth (1983), instructional design has three major components: methods, conditions, and outcomes. Gagne, Briggs, and Wager (1992) considered the issue from a different point of view, arguing that most instructional design models contain needs analysis, objectives, priorities, resources, and environmental and social elements. Gustafson and Branch (2002) outlined three instructional design model types: product, class, and system. Combining these approaches, instructional design can be defined as a systematic method that (a) covers such stages of the teaching process as analysis, design, development, evaluation, and management; (b) is based on instructional and learning theories; and (c) enhances the quality of teaching (Dick, Carey, & Carey, 2001; Dooley, 2005; Gustafson & Branch, 1997; Morrison, Ross, & Kemp, 2004; Posner & Rudnitsky, 2001; Smith & Ragan, 1993, 1999).

Hakkinen (2002) denoted that traditional instructional design models are rooted in behaviorism and that the field of instructional design has been developing since the first models appeared. Instructional design models help illustrate a problem and divide it into manageable parts (Fauser, Henry, & Norman, 2006). To Hannafin (1993), the shortcomings of traditional instructional design models have become clearer as a result of advancements in instructional technologies. As interest in constructivism has increased because of a paradigm change, instructional design models have become more learner-centered (Crawford, 2004; Edmonds, Branch, & Mukherjee, 1994). In this regard, most instructional design models aim to explain the key elements of an instructional environment (Hakkinen, 2002).

Most instructional design models are built upon the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) created by the Center for Educational Technology at Florida State University for the U.S. Army (Branson et al., 1975; Dooley, 2005; Hoogveld, Paas, Jochems, & van Merriënboer, 2002; Strickland, 2006; Şimşek, 2013; Watson, 1981; Zheng & Smaldino, 2003). To Fer (2009), a performance-oriented, interactive, and innovative mentality is adopted during instruction under the ADDIE model; a systematic process is carried out with learner-centered teaching.

The ARCS (Attention, Relevance, Confidence and Satisfaction) Model of Motivational Design (Keller, 1983, 1987a, 1987b) is widely used for designing, developing, and evaluating motivational strategies, due to its ease of implementation with instructional design processes (Huang & Johnson, 2002). Each of the four elements plays a critical role in motivating students in the learning process. The development of the ARCS model has been influenced by various learning and instructional theories (Driscoll, 2000). Keller's work was based on social learning and expectancy theories and is popular because it offers strategies that enhance instructional motivation and quality (Bohlin, Milheim, & Viechnicki, 1993; Main, 1993; Pearson & Carey, 1995; Small, 2000; Small & Gluck, 1994). Some researchers have argued that student motivation has a key role in understanding the content being taught (Bigge & Hunt, 1980; Keller, 1979, 1984; Keller & Kopp, 1987; Reigeluth, 1987; Small, 2000).

Previous research on instructional design models indicates that basic models such as ADDIE and ARCS continue to be represented in available research. However, the number of studies on instructional design is limited. Rourke and Szabo (2002) revealed that only 10% of papers published in the *Journal of Distance Education* between 1996 and 2001 were about instructional design. Gülbahar and Alper (2009) conducted a content analysis of studies carried out in Turkey between 2006 and 2009 and found that only 12 of 149 were about instructional design. Alzand (2010) conducted a study in the Middle East to examine studies between 1998 and 2008 and determined that three instructional design models—Gagne and Briggs (1979), Merrill (2002), and Reigeluth and Stein (1983)—were found to have a positive impact on students' achievement, thinking skills and quality of teaching. Andrew and Goodson (1980) made a comparative analysis of 40 instructional design models and suggested that educators should be careful to assess quality

levels among the various options. Li (2003) reported that the most used models in designing web-based instruction were ADDIE, Dick and Carey (1978), and Gagne and Briggs (1979), while Royal (2007) indicated that ADDIE, Gagne and Briggs, and Dick and Carey were used most frequently and Khodabandelou and Abu Samah (2012) reported ADDIE, Gagne and Briggs, and Morrison, Ross and Kemp (2004) to be most popular. Finally, Göksu, Özcan, Çakir and Göktas (2014) examined 62 instructional design models implemented in Turkey and found that ADDIE, ARCS, and Dick and Carey were most common.

Studies involving content analysis have been conducted on instructional design models in various countries, but their findings are mostly specific to those regions. Thus, more research is needed to investigate instructional design models with an international framework. Comprehensive, quality research will provide more reliable, generalizable results. Accordingly, this study will examine papers published in SSCI and SCI journals between 1999 and 2014 by investigating the following six research questions:

1. What is the distribution of instructional design models?
2. What is the distribution of studies by year, journal, and country?
3. In the studies on instructional design models,
 - a. What research methods and designs are widely used?
 - b. What data collection tools and analysis methods are widely used?
 - c. What sampling intervals and levels are widely used?
4. What is the distribution of instructional design models by scientific field?
5. What is the distribution of instructional design models by orientation (i.e., product-oriented, class-oriented, or system-oriented)?
6. What variables did the studies examine in relation to the instructional design models, and what results did they obtain?

