

EFFECTS OF WEB 2.0 ENHANCED LEARNING ENVIRONMENT ON HIGHER
ORDER THINKING: EXPERIENCES AND OPINIONS OF SOPHOMORE CEIT
STUDENTS

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**EFFECTS OF WEB 2.0 ENHANCED LEARNING ENVIRONMENT ON
HIGHER ORDER THINKING: EXPERIENCES AND OPINIONS OF
SOPHOMORE CEIT STUDENTS**

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

EFFECTS OF WEB 2.0 ENHANCED LEARNING ENVIRONMENT ON HIGHER ORDER THINKING: EXPERIENCES AND OPINIONS OF SOPHOMORE CEIT STUDENTS

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The enhancements of technology have profound effects on education. With the advent of Web 2.0 technologies into our lives, the conventional understanding of education has changed. One of the various uses of Web 2.0 in teaching and learning processes is digital artifact generation. This study has two aims: to investigate sophomore students' level of learning through generating digital artifacts with Web 2.0 tools, namely, blog, concept map, and infographic based on Bloom's Revised Taxonomy; and to investigate sophomore students' opinions about learning and their perceived level of learning through generating digital artifacts with these Web 2.0 tools. For these purposes, a case study is designed. The data were collected through digital artifacts and semi-structured interviews. The participants were 10 sophomore students from the Department of Computer Education and Instructional Technology at one of the public universities in Ankara, Turkey. The results showed that learning from generating digital artifacts with blogs, concept maps, and infographics carried

students' learning to higher levels of thinking skills in accordance with Bloom's Revised Taxonomy. In addition, students have mainly positive opinions regarding generating digital artifacts within the learning process and they perceive their learning outcomes as significant.

Keywords: Digital artifact creation, Bloom's Revised Taxonomy, Higher Order Thinking Skills, Web 2.0 in Education.

ÖZ

WEB 2.0 ARAÇLARI İLE ZENGİNLEŞTİRİLMİŞ ÖĞRENME ORTAMININ ÜST DÜZEY BİLİŞSEL BECERİLER ÜZERİNDEKİ ETKİLİLİĞİNİN İNCELENMESİ: BÖTE İKİNCİ SINIF ÖĞRENCİLERİNİN DENEYİM VE DÜŞÜNCELERİ

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Yüksek Lisans, Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü

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Teknolojik gelişmeler eğitim üzerinde derin etkiler yaratmaktadır. Web 2.0 teknolojilerinin hayatımıza girmesi ile birlikte geleneksel eğitim anlayışı değişime uğramıştır. Web 2.0' ın öğrenme ve öğretme süreçlerinde çeşitli kullanımlarından biri de dijital eserler oluşturmaktır. Bu çalışmanın iki amacı vardır. Birincisi, üniversite ikinci sınıf öğrencilerinin, blog, kavram haritası ve infografik gibi Web 2.0 araçlarını kullanarak oluşturdukları dijital eserlerin öğrenme düzeylerine etkisini Bloom'un Revize Edilmiş Taksonomisine göre belirlemektir. İkincisi ise üniversite ikinci sınıf öğrencilerinin Web 2.0 araçları ile dijital eserler oluşturarak öğrenmeye dair fikirlerini ve algıladıkları öğrenme çıktılarını belirlemektir. Bu amaçla bir durum çalışması tasarlanmıştır. Veriler dijital eserler ve yarı yapılandırılmış görüşmeler ile toplanmıştır. Katılımcılar Ankara'daki bir devlet üniversitesinin Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü ikinci sınıf öğrencilerinden oluşan 10 kişidir.

Sonuçlar göstermiştir ki; öğrencilerin, blog, kavram haritası ve infografik gibi Web 2.0 araçlarıyla öğrenme süreçleri öğrencileri Bloom'un Revize Edilmiş Taksonomi'sine göre üst düzey düşünme becerilerine ulaştırmıştır. Ayrıca, öğrencilerin öğrenme süreçlerinde dijital eserler yaratmaya dair fikirlerinin çoğunlukla olumlu olduğu ve bu süreçteki öğrenme çıktılarına dair algılarının da önemli ve anlamlı olduğu bulunmuştur.

Anahtar Kelimeler: Dijital Artefakt Oluşturma, Bloom'un Revize Edilmiş Taksonomisi, Üst Düzey Düşünme Becerileri, Eğitimde Web 2.0 Kullanımı.

To my family and my beloved

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TABLE OF CONTENTS

ABSTRACT.....	v
ÖZ	vii
ACKNOWLEDGEMENTS	x
TABLE OF CONTENTS	xi
LIST OF TABLES	xv
LIST OF FIGURES	xvii
LIST OF ABBREVIATIONS	xix
CHAPTERS	
1 INTRODUCTION	1
1.1 Background of the Study	1
1.2 Statement of the Problem	4
1.3 Purpose of the study	5
1.4 Research Questions	6
1.5 Significance of the Study	6
1.6 Definition of Terms	8
2 LITERATURE REVIEW	11
2.1 Bloom’ s Taxonomy	11
2.1.1 Original Taxonomy	11
2.1.2 Need for Revision	12
2.1.3 Bloom’ s Revised Taxonomy	13
2.1.4 The Taxonomy Table	14

2.1.5	Higher Order Thinking	19
2.2	Web 2.0.....	21
2.2.1	Web 2.0 in Higher Education	22
2.2.2	Blogs.....	24
2.2.3	Blogs in Education	25
2.2.4	Concept Maps.....	26
2.2.5	Infographics.....	27
2.2.6	Infographics in Education	28
2.3	Media & Method Debate	29
2.4	Learning by Design	30
3	METHODOLOGY	33
3.1	Research Questions.....	33
3.2	Overall Design of the Study and Justification of the Method	34
3.3	Context of the Study	36
3.3.1	Course Description.....	36
3.3.2	Web 2.0 Tools Utilized within the Study.....	37
3.3.3	Procedures of the Study.....	41
3.4	Participants of the Study.....	50
3.5	Data Collection Instruments	51
3.5.1	Learner Generated Digital Artifacts	52
3.5.2	Interview Guide.....	53
3.6	Quality of the Research	54
3.7	Data Analysis.....	56
3.7.1	Document Analysis	56
3.7.2	Interviews	62

3.8	Role of the Researcher	63
3.9	Assumptions	63
3.10	Limitations.....	64
4	RESULTS	65
4.1	Sophomore students’ level of learning from digital artifacts they had created using designated Web 2.0 Tools in accordance with Bloom’ s Revised Taxonomy.....	65
4.1.1	Blogs	66
4.1.2	Concept Map	71
4.1.3	Infographic	73
4.1.4	Summary of Blog, Concept Map, Infographic Findings.....	76
4.2	Sophomore students’ opinions on learning by generating with designated Web 2.0 tools.....	78
4.2.1	Positive Aspects	78
4.2.2	Negative Aspects.....	91
4.3	Sophomore students’ perceived learning outcomes by generating visuals with designated Web 2.0 Tools.	93
4.3.1	Encouraging Active Learning	94
4.3.2	Meaningful learning	95
4.3.3	Permanency	96
4.3.4	Awareness	97
4.4	Summary of Findings	98
5	DISCUSSION CONCLUSION, AND IMPLICATIONS	101
5.1	Discussion	101

5.1.1	The Level of Learning through Generating Digital Artifacts Based on Bloom’ s Revised Taxonomy.....	101
5.1.2	Opinions on Generating Digital Artifacts with Selected Web 2.0 Tools	102
5.1.3	Perceived Learning Outcomes Based on Generating Digital Artifacts with Selected Web 2.0 Tools	104
5.2	Implications for Practice.....	106
5.3	Suggestions for Further Research.....	109
	REFERENCES.....	111
APPENDICES		
	ETHICS COMMITTEE OF MIDDLE EAST TECHNICAL UNIVERSITY RESEARCH CENTER FOR APPLIED ETHICS APPROVAL FORM (TURKISH)	121
	INFORMED CONSENT FORM	123
	THEMES AND CODES IN THE INTERVIEW	125
	WEEBLY BLOG WEB 2.0 TOOL GUIDELINE	127
	SPICYNODES CONCEPT MAP WEB 2.0 TOOL GUIDELINE	135
	PIKTOCHART INFOGRAPHIC WEB 2.0 TOOL GUIDELINE.....	139
	INTERVIEW QUESTIONS (TURKISH)	143
	BLOG PROMPTS.....	145

LIST OF TABLES

TABLES

Table 2.1 The Taxonomy Table	15
Table 2.2 Structure of the Knowledge Dimension of the Revised Taxonomy.....	16
Table 2.3 Structure of the Cognitive Process Dimension of the Revised Taxonomy	18
Table 3.1 Study Schedule	49
Table 3.2 Distribution of Participants by Age and GPA	50
Table 3.3 Participant Details	51
Table 4.1 Classification of Students' Blog Contents Based on Bloom's Revised Taxonomy	68
Table 4.2 Each participant's GPA and number of higher order thinking achievement based on blog contents.	71
Table 4.3 Classification of Students' Concept Map Contents Based on Bloom's Revised Taxonomy.....	72
Table 4.4 Each participant's GPA and number of higher order thinking achievement based on concept map contents.	73
Table 4.5 Classification of Students' Infographic Contents Based on Bloom's Revised Taxonomy.....	74
Table 4.6 Each participant's GPA and number of higher order thinking achievement based on infographic contents.	75
Table 4.7 Classification of Students' Blog, Concept Map, and Infographic Contents Based on Bloom's Revised Taxonomy	77
Table 4.8 Each participant's GPA and number of higher order thinking achievement based on all designated Web 2.0 contents.....	78
Table 4.9 Positive Opinions on Generating Digital Artifacts with Designated Web 2.0 Tools.....	80
Table 4.10 Negative Opinions on Generating Digital Artifacts with Designated Web 2.0 Tools.....	91

Table 4.11 Perceived Learning Outcomes with Generating Digital Artifacts with Designated Web 2.0 Tools.	94
Table C.1 Themes and Codes in the Interview	125

LIST OF FIGURES

FIGURES

Figure 2.1 Original and revised versions of Bloom's taxonomy.....	13
Figure 3.1 Diagram that shows the post-facto and in-vivo naturalistic case research frameworks (adapted from Reigeluth & Frick, 1999).....	35
Figure 3.2 Design Interface of Weebly Blogging Tool.....	39
Figure 3.3 Design Interface of Spicynodes Concept Mapping Tool.....	40
Figure 3.4 Design Interface of Piktochart Infographic Creation Tool	41
Figure 3.5 Blog prepared by one of the sophomore students.....	59
Figure 3.6 Concept Map prepared by one of the sophomore students.....	60
Figure 3.7 Infographic prepared by one of the sophomore students.....	62
Figure D.1 Weebly login screen.....	127
Figure D.2 Weebly my sites screen.....	127
Figure D.3 Weebly website type selection screen.....	128
Figure D.4 Weebly theme selection screen.....	128
Figure D.5 Weebly domain selection screen.....	129
Figure D.6 Weebly design interface.....	129
Figure D.7 Text element button	129
Figure D.8 Text toolbar.....	130
Figure D.9 Several buttons on Weebly interface	130
Figure D.10 Columns button.....	130
Figure D.11 Columns on design screen	131
Figure D.12 Adding page screen.....	131
Figure D.13 Appearance of generated pages	131
Figure D.14 Rearranging pages screen	132
Figure D.15 Creating subpages screen.....	132
Figure D.16 Adding button screen	133
Figure D.17 Adding link screen	133

Figure D.18 Publishing screen	134
Figure E.1 Adding nodes screen	136
Figure E.2 Embedding URL screen	136
FigureE.3 Getting URL screen.....	137
Figure F.1 Infographic design screen.....	139
Figure F.2 Adding elements screen.....	140
Figure F.3 Infographic publishing screen	141

LIST OF ABBREVIATIONS

METU: Middle East Technical University

CEIT: Computer Education and Instructional Technology

HOT: Higher Order Thinking

CHAPTER 1

INTRODUCTION

This introductory chapter addresses the issues that underlie the background of the study; statement of the problem based upon this background; purpose and significance of the study along with the research questions that were pursued throughout the study; and the definitions of terms that were used in the study.

1.1 Background of the Study

Rapid advancements in technology has brought Web 2.0 systems into our daily lives. Therefore, the role of human in technology use has changed rapidly. Web 2.0 introduced Internet users with dynamic technologies, rather than the previously used static technologies, in terms of both use and development of web technologies (Hossain & Aydın, 2011). Web 2.0 allow users to interact, collaborate, and produce information interdependently (Richardson, 2010). There is a wide range of Web 2.0 systems, which foster users to generate contents. User-generated contents have an important position in educational contexts (Franklin & Harmelen, 2007). Franklin and Harmelen (2007) identified the attributes of attractiveness, interdependency, collaboration, and pedagogical structure as the reason for Web 2.0's mentioned significant position. Solomon and Schrum (2007) stated that Web 2.0 Tools and their attributes can engage and motivate students. However, Web 2.0 research in education has remained on a low level (Franklin & Harmelen, 2007). Richardson (2010) stated that the rapid changes in Web 2.0 technologies have little impact on educational practice. He claimed that students have already been using wide variety of technologies with little or no guidance but with regard to schools there is either little

or no practical use of web technologies at all. In other words, we use Web 2.0 technologies in our daily lives; yet there is little or no research regarding the use of these tools in educational settings. Considering these few studies on this issue, there seems to be contradictory views. One example for this might be the famous debate between Clark and Kozma going on for a few decades. Clark (1994) stated that media and media attributes –which also include Web 2.0 tools- will never influence learning, their benefit can be only economical in terms of speed and cost. He based his argument on various research studies conducted over 70 years. On the other hand, Kozma (1994) stated that learners construct knowledge by actively collaborating with medium or media attribute and there is a need to conduct more research on the effectiveness of various Web 2.0 Tools in educational settings. As for Grosseck (2009), she expressed both advantages and disadvantages of Web 2.0 Tools. She listed advantages as cost reduction, flexibility, ease of use, compatibility with the elements of the educational fields, reliability in continuous usage, the increase in the number of modalities, etc., whereas the disadvantages were itemized as the variations between browsers, introduction of contents that have uncertain significance, low quality content, being a medium for low digital ability people, time and knowledge investment in Web 2.0 Technologies (Grosseck, 2009, p.480).

There are several tools commonly used in educational settings. Three of them are blogs, concept maps, and infographics. Jorn Barger coined the name of *blog* or *web-log* in 1997, where it stands for a personal web page consisting of paragraphs of opinion, information, and links which is written by an author (or sometimes a group of authors) REF???. Blogs primarily consist of texts but they can include images, videos, charts, graphs, and various audio types (Solomon & Schrum, 2010). Blogs have various features from enabling users share their posts with their audiences to commenting another users' posts (Anderson, 2007; Franklin & Harmelen, 2007). In education, blogging can help students to overcome writing across the curriculum which can be resulted in more clear and organized ideas on articles (Solomon & Schrum, 2010). In addition Richardson (2010) described several educational attributes of blogs as: enabling collaboration, keeping history of works, considering

individual differences, giving equal opportunity to all class residents, increasing students' expertness on a topic, etc.

Regarding concept map, Novak and Gowin (1984), defined concept maps as tools used to create schemas for "representing a set of concept meanings embedded in a framework of propositions" (p.15). Proposition means two or more concept tags connected by words semantically. They proposed that concept mapping was a powerful way of "knowledge capture and utilization" in the process of students' meaning making. There are several educational benefits of concept maps. Some of them are: helping learners for identifying, organizing, and clarifying abstract concepts, encouraging active interactions, organizing and elaborating the information, and helping learners for processing information effectively (Wang, 2003).

Infographic, a relatively new Web 2.0 technology also have several impacts on educational settings. It is defined as a visualization consisting of data or knowledge often accompanied by text and aims to carry complex information in a clear and easily understandable way. Infographics consist of charts, signs, diagrams, icons or maps that help comprehension of a given text-based content. These elements have been used to build knowledge, tell stories, and share information (Mol, 2011). According to Newcombe & Learmonth (2005), graphs have a significant role in educational settings. It is argued that a good infographic is able to tell a story and show facts that would be hard to show otherwise (Mol, 2011). Creation of infographic for educational purposes improve students design skill, facilitate exploration of modern tools. Moreover students can even publish their infographics so that authentic audiences can reach them (MacQuarrie, 2012).

As put forth by various researchers mentioned above, examining the effectiveness of Web 2.0 Tools is an important issue in educational settings. To perform a sound examination; Bloom's Revised Taxonomy can provide an effective theoretical lens for such examination. Anderson and Krathwohl (2001) stated that, Bloom's Revised Taxonomy provides classifications of learner's cognitive processes in instructional

objectives on a broad range to the instructional designers. In addition, McLoughlin and Lee (2008) claimed that with learner-generated content approach individual and social thinking of student might be prompted. Besides, this approach foster higher level of cognitive activities like analyzing, evaluating, synthesizing, and creating digital artifacts (Van Harmelen, 2006), which puts forth learner generated contents such as digital artifacts, as important means to foster higher order thinking levels. Thus Bloom's Revised Taxonomy can be a significant guide to evaluate how digital artifacts, which are created by the students themselves, affect their higher order thinking levels.

1.2 Statement of the Problem

In recent years, Web 2.0 technologies became available everywhere. These tools offers many unique features such as dynamic and updated information, sharing, and collaboration. Thanks to Web 2.0 Tools, students, teachers, and community members around the world are enabled to collaborate with each other. However, there seems to be an apparent need to carefully think and research these tools in learning activities (Grosbeck, 2009). Thus, the issue of using these tools for educational purposes as effectively as possible should be considered. Moreover, the outcome of the formal professional development of teachers should be consistent with "what teachers learn and what goes on in the classroom" (Ertmer, Lehman, Park, Cramer & Grove 2003, p. 1958). To benefit from qualified educational practices; varying pedagogical and technological needs of students and teachers should be considered by professional development initiatives (Gorder, 2008).For this reason, teacher education programs are important places to start associating Instructional Technologies in education (Çelik, 2014).

There are several research studies on the instructional effectiveness of media and media attributes which contains Web 2.0 Tools. However, there is no consensus on whether they are effective or not. Several research studies argue that Web 2.0 Tools are effective tools to promote higher order thinking levels, to let students and

teachers collaborate with each other, and motivate them in learning processes (Franklin & Harmelen, 2007; Solomon & Shrum, 2007). In response to these arguments, Clark (2002) stated instructional method and novelty effects cannot be controlled therefore, we cannot mention the instructional effectiveness of media and media attributes. In line with the famous Clark-Kozma debate on this issue, while Clark (2002) stated that “media and attributes of media do not have unique effects on learning” (p. 329); Kozma (1994) stated that “if there is no relationship between media and learning, it may be because we have not yet made one” (p. 7). Similar to Kozma, Windschitl (1998) claimed that qualitative research methods should be used to discover, identify and document sophisticated changes arising from Web-based teaching and learning; the role of the students and teachers can be redefined.

1.3 Purpose of the study

This study has a general aim to add to the currently scarce knowledge base about the instructional effectiveness of learner generated digital artifacts with Web 2.0 Tools, and to make a humble contribution to the emerging literature. More precisely, the purpose of this study is to examine the Web 2.0 user experiences of sophomores in light of Bloom’s Revised Taxonomy. Specifically, the purpose of the study is threefold:

- To examine effectiveness of creating digital artifacts with designated Web 2.0 Tools, namely, Weebly Blog, Spicynodes Concept Map, and Piktochart Infographics, on higher order thinking skills of female sophomores according to the Bloom’s Revised Taxonomy;
- To explore and explain sophomores’ opinions on creating digital artifacts with the designated Web 2.0 Tools; and

- To explore and identify sophomores' perceived learning outcomes while creating digital artifacts with designated Web 2.0 Tools.

1.4 Research Questions

To achieve the purpose of the study, the following research questions were pursued:

- 1) How do the digital artifacts generated with designated Web 2.0 Tools by sophomores move their learning to higher levels of cognitive dimensions within the Revised Bloom's Taxonomy?
- 2) What are sophomore students' opinions about learning by generating with the designated Web 2.0 tools?
- 3) How does generating visuals in the learning process affect sophomore students' perceived learning outcomes?

1.5 Significance of the Study

From early childhood education to higher and further education programs there is an increasing use of technology and technology integration into educational settings. However, there are several problems with this integration and there are limited research studies on this issue.

Today's learners have different preferences and abilities than early generations. New generation is interactive, creative and media oriented; Web 2.0 have an important place in their everyday lives; and they have positive attitude towards Web 2.0 use in education (Solomon & Schrum, 2007). At this point following questions arouse: whether new student profile require different ways of teaching, and how educators can prepare students with the presence of Web 2.0 tools (Franklin & Harmelen, 2007; Solomon & Schrum, 2007). To examine and accommodate these changes and Windschitl (1998) suggested that researchers should turn to qualitative research methods in an effort to discover, document, and identify sophisticated alterations

arising within the scope of Web-based teaching and learning. He added that teachers' and students' roles can be revised and new ways of interaction can emerge.

Several research studies argue that Web 2.0 Tools are effective tools to promote higher order thinking levels, to let students and teachers collaborate each other, and motivate them in learning processes (Franklin & Harmelen, 2007; Solomon & Shrum, 2007). In addition, Kozma (1994) stated learners construct knowledge by actively collaborating with media or media attributes which contains Web 2.0 Tools. Moreover, McLoughlin and Lee (2008) claimed that generating digital artifacts with Web 2.0 Tools foster higher order thinking levels and combination of multiple web tools and resources is a significant student-driven instructional tool because of developing autonomy, openness, diversity, and connectedness (Van Harmelen, 2006). On the other hand Clark (1994) emphasized that media and media attributes have no impact on learning, then, in the days when technology began to affect our lives much more, he reiterated his argument and stated that "media and attributes of media do not have unique effects on learning" (Clark, 2002, p. 329). These contradictory views showed that there is a need for careful examination of the effectiveness of Web 2.0 Tools within educational settings.

Anderson and Krathwohl (2001) state that Bloom's Revised Taxonomy provides classifications of learner's cognitive processes in instructional objectives on a broad range to the instructional designers as a measurement tool. Bloom saw this taxonomy not only as a measurement tool but also as a common language about learning objectives which ease communication between people, subject, and grade levels (Krathwohl, 2002). Moreover, Bloom's Taxonomy is a powerful tool for stating goals of objective based evaluations (Marzano & Kendall, 2007). Therefore to measure student learning outcome Bloom's Revised Taxonomy can be an effective tool. Churches (2008) confirms this argument and states that digital learning activities like mind mapping, content organizing, monitoring, content mixing, storytelling, and generating digital artifacts were attributed to higher order thinking skills corresponds to analyze, evaluate, and create levels of the Revised Bloom's Taxonomy (Churches, 2008).

There are various Web 2.0 Tools and they are being used for several purposes. Current research study aimed to examine the effects of blog, concept map and infographic. The reviewed literature showed that there is no research study which examines the effectiveness of blog, concept map, and infographic as digital artifact creation tools in educational settings. In addition, to examine these tools effects on students' higher order thinking skills; use of Bloom's Revised Taxonomy is important for allowing teachers to measure student outcomes objectively. It is also important to understand students' opinions on and perceived learning outcome with generating digital artifacts with the designated Web 2.0 Tools.

1.6 Definition of Terms

Digital Artifact: An online or multimedia publication of a man-made thing created for a purpose.

Formative research: Is a kind of developmental research or action research that is intended to improve design theory for designing instructional practices or processes (Reigeluth & Frick, 1999, p.633).

Learner Generated Content: Any form of content such as blogs, wikis, discussion forums, posts, chats, tweets, podcasting, pins, digital images, video, audio files, and other forms of media that was created by users of an online system or service, often made available via.

Cognitive Dimension: The Cognitive Process dimension consist of six types of thinking (Anderson et al., 2001, p. 31): remember, understand, apply, analyze, evaluate, and create.

Remember: Retrieving relevant knowledge from long-term memory; recognizing, identifying, recalling, retrieving.

Understand: Construct meaning from instructional messages, including oral, written, and graphic communication; interpreting, clarifying, paraphrasing, representing, translating exemplifying, illustrating, instantiating, classifying, categorizing, subsuming, summarizing, abstracting, generalizing, inferring, concluding, extrapolating, interpolating, predicting, comparing, contrasting, mapping, matching, explaining, and constructing models.

Apply: Carry out or use a procedure in a given situation; executing, carrying out, implementing, using.

Analyze: Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose differentiating, discriminating, distinguishing, focusing, selecting, organizing, finding coherence, integrating, outlining, parsing, structuring, attributing, deconstructing.

Evaluate: Make judgments based on criteria and standards; checking, coordinating, detecting, monitoring, testing, critiquing, judging.

Create: Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure; generating, hypothesizing, planning, designing, producing, constructing.

Knowledge Dimension: The Knowledge dimension consist of four types of knowledge (Anderson et al., 2001, p. 29): factual, conceptual, procedural, and metacognitive.

Factual Knowledge: The basic elements students must know to be acquainted with a discipline or solve problems in it.

Conceptual Knowledge: The interrelationships among the basic elements within a larger structure that enable them to function together.

Procedural Knowledge: How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods.

Metacognitive Knowledge: Knowledge of cognition in general as well as awareness and knowledge of one's own cognition.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the related literature in order to provide the theoretical background for the research study, regarding the scope of the study and the boundaries set by the research questions articulated in the previous study. More specifically, the chapter consists of four main parts that summarize and synthesize Bloom's Taxonomy, Web 2.0, Media & Method Debate, and Learning by Design. The part that explains the Bloom's Taxonomy includes the Original Taxonomy, Need for Revision, Bloom's Revised Taxonomy, The Taxonomy Table and Higher Order Thinking. Web 2.0 part addresses the development of the Web 2.0 as a terminology and its connotations; its general use in educational settings; and definitions and specific uses of three Web 2.0 tools, namely, blogs, concept maps, and infographics. Moreover, media and method debate was included to present two important contradictory views on the instructional effectiveness of media and media attributes. Lastly, as the name implies, learning by design part was provided to emphasize 'learning by design' feature of Web 2.0 Tools.

2.1 Bloom's Taxonomy

2.1.1 Original Taxonomy

In 1956, one of the most familiar educational books of all time, *The Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain* (Bloom et al., 1956) was published. It provided a framework to classify intended and expected that are to be learned by the students at the end of the

instruction. The purpose of this emergent taxonomy was to provide a hierarchical structure for creating bulks of test items, measuring the same learning objective. Bloom saw this taxonomy not only as a measurement tool but also as a common language for easy communication of the learning objectives among people, subject matters, and grade levels (Krathwohl, 2002).

Bloom divided the original taxonomy into six major categories in cognitive domain. These categories were *Knowledge, Comprehension, Application, Analysis, Synthesis,* and *Evaluation*. Other than application, all categories consisted of subcategories ordered from simple to complex, and concrete to abstract. Original taxonomy has been commonly used for classifying curricular objectives and test items. Analyzing objectives and test items by this way provided a basis for moving curricula more complex categories (Krathwohl, 2002).

In field of education Bloom's Taxonomy is used widely and Bloom's taxonomy is a powerful tool for stating goals of objective based evaluations (Marzano & Kendall, 2007).

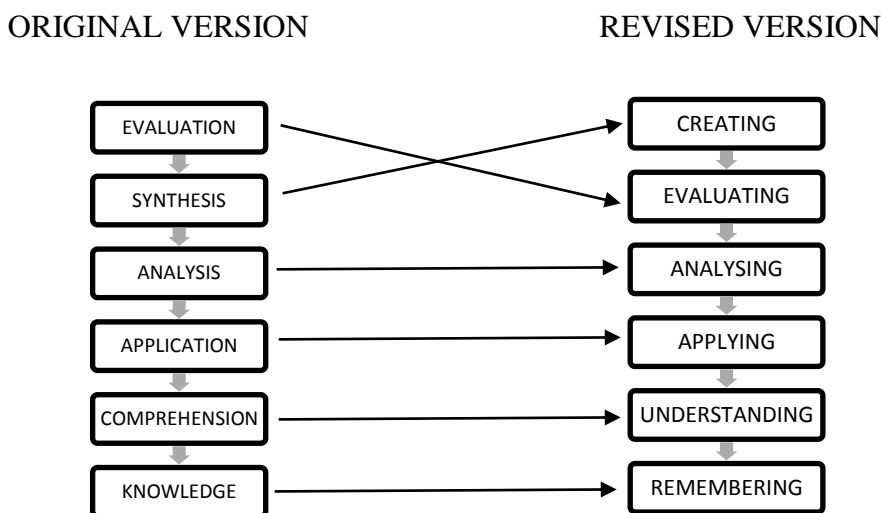
2.1.2 Need for Revision

Since the emergence of the original taxonomy in 1956, new learning theories and approaches have arouse in which students are more knowledgeable of and responsible for their learning (Amer, 2006). One of the most important reason for criticism of Original Taxonomy was oversimplification of thinking and its relation to the learning (As cited in Marzano & Kendall, 2007). Being aware of the problem Bloom, Krathwohl and Masia authors of original taxonomy stated that:

Although evaluation is placed last in the cognitive domain because it is regarded as requiring to some extent all the other categories of behavior, it is not necessarily the last step in thinking or problem solving. It is quite possible that the evaluation process will in some cases be the prelude to the acquisition of new knowledge, a new attempt at comprehension or application, or a new analysis and synthesis. (As cited in Marzano & Kendall, 2007, p.9)

In 1980s, teaching thinking and reasoning skills became visibly important in educational areas. Various books, articles, reports emphasized the importance of teaching thinking skills (Marzano & Kendall, 2007). Starting from these years' approaches and theories, which requires metacognitive and self-initiated behavioral and motivational processes have emerged (Zimmerman, 1998) such as Constructivism, Self-Regulated Learning, Metacognition. Along with the emergence of these theories, in 1994, *A Forty-Year Retrospective* (Anderson & Sosniak, 1994), was published and in the last chapter Krathwohl (1994) put emphasis on some unsolved problems related with original taxonomy. Thereupon from 1995 to 2000 a group of educators who were specialized on cognitive psychology, curriculum and instruction, testing, measurement, and assessment, embarked on the revision on the Original Taxonomy. The main topics of this revision were to address weaknesses of original taxonomy and come up with educational and psychological improvements (Anderson et al., 2001).

2.1.3 Bloom's Revised Taxonomy



(Based on Pohl, 2000, *Learning to Think, Thinking to Learn*, p. 8)

Figure 2.1 Original and revised versions of Bloom's taxonomy.

Two of the original authors of Bloom's taxonomy, Anderson and Krathwohl (2001), with other researchers, noticed that revision was needed for Taxonomy framework. It

was aimed to increase usability and usefulness of the taxonomy in revised version. Significant alterations were made in definition of terms. When defining objectives in the original Taxonomy knowledge dimension includes both verb and noun aspects. This situation was resulted in confusion. In the revised taxonomy this problem obviated by noun forming Knowledge dimension, verb forming Cognitive Process dimension (Krathwohl, 2002). Apart from that Revised Taxonomy was prepared towards elementary and secondary school levels contrarily Original Taxonomy that targeted university or collage level. Furthermore, in Revised Taxonomy, developments of educational and cognitive psychology has been taken into consideration (Anderson, 2002).

2.1.4 The Taxonomy Table

Framework of Revised Taxonomy can be shown in a two dimensional table in which rows and columns contain categories of cognitive process and knowledge that carefully described and defined, respectively (Anderson et al., 2001, p. 27). Table 2.1 shows the Taxonomy table in terms of cognitive process and knowledge dimensions.

Table 2.1The Taxonomy Table

Knowledge Dimension	The cognitive process dimension					
	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Metacognitive						

A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives (p. 28), by L. Anderson, D. Krathwohl, P. Airasian, K. Cruikshank, R. Mayer, P. Pintrich, J. Raths, and M. Wittrock, 2001, New York, NY: Longman.

2.1.4.1 Knowledge Dimension

The Knowledge dimension consist of four types of knowledge instead of three (Anderson et al., 2001, p. 29): factual, conceptual, procedural, and metacognitive.

- *Factual knowledge* comprises “basic elements students must know to be acquainted with a discipline or solve a problem in it”.
- *Conceptual knowledge* comprises “the interrelationships among the basic elements within a larger structure that enable them to function together”.
- *Procedural knowledge* comprises “how to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods”.

- *Metacognitive knowledge* comprises “knowledge of cognition in general as well as awareness and knowledge of one’s own cognition”.

Table 2.2 shows the structure of the knowledge dimension of the Revised Taxonomy:

Table 2.2 Structure of the Knowledge Dimension of the Revised Taxonomy

Factual Knowledge - The basic elements that students must know to be acquainted with a discipline or solve problems in it.

- Knowledge of terminology
- Knowledge of specific details and elements

Conceptual Knowledge - The interrelationships among the basic elements within a larger structure that enable them to function together.

- Knowledge of classifications and categories
- Knowledge of principles and generalizations
- Knowledge of theories, models, and structures

Procedural Knowledge - How to do something; methods of inquiry, and criteria for using skills, algorithms, techniques, and methods.

- Knowledge of subject-specific skills and algorithms
- Knowledge of subject-specific techniques and methods
- Knowledge of criteria for determining when to use appropriate procedures

Metacognitive Knowledge - Knowledge of cognition in general as well as awareness and knowledge of one's own cognition.

- Strategic knowledge
 - Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge
 - Self-knowledge
-

2.1.4.2 Cognitive Process Dimension

The Cognitive Process dimension consist of six types of thinking as the original taxonomy's knowledge dimension, but with some changes (see Figure 2.1). *Remembering* comprises recalling "relevant knowledge from long-term memory". *Understanding* comprises making "meaning from instructional messages, including oral, written, and graphic communication." *Applying* comprises practicing or using "a procedure in a given situation." *Analyzing* comprises dividing material into components and appointing "how parts relate to one another and to an overall structure or purpose." *Evaluating* comprises making "judgments based on criteria and standards." *Creating* comprises setting "elements together to form a coherent or functional whole" and reorganizing "elements into a new pattern or structure" (Anderson et al., 2001, p. 31). Table 2.3 shows the structure of the cognitive process dimension of the Revised Taxonomy:

Table 2.3 Structure of the Cognitive Process Dimension of the Revised Taxonomy

Remember - Retrieving relevant knowledge from long-term memory.

- Recognizing
- Recalling

Understand - Determining the meaning of instructional messages, including oral, written, and graphic communication.

- Interpreting
- Exemplifying
- Classifying
- Summarizing
- Inferring
- Comparing
- Explaining

Apply - Carrying out or using a procedure in a given situation.

- Executing
- Implementing

Analyze - Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.

- Differentiating
- Organizing
- Attributing

Evaluate - Making judgments based on criteria and standards.

- Checking
- Critiquing

Create - Putting elements together to form a novel, coherent whole or make an original product.

- Generating
- Planning
- Producing

2.1.5 Higher Order Thinking

As one of the main research question of the current research study aimed to examine sophomore students' higher order thinking levels, Higher Order Thinking (HOT) is also included in literature review. Systematic research interest in HOT derived from Bloom's Taxonomy (1956) which proposed a hierarchy of intellectual skills based on six verbs. The lower three were recall, comprehend and apply, and the upper three were analyze, synthesize, and evaluate. After the revision of Bloom's Taxonomy all these levels changed. The lower three are changed as remember, understand, apply and the upper three are changed as analyze, evaluate, and create (Anderson and Krathwohl, 2001). Higher Order Thinking is defined (Brookhart, 2010) in three different categories; "transfer, critical thinking and problem solving" (p.3). Regarding transfer "Higher-order thinking is conceived as students being able to relate their learning to other elements beyond those they were taught to associate with it." (p.5). Regarding critical thinking, higher order thinking is defined as students' practice of wise judgment or production of a reasoned critique. And regarding problem solving, "the goal of teaching is equipping students to be able to identify and solve problems in their academic work and in life" (p.7). Besides, King, Goodson and Rohani (1998) also have a definition for higher order thinking skills (p.1);

Higher order thinking skills include critical, logical, reflective, metacognitive, and creative thinking. They are activated when individuals encounter unfamiliar problems, uncertainties, questions, or dilemmas. Successful applications of the skills result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience and that promote continued growth in these and other intellectual skills. Higher order thinking skills are grounded in lower order skills such as discriminations, simple application and analysis, and cognitive strategies and are linked to prior knowledge of subject matter content. Appropriate teaching strategies and learning environments facilitate their growth as do student persistence, self-monitoring, and open-minded, flexible attitudes.

Higher order thinking is a significant concept for student achievement. There are several teaching strategies to develop higher order thinking skills. The lessons in which higher order thinking skills are used require clear communication to decrease ambiguity. In this way, students' attitudes about thinking tasks will be improved. Thinking skills should be modeled in lesson plans. Besides, examples of the applied

thinking and adaptations for various student needs should be included in lesson plans. Moreover, scaffolding is a good strategy to foster students develop higher order thinking skills. Lessons should be student centered and designed to teach certain learning strategies. To inform learners about their learning progress, immediate feedback and corrective information should be provided (King, Goodson and Rohani, 1998).

Due to dramatic developments in technology students can study collaboratively, publish their works, and it can contribute to the development of higher order thinking skills (King, Goodson and Rohani, 1998). Higher order thinking skills and digitization of learning have been proclaimed as an important competency for success (Yang, Gamble, Hung & Lin, 2013).

Brookhart (2010) stated that assessing higher order thinking regularly increases student achievement and motivation. Fostering intellectual work and critical thinking by suitable assessments and assignments will result in student achievement. Giving responsibility of higher order thinking to students by assignments and assessments that require critical thinking improves student motivation. For assessment of higher order thinking there are several principles (Brookheart, 2010, p.17);

- Specify clearly and exactly what it is you want to assess.
- Design tasks or test items that require students to demonstrate this knowledge or skill.
- Decide what you will take as evidence of the degree to which students have shown this knowledge or skill.
- Present something for students to think about, usually in the form of introductory text, visuals, scenarios, resource material, or problems of some sort.
- Use novel material—material that is new to the student, not covered in class and thus subject to recall.
- Distinguish between level of difficulty (easy versus hard) and level of thinking (lower-order thinking or recall versus higher-order thinking), and control for each separately.

To sum up, as containing reflective, critical, metacognitive logical, and creative thinking skills higher order thinking is an important concept for student achievement. Rapid advancements in technology foster the development of

higher order thinking. Thanks to Web 2.0 Tools, students find the opportunity to display higher order thinking skills. Therefore, effects of Web 2.0 Tools on higher order thinking skills is a notable issue.

2.2 Web 2.0

Web 2.0 defined in Cambridge Dictionary (“Web 2.0”, 2014a) as the “advanced Internet services, especially involving ordinary people creating and sharing information, for example using blogs and social networking”. Besides, Oxford Dictionary (“Web 2.0”, 2014b) defined this term as “The second stage of development of the Internet, characterized especially by the change from static web pages to dynamic or user-generated content and the growth of social media”. Vice-chairperson of O’reilly Media Inc., Dale Dougherty, coined the Web 2.0 term officially in 2004 (Anderson, 2007). This term encompasses various meanings such as content which is generated by user, collaborative data and content sharing, socialization, interacting with web-based applications, etc. (Conole & Alevizou, 2010; Franklin & Harmelen, 2007). All definitions includes similar terms as creating content by users, socialization, and interaction with web based applications.

With the introduction of Web 2.0, interaction, collaboration and interdependent production of information is available (Richardson, 2010; Anderson, 2007). Right along with facilitation of publication, Web 2.0 encourages users to upload and share digital artifacts like videos, images, and documents. Therefore it changes practices and the role of web in these practices from “content repository and information retrieval mechanism” to an environment “that enables more social mediation and user generation of content” (Conole & Alevizou, 2010, p.10). Hossain and Aydın (2011), stated that Web 2.0 moves internet users from static technologies to dynamic technologies in terms of not only use but also development of web technologies. In the past, content creation on Web was not easy due to its requirement of technological knowledge (Richardson, 2010). With the emergence of Web 2.0, non-

experts in the technology field have the opportunity to create and publish artifacts easily (Crane, 2009). Owing to Web 2.0, producing and sharing content on the web as simple as consuming it (Çelik, 2014).

The second stage of development of the Internet, characterized especially by the change from static web pages to dynamic or user-generated content and the growth of social media and there is a wide range of Web 2.0 systems and the most important ones used in education are blogs, wikis, social bookmarking, media sharing services, social networking systems, collaborative editing tools, and syndication and notification technologies. (Franklin & Harmelen, 2007). A number of web 2.0 resources can be found in the websites web20guru and go2we20. Moreover, through mobile tools and computers, Web 2.0 enables users to construct a collaborative online society which allow users to share information interactively and in an interoperable manner (Hossain and Aydın 2011).

2.2.1 Web 2.0 in Higher Education

The opportunities which Web 2.0 created in learning and teaching have not been probable substantially before. One of the resource of change in Higher Education is shown as Web 2.0 technology with its attractive, interdependent, collaborative and pedagogical structure (Franklin & Harmelen, 2007). Solomon and Schrum (2007) stated Web 2.0 tools and their features can engage and motivate students:

They can search for content online, read it, and analyze it to decide what's important, interact with the author, and post the resulting knowledge. The work they post online could have as much impact as the work of any known author or expert on the topic, and the potential audience may be large and international. This is power that was unheard of before (p. 15-16).

Several universities have pioneered the use of Web 2.0. These are: University of Warwick which offering personal blogs since 2004, University of Leeds which offering wikis and blogs since 2005, University of Brighton which offering ELGG (Open Source Social Networking Engine) since 2006, University of Edinburgh which is the first university have a Web 2.0 strategy in UK (Franklin & Harmelen, 2007).