Method

Content analysis was applied to 113 papers from 44 Social Science Citation Index (SSCI) and Science Citation Index (SCI) journals. Content analysis refers to describing an existing situation and reaching a general judgment by working on a sample taken from an existing large universe (Karasar, 2012). Cohen, Manion, and Morrison (2007) defined content analysis as summarising the contents of accessible resources. Further to this, Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, and Demirel (2012) argued that content analyses synthesise results of studies conducted for a specific purpose or on a specific subject within a common framework. The present study employed content analysis to produce a general evaluation of research trends in instructional design models.

Data collection process

Data collection began with the identification of SSCI and SCI journals, followed by determining search terms. A search across *ScienceDirect*, *Web of Knowledge*, and *EBSCOhost* revealed 352 studies in 102 journals from 1999 to 2014 containing “model” and “instructional design” in their abstract, title, or keywords. After the researchers had examined these studies individually, those that did not focus on instructional design models were removed. Ultimately, 113 papers from 44 journals were deemed to meet the study criteria; distributions of these papers by journal, index,

and year are presented in the findings below (and as Supplementary File to this article). Figure 1 summarises the data collection and analysis process which begins with accessing the relevant bibliographic databases and ends with writing to the research questions.

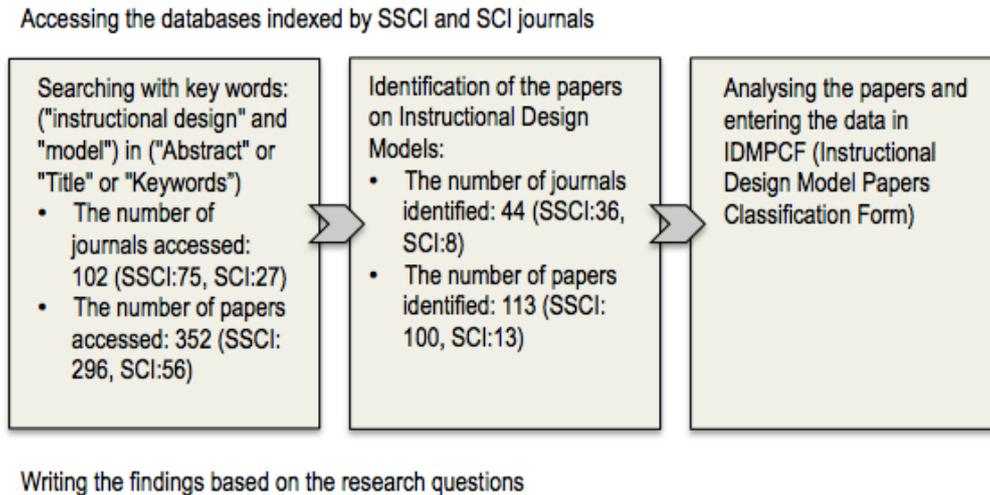


Figure 1. Research process.

The data obtained from the studies included in the present research were electronically entered into the Instructional Design Model Papers Classification Form (IDMPCF), based on the Educational Technology Papers Classification Form (ETPCF) developed by Göksu, Özcan, Çakir and Göktas (2014). The researchers verified data by checking each entry one at a time, ensuring research validity and reliability. The IDMPCF, which consists of 16 parts, is available as Supplementary Document 1.

Data analysis

Two doctoral students examined the 113 papers included in the present study. Any uncertainties which emerged during classification of the data and acquisition of the findings were resolved by two faculty members. In this way, an attempt was made to increase data reliability and validity. The descriptive method was applied in the analysis of the data entered into the IDMPCF. Frequency (f) and percentage (%) tables were formed, and some data were visualised through graphs to see answers to the research questions easily.

Findings

The order in which the findings of the analyses are presented reflects the research questions addressed in this study.

Instructional design models

Table 1 gives the annual distribution of instructional design models used more than once in the 113 papers published in SSCI and SCI journals between 1999 and 2014.

Table 1. Preferred instructional design models (by frequency)

Instructional Design Model	1999-2014																N
	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	
ADDIE (Florida State University, 1975; Branson et al., 1975)				1		1		1		2	2	3	1	2	3	4	20
ARCS (Keller, 1979)	1				1			1	1	1	1	1		1	1	1	10
Gagne & Briggs (1979)			2	1				1		2				2		1	9
4C/ID (van Merriënboer, Clark, & de Croock, 2002)			2	1	1		1	1				1		1	1		9
Dick & Carey (1978)		1	1				1		2		1	1		1			8
Morrison, Ross, & Kemp (2004)		1							2		2	1					6
5E Model (Bybee, 1997)										1	1	1			1	1	5
Problem-based Learning (PBL) Model (Barrows, 1985)												1		1	1		3
Multiple Cultures (Henderson, 1996)	1									1							2
Rapid Prototyping (Tripp & Bichelmeyer, 1990)											1				1		2
Reflexive Model (Richey & Nelson, 1996)			1		1												2
TPACK-based Model (Mishra & Koehler, 2006)															2		2
Smith & Ragan (1999)								1	1								2
Review Studies		1		1			1		1		2			1	1	1	9
<i>Total</i>	<i>2</i>	<i>3</i>	<i>6</i>	<i>4</i>	<i>3</i>	<i>1</i>	<i>3</i>	<i>5</i>	<i>7</i>	<i>7</i>	<i>10</i>	<i>9</i>	<i>1</i>	<i>9</i>	<i>9</i>	<i>10</i>	<i>89</i>