Students who has grown up with digital technology can perform multiple activities simultaneously, they have obtained various ways of thinking, and they have greater visual skills. On the other hand they lose their attention more quickly and have less reflective thinking ability. This generation has different cognitive abilities than its predecessors (Prensky, 2001). Oblinger and Oblinger (2005) stated that this generation is different compared to previous ones. He characterizes them as: highly social, digitally literate, on a large scale internet familiar, opting collaborative learning, willing to interact in image rich environment. Franklin and Harmelen (2007) claim that one of the reasons for this alteration in the new generation is Web 2.0 Technologies. To sum up, new generation is interactive, creative and media oriented; Web 2.0 have an important place in their everyday lives; and they have positive attitude towards Web 2.0 use in education (Solomon & Schrum, 2007). At this point following questions aroused: whether new student profile require different ways of teaching, and how educators can prepare students with the presence of Web 2.0 tools (Franklin & Harmelen, 2007; Solomon & Schrum, 2007). To examine and accommodate these changes and Windschitl (1998) suggested that researchers should turn to qualitative research methods in an effort to discover, document, and identify sophisticated alterations arising within the scope of Web-based teaching and learning. He added that teachers' and students' roles can be revised and new ways of interaction can emerge. Moreover, Greenhow, Robelia, and Hughes (2009) stated constructs of learning and instruction are affected from shifts occurred in the nature of web and class conceptualization. Their prediction is that the researchers will be more interdisciplinary, open to sharing and learning outside their fields. With regard to web 2.0, they forecast cloud computing and social operating systems will most probably influence research and education in next decade. Grosseck (2009) argue that Web 2.0 tools give the opportunity to work collaboratively to both students and teachers. However she adds that to benefit from unique opportunities provided by Web 2.0 Tools, rigorous research is needed.

Web 2.0 tools are used in education in various ways. In group works these tools gain great importance. Social software eases group process. Blogs and wikis are the

environments where this kind of use occurs. Beyond group use, students can create courses and instructional materials by using Web 2.0 tools.

Despite its wide-spread use, Web 2.0 research in education has remained on a low level (Franklin & Harmelen, 2007). Richardson (2010), stated the rapid changes in web technology affect every aspects of our lives substantially however, in education, these changes have very little impact. He explained his idea as students use wide variety of technologies with little or no guidance but when it comes to schools there is no or little practical use of web technologies. The most important question should be answered is how we can benefit from the opportunities introduced by these tools.

There are also studies that present the advantages and disadvantages of Web 2.0 Tools. The main advantages and disadvantages of Web 2.0 are expressed (Grosseck, 2009); Web 2.0 technologies reduce costs, it provides flexibility in terms of offering many alternatives, and it enables users to reach information easily and quickly. It also has an important role in teaching and learning activities. On the other hand, it has limited security, promotes amateurishness which can be mean invaluable contents, and it can be transform an electronic junk easily.

2.2.2 Blogs

Blog is a portmanteau of the *web log* (Solomon &Schrum, 2010). Blog is defined as “A regularly updated website or web page, typically one run by an individual or small group that is written in an informal or conversational style.” in Oxford Dictionary (“Blog”, 2014a). Similarly, in Cambridge Dictionary (“Blog”, 2014b), blog is defined as “1- A regular record of your thoughts, opinions, or experiences that you put on the internet for other people to read. 2- To write or add material to a blog”. Historically, Jorn Barger coined the name of *blog* or *web-log* in 1997, stating a personal web page comprising of paragraph of opinion, information, and links which is written by an author (or sometimes a group of authors). Blogs primarily consist of texts but they can include images, videos, charts, graphs, and various audio types (Solomon &Schrum, 2010). Discrete entries in blogs called as *posts*. Posts are displayed publicly in chronological order. Blogs offer various features to users. Most

blogs let visitors to add comments (Anderson, 2007; Franklin & Harmelen, 2007). This posting and commenting processes enables blog articles to access unlimited number of readers. Tagging posts with a few words ease categorization according to subject which facilitate users to access previous posts. Also by means of linking feature, retrieval and referencing of content on different blogs is facilitated (Anderson, 2007).

2.2.3 Blogs in Education

Ease of writing on web and knowing the audiences can access blogs are the two of the most powerful features of blogs. As they allow readers leave comment or ask question, they are collaborative spaces which let readers become a part of learning process (Richardson, 2010). Brock Eide researched the influences of blogging on the bloggers' brain and found the following results:

- Blogs can promote critical and analytical thinking
- Blogs can be a powerful promoter of creative, intuitive, and associational thinking.
- Blogs promote analogical thinking.
- Blogging is a powerful medium for increasing access and exposure to quality information.
- Blogging combines the best of solitary reflection and social interaction (Eide Neurolearning Blog, 2005).

Educators who adopt blog use in their classrooms take the advantage of these tools in a various ways. Blogs has been used in classrooms as knowledge management tools, e-portfolios, collaborative spaces, class portals. Blogging process foster students to think critically, read more analytically, and write more clearly. In addition, being a publicly displayed environment, blogs make students to write or comment carefully and it helps students to establish relationship with peers and teachers (Richardson, 2010; Solomon & Schrum, 2010).

Richardson (2010, p.27), explains why teachers should use blog as a tool in the instructional process as;

Blogs

- Are constructivist tools, because they contribute the wider body of knowledge created on Word Wide Web
- Enables collaboration
- Keeps the history of work in an ordered, searchable manner
- Consider individual differences and give equal opportunity to all class residents
- Increase students' expertness on a topic
- Make students literacy in ever-expanding information society.

Besides, Solomon and Schrum (2010), stated blogging can help students to overcome writing across the curriculum which can be resulted in more clear and organized ideas on articles.

2.2.4 Concept Maps

Novak and Gowin (1984), defined concept maps as tools used to create schemas for “representing a set of concept meanings embedded in a framework of propositions” (p.15). Proposition means two or more concept tags linked by words semantically. They proposed that concept mapping was a powerful way of “knowledge capture and utilization” in the process of students’ meaning making.

Concept maps work to make clear to both students and teachers the small number of key ideas they must focus on for any specific learning task. A map can also provide a kind of visual road map showing some of the pathways we may take to connect meanings of concepts in propositions. After a learning task has been completed, concept maps provide a schematic summary of what has been learned. (p.15)

To progress meaningful learning, concept maps should be hierarchical, new concepts should be added under broader concepts. That is, more inclusive concepts should be placed top of the map, less inclusive concepts should be placed in the lower orders on the map (Novak & Gowin, 1984).

The question of how new concepts and propositions were associated with learner’s cognitive structure resulted in the emergence of the concept map tool in early 1970’s (Novak, 1977; Novak & Musonda, 1991). Novak and Gowin (1984) argue that concept maps can help students in the learning process of learn how to learn. The new concept mapping tools enable researchers to investigate human learning in any context (Novak, 2010).

A meta-analysis conducted on the use of concept maps inferred that regardless of educational level and learning context, concept maps are helpful tools (Nesbit & Adesope, 2006). They also stated that to achieve knowledge transfer and retention concept maps are more effective than traditional methods like reading, attending lectures, class discussions, etc. Wang (2003), examined the influences of concept maps depending on previous research and theory. He stated that concept mapping fosters learning by (Wang, 2003, pp. 24-25):

- Helping learners identify, clarify, and organize abstract concepts and relationships among information by presenting them with visual and thus a more tangible format.
- Encouraging active interactions between learners and the information being processed by linking what is being processed in the working memory to what is in the long-term memory. As a result, schema modification and creation become easier and occur in an organized fashion
- Elaborating and organizing the information being processed to ensure that schema modification and creation are easier and happen in an organized fashion.
- Helping learners process the information effectively through dual coding.

Approach used for learning a subject matter distinguishes learning quality from deep learning to surface learning. In meaningful learning, students integrate new concepts and propositions to an appropriate existing concept in his/her cognitive structure (Novak, 2010).

2.2.5 Infographics

Infographic is a visualization consist of data or knowledge often accompanied by text and aims to convey complex information in a clear and easily understandable way. Infographics consist of charts, signs, diagrams, icons or maps that help comprehension of a given text-based content. These elements have been used to build knowledge, tell stories, and share information throughout history. That is, infographic is not a novel visualization technique and today it takes place in our everyday life within newspapers, magazines, and across digital channels. With the emergence of web tools and increased communication possibilities infographic take its place on digital world. (Mol, 2011; Smiciklas, 2012). Free and easy-to-use tools enable the creation of infographics by a large segment of the population therefore infographic is one of the most effective visualization for communicating information.

Development and publish process of infographics is called information design, information architecture and data visualization (Smiciklas, 2012).

Today's conditions which have created "information overload and shortened attention spans" (p.6) make quick delivery of information have importance. Individuals and organizations use infographic which makes information more interesting and accessible to enhance their communication. (Smiciklas, 2012).

2.2.6 Infographics in Education

How people think and learn with graphics is an important question for research studies conducted on multimedia learning. To understand complex information, graphics are necessary tools (Mayer, 2010). Effective graphics are proper way to comprehend sophisticated information. Tufte (1983) stated that John Snow found the origin of the 1854 London cholera epidemic by using map-based diagram. It provides evidence regarding graphs ease comprehension and understanding. According to Newcombe & Learmonth (2005), graphs have an important role in educational settings. It is argued that a good infographic is able to tell a story and show facts that would be hard to show otherwise (Mol, 2011).

By its eye-catching, easily sharable and engaging features infographics transform visually intense and complex information to a clear and accessible form. Infographics have started play an active role in classrooms both by using existing infographic and by creating infographic.

An existing infographic can be used

- as a discussion starter in class
- to draw attention when starting a new topic
- to practice reading charts and interpreting statistics

An infographic created by students can be used

- to make an historical timeline

- to create a step-by-step guide
- to explain an event, invention, etc.
- to create a chart, graph, etc.

Creation of infographic for educational purposes enhances students design skill, helps to explore modern tools. Students can publish even their infographics therefore authentic audiences can reach them (MacQuarrie, 2012).

2.3 Media & Method Debate

As described above, on the effectiveness of Web 2.0 Tools in education there are opposing viewpoints. The most important one of these opposing viewpoints is Clark-Kozma debate. Their debate based on media and method effectiveness. As Web 2.0 Tools included in media concept, this debate is included in literature review. Clark (1983) claims that any media have no positive impact on learning through the delivery of instruction. Research studies showing favorable results in terms of performance and time-saving remain weak against to the strong hypotheses on uncontrollability of instructional method's effect and novelty effect. His argument based on his literature review about media comparison studies, reviews and meta-analysis of media research. He said that in media comparison studies advantages of one medium over another will confuse medium with method of instruction. And he added that method, aptitude, and task variables of instruction should be examined when the issue is learning benefits. Clark (1994) also says that for more than one medium the same or similar learning outcomes are available. For this reason the thing which makes the difference is instructional method. For Clark, external events which must promote cognitive processes and structures that are necessary for learning goals are equal to instructional method. He claims that in cognitive learning theories, media and media attributes aren't involved as variables of learning. Neither a centuries-old media research nor 80 years cognitive learning research supports media as an instructional method.

On the other hand, Kozma (1991) defined learning with media as “a complementary process within which representations are constructed and procedures performed, sometimes by the learner and sometimes by the medium” (p. 179). He claims that to construct knowledge learner actively collaborates with medium. Kozma (1994) questioned whether or not media will influence learning. If there is not a relationship between learning and media it can be because we haven’t yet connect. There should be more supplemental relationship between media and method and both are part of the instructional design. He thinks that media must be designed to provide strong new methods and methods must profit from a medium’s capabilities. He says developing capabilities of media will enable designers to make more powerful designs.

In contrast with Kozma’s argument, Clark (1994) stated media will never influence learning, its benefit can be only economical in terms of speed and cost. He based his argument on various research studies conducted over 70 years. He said some of media attributes can have effect on the development of cognitive process. However if the replaceability of media attributes is possible, the reason for results is the same uncontrolled properties contained in both studies. He thinks enthusiasm prevailed strong examination of structural processes in learning and instruction on media research. In addition, Clark (2002) investigated the issue in the light of developments in cognitive instructional psychology. He says he and Kozma are agreed there is no causal connection evidence between learning and media. He is determined to maintain his claim.

2.4 Learning by Design

Enhancements in web technologies resulted in a huge transformation in education. Web 2.0 Technologies offer various advantages which engage students in meaningful learning activities. These activities are student-centered and transform classes into

more active and interactive learning environments. (Neo, Neo, Lim & Tan, 2013). In addition, multimedia approaches to learning indicated that in learning processes, multiple representations – a combination pictorial of and verbal representations – can foster deep learning (Mayer, 2009 & Schnotz, 2005). To obtain maximum efficiency from learning with multimedia, there are several steps that should be followed. Firstly, students should select the relevant pictorial and verbal information, secondly, they should organize the information into appropriate pictorial and verbal mental representations thirdly, and they should integrate corresponding verbal and pictorial representations with each other and prior knowledge (Mayer, 2009). However, this process is a difficult process (Seufert, 2003).

On the other side, learner generated contents have several important features like encouraging active learning, fostering deep level of understanding, and engaging students in metacognitive processing (Van Merter, 2001). Moreover, Türker and Zingel (2008) stated that learner generated contents encourage meaningful learning. Similarly, McLoughlin and Lee (2008) claimed that as a learning approach, learner generated content can stimulate individual and social thinking of student and promote higher level of cognitive processes. Web 2.0 allow users to interact, collaborate, and produce information interdependently (Richardson, 2010) Thanks to Web 2.0 Tools, generating or designing the learning environment is both easier and enjoyable with their attractive, interdependent, collaborative and pedagogical structure (Franklin & Harmelen, 2007). Hsu, Hwang, Chuang and Chang (2012) considered the dimensions of enjoyment, ease of use, and satisfaction of Web based Tools as learning enhancer. It means that learning by design activities with Web 2.0 Tools make students feel happier and satisfied and allow them to acquire more organized and meaningful learning.

In education, Web 2.0 Tools allow learners to create and design their own learning environment. This situation motivate students and make them active in learning processes. In addition in literature, learner generated contents are shown as effective Tools to promote higher order thinking skills. Therefore, learning by design activities' use in educational contexts provide important benefits to students.

CHAPTER 3

METHODOLOGY

Throughout this chapter, detailed information about the design of the study will be covered: research questions guiding the study, overall design of the study along with the justification of the method, context of the study, participants of the study, data collection instruments and procedures, quality of the research, and the data analysis process will be explained thoroughly.

3.1 Research Questions

This study aimed to examine and explain sophomore students' level of learning from digital artifacts that they created using designated Web 2.0 tools in accordance with Bloom's Revised Taxonomy; to explore and explain their opinions about generating digital artifacts with designated Web 2.0 Tools; and to explore and identify their perceived learning outcomes. The main research questions for this study are as follows:

- 1) How do the digital artifacts generated with designated Web 2.0 Tools by sophomores move their learning to higher levels of cognitive dimensions within the Revised Bloom's Taxonomy?
- 2) What are sophomore students' opinions about learning by generating with the designated Web 2.0 tools?
- 3) How does generating visuals in the learning process affect sophomore students' perceived learning outcomes?

In order to answer these questions; an undergraduate must course named "CEIT 216 Principles and Methods of Instruction" in the Department of Computer Education

and Instructional Technology (CEIT) at Middle East Technical University (METU) was selected as an instance to collect data.

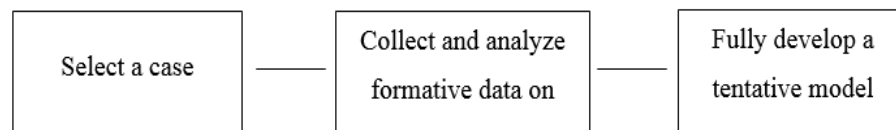
3.2 Overall Design of the Study and Justification of the Method

The study was designed to examine sophomores' level of learning through generating digital artifacts with designated Web 2.0 tools based on Bloom's Revised Taxonomy, to explore and explain their opinions about learning through generating digital artifacts with the selected Web 2.0 tools, and their perceived level of learning through generating digital artifacts with designated Web 2.0 tools. To address the research aim and research questions, a special methodology was employed which is the combination of formative evaluation and case study method of qualitative research (Yin, 1994). Formative evaluation is a methodology that aims to improve instructional resources and curricula (Bloom, Hastings & Madaus, 1971; Cronbach, 1963; Thiagarajan, Semmel & Semmel, 1974; Triantafillou, Pomportsis & Demetriadis, 2003; Weston, McAlpine & Bordonaro, 1995). Its main objective is to improve impact and efficiency of the instruction (Triantafillou, Pomportsis & Demetriadis, 2003).

Reigeluth and Frick (1999) questioned the most helpful research methods in the creation and improvement process of instructional design theories and they found their answer with "formative research". They define it as "a kind of developmental research or action research that is intended to improve design theory for designing instructional practices or processes" (p. 633). In education, in terms of both usefulness and easy application, design theory stays one step ahead of learning theory. For instructional design theories, formative research methodology has been proved to be significant in the identification of improvement ways (Reigeluth & Frick, 1999). Reigeluth and Frick (1999) argue that formative research pursues a holistic single case outlined by Yin (2009). According to Yin (1984) a single case study is appropriate when "a how or why question asked about a contemporary set of events" (p. 20) and that contains how to improve design theory.

Case studies are categorized as designed cases and naturalistic cases. Designed cases require instantiation of the theory before its formative evaluation. As regards with the naturalistic cases, they are not designed according to a certain design theory. Since the instance in this study was not designed according to a certain theory, it is a naturalistic case study. There are two types of naturalistic case study depending on the time of instantiation during or after practical application. Since the formative evaluation of the instantiation is done after its application, this research study is a *post facto* naturalistic case (Reigeluth & Frick, 1999).

Both for post-facto, and in-vivo naturalistic case studies the structural framework of the research process as follows:



*Figure 3.1*Diagram that shows the post-facto and in-vivo naturalistic case research frameworks (adapted from Reigeluth & Frick, 1999)

Naturalistic case study requires three conditions (Reigeluth & Frick, 1999):

1. “The researcher picks an instance (or case) that was not specifically designed according to the theory but serves the same goals and the context as the theory” (p. 637).

The case which researcher selected with her advisor’s guidance is based on exploring, examining, explaining the effectiveness of generating digital artifacts via designated Web 2.0 Tools in sophomore students’ learning processes. There was no theory regarding this study in the accessible literature.

2. “The researcher analyzes the instance to see in what ways it is consistent with the theory, what guidelines it fails to implement, and what valuable elements it has those are not present in the theory.” (p. 637).

There is no theory therefore, new and specific elements that are emerged during the course of the study are identified. In the implementation process situations that create trouble or slow the process and situations that are valuable have been determined and presented.

3. “The researcher evaluates that instance formatively to identify how each consistent element might be improved, whether each absent element might represent an improvement in the instance and whether removing the elements unique to the instance might be detrimental.” (p. 637).

The elements and problems are evaluated formatively during implementation process of the study. These evaluations lead researcher to understand whether an improvement occur in the existing elements or whether extraction of existing elements would be inhibitive or which new elements can be included in the instance to provide improvement.

To sum up, design theory is more preferable with its useful and easily applied structure than its descriptive counterpart that is learning theory. Formative research emerges before a program is designed and implemented or during the implementation of the program and it aims to ensure accurate application of instructional design theories.

3.3 Context of the Study

3.3.1 Course Description

An undergraduate must course named “CEIT 216 Principles and Methods of Instruction” was selected to investigate the focus of the current study. This three-

credit course was given in two sections by two instructors and four teaching assistants in the Spring Semester of the 2013-2014 Academic Year in the Department of Computer Education and Instructional Technology (CEIT) at Middle East Technical University (METU). Except from being a sophomore CEIT student, there was no prerequisite for attending the course. The description of the course which is given in General Catalog 2013-2014 of METU is as follows:

Basic concepts and principles of teaching and learning. The importance and benefits of instructional planning. Planning instruction yearly plan based on units, daily plan and examples of activities. Teaching and learning strategies. Instructional methods and techniques and their relation to practice. Instructional tools and materials. Teacher's duties and responsibilities in improving the quality of instruction. Teachers' qualifications.

For this study participation was on a voluntary basis. All students taking this course had to participate in three-hour face-to-face meeting every week. Two hours of the course was theoretical and conducted by the instructor. The researcher was responsible for conducting the remaining one hour recitations. Within the scope of research study, volunteer students created digital artifacts in line with the given assignments via blogs concept maps, and infographics for five weeks. Detailed information on the given assignments could be found under the "Procedures of the Study."

For this study CEIT 216 course was selected. Because this course was a theoretical course and students were not able to synthesize their learning with the instructional method used in the class. For this reason providing a learning environment where students can synthesize their learnings was important. As the current study aimed to enable students to reach higher order thinking levels according to Bloom's revised Taxonomy CEIT 216 course was an appropriate course.

3.3.2 Web 2.0 Tools Utilized within the Study

Researcher selected three different Web 2.0 tools with her advisor's guidance for generating digital artifacts to be used throughout the learning process. Within the selection process several features were considered:

First and the foremost important, the tools must have been easy to use. That is, the interfaces of prospective Web 2.0 Tools must have high qualities. Features of a high quality interface is described as striving for consistency, meeting the requirements of universal usability, presenting informative feedback, designing dialogs to yield closure, inhibiting errors, allowing easy inversion of actions, promoting internal locus of control, and decreasing short term memory load (Shneiderman & Plaisant, 2004). On this basis, researcher and her advisor attempted to decide on optimal Web 2.0 Tools. Second, they must have been rich in terms of their features, attributes and properties. Third, they must have minimized the problems resulted from browser differences. Fourth, they must have been free to let students create and publish their digital artifacts easily. After a detailed investigation and elimination researcher and her advisor decided to use Weebly for blogs, Spicynodes for generating concept maps, and Piktochart for generating infographics.

3.3.2.1 Weebly: Blog Tool

Weebly is a web-based application that enables users for generating web sites or blogs. For the present study, Weebly was used to create a blog. Initially each student created her own blog, then they created the subsequent visuals. Each student created a blog entry for a total of four times consisting of their reflections on the Behaviorism, Cognitivism, Constructivism, and Social Learning topics in the first four weeks of the study. Figure 3.2 shows the design interface of the Weebly blog. As seen in Figure 3.2, menu bar and publish button located at the top of the screen. Elements are placed at the left side of the screen and design space is located in the center of the screen. Elements are used by drag-and-drop method to form the blog within the design space. All pages of the blog are situated in the right upper side of the screen. Before engaging in the given assignments, students are informed about how to prepare a blog by using Weebly (See [Appendix D](#)).

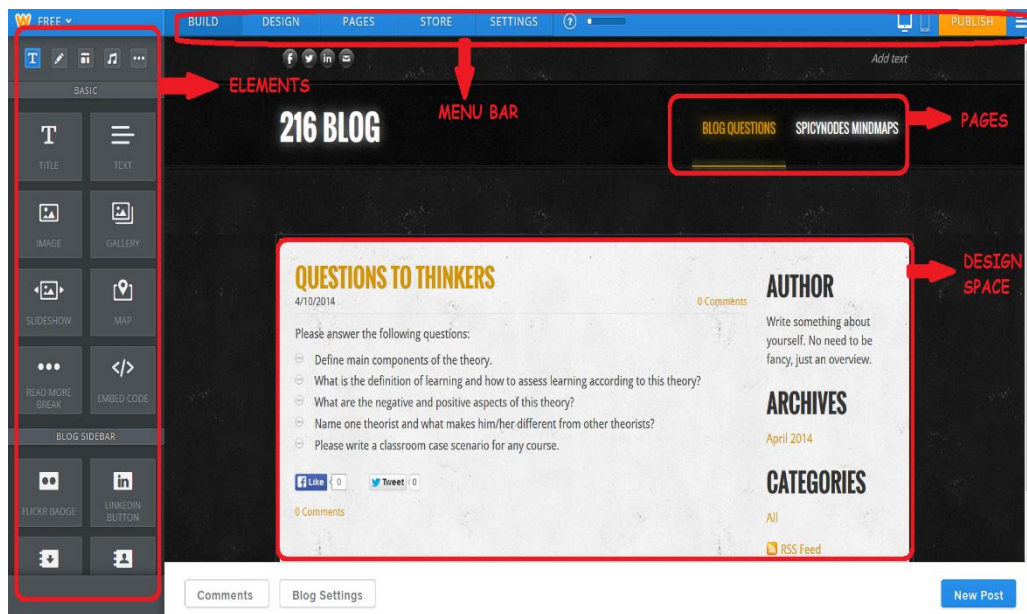


Figure 3.2 Design Interface of Weebly Blogging Tool

3.3.2.2 Spicynodes: Concept Mapping Tool

Concept mapping tools are useful for generating diagrams of relationships between concepts, ideas or different pieces of information. For the current study, each student created a total of four individual concept maps for the Behaviorism, Cognitivism, Constructivism, and Social Learning topics in the first four weeks of the study. Figure 3.3 shows the design interface of concept map on Spicynodes. As seen in Figure 3.3, there are two bars within the interface: menu and edit bars. Menu bar shows various tabs including a gallery of various visual designs that can be used for concepts maps, a tab for support that includes hints and help topics about the use, general information and pricing information about the tool, etc. Edit bar enable users to design and form the concept map as they want by enabling them to rearrange the styles, content and nodes of the created concept map. Similar to blogging tool, before engaging in the given assignments, students are informed about how to prepare a concept map by using Spicynodes (See [Appendix E](#)).

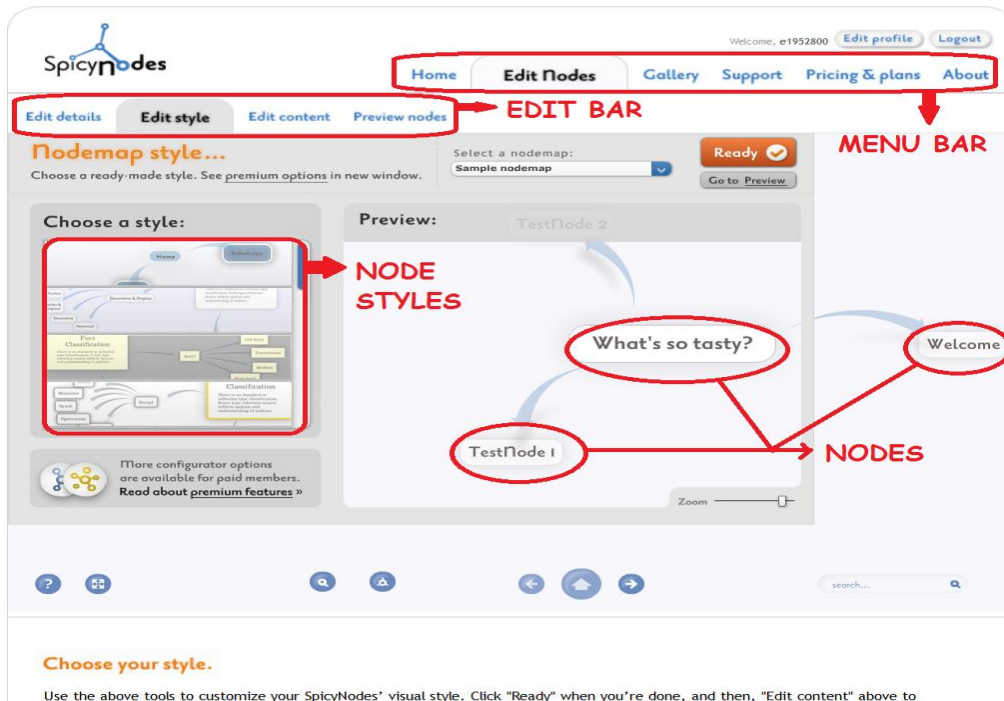


Figure 3.3 Design Interface of Spicynodes Concept Mapping Tool

3.3.2.3 Piktochart: Infographic Creation Tool

Infographics are visuals that help people to view complex information, data or knowledge clearly and quickly. In the last week of the study, students are instructed to create an individual infographic which includes information on Behaviorism, Cognitivism, Constructivism, and Social Learning theory. Figure 3.4 shows the design interface of an infographic created on Piktochart. As seen in Figure 3.4 there are several bars for generating and shaping the infographic: Menu, edit and output bars. Menu bar includes file-related options such as naming and saving the infographic, etc. along with the login information. Edit bar includes basic editing options such as cut, copy, paste, undo, redo, etc.; whereas output bar, as the name implies, includes output-related options such as publishing, reviewing, downloading, file type, sharing, etc. As for the elements, they are located on the left side of screen and can be used by drag-and-drop method to form the infographic within the design space, which is located in the center of the screen, similar to Weebly interface. Like blogging and concept mapping tools, before engaging in the given assignments,

students are informed about how to prepare an infographic by using Piktochart (See [Appendix F](#)).

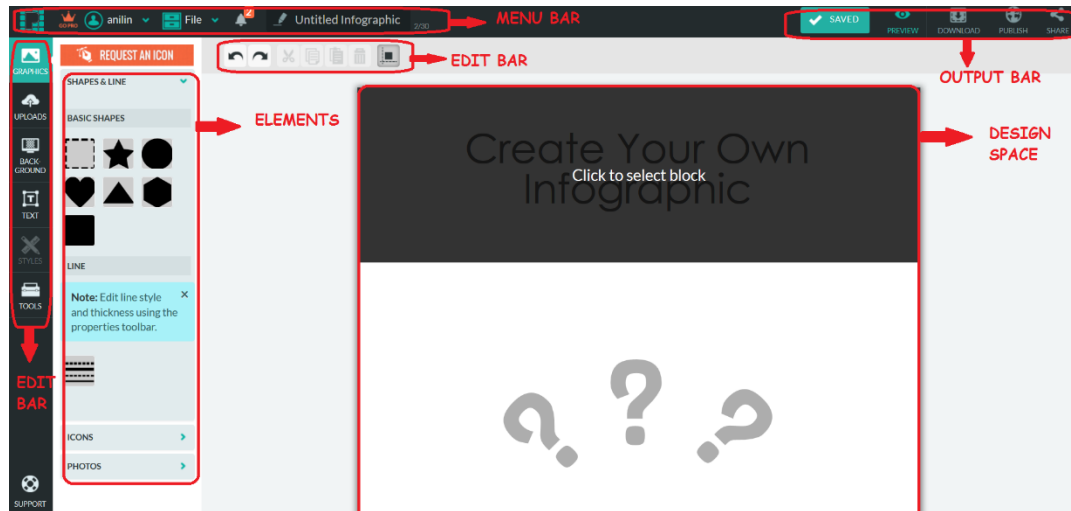


Figure 3.4 Design Interface of Piktochart Infographic Creation Tool

3.3.3 Procedures of the Study

Before beginning the study an application was submitted to the Middle East Technical University Human Subjects Ethical Committee (HSEC) to receive approval. The approval document can be found in Appendix A. After obtaining permission from HSEC, the researcher sought volunteers for this study in the class. With one of the main instructors of the course, she participated into one hour of recitation to inform the students about the study and ask for their voluntary participation to the study. Within this informative session, the purpose of the research, general procedure of the study, and its potential contributions to students are briefly described and their questions about the study are answered. After these explanations, invitation for volunteers took place. At the next meeting of the recitation, students, who want to participate in this study voluntarily, were informed about ethical conditions for participating in the study including their confidentiality, privacy, and voluntary participation and the consent forms were filled by the voluntary participants (see Appendix B for the consent form). At the same meeting, Web 2.0 Tools that will be used throughout the study were also briefly introduced

and explained, since informing students on expectations, purposes, and goals prior to using any of the technological tool will better facilitate reflection (Seale & Cann, 2000). The researcher explained the purpose and expectations of using these tools to the sophomores. That are, using designated Web 2.0 Tools to generating their own learning material could carry students to higher order thinking levels of the Revised Bloom's Taxonomy. In addition, the activities that will occur could be enjoyable and provide interactive and active learning environments to sophomores.

3.3.3.1 Introduction of Web 2.0 tools to be used and study schedule

The researcher gave students explicit technological instructions about how to create blog, concept maps and infographic through in-class tutoring and via email. In-class tutoring, students, who wanted to participate in the current study, were taken to an empty classroom and they were explained the process. The classroom was a traditional classroom and students sit down on straight rows of desks facing the front of the classroom. In front of the classroom there was a projection screen. This screen was managed by the researcher via a desktop computer between students and projection screen. The researcher performed predetermined tutorials and made explanations regarding these tutorials simultaneously. While determining the tutorials both technological and pedagogical use of designated tools were considered together.

Firstly, concept map creation tool Spicynodes was introduced. Spicynodes is a way to visualize online information that mimics the way that people look for things in the real world and its website is <http://www.spicynodes.org/> . The students received tutorial on not only how to use Spicynodes but also how to generate powerful concept maps. Tutorial was given on the behaviorism topic. Regarding use of Spicynodes, students were explained how to generate an interactive concept map, how to separate or associate concepts and how to choose main and sub concepts, adding description, image, video ...etc. Besides this, getting concept map URL was demonstrated. Regarding generating concept maps, students were mentioned features of a good concept map. That are: ordering concepts hierarchically, linking concepts

semantically, and making contents clearer. On behaviorism topic, students were shown a small illustration and said that they need to determine main and sub concepts elaborately not to disrupt content integrity. In addition, they were said that they can add explanation sentences under concepts but not too long. And they were warned about their concepts that should consist of maximum three words. Moreover, it was said that, if they want they would add pictures and videos regarding the topic. The same night they were received a guideline regarding Spicynodes tutorial. (See Appendix E).

Secondly, a tutorial was given on how to use Weebly and how to blog. Weebly is a web based application enable users for generating web sites or blogs and its website is <http://www.weebly.com> . Regarding technical aspect of Weebly, students were tutored on how to create a personal blog, using dashboard, adding pages, embedding links, and publishing the blog. It was said that their blog should consists of a main page which include the blog prompts prepared by the researcher, and its subpages to post on theories. That is, there should be four subpages which have the names of Behaviorism, Cognitivism, Constructivism, and Social Learning. In addition tasks were about learning content of the previous weeks; therefore, they had enough time to write their blogs and prepare concept maps.

Weebly blog tutorial also was given on behaviorism topic. Sophomores were said that they should post based on same five prompts for each theory. For behaviorism the illustration was done according to the first prompt “*Define main components of the theory*”. Sophomores were said that they should determine and write main components of the theory according to their learning experiences. For example, observable behavior can be one of the main components of the theory. Because this component is an indispensable component of behaviorism. They were told that, they need to write other components which are indispensable to behaviorism. Then the second prompt was introduced: “*What is the definition of learning and how to assess learning according to this theory?*” It was said that there are no formal learning definition according to a certain theory. However, a definition can be inferred from the characteristics of the theory. Similarly, although there are no formal assessment

based on the theory it can also be inferred from the theory. Then the third prompt was defined “*What are the negative and positive aspects of this theory?*” Sophomores were explained that they were expected to emphasize positive and negative aspects, advantages and disadvantages of the theory according to them. Then the fourth prompt was explained: “*Name one theorist. What makes him/her different from other theorists?*” With this prompt they were said that they were expected to express the most important theorist according to them and the reasons for this choice. And the last prompt “*Please write a classroom case scenario for any course.*” With this prompt students were expected to create a classroom case regarding theory. That is, the case should be created based on the characteristics of the theory. For example, if the theory behaviorism, then the case can be shaped around reinforcement, observable behavior, punishment etc. sophomores were told that these prompts and their use also valid for other theories. Therefore, they should track these prompts and explanations for all theories while posting on their blogs. Besides, they were told that they will receive feedback to revise and correct their posts.

They were also informed about they need to create a button on each subpage (that are behaviorism, cognitivism, constructivism, and social learning) named Spicynodes to embed their concept maps’ URLs. That is, under behaviorism post there should be a button named spicynodes directing behaviorism concept map. In addition, in later weeks, after they received infographic tutorial, they were said that they need to publish their Piktochart infographic on the main page of their Weebly blog. The same night they were received a guideline regarding Weebly blog tutorial. (See Appendix D).

Lastly, infographics creation tool Piktochart was introduced. They were told that the infographic assignment will be created on <https://magic.piktochart.com> website. Although in the following weeks they will receive infographic tutorial (face to face) and guideline (via e-mail), a small tutorial also given at the first meeting regarding how to manage infographic canvas, adding blocks, images, videos, etc. and publishing the infographic.

After introduction of these information, their questions were answered. They were informed about the procedure of the study that they will receive feedback about their answers to the blog questions and concept maps. It is also stated that they need to complete initial version of the tasks at the expected time and then they will receive feedback in a day or two. After this immediate feedback, they need to complete final version of tasks at the expected time. In the same evening, they were sent guidelines via e-mail with regard to Weebly and Spicynodes tools and due date for Behaviorism assignment was set as May 11, 2014.

3.3.3.2 Behaviorism Assignment

Behaviorism assignment was given at May 8, shortly after the introduction of Web 2.0 tools and study schedule. Sophomores were said that, they need to write a blog post based on blog prompts (See [Appendix H](#)) on behaviorism topic.

Regarding concept map assignment they were said that they need to create a concept map which represents behaviorism quite adequately and presents concepts interrelatedly. (Theorists, concepts special to the theory, etc.).

The assignments were conveyed not only at the face to face meeting but also via e-mail. The sophomores had three days to complete this assignment. As they have learned the behaviorism topic a few weeks ago, they had a grasp of the topic. Therefore, synthesizing the information on this topic has become easier. However, they were novel to learning by generating digital artifacts, they faced some problems. The researcher provided immediate assistance as long as they talk about their problems related with designated Web 2.0 Tools, learning contents, generating artifact etc. At the due date of behaviorism assignment the researcher checked their digital artifacts based on a rubric which was prepared by researcher with the help of two field experts. According to rubric, at May 12 sophomores were provided feedback and they were explained the deadline for behaviorism corrections as May 14 and Cognitivism assignment as May 18. Then they were send behaviorism corrections to the researcher and she checked the revised versions of digital artifacts on behaviorism topic. On Sunday 14th most of the students made changes on their

blogs and concept maps. A few of them, who did not complete the task were informed via e-mail again. They were told that they had to complete the revised version of task as soon as possible. Then all of them completed behaviorism task.

3.3.3.3 Cognitivism Assignment

The following assignments were done based on the same prompts. Sophomores received cognitivism assignment on May 12 via e-mail. They were said that they need to do cognitivism assignment based on the same blog and concept map prompts. They were told that they had time until May 18 to complete cognitivism task. However only three students performed this task. Because of this, all students were sent a study schedule via e-mail. Study schedule contains deadline for first version of task, feedback, and revised version of task. Because the students were studying for their upcoming midterms during the designated timeframe, due date for cognitivism task had been extended until May 20. All of the students completed cognitivism task and they received feedback within the same day. These students were asked to revise the cognitivism task on Wednesday (May 21). As they became more familiar with the activities their digital artifacts were more suitable for rubric. Therefore completing the cognitivism corrections on May 21 was easier.

3.3.3.4 Constructivism Assignment

With the cognitivism feedback, sophomores received due date for constructivism assignment as May 25 on May 19. As they learned the process more detailed they knew that they need to prepare digital artifacts based on blog and concept map prompts. Researcher received sophomores' artifacts on May 25 and gave feedback on May 26. They sent corrected versions of constructivism assignment on May 28. The researcher checked corrected versions and provided some additional feedback for one or two students regarding a few small problems. They corrected the assignments in that day.

3.3.3.5 Social Learning Assignment

The last theory was the social learning theory and they were informed about due date at May 26. Based on same blog and concept map prompts, sophomores sent their digital artifacts on June 1. For the last theory assignment they needed very few feedback. Therefore they needed to make very few corrections until June 4. The researcher checked corrected versions and there were no problem related with digital artifacts.

The due date was June 8th for the completion of the infographic task. Then they receive feedback on June 9th and deadline for the final corrections was until June 11th. After completion of the infographic task, implementation process of the study was ended. Between dates of June 12-25th, six of the 10 students were interviewed face to face and the rest was interviewed online.

3.3.3.6 Guideline for Infographic and Infographic Assignment

Infographic guideline was prepared by researcher after consulting the course instructor. As infographic assignment was at the last week of the study, sophomores received face to face tutorial and guideline via e mail (See Appendix F) at June 7. The following prompts were emphasized to the students which are included in Appendix F.

- *A picture that symbolize the theory in general.*
- *A few sentences that represent the theory in general.*
- *One video that represents the theory in general*
- *Theorists*
- *One specific theorist to explain his/her principles. (by visual and verbal elements)*

Therefore, in the fifth week, they prepared only an infographic which includes information from all of the theories, namely, Behaviorism, Cognitivism, Constructivism, and Social Learning theories depending on the above items. They were said that their infographic should be clear and easy to understand.

As sophomores had a grasp on all learning theories within the scope of current study they were given one day to generate their infographics based on infographic prompts. Therefore, they sent initial version of their infographics on June 8. The researcher provided feedback on June 9 to sophomores. They corrected their infographics on June 11. Therefore implication phase of the study has ended in this way.

Throughout this process to decrease the number of late submissions, students were informed frequently regarding tasks and deadlines. They were also reminded frequently that they can ask all of their questions without time restrictions to the researcher.

Henceforward, learning theories phrase will be used to designate Behaviorism, Cognitivism, Constructivism, and Social Learning theories.

The Table 3.1 shows the study schedule with dates and implementation process.

Table 3.1 Study Schedule

Study Schedule	
Date	Implementation
May 8, 2014	Introduction of Web 2.0 tools to be used and study schedule
May 11, 2014	Due date for generating Weebly blogs and doing Behaviorism
May 12, 2014	Giving feedback on Behaviorism assignment
May 14, 2014	Deadline for Behaviorism corrections
May 18, 2014	Due date for doing Cognitivism assignment
May 19, 2014	Giving feedback on Cognitivism assignment
May 21, 2014	Deadline for Cognitivism corrections
May 25, 2014	Due date for doing Constructivism assignment
May 26, 2014	Giving feedback on Constructivism assignment
May 28, 2014	Deadline for Constructivism corrections
June 1, 2014	Due date for doing Social Learning assignment
June 2, 2014	Giving feedback on Social Learning assignment
June 4, 2014	Deadline for Social Learning corrections
June 7, 2014	Guideline for infographic (face to face and via e-mail)
June 8, 2014	Due date for infographic assignment
June 9, 2014	Giving feedback on infographic
June 11, 2014	Deadline for infographic corrections
June 12-25, 2014	Interviews

3.4 Participants of the Study

The participants of the study were 10 sophomore female students enrolled in an undergraduate course named “Principles and Methods of Instruction”, which was given during the Spring Semester of the 2013-2014 Academic Year in the Department of Computer Education and Instructional Technology (CEIT) in Middle East Technical University (METU). Participants voluntarily took part in the study and all of them were female. All participants participated in all phases of the study; however, one of the participants interview record was not considered because of the poor quality of the online recording. Age of the participants were in the range of 20 to 23. The cumulative GPA of the participants ranged from 2.48 to 3.7. Table 3.2 shows the distribution of participants by age and GPA.