As seen in Table 1, the most frequently researched/reported model was ADDIE ($n = 20$, 22.47%), followed by ARCS ($n = 10$, 11.24%), Gagne and Briggs ($n = 9$, 10.11%), and 4C-ID ($n = 9$, 10.11%). Some literature review studies ($n = 9$) were included that made a general evaluation of instructional design models. In addition, a further 40 instructional design models were used in a single study, while some studies applied more than one model (see Supplementary Document 2).

Annual distribution of papers on instructional design

The majority of papers were published in 2013 ($n=14$) and 2014 ($n=14$). A further 12 were published in 2010 while 10 were published in 2012, 2009, and 2001. Only two papers were published in 2011, 2004, and 2000.

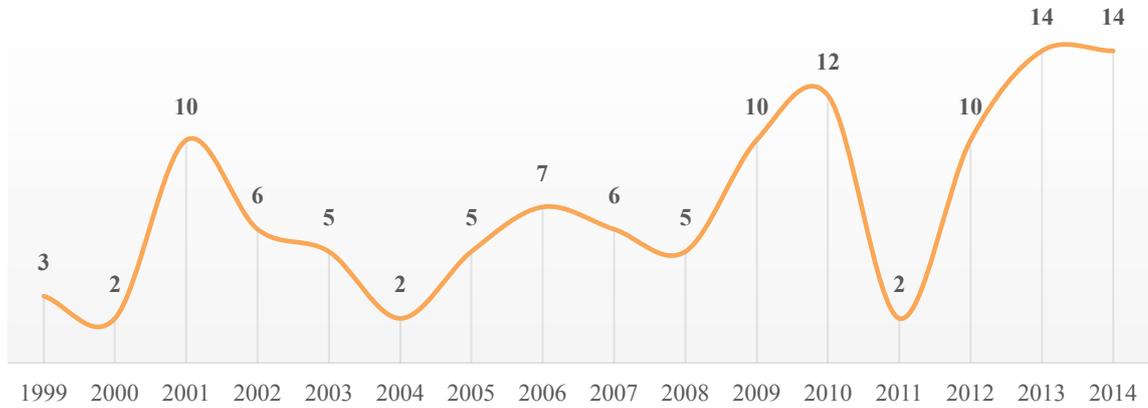


Figure 2. Annual distribution of papers 1999-2014 (by year).

Distribution of papers by journal

Most ($n=22$, 25.88%) of the papers on instructional design models were published in *ETR&D-Educational Technology Research and Development*, followed by *Computers & Education* ($n=14$, 16.47%), the *British Journal of Educational Technology* ($n=10$, 11.76%), *Educational Technology & Society* ($n=6$, 6.74%), *Computers in Human Behavior* ($n=5$, 5.88%), and *Medical Teacher* ($n=5$, 5.88%). The Turkey-based *Hacettepe University Journal of Education* ranked seventh with four papers. Table 2 shows the paper distribution of the 16 journals that published the most papers.

Table 2. Distribution of papers by journal (in descending order of publications)

Journal Name	Index	1999-2014														N	
		99	00	01	02	03	04	05	06	07	08	09	10	11	12		13
<i>ETR&D-Educational Technology Research and Development</i>	SSCI	1	2	2		1		2	2	1	3			1	4	3	22
<i>Computers & Education</i>	SSCI		2				2		1		1	3		4	1		14
<i>British Journal of Educational Technology</i>	SSCI	1		1		1		1	1	1	1	2			1		10
<i>Educational Technology & Society</i>	SSCI			1						1	1	1	1			1	6
<i>Computers in Human Behavior</i>	SSCI			2						1		1				1	5
<i>Medical Teacher</i>	SCI				1			1						2	1		5

Journal Name	Index	1999-2014														N	
		99	00	01	02	03	04	05	06	07	08	09	10	11	12		13
<i>Hacettepe University Journal of Education</i>	SSCI											2			2		4
<i>Science Education</i>	SSCI							1	1					1			3
<i>Distance Education</i>	SSCI									2							2
<i>Eurasia Journal of Mathematics Science and Technology Education</i>	SSCI															2	2
<i>Interactive Learning Environments</i>	SSCI												1		1		2
<i>International Journal of Science Education</i>	SSCI			1										1			2
<i>Instructional Science</i>	SSCI			2													2
<i>Journal of Computer Assisted Learning</i>	SSCI							1						1			2
<i>Journal of Educational Computing Research</i>	SSCI							1	1								2
<i>Medical Education</i>	SCI													2			2

As seen in Table 2, three studies were published in *Science Education* while each of the following journals published two: *Distance Education*, *Eurasia Journal of Mathematics Science and Technology Education*, *Interactive Learning Environments*, *International Journal of Science Education*, *Instructional Science*, *Journal of Computer Assisted Learning*, *Journal of Educational Computing Research*, and *Medical Education*. Each of the other 28 journals published just one study (see Supplementary Document 3).

Countries where studies were carried out

Among the countries where studies on instructional design models were conducted, the United States ranked first with 50 published papers, followed by the Netherlands (16 papers) and Taiwan (10 papers). Turkey published 8 papers; Australia, 5; and Malaysia, 4. Three studies were conducted in Spain and the United Kingdom, and two were carried out in Canada, Colombia, Cyprus, Finland, Korea, and South Africa. Only one study was conducted in each of the following countries: Bulgaria, Chile, China, Greece, Jamaica, Mexico, Norway, Romania, Sri Lanka, Switzerland, and United Arab Emirates.

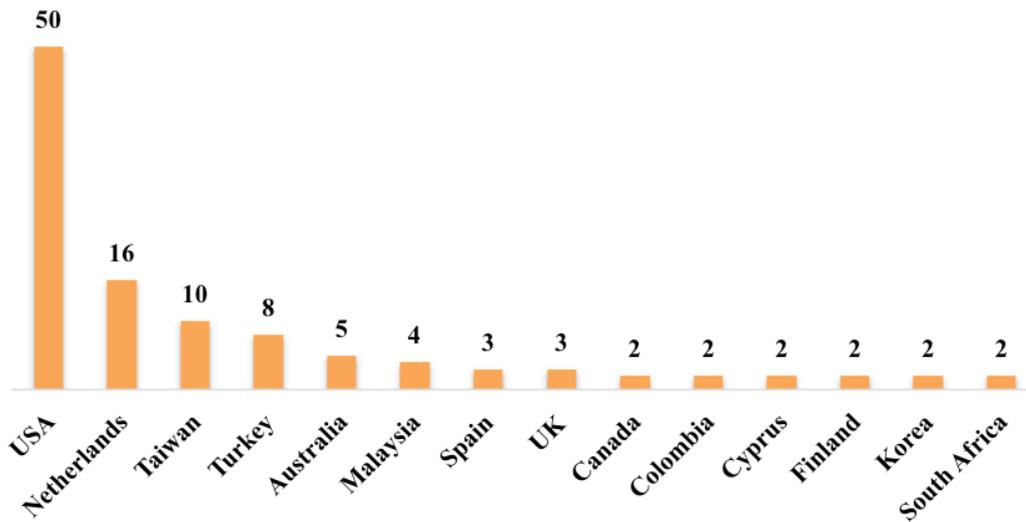


Figure 3. Countries where studies were conducted (in descending order of publication).

Examination of studies by method

The methods and designs used in the papers are presented in Table 3, which shows qualitative research ($n=45$) as the most preferred, followed by literature review ($n=28$), quantitative research ($n=26$), and mixed research ($n=14$). Literature review design was mostly used ($n=26$) in studies employing the literature review method. Meta-analysis design was used in just two studies employing the literature review method.

Table 3. Research methods and designs used in the studies.

Research Method	Design	N (113)	%
Qualitative	Case Study	28	39.82
	Grounded Theory	14	
	Action Research	3	
Literature Review	Literature Review	26	24.78
	Meta-analysis	2	
Quantitative	Experimental	20	23.01
	Non-experimental	6	
Mixed	Explanatory (Quantitative → Qualitative)	9	12.39
	Exploratory (Qualitative → Quantitative)	3	
	Triangulation (Quantitative + Qualitative)	2	

Experimental design ($n=20$) was preferred over non-experimental methods ($n=6$) in quantitative research. Explanatory ($n=9$) design was used most in studies employing the mixed research method, followed by exploratory ($n=3$) and triangulation ($n=2$) designs. Case study ($n=28$) was used most in qualitative research, followed by grounded theory ($n=14$) and action research ($n=3$). No other qualitative design was used in the studies examined. Among the studies using grounded

theory, 12 proposed new models, while the other two revised existing models. Table 4 presents the studies using grounded theory.

Table 4. *Studies using grounded theory*

Proposed Model	Models Taken As Basis	Author (Year)
Curriculum Reference	ADDIE	Lee & Kolodner (2011)
Hybrid Design	Dick and Carey; Morrison, Ross, and Kemp; McManus Model	Passerini & Granger (2000)
Living-Systems Design	ADDIE	Plass & Salisbury (2002)
Courseware Development	ADDIE; Morrison, Ross, and Kemp; Rapid Prototyping	Durdu, Yalabik, & Çağıltay, (2009)
ELESS	Not specified	Freitas & Routledge (2013)
Eternal, Synergistic Design	ADDIE	Crawford (2004)
Integrative	ARCS	Burke & Moore (2003)
Multiple Intelligence Design	ARCS; Seels and Glasgow; Morrison, Ross, and Kemp; Smith and Ragan;	Tracey & Richey (2007)
RETAIN	ARCS; Gagne and Briggs	Gunter, Kenny, & Vick (2008)
Six-step ID	4C-ID	Nadolski, Kirschner, van Merriënboer, & Hummel,
WisCom	Not specified	Gunawardena et al. (2006)
New Model Proposed	Gagne and Briggs; Smith and Ragan	Cronjé (2006)
<i>Existing Model Revised</i>	Appreciative Instructional Design	Norum (2000)
<i>Existing Model Revised</i>	Virtual Reality Model	Chen & The (2013)

Data collection tools and analysis methods

Figure 4 presents the data collection tools used in the papers examined and indicates that the tools most preferred were: interview ($n= 36$); questionnaire ($n=30$); achievement test ($n=14$); attitude/perception/personality/interest/aptitude tests ($n=13$); observation ($n=7$); and logs ($n=5$).