Table 3.2 Distribution of Participants by Age and GPA

Age	
Minimum	Maximum
20	23
GPA	
Minimum	Maximum
2.48	3.70

To give more detail, participants were coded from P1 to P10 and their ages and GPAs were given in detail in the Table 3.3.

Table 3.3 Participant Details

Participants	Ages	GPA's
P1	20	2.48
P2	23	2.97
P3	21	3.24
P4	21	3.08
P5	21	3.52
P6	22	3.70
P7	20	3.09
P8	21	3.20
P9	20	3.28
P10	21	3.20

3.5 Data Collection Instruments

In this study the research questions were focused on multiple topics. The first research question focused on instructional effectiveness of use of web 2.0 tools use in learning process. The focus of other two research questions were students' perceived learning outcomes with selected tools and opinions about learning with these tools. Thus, data collection instruments are primarily consisted of various documents and interviews. Artifacts created by the students in their learning process were important instruments of this study, because researcher aimed to understand the effectiveness of these documents. Interviews were conducted because one of the sub foci of the study was participants' perspectives on, reactions to, or experiences of the selected web 2.0 tools. Observation was not used as a data collection method because observation should be conducted in natural settings of those activities under study

(Angrosino & Pérez, 2000), which was not possible due to the nature of the study. This study mainly consisted of extracurricular activities and it was difficult and impractical conducting observations. In addition, observations also did not conducted in class activities. Because, class was too crowded and activities were mainly based on mobile technologies which decreased participant – researcher interaction in one hour recitations. Therefore, it was very difficult to observe volunteer students healthfully.

3.5.1 Learner Generated Digital Artifacts

McLoughlin and Lee (2008) claimed that with learner-generated content approach, individual and social thinking of student might be prompted. Besides, this approach foster higher level of cognitive activities like analyzing, evaluating, synthesizing, and creating digital artifacts. Combination of multiple web tools and resources is a significant student-driven instructional tool because of developing autonomy, openness, diversity, and connectedness (Van Harmelen, 2006). Within the scope of this study participants were required to create blogs, concept maps and infographics. To be more specific, each student was required to create four blog pages on their own Weebly website, four concept maps on their own Spicynodes account and one infographic on their own Piktochart account. Participants of the study received guidance via both face to face sessions and e-mail. The guidelines sent by e-mail for blogs can be found in [Appendix D](#), for concept map can be found in [Appendix E](#), for infographic can be found in [Appendix F](#). Participants were responsible for the whole of the production and publishing process of these digital artifacts.

Bloom's Revised Taxonomy of Educational Objectives were adapted to create prompts for blog, concept map and infographic. Used prompts were as follows;

For blog:

- Define main components of the theory.
- What is the definition of learning and how to assess learning according to this theory?
- What are the negative and positive aspects of this theory?

- Name one theorist and what makes him/her different from other theorists?
- Please write a classroom case scenario for any course.

For concept map:

- Create a concept map which represents the theory quite adequately and presents concepts interrelatedly. (Theorists, concepts special to the theory, etc.)

For infographic:

- A picture that symbolize the theory in general.
- A few sentences that represent the theory in general.
- One video that represents the theory in general
- Theorists
- One specific theorist to explain his/her principles. (by visual and verbal elements)
- Think that in a case a student have trouble with his/her homework. Because of this reason student goes to school without doing homework. What would teacher do in this situation? Please explain by visuals and verbal for each theory. (Behaviorism, cognitivism, constructivism, and social learning.)

In terms of contents, blogs were planned to be in a more narrative structure than infographic and concept map. For new experiences and knowledge creation narrative offers an organizational frame (Pachler & Daly, 2009). Falk and Dierking (2000) argue that if information is stored in the form of a story, its mental organization will be more effective.

3.5.2 Interview Guide

Besides documents, semi-structured interviews were conducted to gather qualitative data. Therefore, an interview guide was developed by the researcher and her advisor in Turkish language to obtain information about sophomore students' opinions, experiences about their learning process with the designated Web 2.0 Tools and their

perceived contributions of these tools to their learning experiences. The interview questions were prepared based on the research questions of the study.

The interview guide consists of three parts: in the introduction part, where participants were provided to feel comfortable and they were informed about the purpose of the study, number of questions, and approximate duration of interviews. In the body-part semi structured interview questions were asked. And in the closing part, the researcher asked the participants for any additions that they want to make and thanked for their participation to the study.

The first interview question focused on their perception on learning with designated Web 2.0 Tools. The following six questions, in pairs, focused specifically on students' opinions for each tool, whereas the next question was about perceived achievement and the following last four questions were about perceived effectiveness of the tools (see [Appendix G](#)).

One faculty member and one PhD student in the field checked the interview guide and provided feedback. Additionally, two sophomore students in the field reviewed the guide whether the questions were clear. They also provided feedback and based on all the feedbacks, the questions were revised and the wording of questions were revised to make them clearer.

3.6 Quality of the Research

Throughout years, methodologists attempted to increase the quality of qualitative research. The terms reliability and validity were used for quantitative research over the years. However, use of these terms in qualitative research is a debatable issue (Seale, 1999).

In qualitative research, the criteria for judging the quality are “credibility,” “transferability,” “dependability,” and “conformability” of the study (Lincoln & Guba, 1985). These criteria used in this naturalistic inquiry to indicate the quality of the study (Cresswell, 2003). Credibility of the research is provided by storing all raw

data (documents and interviews) on the researcher's computer throughout the study and for later recall and comparison (if needed). Transferability of the research is provided by describing the research context and the assumptions that were central to the research in a detailed way. In addition during semi structured interviews, member checking (Fraenkel, Wallen & Hyun 2012, p. 147) was used.

For providing dependability, an independent auditor reviewed the activities of the researcher.

Complying with the Gibbs' recommendation, transcriptions were continuously checked to avoid possible mistakes (As cited in Creswell, 2009). It was made sure that the codes were meant the same thing over the course of the study and they were cross-checked continually and intercoder agreement (Creswell, 2009) was reached with a PhD student. In addition while preparing answer key to examine students' level of learning for the concept maps and infographics, two field experts checked and gave feedback for the answer key. Therefore conformability of the study was also enhanced.

In addition, Mathison (1988) stated that regardless of philosophical, epistemological, or methodological perspective, a good research necessitate triangulation of methods or data sources to improve validity of findings. Regarding triangulation Miles and Huberman (1984) states "triangulation is supposed to support a finding by showing that independent measures of it agree with it or at least do not contradict it" (p. 235). According to Denzin, data triangulation refers not only using several data sources but also expanding time and space (As cited in Mathison, 1988). In the current study, sophomores' responses to interview questions and analysis of their digital artifacts triangulated to enhance validity of the study.

According to Clark (1983) research subjects can pay more attention and effort to a novel media, therefore their success or achievement can be higher than their potential achievement. The more they get familiar with the media the more decrease can be resulted in their achievement. For this reason to eliminate novelty effect, the current study was conducted throughout five weeks. Sophomores exposed to designated Web 2.0 Tools at least two times in a week (One for first version, other one for revised version). It means that they exposed to the designated Web 2.0 Tools at least ten

times, in total. Moreover the researcher tried to uncover her assumptions and theoretical orientation, by explaining her role within the study to enhance the internal validity of the study.

3.7 Data Analysis

Analyzing the study evidence is the most difficult step of the case studies. Investigator must think empirically, present efficient evidence, and consider alternative interpretations. Having a strategy makes the tools highly useful but the most important strategy is to base the case study upon the study's theoretical proposition. It helps researcher to focus on certain data (Yin, 2009).

Since there was no leading theory or model for learning from artifacts created on Web 2.0 Tools, finding possible codes by scanning the literature was impossible. For this reason, the researcher tried to come up with themes and codes from the transcribed interviews and documents by conducting open coding (Creswell, 2003).

3.7.1 Document Analysis

Document analysis is a procedure which aims to review or evaluate printed or electronic materials systematically (Corbin & Strauss, 2008). Document analysis is especially useful for qualitative case studies which aims to produce rich descriptions of a single phenomenon, organization, or event (Stake, 1995; Yin, 1994). Document analysis allow researcher to make data triangulation or methodological triangulation; or it may be the only source (Bowen, 2009).

The documents were one of the most important data collection instrument in this study. Frenchtling and Sharp (1997) stated “existing records often provide insights into a setting and/or group of people that cannot be observed or noted in another way” (p. 92). According to Guba and Lincoln (1981), public records, and personal documents were two major categories of documents. Documents collected in this study took place in personal documents category because events and experiences were acquired directly from person (Frenchtling & Sharp, 1997).

In some cases, documents include more than transcriptions of interviews or other type of talk (Bowen, 2009). In this study documents are consist of digital artifacts generated by sophomore students. Since one of the research questions aimed to examine sophomore students' level of learning from digital artifacts they had generated with designated Web 2.0 tools, Revised Bloom's Taxonomy was chosen as a measurement criterion. Churches (2008) argued that digital learning activities like retrieving, finding, bookmarking, social networking, searching, blogging and sharing might be attributed to the lower order thinking skills of the Revised Bloom's Taxonomy, namely, remember, understand, and apply levels (Anderson et al., 2001). Additionally, digital learning activities like mind mapping, content organizing, monitoring, content mixing, storytelling, and generating digital artifacts were attributed to higher order thinking skills that corresponds to analyze, evaluate, and create levels of the Revised Bloom's Taxonomy (Churches, 2008).

To analyze digital artifacts created by sophomore students, a document was prepared as a rubric by the researcher. Her advisor who is the instructor of the course and one professor of the field checked the rubric. The rubric was grounded on textbook used for the CEIT 216 course with the professor's advice. Besides, information obtained from different sources were added to this rubric. While analyzing digital artifacts created by sophomore students according to Revised Bloom's Taxonomy, in some cases, evaluation criteria corresponded to more than one cognitive dimensions. In such circumstances only the higher level was considered.

While analyzing documents, prompts that were provided to students with guidelines (see Appendix D, Appendix E, Appendix F) had important roles. That is, to match the students' verbal and pictorial generations on digital artifacts -namely, blog concept map and infographic- with Bloom's Revised Taxonomy's cognitive levels, prompts' were set to work.

In blog activities, for each learning theory -which are behaviorism, cognitivism, constructivism, and social learning theory - same prompts were given and sophomore students are asked to form four posts regarding each theory, during four weeks. Based on verbal and pictorial generations on blog, matching was done as following;

- Definition of learning based on the theory with their own sentences requires paraphrasing of learning definition according to that theory. Therefore, accurate answer is considered at the understand level of Cognitive Dimensions within the Bloom's Revised Taxonomy.
- Selecting at least three main components of the theory and distinguishing the positive and negative aspects of the theory requires breaking concepts of the theory into its constituent parts, and understanding how the parts relate to one another and an overall structure of the purpose. Therefore accurate description of main components of the theory and positive and negative aspects are considered at the analyze level of Cognitive Dimensions within the Bloom's Revised Taxonomy.
- Accurate judgment for student measurement and assessment and detecting the most important theorist and reasons behind this decision requires making judgments based on criteria and standards therefore, accurate answers are considered at the evaluate level of Cognitive Dimensions within the Bloom's Revised Taxonomy.
- Designing an accurate classroom use case scenario based on the theories requires putting elements together to form a consistent whole; reorganize elements into a new structure. Therefore designing an accurate case scenario is considered at the create level of Cognitive Dimensions within the Bloom's Revised Taxonomy.

One of the blogs created by one of sophomore students, which was analyzed within the scope of this study is given in figure 3.5.

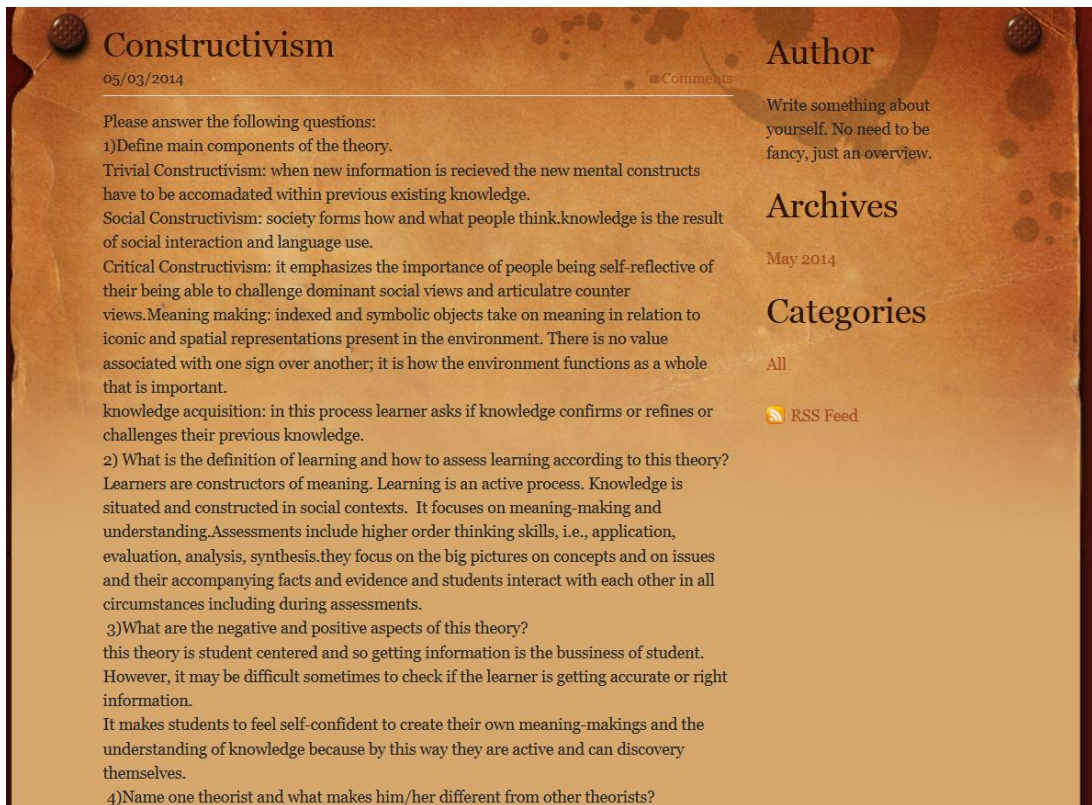


Figure 3.5 Blog prepared by one of the sophomore students

In concept map activities, for each learning theory same prompts were given and sophomore students are asked to form one concept map regarding each theory, during four weeks. Based on verbal and pictorial generations on concept maps, matching was done as following;

- Accurate definitions of concepts related with theory and theorists considered at the remember level of Cognitive Dimensions within Bloom’s Revised Taxonomy as enabling retrieving relevant knowledge from the long term memory.
- Concept maps that outlines the theory accurately considered at the analyze level of Cognitive Dimensions within Bloom’s Revised Taxonomy as breaking theory into its constituent parts and determine how the parts relate to one another and to an overall structure.

One of the concept maps created by one of sophomore student, which was analyzed within the scope of this study is given in figure 3.6.

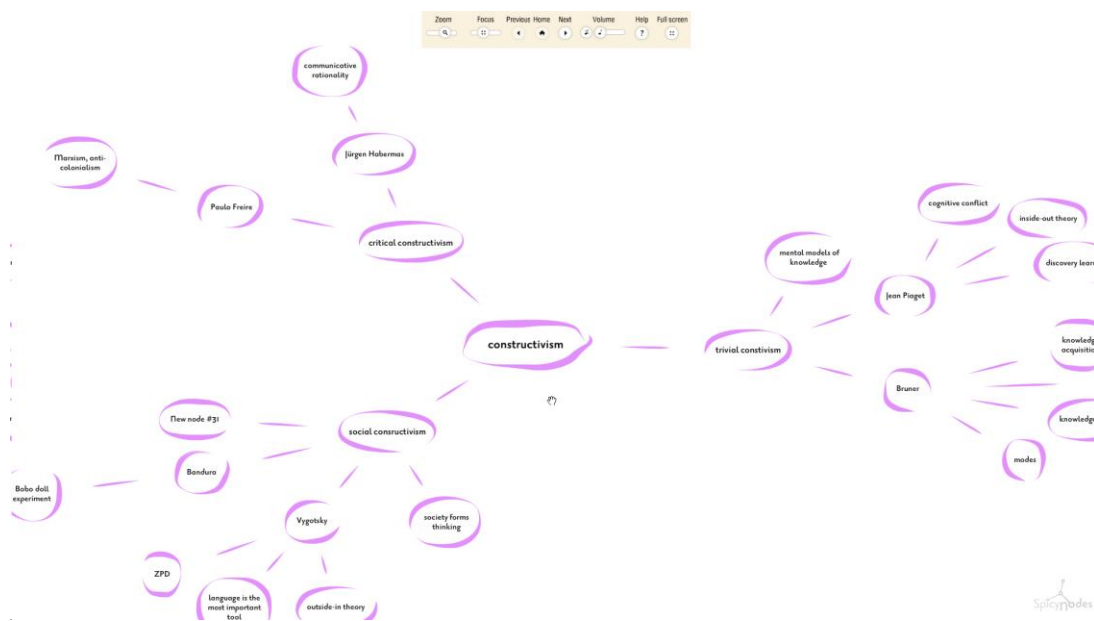


Figure 3.6 Concept Map prepared by one of the sophomore students

In infographic activity, for each learning theory same prompts were given and sophomore students are asked to form a whole infographic contains all theories, during fifth week. Based on verbal and pictorial generations on infographics, matching was done as following;

- Writing a few sentences regarding theory and writing theorists' names correspond to remember, as enabling retrieving relevant knowledge from the long term memory.
- Adding a picture of theory, and video correspond to understand, as requiring construct meaning from instructional messages.
- Selecting a specific theorist and explaining the importance of his theory corresponds to evaluate, as requiring making judgments based on criteria.
- Designing an accurate classroom use case scenario based on the theory by answering the question created by researcher corresponds to create level as requiring putting elements together to form a consistent whole.

One of the infographics created by one of sophomore student, which was analyzed within the scope of this study is given in figure 3.7.

COGNITIVISM

Cognitivism focuses on the inner mental activities – opening the “black box” of the human mind is valuable and necessary for understanding how people learn.

The learner is viewed as an information processor (like a computer).

Knowledge can be seen as schema or symbolic mental constructions. Learning is processing information into the long term memory and defined as change in a learner's schemata.



Major Theorists in Behaviorism: Frederic Bartlett, Jean Piaget, Bruner, Atkinson and Shiffrin

Piaget's Stages of Development



Cognitivism



Figure 3.7 Infographic prepared by one of the sophomore students

3.7.2 Interviews

In the analysis process of interviews content analysis was employed. Four out of ten students' interviews were conducted via online Skype voice call. The approach recommended by Creswell (2009) was used in the analysis of the interviews and the data analysis was done following 6 steps. Those steps are:

- Step1. Organize and prepare the data for analysis
- Step2. Read through all the data
- Step3. Begin detailed analysis with a coding process
- Step4. Use the coding process to generate categories or themes for analysis
- Step5. Advance how the themes will be represented in the qualitative narrative
- Step6. Making an interpretation or meaning of the data (Creswell, 2009, pp. 185-190)

The audio files were checked by the researcher whether there was a problem or not. Unfortunately one of the interviewee record obtained from Skype voice call had very poor quality. For this reason it was not considered in the transcription process. The researcher listened to the remaining nine interview records and transcribed the records word by word. The transcription was checked by the researcher to prevent data loss. Then the researcher and one of her colleagues read the transcriptions to get “a general sense of information” (Creswell, 2009, p. 185), which was followed immediately by the open coding conducted with the same colleague. The codes were discussed and mutual decision was reached in terms of codes. Then, themes were created and the developed themes were presented as a qualitative narrative in the results section. They were also added as a table to the Appendix C. Lastly, essential interpretations depending on the research questions were made.

3.8 Role of the Researcher

In the present study, the researcher had an insider status. The researcher selected the necessary Web 2.0 Tools, formed digital artifact generating activities, prepared necessary guidelines and offered guidance to participants. She was one of the teaching assistants of the CEIT 216 course. She was responsible for conducting one-hour-recitations. In addition, she gave feedback to all digital artifacts created by students, and checked the last versions of them. Besides she provided assistance to the students on all matters related with the study during the activity processes.

3.9 Assumptions

This study was fulfilled based on following assumptions:

- The sophomore students did all activities by themselves.
- The contents of digital artifacts were not directly quoted from anywhere.
- The sophomore students were honest during qualitative data collection.

- The sophomore students completed their tasks on time and obeyed the instructions that are required to conduct this study.
- Quality of the study were to be assured with necessary methods.

3.10 Limitations

There are several limitations of the present study that need to be taken into consideration. They can be summarized as the following:

- This study is limited to assumption of the contents of digital artifacts were not directly quoted from anywhere by sophomore students.
- The findings of this study were based on the sophomore students in Computer Education and Instructional Technology Department at Middle East Technical University. In other words, the participants are homogenous.
- The data of the study were gathered through self-reported measures of the participants and these measures were relied on.
- Since the study is based on self-reporting of the subjects, bias can be inevitable. That is, further data may be needed to verify the results.