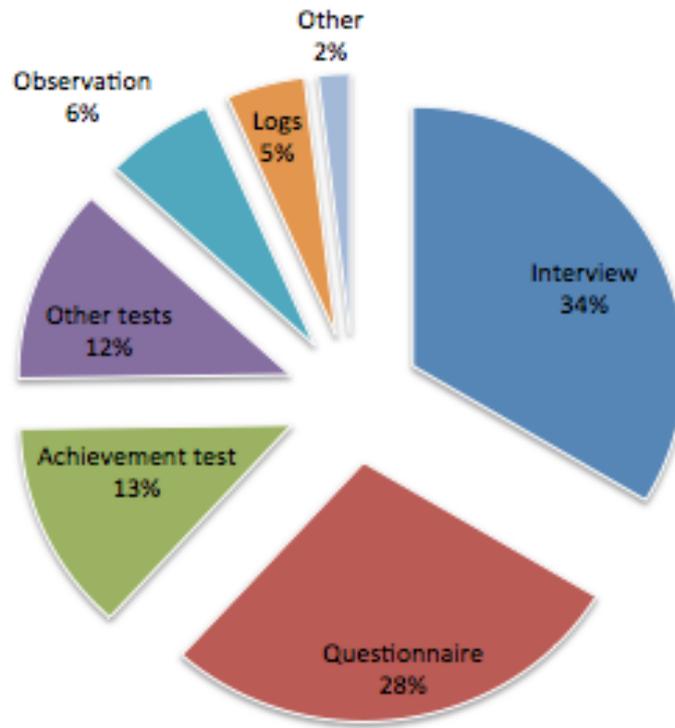


Figure 4. Distribution of the data collection tools used in the papers.

Table 5 presents the data analysis methods and techniques used in the studies.

Table 5. Distribution of data analysis methods and techniques used in the studies

Data Analysis Method	Data Analysis Technique	N (63)	%
Quantitative	Predictive	24	57.14
	Descriptive	12	
Qualitative	Descriptive Analysis	20	42.86
	Content Analysis	6	
	Document Analysis	1	

Table 5 indicates that quantitative analysis ($n=36$) was more preferred than qualitative analysis ($n=27$). Among quantitative data analysis techniques, predictive analysis ($n=24$) was used more frequently than descriptive analysis ($n=12$). Among qualitative data analysis techniques, descriptive analysis ($n=20$) was most preferred, followed by content analysis ($n=6$). Document analysis ($n=1$) was the least preferred qualitative data analysis technique.

Sampling intervals and levels

Findings are given in Table 6, which shows the most preferred interval as 11 to 30 participants ($n=22$), followed by 101 to 300 ($n=21$), 31 to 100 ($n=18$), 1 to 10 ($n=6$), and 301 to 1000 ($n=4$). One study included over 1000 participants while three studies did not specify sampling intervals.

Table 6. *Sampling intervals used in the studies*

Sampling Size	<i>N</i> (75)	%
11-30	22	29.33
101-300	21	28.00
31-100	18	24.00
1-10	6	8.00
301-1000	4	5.33
>1000	1	1.33
Not specified	3	4.00

Table 7 presents sampling levels, including various learning levels and professions.

Table 7. *Sampling levels used in the studies*

Sampling Level	<i>N</i> (75)	%
Undergraduate Student	22	29.33
Instructional Designer	9	12.00
High School Student	7	9.33
Teacher	7	9.33
Post-graduate Student	6	8.00
Faculty Members	5	6.67
Middle School Student	5	6.67
Primary School Student	4	5.33
Administrator	2	2.67
Nurse	2	2.67
Doctor	1	1.33
Attorney	1	1.33
Other	4	5.33

The sampling level preferred most in studies on instructional design models was undergraduate students ($n=22$), followed by instructional designers ($n=9$), high school students ($n=7$), teachers ($n=7$), and post-graduate students ($n=6$). Less common samples were faculty members ($n=5$), middle school students ($n=5$), primary school students ($n=4$), administrators ($n=2$), and nurses ($n=2$). Doctors were the research participants of just one study, as were attorneys.

Scientific fields in which studies were conducted

Table 8 presents the distribution of studies investigating the influences of instructional design models on different elements by scientific field.

Table 8. *Distribution of studies by scientific field*

Scientific Fields	<i>N (64)</i>	%
Computer and Instructional Technologies	16	25.00
Science Education	11	17.19
Engineering Sciences	8	12.50
Social Sciences	7	10.94
Educational Sciences	6	9.38
Medicine	5	7.81
Mathematics	3	4.69
Linguistic Sciences	2	3.13
Not Specified	2	3.13
Other	4	6.25

Table 8 shows that the models were mostly implemented in Computer and Instructional Technologies ($n=16$), followed by Science Education ($n=11$) and Engineering Sciences ($n=8$). Seven studies were carried out in Social Sciences, six in Educational Sciences, five in Medicine, three in Mathematics, and two in Linguistic Sciences.

Instructional design models used in the studies

Figure 5 presents the findings concerning the orientation of the instructional design models used in the papers examined (i.e., system-oriented, class-oriented, and product-oriented). The studies were mostly on system-oriented models ($n=76$, 59.84%), followed by class-oriented ($n=39$, 30.71%) and product-oriented ($n=12$, 9.45%) models.

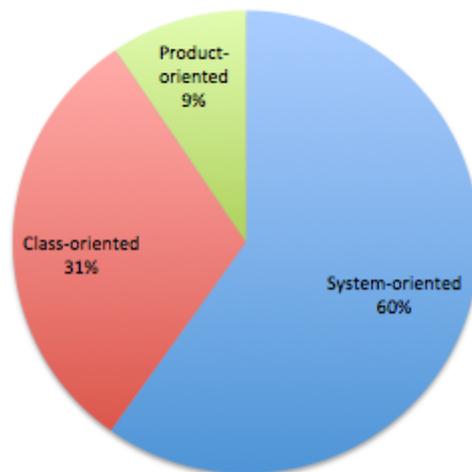


Figure 5. Types of the instructional design models.

Study variables

Table 9 presents findings concerning the variables discussed in the papers examined and the results obtained through the investigation of these variables.

Table 9. Study variables and the influences of the models on those variables

INSTRUCTIONAL DESIGN MODELS	VARIABLES EXAMINED														
	Academic success	Attendance to lesson	Collaborative learning	Complex learning	Creative thinking	Effective learning	English reading skills	Individual learning	Individual learning	Mathematics	Metacognitive skills	Motivation	Problem-solving skills	Self-efficacy	Social skills
ADDIE	+	-	+	-	+	+	-	-	-	-	-	+	-	-	-
ARCS	-	-	-	-	-	-	+	-	+	-	-	+	-	-	-
Case-based Reasoning ID Model	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Cognitive Load Theory	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Collaborative Design Model	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Constructivist Learning Environment	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Continuum of Knowledge	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-
Dick and Carey	-	-	+	-	-	-	-	+	-	-	-	+	-	-	-
Differentiated ID Model	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-
Gagne and Briggs	-	-	+	-	-	+	-	+	-	-	-	+	-	-	-
IDEAS Model	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Laurillard's Model	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Morrison, Ross, and Kemp	-	-	-	-	-	-	-	-	+	+	-	+	-	-	-
PBL Model	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reflexive Model	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-
Rapid Prototyping	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
RTI Model	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
TUM Model	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-
WisCom Model	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-
3D Model	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
3C3R Model	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
4C-ID	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
5E Model	+	-	-	-	+	-	-	-	-	+	-	+	-	-	+

In summary, it can be noted that:

- ADDIE, the PBL Model, and the 5E Model were shown to improve academic success;
- Dick and Carey, Gagne and Briggs, and the WisCom Model were shown to improve individual learning;
- Cognitive Load Theory and Laurillard's Model were shown to improve complex learning;
- ADDIE and Gagne and Briggs were shown to improve effective learning;
- ADDIE, Dick and Carey, Gagne and Briggs, and the WisCom Model were shown to improve collaborative learning;
- The Continuum of Knowledge and the Differentiated ID Model were shown to improve

metacognitive skills;

- TUM and the Reflexive Model were shown to increase attendance to lesson;
- ARCS and the Continuum of Knowledge were shown to improve English reading skills;
- The Differentiated ID Model, Morrison, Ross, and Kemp, and the 5E Model were shown to improve mathematical skills;
- The Differentiated ID Model was shown to improve self-efficacy;
- The Constructivist Learning Environment, the Reflexive Model, and 4C-ID were shown to improve problem-solving skills;
- The 5E Model was shown to improve social skills;
- ADDIE, ARCS, the Case-based Reasoning ID Model, the Collaborative Design Model, Dick and Carey, Gagne and Briggs, the IDEAS Model, Morrison, Ross, and Kemp, Rapid Prototyping, and the 5E Model were shown to increase motivation;
- ADDIE and the 5E Model were shown to improve creative thinking; and
- ARCS, Morrison, Ross and Kemp, the RTI Model, TUM, the 3D Model, and the 3C3R Model were shown to improve learning rate (efficacy).