CHAPTER 4

RESULTS

The purpose of the present study is to determine effects of Web 2.0 enhanced learning environment on sophomore students' learning and perception regarding this learning experience. This chapter presents the results obtained from the documents and interviews. Documents were analyzed to explain sophomore students' learning levels according to the Bloom's Revised Taxonomy and interviews were analyzed to explore, examine, and explain sophomore students' opinions about used Web 2.0 tools and perceived learning outcomes within the scope of use of these tools. Results which answer the related research question given in detail in each subsection. This chapter is comprised of the following headings:

- Sophomore students' level of learning from digital artifacts they had generated using designated Web 2.0 tools in accordance with Bloom's Revised Taxonomy.
- Sophomore students' opinions on learning by generating with designated Web 2.0 tools.
- Sophomore students' perceived learning outcomes by generating visuals with designated Web 2.0 Tools.

4.1 Sophomore students' level of learning from digital artifacts they had created using designated Web 2.0 Tools in accordance with Bloom's Revised Taxonomy.

All of the sophomore students' documents were analyzed. These are; four blog posts, four concept maps and one infographic for each participant. That is, a total of 90 documents were analyzed. Bloom's Revised Taxonomy of Educational Objectives were adapted to create prompts for blog, concept map and infographic. Used prompts were given in the Methodology chapter. Sophomore students learning levels based on Bloom's Revised Taxonomy was determined by the researcher with her advisor's guidance. Sophomore students' learning levels according to Revised Bloom's taxonomy examined under three subheadings: blogs, concept maps, and infographics. In addition, participants' GPAs and higher order thinking achievements also provided under each subtitle.

4.1.1 Blogs

Blogs created by sophomore students consist of answers given to five prompts determined by researcher and her advisor (see [Appendix H](#)). For each learning theory, which are behaviorism, cognitivism, constructivism, social learning theory, same prompts were given and sophomore students are asked to form four posts during four weeks. While analyzing sophomore students' documents, the prompts and their answers were considered together.

Definition of learning based on the theory with their own sentences requires paraphrasing of learning definition according to that theory. Therefore, accurate answer is considered at the understand level of Cognitive Dimensions within the Bloom's Revised Taxonomy.

Selecting at least three main components of the theory and distinguishing the positive and negative aspects of the theory requires breaking concepts of the theory into its constituent parts, and understanding how the parts relate to one another and an overall structure of the purpose. Therefore accurate description of main components of the theory and positive and negative aspects are considered at the analyze level of Cognitive Dimensions within the Bloom's Revised Taxonomy.

Accurate judgment for student measurement and assessment and detecting the most important theorist and reasons behind this decision requires making judgments based on criteria and standards therefore, accurate answers are considered at the evaluate level of Cognitive Dimensions within the Bloom's Revised Taxonomy.

Designing an accurate classroom use case scenario based on the theories requires putting elements together to form a consistent whole; reorganize elements into a new structure. Therefore designing an accurate case scenario is considered at the create level of Cognitive Dimensions within the Bloom's Revised Taxonomy.

The analysis of blog posts were as shown in Table 4.1.

Table 4.1 Classification of Students' Blog Contents Based on Bloom's Revised Taxonomy

Cognitive Process Category	Evaluation Criteria	Theories			
		Behaviorism (n)	Cognitivism (n)	Constructivism (n)	Social learning theory (n)
Understand	Accurate definition of learning with their own sentences Example: <i>“Learning is a social process and it occurs observing and imitating”</i>	10	10	10	10
Apply	Accurate use of case	9	9	10	10
Analyze	Accurate selection of main components of the theory (at least three component) Example: <i>“Observing, Modeling, Reciprocal determinism, Imitating Selecting”</i>	8	10	9	9
	Accurate description of the positive and negative aspects Example: <i>“Positive aspect is that you can make use of reinforcements in order to encourage students to learn and enhance their knowledge. However, if you cross the border, it will only make him/her stimulus respondent, which is less in quality compared to being self-learner. Moreover, the theory believes that all learning outcomes are observable and if you cannot observe the change that means the student has not learned. This idea brutally disrupts the cognitivist theory and does not concern about the inner thoughts and process of the learner.”</i>	10	9	9	9

Table 4.1 (Continued)

Evaluate	<p>Accurate judgment for student measurement and assessment based on the theory</p> <p>Example: <i>“Assessment could be done by essay type questions in appropriate classes or if it is a science class, the instructor may ask students to show the steps of their solution.”</i></p>	10	6	9	8
	<p>Determining the most important theorist and explaining reason / reasons behind their decision</p> <p>Example: <i>“Vygotsky. He suggests ZPD and logically explains why some people are not able to understand and maintain equilibrium like everybody else at the same time. Unlike the other theorists, he does not think it is because of the person’s inability, but it is the time or the idea that has been chosen inappropriately.”</i></p>	10	10	10	10
Create	<p>Designing an accurate classroom use case scenario based on the theory</p> <p>Example: <i>“6th grade math teacher teaches a new concept to her students. Everybody seems to understand the topic. However, when she gives another a bit complicated problem, which requires older topics’ involvement, the students get confused and cannot solve the problem. She then realizes that the students are still in concrete-operational stage and not able to generalize ideas yet. She decides to solve more problems related only with the new topic. Later, she starts to show some problems, which involve older topics. After showing a few examples, she asks students to try to repeat the solution by themselves and asks volunteers to come to the board and solve the problems and make discussion about the way of solution.”</i></p>	9	9	10	10

Interview results, also support these findings. Expressions of some students on learning with generating Blog as follows;

“Blog en büyük katkıyı sağladı diye düşünüyorum. Çünkü onda çok hani kendim araştırma yaptım dersten öğrendiklerimi hatırlamaya çalıştım, aldığım notlarıma baktım, ona göre hani, hem de orada bize soru sorulmuş olması güzeldi. Hani o sorulara cevap vermek kapsamında bence gayet güzel bir etkinlikti.” [P6I]

“I thought that the Blog made a great contribution because I researched, I tried to recall the things that I learnt from lesson, checked the things that I noted down in the lesson. It was good to being asked for those in there. It was a good activity.”

“Blog’da da bunları tekrardan kendim yazmam bana daha faydalı oldu. Yani birisinin anlatmasına göre... Orada kendim tamamen yazdım kendim ekledim bir şeyleri. O şekilde.” [P7I]

“It was more helpful for me to re-write these on the blog rather than someone’s explanation... I wrote it and added something myself.”

Moreover, to match the participant GPA and her higher order thinking level according to Bloom’s Revised Taxonomy, a table was also prepared. There were a total of five tasks aimed higher order thinking levels on blog. To be more specific, two tasks aimed analyze level, two tasks evaluate level, and one task create level of cognitive dimensions within Bloom’s Revised Taxonomy. Table 4.2 presents each participant’s number of higher order thinking achievement that were based on tasks completed correctly. The remarkable detail on the table is, while P1 who has the lowest GPA completed all higher order thinking tasks for each theory correctly, P6

who has the highest GPA completed minimum number of higher order thinking tasks correctly.

Table 4.2 Each participant's GPA and number of higher order thinking achievement based on blog contents.

Participant	GPA	Higher order thinking level achievements (For each theory)			
		Behaviorism	Cognitivism	Constructivism	Social Learning
P1	2,48	5	5	5	5
P2	2,97	5	4	5	4
P3	3,24	3	4	5	5
P4	3,08	5	4	5	5
P5	3,52	4	5	5	5
P6	3,70	5	4	2	2
P7	3,09	5	5	4	5
P8	3,20	5	4	5	5
P9	3,28	5	5	5	5
P10	3,20	5	5	5	5

4.1.2 Concept Map

Each sophomore student has created one concept map for each learning theory. A total of 40 concept maps created by ten sophomore students. Created concept maps that outlines the theory accurately considered at the analyze level of Cognitive Dimensions within Bloom's Revised Taxonomy as breaking theory into its constituent parts and determine how the parts relate to one another and to an overall structure. In addition, accurate definitions of concepts related with theory and theorists considered at the remember level of Cognitive Dimensions within Bloom's Revised Taxonomy as enabling retrieving relevant knowledge from the long term

memory. Sophomore students reached analyze level of Bloom’s Revised Taxonomy as shown in as shown in Table 4.3.

Table 4.3 Classification of Students’ Concept Map Contents Based on Bloom’s Revised Taxonomy

Cognitive Process Category	Evaluation Criteria	Theories			
		Behaviorism (n)	Cognitivism (n)	Constructivism (n)	Social learning theory (n)
Remember	Accurate definition of the theories	10	10	10	10
	Accurate identification of theorists	8	6	9	9
Analyze	Accurate display of relationships among concepts	8	6	9	9

Interview results, also supported these findings. Expressions of some students on learning with generating Concept Map as follows;

“Concept map’de biraz daha yani infografik gibi daha geniş bir çerçeveden bakmamızı sağladı konuya.” [P2I]

“Concept map contributed us to look at the subject from a more general view similar to the infographic.”

“Konuyu tamamen uzaktan görmemi sağladı. Yani daha kısa özet şekilde daha ana noktalarıyla en belirgin kişilerle mesela belirgin örneklerle” [P7I]

“It provided me to see the subject with a bird’s eye view. I mean with the most important points but in summary and with specific persons and examples.”

To match the participant GPA and her higher order thinking level according to Bloom’s Revised Taxonomy, a table was also prepared regarding concept map (see Table 4.4). There was one task aimed analyze level on concept map. Following table presents each participant’s number of higher order thinking achievement that were

based on tasks completed correctly. When we look at the participants, who has the highest and lowest GPA, P6 (has the highest GPA) completed all concept map tasks correctly and reached analyze level of cognitive dimensions within the Bloom's Revised Taxonomy. On the other hand P1 (has the lowest GPA) completed only one task correctly.

Table 4.4 Each participant's GPA and number of higher order thinking achievement based on concept map contents.

Participant	GPA	Higher order thinking level achievements based on concept map (For each theory)			
		Behaviorism	Cognitivism	Constructivism	Social Learning
P1	2,48	0	0	1	0
P2	2,97	1	0	1	1
P3	3,24	1	1	1	1
P4	3,08	1	1	1	1
P5	3,52	0	1	0	1
P6	3,70	1	1	1	1
P7	3,09	1	1	1	1
P8	3,20	1	0	1	1
P9	3,28	1	0	1	1
P10	3,20	1	1	1	1

4.1.3 Infographic

In the last week of the data collection process, each student created an infographic. Infographics were created according to a guideline prepared by the researcher and her advisor (Appendix F). The concepts in the infographic categorized as their corresponding learning levels according to the Bloom's Revised Taxonomy. Writing a few sentences regarding theory and writing theorists' names correspond to remember, adding a picture of theory, and video correspond to understand, selecting a specific theorist and explaining the importance of his theory corresponds to

evaluate, and designing an accurate classroom use case scenario based on the theory by answering the question created by researcher corresponds to create level of Bloom's Revised Taxonomy. A total of 10 infographics examined and results are shown in the Table 4.5.

Table 4.5 Classification of Students' Infographic Contents Based on Bloom's Revised Taxonomy

Cognitive Process Category	Evaluation Criteria	Theories			
		Behaviorism (n)	Cognitivism (n)	Constructivism (n)	Social learning theory (n)
Remember	Accurate definition of the theories	10	10	10	10
	Accurate identification of theorists	8	9	9	9
Understand	Accurate illustration of picture regarding theories	10	10	10	10
	Accurate illustration of video regarding theories	10	10	10	10
Evaluate	Determining the most important theorist and explaining reason / reasons behind their decision	9	9	9	9
Create	Designing an accurate classroom use case scenario based on the theory	8	8	7	7

Interview results, also support these findings. Expressions of some students on learning with generating Infographic as follows;

“Her konu için bir hafta süremiz vardı ve bu infografikte genel olarak genel bakış açısı olduğu için bir toplama yani bir özetleme olarak katkı sağladı.” [P1I]

“*We had a week for each subject and since this infographic had a general view, it contributed as a summary [of all weeks].*”

“İlk defa infografik hazırladım ve güzeldi. Tüm bilgiler bir arada böyle bir konuyla ilgili hani videosu resmi açıklaması örneği hepsi bir arada güzeldi” [P3I]

“It was the first time that I have prepared an infographic and it was good. I mean it was good to find all details and information about the subject all in one place.”

To match the participant GPA and her higher order thinking level according to Bloom’s Revised Taxonomy, a table was also prepared regarding infographic (see Table 4.6). There were two tasks aimed higher order thinking levels on infographic. One aimed evaluate level and the other one aimed create level. Following table presents each participant’s number of higher order thinking achievement that were based on tasks completed correctly. In infographic both P1 and P6 reached higher order thinking levels by completing tasks correctly. On the other hand, P10 did not complete both of the tasks regarding higher order thinking levels of cognitive dimensions within Bloom’s Revised Taxonomy.

Table 4.6 Each participant’s GPA and number of higher order thinking achievement based on infographic contents.

Participant	GPA	Higher order thinking level achievements on infographic (For each theory)			
		Behaviorism	Cognitivism	Constructivism	Social Learning
P1	2,48	2	2	2	2
P2	2,97	2	2	1	1
P3	3,24	2	2	2	2
P4	3,08	1	1	1	1
P5	3,52	2	2	2	2
P6	3,70	2	2	2	2
P7	3,09	2	2	2	2
P8	3,20	2	2	2	2
P9	3,28	2	2	2	2

P10	3,20	0	0	0	0
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4.1.4 Summary of Blog, Concept Map, Infographic Findings

In Table 4.7 classification of students' blog, concept map, and infographic contents is given based on Bloom's Revised Taxonomy.

Table 4.7 Classification of Students' Blog, Concept Map, and Infographic Contents Based on Bloom's Revised Taxonomy

Cognitive Process Category	Evaluation Criteria	Digital Artifact	Theories			
			Behaviorism (n)	Cognitivism (n)	Constructivism (n)	Social learning theory (n)
Remember	Accurate definition of the theories	Concept Map	10	10	10	10
		Infographic	10	10	10	10
	Accurate identification of theorists	Concept Map	8	6	9	9
		Infographic	8	9	9	9
Understand	Accurate definition of learning with their own sentences	Blog	10	10	10	10
	Accurate illustration of picture regarding theories	Infographic	10	10	10	10
	Accurate illustration of video regarding theories	Infographic	10	10	10	10
Apply	Accurate use of cases	Blog	9	9	10	10
		Infographic	8	8	7	7
Analyze	Accurate selection of main components of the theory (at least three component)	Blog	8	10	9	9
	Accurate description of the positive and negative aspects	Blog	10	9	9	9
	Accurate display of relationships among concepts	Concept Map	8	6	9	9
Evaluate	Accurate judgment for student measurement and assessment based on the theory	Blog	10	6	9	8
	Determining the most important theorist and explaining reason / reasons behind their decision	Blog	10	10	10	10
		Infographic	9	9	9	9
Create	Designing an accurate classroom use case scenario based on the theory	Blog	9	9	10	10
		Infographic	8	8	7	7

To show participants GPA and number of higher order achievement, a summary table also created. According to table, P7 and P9 have the highest number of higher order achievement (n=31) based on all tasks and P6 and P10 have the lowest number of higher order achievement based on all tasks. On the other hand, when we look at the participants who has the highest and lowest GPA, P6 has the lowest higher order thinking achievement (n=24) and P1 has a higher number of higher order thinking achievement (n=29).

Table 4.8 Each participant’s GPA and number of higher order thinking achievement based on all designated Web 2.0 contents.

Participant	GPA	Higher order thinking level achievements based on all designated Web 2.0 contents (For each theory)			
		Behaviorism	Cognitivism	Constructivism	Social Learning
P1	2,48	7	7	8	7
P2	2,97	8	7	7	6
P3	3,24	6	7	8	8
P4	3,08	7	6	7	7
P5	3,52	6	8	7	8
P6	3,7	8	7	4	5
P7	3,09	8	8	7	8
P8	3,2	8	6	8	8
P9	3,28	8	7	8	8
P10	3,2	6	6	6	6

4.2 Sophomore students’ opinions on learning by generating with designated Web 2.0 tools.

4.2.1 Positive Aspects

Interview results revealed the sophomore students’ comments on positive aspects of Web 2.0 Tools. According to sophomore students’ responses, their opinions related with used Web 2.0 Tools classified as pedagogical positive aspects and technical

positive aspect. In positive pedagogical aspects title a total of eleven codes were found: [1] Permanency, [2] Sum up, [3] Associability, [4] Motivational, [5] Sense of Control / Ownership, [6] Interactivity, [7] Enjoyment, [8] Ease of Comprehension, [9] Feedback, [10] Duration, [11] Experience. In technological positive aspects title a total of three codes were found: [1] Ease of Creation and Use, [2] Visuality, [3] Mobility. Table 4.9 shows the sophomore students' opinions regarding positive aspects of generating digital artifacts with designated Web 2.0 Tools.

Table 4.9 Positive Opinions on Generating Digital Artifacts with Designated Web 2.0 Tools.

Positive Aspects	Pedagogical Positive Aspects	Permanency
		Sum up
		Associability
		Motivational
		Sense of Control / Ownership
		Interactivity
		Enjoyment
		Ease of Comprehension
		Feedback
		Time Efficiency
		Experience
	Technological Positive Aspects	Ease of Creation / Use
		Visuality
		Mobility

4.2.1.1 Pedagogical Positive Aspects

Permanency

Thanks to generating digital artifacts by using Blog, Concept Map and Infographic, sophomore students stated that their learnings were permanent. Most of them (n=8) mentioned that the Web 2.0 activities through the study allow them to obtain more permanent learnings. Sophomores show several aspects as reason for the permanency. Four of them stated that visual aspect of the artifacts enabled and contributed to the permanency of their learning and retrieval of information rather than reading or writing. Being an active participant and engaging ii hands-on learning activities also shown as reasons for permanency. Moreover, prompts were

perceived as useful. Two participants emphasized that using prompts was an important factor in permanency, by stating:

Some of the sophomores' explanations regarding permanency as follows:

“Evet. Çünkü mesela insanın görsel şeyler daha çok aklında kalıyor. Mesela benim o oluşturduğum sayfa şu anda gözümün önünde. Mesela hangi videoyu buldum, ya da hangisini hazırladım, onunla daha akılda kalıcı oldu. Hani yazmaktan ziyade... O videolar özellikle bi de görseli kendi hazırlaması. Benim daha çok aklımda kaldı.” [P6I]

“Yes. Visual things are more permanent. For instance the page which I formed is under my eyes. I mean the video I found or which I prepared. It is more permanent with that rather than writing. Preparing the visual myself and these videos helped me to keep in mind easily.”

Another one stated:

“Dediğim gibi o konuları biraz geçmiştik başladığımızda ama en azından 11 konu başlığı söylendiğinde o sorular, o sorulara verdiğim cevaplar aklıma geldi, ya da o şema.” [P4I]

“As I said, we passed these subjects but when the topics were said I remembered the questions and answers or the schema at least.”

Another one stated:

“Çünkü hani mesela normalde ben böyle bir projede yer almasaydım hani ben o konuları sadece sınav için öylesine okuyup geçecektim. Ama hani dört haftam onlarla geçti hani o yüzden daha şey oldu benim için. Daha akılda kalıcı oldu.” [P9I]

“If I hadn't been involved in such project I wouldn't have focused on those subjects. However, I spent four weeks with those subjects and they were more permanent for me.”

Sum-up

The interview results revealed that Web 2.0 activities summed sophomore students' learnings up. Most of them (n=8) stated especially infographic and concept map activities helped them to summarize their learnings. They stated concept map and infographic contributed them to look the subjects from a general viewpoint, summarize learnings and helped them to put together all of the learnings. Moreover,

using multiple media and resources also shown as reasons for summarize their learning and provided them with a general view of the subjects. They think that the digital artifacts that they generated have acted as an advance organizer. Some of the students referred to the prompts' effectiveness in this process. Underlining important parts of the topic made them to thought they summarized their learnings.

Some of the participants stated that:

“İnfografiği hepsi hakkında toplam bir 111 öngörü kazanmamı sağladı. Yani hepsini bir özet gibi görebildim. Tablolar halinde. Hepsinin önemli bilgilerini key kısımlarını görmeme yardımcı oldu” [P5I]

“Infographic helped me to have a foresight at total. I mean I saw all of it as a summary in tables. It helped me to see the key points and important information.”

“Konuyu tamamen uzaktan görmemi sağladı. Yani daha kısa özet şekilde daha ana noktalarıyla en belirgin kişilerle mesela belirgin örneklerle” [P7I]

“It provided me to see the subject in general. I mean with the most important points but in summary and with clear person and examples.”

“Mesela bu şey gibi hani dönemin başında unite planını görmek gibi bir şey. Yani bi düzen var hani. Konuya başlayıp o konu bittikten sonra yeni bir konu. Yeni bi konu. O tarz bir şey olmadığı için her şeyi bir arada görmek daha güzel oluyor” [P4I]

“For instance it is like to see the unit's plan at the beginning of the term. There is an order. When you finish present subject there is always a new subject. Since there isn't anything like this it is good see the things all in one.”