Findings were also obtained that could not be summarised in Table 9. These are:

- A study focusing on the 3D Model concluded that it reduced cognitive load (Boot, Nelson, van Merriënboer, & Gibbons, 2007).
- Another study revealed that the 7E Model contributed to conceptual change and knowledge permanence (Demirezen & Yağbasan, 2013).
- Three studies applying the 4C-ID Model determined that it supported teachers in designing learning tasks (Hoogveld et al., 2002); that product-oriented practices were more effective for teacher training in comparison to process-oriented practices (Hoogveld, Paas, & Jochems, 2005); and that instructional design should be applied in medical training (Levinson, 2010).
- Another study applied the PBL Model and emphasised the importance of instructional design in globalizing modern medical training (Stevens & Goulbourne, 2012).
- Craft, Feldon, and Brown (2014) concluded from their study on medicine that the GEL model was more efficient than ELT in simulation-based learning.
- Shambaugh and Magliaro (2001) found that the systematic features of the Reflexive Model made students attach particular importance to learning.
- Visscher-Voerman and Gustafson (2004) concluded that ADDIE facilitated the design of effective learning experiences while Güler, Kılıç, and Çavuş (2014) suggested that mobile learning based on teaching design would be more effective and that ADDIE would make mobile learning both more effective and more productive.
- Some studies revealed the effectiveness of ARCS applied in Matlab training (Huang,

Huang, Diefes-Dux, & Imbrie, 2006) and the effectiveness of the Content-based ID Model in virtual learning environment designs (Laverde, Cifuentes, & Rodriguez, 2007).

- Angeli and Valanides (2005) took Dick and Carey's model as a basis and mentioned the importance of integrating technology into the teacher training curriculum. Lee and Kim (2014) conducted a study using the TPACK-based ID Model with preservice teachers, also studying technology integration.
- In another study, the same model was found to improve technology integration and students' geographical questioning skills (Doering, Koseoglu, Scharber, Henrickson, & Lanegran 2014).
- A study employing Dick and Carey, Morrison, Ross, and Kemp, and the Collaborative Design Model highlighted that motivation and results processing should be taken into account when designing digital game-based learning (Huang, Huang, & Tschopp, 2010).
- Woo (2014) concluded in his similar ARCS-based study that it was necessary to increase the motivation and germane cognitive loads of digital game-based learning designers to improve their processes.
- Meanwhile, Freitas and Routledge (2013) developed the ELESS model for evaluating educational games.
- Another study revealed Jonassen's Constructivist Learning Environment Model as effective in improving students' unstructured problem-solving skills (Choi & Lee, 2009).
- In addition, it was reported that the Multiple Cultures Model can provide culturally sensitive and appropriate online education if students' socio-cultural backgrounds and learning styles are known and a suitable instructional paradigm is applied (McLoughlin, 1999). This model provides a structure that improves the design process through the integration of culture-based design features (Young, 2008).
- A study employing the Living-Systems Approach Model indicated that this model not only allows individuals to regulate the learning process but indeed grows and changes in order to accommodate their needs (Plass & Salisbury, 2002).
- Meyen, Aust, Bui, Ramp, and Smith (2002) concluded that online instructional designs should be developed in coordination with product systems.
- Chang and Chen (2014) concluded in their study based on the Kirkpatrick model that it was effective in developing lifelong learning and digital learning at universities and that it improved students' attitudes and research abilities.
- Finally, Lin et al. (2014) concluded that the 5E model was effective in improving educational materials and attitudes in science education.

Discussion and conclusion

This study analysed 113 papers on instructional design models published in 44 SSCI and SCI journals in terms of: models used; distribution by year, journal, and country; methods applied; scientific fields in which studies were conducted; orientation of models used; variables examined; and results obtained. The ADDIE model was the most preferred, followed by ARCS, Gagne and Briggs, 4C-ID, Dick and Carey, Morrison, Ross, and Kemp, the 5E Model, the Problem-based Learning (PBL) Model, the Multiple Cultures ID Model, Rapid Prototyping, the Reflexive Model,

the TPACK-based ID Model, and Smith and Ragan, respectively. Across the examined papers, 53 models were used. Besides the models above, a further 40 instructional design models were used in a single study. Consistent with the results of the present study, others (see, for example, Khodabandelou & Abu Samah, 2012; Li, 2003; Royal, 2007) found that ADDIE, Dick and Carey, Gagne and Briggs, Morrison, Ross and Kemp, and Reigeluth's Elaboration Model to be the most preferred models. However, it is noteworthy that ARCS was not generally preferred in these studies. This may be because researchers working on educational technologies in recent years have emphasised motivation in learning. Further to this, Göksu, Özcan, Çakir and Göktas (2014) carried out a content analysis to examine studies on instructional design models conducted in Turkey and concluded that the most preferred models were: ADDIE; ARCS; Dick and Carey; Gagne and Briggs; ASSURE; 5E Model; and, Morrison, Ross, and Kemp. The present study found no studies employing ASSURE in the journals it reviewed. The inclusion of 5E and Problem-based Learning (PBL) Models, which take the constructivist learning approach as a basis, shows how instructional design models vary over time based on current learning approaches.

Most papers of those reviewed were published in 2013 and 2014. In the last six years of the examined period, 62 studies were conducted on instructional design models. However, only 51 papers were published in all ten years from 1999 to 2008. Instructional design models have increased recently as a result of the importance attached to systematising teaching and enhancing quality. In addition, as journals are now published online and electronic databases have been developed, a wider variety of studies can be accessed more easily. As to the journals in which the papers were published, the greatest number was published in *ETR&D*, followed by *Computers & Education* and *British Journal of Educational Technology*. SSCI journals published 100 papers, while SCI journals published 13. Lee and Jang (2014) analysed 20 papers implementing or evaluating instructional design models and similarly discovered that most of these papers were published in *ETR&D* and *British Journal of Educational Technology*. Researchers may prefer *ETR&D*, *Computers & Education*, and *British Journal of Educational Technology* because these journals focus on studies on instructional design.

The greatest number of studies on instructional design models were conducted in the United States, followed by the Netherlands, Taiwan, and Turkey. The number of journals published in these countries may explain this finding. In addition, as to Turkey being near the top, local departments of computer and instructional technologies started to produce graduates in 2002 (see, for example, Göksu, Özcan, Çakir & Göktas, 2014), so research in this field has increased.

Qualitative research methods were preferred in the studies examined, followed by literature review, quantitative methods, and mixed methods. The qualitative methods used were: case study ($n=28$); grounded theory ($n=14$); and, action research ($n=3$). Fourteen new models were proposed in studies using grounded study design mostly based on ADDIE, ARCS, Morrison, Ross, and Kemp, Dick and Carey, or Smith and Ragan. Two models were revised in two different studies employing grounded theory design. Among 28 reviewed studies, only two were carried out through meta-analysis, and experimental design was used most in quantitative studies.

The top three data collection tools used in the studies examined were: interviews, questionnaires, and achievement tests. As to data analysis, quantitative methods were used more frequently than qualitative. Predictive analysis was the most preferred quantitative data analysis technique while descriptive analysis was the most preferred qualitative data analysis technique. Among qualitative analysis, content analysis was applied six times, while document analysis was used only once. Clearly, the reviewed sample indicates that there is a deficiency in content and document analyses on instructional design models.

The most preferred sampling interval was 11 to 30 participants, and most participants consisted of undergraduate students, who are easily accessible to researchers. Other popular sampling levels included instructional designers, high school students, teachers, and post-graduate students.

The studies examined were mostly conducted in the fields of computer and instructional

technologies, science education, engineering sciences, and social sciences. Previously, Göksu, Özcan, Çakir and Göktas (2014) had similarly revealed that studies on instructional design models were mostly carried out in the fields of computer and instructional technologies, science, and mathematics. These findings are not surprising because one of the reasons for the emergence of instructional design models is the need for new learning and teaching methods as a result of advancing instructional technologies. Not many studies were conducted in the field of medicine, though Levinson (2010) has stated that instructional design should be applied in medical training. Furthermore, Stevens and Goulbourne (2012) conducted a study using the PBL Model and highlighted the importance of instructional design in globalising today's medical training. Hsu, Lee-Hsieh, Turton and Cheng (2014) stressed the use of the ADDIE model in their study on medicine which they promoted as guidance for administrative changes.

The majority of the 53 different models used in the studies examined were system-oriented while only a few were product-oriented. The model types of the study were determined based on the literature (Fauser et al., 2006; Gustafson & Branch, 2002). However, a new classification is needed because a number of recently developed models could not be included under the umbrella of existing models.

Motivation, collaborative learning, learning rate (efficacy), individual learning, effective learning, and problem-solving skills were the variables on which the examined models had the highest influence, which was generally positive. This paper has pointed out how the influences of some models have not been investigated. The instructional design models used in the studies examined guided the use of instructional materials and methods in some experimental studies. Some studies made partial use of models while others attempted to reveal influences on differing variables. Others proposed new models or revised existing models. The models were referred to in the studies as instructional design models, learning models, instructional models, motivation models, design models, or design theories. This variety represents how some models function as an instructional method or theory besides being an instructional design model. These concepts are intertwined in the literature.

The following eight recommendations are based on the findings discussed in this paper:

1. SSCI or SCI journals mostly feature studies focusing on basic models. Thus, research must discuss the effectiveness of new models, which may reveal the cause of their limited frameworks.
2. Samples containing participants from different levels could be formed in research on instructional design models.
3. Studies employing content analysis and meta-analysis could be conducted on instructional design models.
4. The number of studies on instructional design models in medicine, linguistic sciences, and social sciences could be increased to reveal their influences.
5. More research may uncover the influences of instructional design models on attendance to lesson, academic success, social skills, metacognitive skills, and creative thinking.
6. Influences of some models on some variables were not investigated (see Table 9). Research may clarify these unknown influences.
7. A study investigating and evaluating recently developed models using the classification of Gustafson and Branch (2002) may increase their usefulness and functionality.
8. The definitions of instructional design terms such as instructional design model, learning model, instructional model, motivational model, design model, and design theory may

need to be reconsidered and clarified.

It is clear that there is considerable nuance in definitions of instructional design with a number of extant models being added to with new and revised models. All, however, share the common goal of categorising and assisting teaching and learning.

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