Associability / Reciprocity

The interview results showed that most of the sophomore students (n=7) think that they associated or compared the concepts of the theories while doing Web 2.0 activities. Some of them stated generating digital artifacts helped them to associate or compare/contrast concepts in general. Some of the participants underlined concept

map as an effective tool for showing relations among concepts. And some of the sophomore students mentioned that infographic allowed them to compare and contrast theories effectively, by providing them with the whole picture. Moreover, they stated learning with associating is more helpful even in subjects that are difficult to understand. Besides, learning by generating also shown as reason for this associability in itself.

For instance they expressed:

“O da böyle m şey birbirleriyle şey ilişkili şekilde hani konuları anlamamızı sağladı bence ilişkilendirerek öğrendik.... İşte böyle ilişkilendirerek öğrenmek için faydalı bence anlamadığımız yerler olursa hani onları bir yerlere bağlarsak en azından daha etkili olur.”

[P3I]

“We learned by the way of associating the subjects with each other. Learning with associating is more helpful and in my opinion if we didn’t understand a subject I mean if we associate it with anything, it will be more effective.”

“Yani mesela orada beş soru vardı. Slaytlarda sürekli hani bayağı bir content vardı. Ama beş soru ile kafamdaki bilgi şekillendi. Yani hepsinin bir sırası vardı hani. Okuyarak daha bir bilgi kazanabiliyordum.... Bu da o şekilde yani conceptler arasında bağlantı kurmamızda bize yardımcı oldu. Hangisini neyle bağlarsın, hangisinin alt başlıkları nelerdir onları görmemize yardımcı oldu.” [P5I]

“For example there were five questions. There were much content in slides. The information about those five questions was shaped in my mind. There was an order. I acquire more knowledge by reading. It helped us to connect the concepts. It also helped us to see the subheadings and you connect which one with what.”

“Mesela googledan arattığımda görsellere de bakıyorum yani yazıya bakıyorum ama hani anlayamadıysam görsellere bakıyorum ve ilişkilendiriyor. Bunu ben yapınca daha bir verimli oluyor. Hani ben ilişkilendiriyorum. Ve hani kendi parçaları bütün haline getiriyorum. Orada daha oturması için anlamın.” [P8I]

“For example when I am surfing on Google I look both the pictures and writings. If I don’t understand the text I look the pictures. I associate them. It is more helpful. I integrate them to make the meaning more significant.”

Motivational

The various features of Web 2.0 activities effected sophomore students' motivation. According to interview results, sophomore students (n=7) stated that through activities they were motivated thanks to Web 2.0 Tools' various features as mobility, visuality, usefulness. Sophomore students expressed that they found concept maps and/or infographic more useful for feedback. This situation generated motivation. Visual design of tools, ease of their use, and presenting various features and tools also motivates sophomores. One of the sophomores emphasized that generating her own learning content helped her to get rid of exam anxiety by increasing motivation. Additionally, providing enjoyment and engagement also increased sophomores' motivation. During these explanations they also compared the current method with traditional one and found this method more motivational.

Some of the sophomores' explanations as follows:

“Hımmmm yani feedback almak için güzel bir yöntem o yüzden hani ya yazılı olmasındansa bu şekilde olması online olması beni daha çok motive ettiğini söyleyebilirim.” [P11]

“Well, it is good way to get feedback so that I can say instead of text-based feedback in a written form, it motivates me more when it becomes online.”

“Motivasyonumu artırdı çünkü sınava daha rahat girmemi sağladı. Hani daha önceden bir çalışma olmuş oldu. Haftalık bir çalışma, her konu üzerine ve o konuları gayet iyi öğrendiğimi düşünüyorum diğer konulara göre.” [P6I]

“It increased my motivation because it provided me to take the exam in a more comfortable way. I mean it was like a pre-studying. It is a weekly studying on every subject so that I think I understood those subjects more than the others.”

[Web 2.0 araçlarını kullanmak motivasyonumu] olumlu yönde etkiledi çünkü şöyle bir şey var. Ben görsel olarak çalışmayı seven bir insanım. Hani sadece böyle kağıt üstünden ödev yapmak sıkıcı oluyor. Bu biraz daha değişik. Böyle ne bileyim word'de bir şey yazmak gibi

değil. Orada yayınlıyorsun ya da concept map'te tasarımlar var oradan seçebiliyorsun. İnfografik mesela bence zevkliydi. Orda görsellerle çalışıyorsun. Visual'lar falan koyuyorsun, video ekliyorsun falan... Hani bence, benim açımdan ben sevdiğim için zevkliydi.” [P9I]

It influenced [my motivation] in a positive way because there is something like that. I like to study as visual. I mean it is very boring to study just on paper. This is a bit different. Like, I mean, not something like writing on Word. You publish there or you can choose some designs from concept map. Infographic was enjoyable for me. You study there with visuals, you add visuals or videos etc. according to me it was enjoyable.”

Sense of Control / Ownership

Because of generating their own digital artifacts sophomore students were felt like they were in charge at all and they become more attentive and more willing to continue these Web 2.0 activities. Sophomore students (n=5) mentioned that these Web 2.0 activities offer them freedom to create digital artifacts as they wished. This situation created ownership in sophomores' feeling. In addition, they compared traditional learning and learning by generating texts with the current method and learning by generating visuals. Sense of control occurred due to this method. Since all of the activities done with designated Web 2.0 Tools were embedded in Weebly Blog, they felt this way mostly with this tool.

One sophomore student said:

“Yani böyle kendi sayfam olduğu için hani daha özenerek hazırlamaya çalıştım. Sorulara daha iyi cevap vermeye çalıştım. Güzel oldu kendimize ait bir blog olarak soruları cevaplamamız. Hani bu bir ödev olarak olsaydı bir word dosyasını isteyip size göndermemizi isteseysiniz bu kadar verimli olmayacaktı” [P4I]

“I tried to prepare elaborately as it was my own page. I tried to answer question well. It was good to answer the questions as the blog belonged to us. If it had been

homework and you had wanted us to send you a word file, it wouldn't have been so productive.”

Another one said:

“Blog’da da bunları tekrardan kendim yazmam bana daha faydalı oldu. Yani birisinin anlatmasına göre... Orada kendim tamamen yazdım kendim ekledim bir şeyleri. O şekilde.”

[P7I]

“It was more helpful for me to rewrite these on the blog. I mean when comparing to someone’s telling... I wrote it and added something myself.”

Interactivity

Sophomore students (n=4) emphasized interactivity as an advantage of generating digital artifacts through Web 2.0 activities. They stated they generated more creative concept maps in time. This interactivity revealed motivation. Moreover, they especially emphasized the social sharing aspect of the interactivity as well as the interactive content that they created so that it also opens a door for collaboration with others and makes their learning more permanent.

For instance one of them stated that:

“... İnteraktif şeyler katıyoruz. Orada da mesela bi mind map durmuyordu orada. Üzerine tıklıyorsun açılıyor böyle. Gittikçe daha güzel mind map’lar oluşturmaya başlıyoruz. Mesela hocam o kapanıyor falan. Hani böyle daha interaktif ve o konuda da bilgisayar üzerinde çalışmak motivasyonumu artırdı.” [P8I]

“.....we add interactive things. For example there isn't a mind map. You click it and it is opened. We start to form more creative mind maps. For instance teacher, it gets closed. Well, it is more interactive and studying on computer has increased my motivation.”

Another one stated:

“Eğitim için ya sonuçta sosyal bir ortam. Hani başkaları da erişebilir. Sen de onunkine erişebiliyorsun. O yüzden ee yani başka interactive bir ortam oluyor blogla birlikte. Kendin

oturup çalışmaktansa sen bilgilerini paylaşıyorsun. Ya da bulamadığın yerlerde başkalarının bilgisine bakıyorsun. Öyle.” [P5I]

“Education is, in a word, a social environment. I mean anyone can reach it. You can reach hers/his, too. That’s why, I mean with blogs there is another interactive environment. Instead of studying by yourself, either you share your data or you look others’ data when you can’t find. It just is.”

Enjoyment

Although a few sophomore student (n=2) stated that Web 2.0 activities were boring from time to time, which is covered in detail under the “Negative Aspects” subtitle, a few sophomore students (n=3) stated they had enjoyment during the activity times. Mostly they compared the activities with traditional reading and writing methods and after this comparison they described the activities as enjoyable. Two of the sophomore students emphasized visuality as the reason for enjoyment:

Sophomore students explained:

“...Yani süreç içerisinde hem konuları aynı zamanda yaptığımız için hem bir yandan kendi alanımızla ilgili olduğu bir şey olduğu için eğlenceli oldu hem de konuları daha rahat kavramamızı sağladı... Ders haricinde faydası olmasa bile ben eğlendim yani.” [P2I]

“... So in the process we handled learning topics simultaneously and for being related with our field, it was enjoyable and it helped us to comprehend topics more easily. Even if we disregard the learning benefit, I had fun.”

“...Orada biraz daha oyun gibi geldi. Daha eğlenceli hali... Bir de renkli görsel olunca daha çok dikkat çekiyor. Chapterları okumak hiç istemedim. Onlarla uğraşmak daha keyifli geliyordu.” [P7I]

“There, it seemed as a game. More enjoyable version...in addition, since it is a colorful visual it attracts more attention. I did not want to read the book chapters. It was more enjoyable to deal with them.”

Ease of comprehension

Sophomore students (n=3) stated Web 2.0 activities facilitated their understanding. Therefore they were able to comprehend theories easily. One sophomore student explained:

“Yani süreç içerisinde hem konuları aynı zamanda yaptığımız için hem bir yandan kendi alanımızla ilgili olduğu bir şey olduğu için eğlenceli oldu hem de konuları daha rahat kavramamızı sağladı hani yani bu kadar” [P2I]

“As we did both the study and lectures simultaneously and it was about our field, it was really enjoyable. Besides, it helped us to comprehend the subjects easily.”

Feedback

Sophomore students (n=2) emphasized these Web 2.0 activities allow them to receive feedback. For this reason it increased their willingness in the digital artifact generation process with Web 2.0 Tools. They stated the usefulness of generating learning content depends on receiving feedback.

One sophomore student stated:

“Yani feedback almak için güzel bir yöntem o yüzden hani ya yazılı olmasındansa bu şekilde olması online olması beni daha çok motive ettiğini söyleyebilirim.... ..feedback için görüşmeler olsun bunun için derse devamlı olarak gelmemi sağladı.” [P1I]

“It is a good way to get feedback so that I can say that instead of being written, it motivates me more when it becomes online... ..the meetings for feedback made me to come to the lessons continuously.”

Another one stated:

“Blog güzel bir alışkanlık devam edilse. Ama işte o da geri dönüt aldıkça hani olacak bir şey. ...benim feedbacklerim son zamanlarda iyi gelmeye başlamıştı. ...Feedback alırsam kullanabilirim ama feedback olursa hocam.” [P8I]

“Blog is a good habit if it continues. However, it is good if you get feedback. The feedback I have taken recently was good. I got motivated then.... I will use these tools my teacher if I get feedback, only if I get feedback”.

Time efficiency

There are conflicting opinions on time efficiency of generating digital artifacts with designated Web 2.0 tools. Negative opinions on time issues are given under Time Consuming subtitle of Negative Aspects. One sophomore student (n=1) stated Web 2.0 activities were time efficient and explained:

“Online olarak olması hani bilgisayar üzerinden olması benim için zaman açısından etkili oldu kullanımı” [P11]

“As it is both online and on computer, it is time-efficient”.

Experience

Sophomore students (n=2) stated generating digital artifacts with Web 2.0 Tools was a nice experience for them. A sophomore student stated she was happy to experience these activities.

One said:

“Blog hazırlamak açıkçası ıı... kendi blogumu oluşturduğum için yazın da buna dair bir ders almıştım onunda temellerini kullanarak benim için daha güzel bir tecrübe oldu. Kendi blogumu oluşturduğum için açıkçası hani bu yüzden ıı deneyim açısından mutluyum” [P11]

“It was a good experience for me to prepare a blog because I formed my personal blog. I had had a course before. I used the basic principles I learned from this course and I am happy to prepare my personal blog.”

4.2.1.2 Technological Positive Aspects

Ease of Creation and Use

The features of selected Web 2.0 tools were emphasized positively by sophomore students (n=7). However, one sophomore student stated these tools were limited to existing features Limited features is given under the Negative Aspects title. Sophomore students said that these tools were easy to use. A few sophomore students stated selected Web 2.0 tools enable them to change appearances as they want. Moreover, students thought that it was surprising that these tools' ease of use

and this feature increased sophomores' positive opinions regarding generating digital artifacts in the learning processes.

Sophomores explained their opinions as:

“Bence bayağı faydası var çünkü en azından bi araç ... Hani elle yapmaktansa sana bir kalıp sunuyor sen de ona göre şekillendiriyorsun. Sana sadece content kısmı kalıyor. O yüzden bence gayet kullanışlı.”[P5I]

“It has many advantages. At least it is a tool. Instead of hand drawing, it provides you a pattern and you shape it on your own. Just content part is remained. So it is useful.”

Another one expressed:

“Hani yazmaktan ziyade. O videolar özellikle bi de görseli kendi hazırlaması. Benim daha çok aklımda kaldı.” [P6I]

“It remained in my mind rather than writing because you prepare the videos and visual”

“Aslında yoktu. Daha önce de yapmışım çünkü ama Daha önce yapmasaydım bile gayet kolaydı yani. Her şey hazırdı çünkü.” [P7I]

“Actually there wasn't. I made it before, too. If I hadn't done it even before, it was extremely easy because everything was ready.”

Visuality

Sophomore students stated that they like to study with visuals. They thought that learning with visuals make learning more permanent. Sophomore students (n=5) mentioned that visuality is a positive feature of the used Web 2.0 tools.

One stated:

“Çünkü mesela insanın görsel şeyler daha çok aklında kalıyor. Mesela benim o oluşturduğum sayfa şu anda gözümün önünde.” [P6I]

“Visual things remain more in the mind. For example, the page which I prepared is under my eyes.”

Another one stated:

“Bir defa zaten görsel olduğu için çok daha fazla aklımda kaldı. Yani renkler farklı daha kalıcı oluyor bazı şeyler.” [P7I]

“As it was visual it remained in my mind. The colors are different so it is more permanent.”

Mobility

Mobility was also mentioned as a positive feature of used Web 2.0 Tools. Sophomore students (n=4) stated mobility of Web 2.0 tools facilitated their studying process.

One sophomore explained how mobility helped them to make such abstract concepts more concrete:

“Ya mesela siz deseydiniz hani şu soruları cevaplayın bize getirin ya da kağıtta map çizin falan getirin. O bizim için daha abstract bir şey olurdu. Ama böyle internet üzerinden araçlarla yapmak daha mantıklı oldu bizim için.” [P51]

“For instance, if you had wanted us to answer those questions or drew a map on paper it would have been more abstract. However, doing on the internet with tools was more logical.”

4.2.2 Negative Aspects

Interview results revealed the sophomore students’ comments on negative aspects of Web 2.0 Tools. In negative aspects title a total of three codes were found: [1] Time Consuming, [2] Boredom, [3] Limited Features. Table 4.10 shows the sophomore students’ opinions regarding negative aspects of generating digital artifacts with designated Web 2.0 Tools.

Table 4.10 Negative Opinions on Generating Digital Artifacts with Designated Web 2.0 Tools.

Negative Aspects	Time Consuming
	Boredom
	Limited Features

Time consuming

With regard to generating digital artifacts with selected Web 2.0 Tools, some of the sophomore students (n=4) stated that the creation process of digital artifacts was very demanding in terms of time. They stated that these generating their own learning contents require having a grasp of the subject, for this reason they were obliged to work on the subject by spending more time. One sophomore students said:

“İ hocam alışana kadar yani biraz yavaş ilerledi” [P8I]

“It went a bit slowly until I got used to it.”

However, two participants clarified what they meant by ‘time consuming.’ They were actually referring to amount of time they spent for the preparation for the activity, rather than the enactment of it:

“Dezavantajları mı. Yani yetiştirmek bazen problem oldu diğer derslerden dolayı... Mesela feedback verdiniz hemen iki gün sonra istediniz. İki gün sonraya sınavımız ya da başka bir projemiz ödevimiz varsa o biraz sıkıntı oldu. Onun dışında başka bir dezavantajını görmedim” [P4I]

“The disadvantages... Well, sometimes it was difficult to complete it because of the other courses. For instance, you gave feedback and wanted [us to submit it] two days later. It caused problems because we couldn’t complete it because of an examination or a project work. Apart from this there wasn’t any disadvantages.”

“Çünkü bazen o konuya çalışmamış oluyordum mesela. Hiçbir fikrim olmuyordu. Tekrardan en bastan onun theorist’leri kim işte içeriğinde ne var. Onlara bakmadan yapmaya çalışmak daha karmaşık oluyordu. O belki zaman kaybı olmuş olabilir.” [P7I]

“For instance, sometimes I couldn’t study that subject and even I didn’t have any idea about it. Trying to do without looking from the beginning who the theorists were and what the content was etc. could sometimes be time consuming.”

Boredom

One of the sophomore students (n=1) stated that Web 2.0 activities were boring sometimes. However, she said that these activities were beneficial eventually:

“Dezavantajları bazen sıkıyordu. Yani bilmiyorum. Hani çok teknik bilgi gerektiren bir olay değildi. Hani sadece yapmak için yapıyormuşuz gibi geliyordu. Sonradan gördük ama faydalarını öyle.” [P2I]

“The disadvantages was making me bored sometimes. Well, I don’t know. It wasn’t an event that you need to know too much technological knowledge. At first we had made it just we had to do but later we realized its benefit”.

Whereas another one stated that if it had been all term it would be boring:

“Evet hani kısa da bir süre olduğu için öyle buluyorum. Belki tüm dönem olsa çok sıkacaktı. Ama beş hafta bence yeterli oldu” [P4I]

“Yes, because it happened in a short time. It would have made us bored if it had been all term but five weeks was enough.”

Limited features

One of the sophomore students (n=1) stated that limited features of selected web 2.0 tools as a negative aspect and expressed:

“Dezavantajları sadece bir kalıba uygun olması. Hani bizim belki başka bir şeyi başka bir şekilde yapmak istiyor olabiliriz. Ama ona uydurma şansımız olmayabilir bazı durumlarda” [P5I]

“Being just suitable for only one pattern was its disadvantage. For instance we want do the things however we want but we can’t make it up in all situation.”

4.3 Sophomore students’ perceived learning outcomes by generating visuals with designated Web 2.0 Tools.

Interview results showed that perceived learning outcomes of sophomore students through generating digital artifacts with selected Web 2.0 Tools were positive. Four codes were found in line with the answers that were given in the interview by the sophomore students. These are; Encouraging Active Learning [1], Meaningful Learning [2], Permanency [3], and Awareness [4].

Table 4.7 shows the sophomore students' perceived learning outcomes with generating digital artifacts with designated Web 2.0 Tools.

Table 4.11 Perceived Learning Outcomes with Generating Digital Artifacts with Designated Web 2.0 Tools.

Perceived Learning Outcomes	Encouraging Active Learning
	Meaningful Learning
	Permanency
	Awareness

4.3.1 Encouraging Active Learning

The sophomore students (n=6) stated that the Web 2.0 activities made them active in this process. They said that they made investigation during the activities and they created digital artifacts in line with these investigations. They expressed that they were more active in the learning process. They stated generating their own learning contents fostered them to make research. Receiving feedback made them to participate in lessons permanently as voluntarily. Some of them underlined that activities forced them to search and organize contents. Moreover, one of them especially emphasized blog's contribution about encouraging active learning.

Some of the sophomore students expressed:

“Yani evet yani çünkü buna dair her hafta yapacağımız toplantılar olsun feedback için görüşmeler olsun bunun için derse devamlı olarak gelmemi sağladı ve açıkçası bunun içerisinde dersimizle alakalı olduğu için ve bu soruları da araştırarak cevapladığım için... Derse katılmak adına istiyordum yani” [P11]

“Well, both the meetings which we made weekly and the discussion we made for feedback provided us to come to lessons permanently. Actually, it involved things about our lesson and it helped me to answer these questions thereby searching. I wanted it on behalf of attending the lesson.”

“Kendimiz araştırıp bulduğumuz şeyler olduğu için hani daha bir kalıcı oluyor. ... Kendimize ait bir şeyler oluşturduğumuz için iyi oldu. Yani hazır bir yerden bakmadık da hani hem kendimize ait kendimiz yaptık o şekilde iyi oldu.” [P3I]

“It is more permanent because we search and found by ourselves. It was good to form something that belongs to us. Well, we didn't look from somewhere that is already prepared.”

“Blog en büyük katkıyı sağladı diye düşünüyorum. Çünkü onda çok hani kendim araştırma yaptım dersten öğrendiklerimi hatırlamaya çalıştım, aldığım notlarıma baktım, ona göre hani, hem de orada bize soru sorulmuş olması güzeldi. Hani o sorulara cevap vermek kapsamında bence gayet güzel bir etkinlikti.” [P6I]

“I thought that the Blog made a great contribution because I researched, I tried to recall the things that I learnt from lesson, checked the things that I noted down in lesson. It was good to be asking there. It was a good activity.”

4.3.2 Meaningful learning

Most of the sophomore students (n=5) stated that their learning became more meaningful by means of generating their own learning contents. Ease of creation and use of the designated Web 2.0 Tools made them to think that these tools were helpful to them while making the contents more comprehensible. They also said that using visuals was effective in this situation and prompts were contributed to their learning. One sophomore student perceived that she learned where she needed to learn. At this point she emphasized the effectiveness of prompts in the learning processes.

“Sadece öğrenmem gereken kısımları öğrendim. Yani mesela chapter'larda çok fazla şey var. O konuyla o konuyu birleştiriyor falan. Ama onun dışında asıl noktaları o soruları cevaplayarak daha iyi öğrendim. Zaten bilmem gerekenler o soruların cevabı gibiydi. ...daha

önceden bunları yaptığım için kafamda zaten oturmuştu. Sadece hocanın bazı söylediği şeylere bir kez daha baktım. O yüzden aslında zaten çalışmış gibi oldum. Onları yaptığım için” [P7I]

“I just learned the parts which I had to. For instance, there were many things on the chapters. It linked the subjects together but apart from this I learned the key points thereby answering those questions. I think what I had to know was the answers to those questions. For instance, we had finished the blog and the other things already. The only thing we had to do was to scan. I didn’t do anything more. Since I have already done these things it was more comprehensible for me. I just looked the things one more time which teacher told me so that it was like re-studying. ”

Another two stated that they had the opportunity to obtain more permanent learnings in this way.

“Hani ben direkt mesela googledan arattığımda görsellere de bakıyorum yani yazıya bakıyorum ama hani anlayamadıysam görsellere bakıyorum ve ilişkilendiriyor. Bunu ben yapınca daha bir verimli oluyor. Hani ben ilişkilendiriyorum. Ve hani kendi parçaları bütün haline getiriyorum. Orada daha oturması için anlamın.” [P8I]

“For instance, when I am surfing on the Google, if I don’t understand the text I look to the visuals and associate them. When I do it by myself it is more permanent. I associate the things to make the parts more comprehensible to make the things clear.”

Another one explained:

“Çünkü hani kafamda daha iyi kodlayabildim. Şu şunun altında, bu bunun altında, bu böyle ayrılıyor falan diye.” [P9I]

“Because I coded them in my mind better.”

4.3.3 Permanency

Most of the sophomore students (n=7) expressed that the Web 2.0 activities affected their learning positively and they obtained permanent information. They showed the reason which lied behind the permanency as the activities being visual and the

process which encouraged them to be active. Some of them emphasized the feature of visuality as the reason for permanency. In addition, sophomore students focused on the process which encouraged them to be active while stating permanency:

One sophomore student stated:

“Evet. Çünkü mesela insanın görsel şeyler daha çok aklında kalıyor. Mesela benim o oluşturduğum sayfa şu anda gözümün önünde. Mesela Hangi videoyu buldum, ya da hangisini hazırladım, onunla daha akılda kalıcı oldu. Hani yazmaktan ziyade... O videolar özellikle bi de görseli kendi hazırlaması. Benim daha çok aklımda kaldı.” [P6I]

“Yes. Visual things are more permanent. For instance the page which I formed is under my eyes. I mean the video I found or which I prepared. It is more permanent with that rather than writing. Preparing the visual myself and these videos helped me to keep in mind easily.”

“Kendimiz araştırıp bulduğumuz şeyler olduğu için hani daha bir kalıcı oluyor.” [P3I]

“As they were the things which we research and found ourselves they were more permanent.”

4.3.4 Awareness

Some of the sophomore students (n=3) expressed that they gained awareness regarding to their knowledge level by means of the Web 2.0 activities during the process. Some of them mentioned their perceived learning level. They also stated that they didn't need extra studying to get prepared for the exams and what they learnt was sufficient and correct.

One sophomore student stated:

“Çünkü neleri bilmediğimi hatta hiçbir şey bilmediğimi anladım. Onun üzerine tekrardan çalışmış oldum zaten. Sınava çalışıyor hazırlanıyor gibi oldum. Hiç bilmediğim şeyleri de öğrendim.” [P7I]

“I understood that I didn't know anything so I studied again. It was like I am preparing for an examination. I learned the things which I didn't know, too.”

Another one stated:

“Gerçekten de o dört konuyu işledik. O dört konudan gerçekten de çok iyi bilgiler edindim. Hani bu hem bloga yazma o soruları cevaplama için ya da infografik için çok caseler vardı. ... Hani basit gibi duruyor ama çok iyi özümseyip onu yazmak gerekiyordu oraya. Hani iyi

anladıysan iyi yapabileceğin bir şeydi. Hani ben de iyi anlamışım ki orada yapabildim o küçük alana sığdırabildim.” [P9I]

“Actually, we studied those four subjects. I really obtained good information from those subjects because there were many things such as writing on the blog and answering the questions or so many cases for infographic. It seemed simple but you needed to absorb the subject well. If you understand it is easy to do. So I think I understood it well and managed to fit it to a small area.

4.4 Summary of Findings

The results showed that generating digital artifacts with selected Web 2.0 Tools move sophomore students learning to higher levels of cognitive dimensions within the Revised Bloom’s Taxonomy. There are a total of six task to measure lower order thinking levels and eight task to measure higher order thinking levels. To be more specific; at lower order thinking levels, four tasks were at remember level and maximum ten minimum six students accomplished these tasks, two tasks were at understand level and all of the ten students accomplished these tasks. Regarding higher order thinking levels, three tasks were at analyze level and maximum ten minimum six students accomplished these tasks, the other three were at evaluate level and maximum ten minimum six students accomplished these tasks, and remaining two were at create level and maximum ten minimum seven students accomplished these tasks. Moreover, it was compared that sophomores GPA’s and their higher order thinking achievement.

According to results, P7 and P9 who have average GPA’s have the highest number of higher order thinking achievement (n=31) based on all of eight tasks and P6 and P10 have the lowest number of higher order achievement (n=24) based on all tasks. On the other hand, when we look at the participants who has the highest and lowest GPA, P6 has the lowest higher order thinking achievement (n=24) and P1 has a higher number of higher order thinking achievement (n=29).

When it comes to sophomore students’ opinions regarding designated Web 2.0 Tools, they mostly expressed positive opinions. Permanency of learning, ease of comprehension, sense of control, summing up learning were expressed as the major

positive aspects. There is an interdependent relationship among these opinions. Because most of the main codes are expressed as result or reason of other main codes. For example, sense of control and being motivational are expressed as each other's reason and result.

Sophomore students perceived their learnings as active, permanent, meaningful, and appreciable. They stated it was an effective learning process. They mostly compared this learning process with traditional ones and found this process a highly valuable and preferable.

Digital artifact analyzes indicated that, most of the students reached higher order thinking levels for all of the tasks. Moreover, their opinions on generating digital artifacts with designated Web 2.0 Tools are quite positive and they perceived their learning outcomes also positive. That is, analyzes of digital artifacts show consistency with sophomore students' not only opinions on but also perceived learning outcomes with designated Web 2.0 Tools.

CHAPTER 5

DISCUSSION CONCLUSION, AND IMPLICATIONS

This chapter presents major findings of the study, discussion and conclusion of the results, implications and suggestions for practitioners, and recommendation for future research.

5.1 Discussion

5.1.1 The Level of Learning through Generating Digital Artifacts Based on Bloom's Revised Taxonomy

Document analysis results showed that generating digital artifacts with designated Web 2.0 Tools enabled sophomore students to practice both lower order thinking skills and higher order thinking skills according to Bloom's Revised Taxonomy. It is consistent with the relevant literature. Churches (2008) states that digital learning activities support not only lower order thinking skills but also higher order thinking skills. Throughout activities, most of the sophomore students reached higher order thinking levels. In learning processes, students' creation of a content fosters higher level of cognitive activities (McLoughlin and Lee, 2008). In addition, one of the purpose and function of learner generated contents is claimed as promoting reflective thinking which is included in higher order thinking skills (Valtonen, Hacklin, Dillon, & Vesisenaho, 2012). Yiqi, (2012) states Web 2.0 use in educational settings creates intellectual conflicts among students therefore, development of critical thinking is fostered. While there are arguments supporting our findings in the literature there are also opposite arguments like Clark's. Clark (1994) articulated that for more than one medium the same or similar learning outcomes are available. For this reason, what makes the difference is the instructional method. That is, according to Clark the effectiveness of learning process of the current study is due to the instructional

method which is followed throughout the course of the study. On the other hand, Kozma (1994) support this study's findings by stating that different media have different features and he sees media and method and both are part of the instructional design. Starting from this point, it can be said that the instructional method and Web 2.0 Tools used in this study have been effective together.

5.1.2 Opinions on Generating Digital Artifacts with Selected Web 2.0 Tools

Almost all of the sophomore students stated that infographics and concept map activities helped them to summarize their learnings. Moreover, they think that they associated and compared/contrasted the concepts of the theories while generating these digital artifacts. Outlining the learning content and showing relationships and differences among concepts can be remarkable features of concept map and infographic. These features can ease the comprehension of contents by students. Concept maps are not only create clearer picture of small number of key ideas but also show relationship among these concepts (Novak & Gowin, 1984). Infographics are clear cut demonstration of contents (Mol, 2011). Therefore it can be said that concept map and infographic can ease associating, differentiating or summarizing learning concepts.

Motivation is a significant component which affects student learning level, particularly in online learning environments (Cole, Fields & Harris, 2004). The various features of generating digital artifacts with Web 2.0 Tools affects sophomore students' motivation in a positive way. Being appropriate to get feedback, being visual, and sense of control are some of these features. Literature show similar results that learner generated contents increase motivation of students (Fullwood, Sheenon & Nicholls, 2009; Goktas & Demirel, 2012).

Supporting students to create their own learning environment let them to feel sense of control substantially. While organizing a self-learning environment, learners both feel happier and do their work more elaborately. Feeling ownership to the learning

environment satisfy and motivate learners (Petty, 2013; Rahimi, van der Berg & Veen, 2014). Web 2.0 can facilitate student understanding from the teaching and learning perspective. Generating their own personal learning environment can facilitate comprehension (Drexler, 2010) as well. As a learning environment blogs can make student learning clearer and let them to acquire greater understanding (Paulus, Payne & Jahns, 2009). Regarding concept map, Novak and Govin (1984) proposed that it was a powerful way of knowledge capture and utilization in the process of students' meaning making. Also infographic has the feature of making things more clear and understandable. (Mol, 2011) This study's findings are in parallel to cited literature. For a novel learning topic, learners' creation of blog, infographic, or concept map can be useful to ease up comprehension.

Web based technologies' integration to pedagogy increase the interaction among learner to learner or learner to tool. Being interactive shown as an important feature of the Web 2.0 Tools in several studies (Neo et al., 2013; Rahimi, van der Berg & Veen, 2014). On the contrary, a small number of students saw activities as boring and time consuming. Literature supports that the workload can be resulted in these ideas (Hsu & Hsieh, 2005). In contrast to these ideas, most of the sophomore students thought that the activities were enjoyable and time efficient. In learning process, learner generated contents not only foster permanency or meaningfulness of learning but also let students experience enjoyment. Goktas and Demirel (2012), states blogs are enjoyable tools. In addition MacQuarrie (2012) emphasized infographics as an eye catching feature in this context. Hsu et al., (2012) considered the dimensions of enjoyment, ease of use, and satisfaction of Web based Tools as learning enhancers. Therefore it could be said that the learning by design activities with designated Web 2.0 Tools, make students feel happier and enable them to use the time more effectively.

Being a member of instructional technology field, students stated that the overall process was a good experience in terms of technology literacy. This finding is also supported with the relevant literature. For instance, blog use is seen as an important factor for familiarizing users with computers (Goktas & Demirel, 2012).

Mobility or being online is shown as an important feature of Web 2.0 by sophomore students. Literature also supports this finding. Yiqi (2012) states that Web 2.0 Tools relieve students from time and space constraints of the traditional classroom. Rahimi, van der Berg and Veen (2014) states that mobility of Web 2.0 offers “just-in-time” and “at-your-fingerprints” learning opportunities.

Features of designated Web 2.0 Tools can be limited as one sophomore student pointed out in her interview. In contrast to this idea, a number of students thought that there were many choices to form and design the digital artifacts within the learning environment. Some of the students could want more choices to create and design their own learning environments.

5.1.3 Perceived Learning Outcomes Based on Generating Digital Artifacts with Selected Web 2.0 Tools

Learner generated contents allow learners to be active in whole learning process and allow them to be not only developer of their own learning environment but also designer of learning activities. Learner centered Web 2.0 activities can transform classrooms more active and interactive environments (Neo et al., 2013; Petty, 2013; Rahimi, van der Berg & Veen, 2014). To be more specific, blogs encourage active learning by constantly forcing students to write carefully, think about their ideas, and communicate effectively (Solomon & Schrum, 2010). On the other hand, for concept map, Wang (2003) states that, active interaction between learners and the processed information is encouraged with concept maps. However, there is no finding on relationship between infographic and active learning in the reviewed literature. The results of current study bears out that generating infographic can make students more active in their own learning experience in a similar way to the concept maps.

Sophomore students stated that as a result of generating digital artifacts with designated Web 2.0 Tools, they acquired meaningful learnings. Literature supports that generating digital artifacts with Web 2.0 Tools in learning activities promote meaningful learning. Türker and Zingel (2008) argue that learner generated contents encourage meaningful learning by allowing students to create and organize their own

learning environment. Similarly, McLoughlin and Lee (2008) claimed that as a learning approach, learner generated content approach can stimulate individual and social thinking of student and promote higher level of cognitive processes. When we look at each tool separately, blog and concept map tools have evidence on encouraging meaningful learning. Novak (2010) states that constructing concept maps force students to draw logical conclusions. In addition, blogs can promote analytical and critical learning (Eide Neurolearning Blog, 2005). Moreover, as blogs were in a narrative structure, it facilitated mental organization. Falk and Dierking (2000) argue that if information is stored in the form of a story, its mental organization will be more effective. Novak (2010) states meaningfully acquired knowledge is more likely to be more permanent. Thus, it facilitate future knowledge and can be used in problem solving. In the accessible literature it could not been found that effects of generating infographic on meaningful learning. According to findings of the current study generating infographics can also support meaningful learning.

Generating digital artifacts by using Blog, Concept Map and Infographic has a remarkable effect on permanency of the learning contents. Almost all of the sophomore students stated that owing to the activities, which were done within the scope of current study, there were no need to study for their midterm exam. Although the midterm exam was conducted six week after this study's first activity, students stated that they were able to remember all of the activities. Both activities and used Web 2.0 Tools could contribute to the permanency of learning. Therefore it can be said that learning by generating with designated Web 2.0 Tools might provide the permanency of learnings. To be more specific, concept maps are effective tools to support knowledge transfer and retention (Wang, 2003). Narrative structure of blogs might also enable sophomore students to organize and remember new experiences (Mandler, 2014).

Constructing and designing the learning environment can enable learner to be aware of their learning level. Moreover, students can enhance their knowledge in this manner. Petty (2013) states that learner-centered and technology-enabled learning

environments generate perceived improvement in knowledge. Correspondingly, sophomore students stated that their learning was improved and their awareness also raised. The activities which require higher order thinking skills help students to improve and enhance awareness on their learning processes (Sart, 2014).

The results suggest that learning from generating digital artifacts with Web 2.0 Tools can be associated with perceived and actual learning outcomes. In addition, having positive opinions about Web 2.0 Tools can engage students much more in these activities. Being easy to use, enjoyable, motivational, online, interactive, time efficient and making students to feel ownership affects each other interdependently. The reason for student engagement with digital artifact might be this interdependence between the mentioned features.

5.2 Implications for Practice

All of the participants in this study were CEIT sophomore students and one should be cautious about interpreting and generalizing the results of this study. This study contributes to learner generated digital contents literature in the field of education and the results of this study have practical implications for practice. Some recommendations for practice can be made and the possible recommendations are presented below:

This study provided understanding about sophomore students' level of learning by, opinions on and perceived learning outcomes with generating digital artifacts with designated Web 2.0 Tools. This study could be helpful for educators who plan to use Learning by Design with Web 2.0 Tools as an instructional strategy.

The current study was a longitudinal study and it required elaborate work and being self-giving. For this reason, grading was used as a reinforcer. At the same time, to prevent taking high grades as a goal, students were informed that their motivation and enthusiasm in studying such a process is very important. In long running studies, student motivation is an important component. Therefore, while starting a new study, researchers should strive to increase student motivation. To increase student

motivation, everything related with the study should be explained clearly to the participants. These are, the learning process, tasks, activities and expected learning outcomes, etc. Moreover getting higher grades as a byproduct could be good for students.

In such a study, which includes Web 2.0 Technologies, the media selection could be made carefully. There are ever increasingly Web 2.0 technologies and selecting the correct tool is not easy. Therefore, context of the study, participants, implication of the study, the research aim could be considered while determining the prospective Web 2.0 Technologies. In addition, technical development of the tools also important in terms of providing high quality of interface which ease the process and tolerating browser differences. And another important issue is being free of charge. Most of the Web 2.0 tools were free when they first introduced. However, after a while some of them can be chargeable or introduce a limited number of property for free. For this reason, while determining Web 2.0 Tools this issue should be considered.

Instructional method and media interoperable parts of the learning processes in digital environments. Therefore, instructional method which accompanies the designated media could be determined elaborately. Without correct instructional method, media may not be effective by itself. The instructional method and media could be determined simultaneously, at the beginning of the study.

In the beginning of the current study, a schedule was introduced to the students. However, they did not follow the schedule. Then it is determined to remind students the next activity time both in class and via e-mail, additionally. The students should be informed about the process as many as possible. The teacher or the researcher should be in constant communication with students. Therefore, not only students' engagement with activities can be strengthened but also they can comply with the designated schedule.

To activate students' higher order thinking levels, allowing them to create and design their own learning environment could be an effective strategy. Therefore students can feel more ownership and control, and they can be more willing to participate in

learning activities. In this process teachers or educators must follow the student progress and development and if needed feedback should be provided. Feedback can foster students' active participation in the learning process.

Feedback was an important component of the current study. Researchers thinking to conduct similar studies, must be sensitive about giving feedback. The feedback time and wording of the feedback should be suitable for the purpose. Immediate feedback can enable students being into the lesson. Besides, constructive language in terms of wording supports students to acquire more positive attitudes toward the study.

In the first weeks of a longitudinal study, students may need more scaffold and feedback than the last weeks of the study. For this reason, in a study which is similar to the current study, researchers should be careful about giving enough scaffolding or feedback to the participants.

The time period of learning by design activities can be a critical component. The workload and length of these activities should be meticulously and carefully determined. Longitude of the study and workload can affect the student attitude towards generating digital artifacts with Web 2.0 Tools.

In the current study, to decrease the number of late submissions, students were informed more frequently regarding tasks and deadlines. They were also reminded frequently that they can ask all of their questions without time restrictions to the researcher. Giving students confidence and comfort can increase the students' willingness in the process.

5.3 Suggestions for Further Research

This study could be replicated with the students from other departments of Faculty of Education and the results could be compared. Moreover, further research should consider collecting data from different universities to compare the differences and similarities in the findings. In this way, it could be found whether learning by design activities would be effective in other departments for improving students' higher order thinking levels.

Future research could foster interaction among students since this interaction can enhance learning. Therefore, the effect of student interaction to learning in the cognitive domain levels can be observed in a more detailed manner.

This study can be carried out with more students along with a pretest-posttest implication to measure students' learning levels more sensitively. Moreover, this study can be conducted with quantitative research methods to provide generalization.

As the current study was on a voluntary basis, only sophomore female students preferred to participate and continue to the study. Namely, male students did not want to participate or continue to the study. For this reason, future study can foster the male participants to take part in the study. Therefore, male students' learning levels and opinions on the generating digital artifacts might also be examined and explained.

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APPENDIX A

ETHICS COMMITTEE OF MIDDLE EAST TECHNICAL UNIVERSITY RESEARCH CENTER FOR APPLIED ETHICS APPROVAL FORM (TURKISH)

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER



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12.05.2014

Gönderilen : Dr. Göknur Kaplan Akıllı
Bilgisayar ve Öğretim Teknolojileri Eğitimi

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü öğrencisi Sonay Caner'in "Effects of a Web 2.0 Enhanced Classroom on Higher Order Thinking Skills." isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

12/05/2014

Prof. Dr. Canan Özgen
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
ODTÜ 06531 ANKARA

APPENDIX B

INFORMED CONSENT FORM

This study is a MS thesis conducted by research assistant Sonay Caner from the Department of Computer Education and Instructional Technology. The aim of the study is to investigate using Web 2.0 tools impact on sophomores' higher order thinking skills according to Bloom's Revised Taxonomy.

The study comprises creation of four concept maps, one infographics, five blog entries, one interview and two questionnaires: **Demographic information questionnaire**, which aims to collect data about participants' characteristics and **Visualizer-Verbalizer Questionnaire**, which aims to describe characteristics of the way students think in various situations.

Participation in the study is on a voluntary basis; your answers will be kept strictly confidential and analyzed only by the researcher. The obtained data will be used for scientific purposes.

The data collection does not contain questions or procedures that may cause discomfort. However, during participation, for any reason, if you feel uncomfortable, you are free to quit at any time. In such a case, it will be sufficient to inform the researcher.

If you have any questions related to the study, please do not hesitate to contact the researcher. We would like to thank you in advance for your participation to the study. For further information about the study, you can contact Research Assistant from the Department of Computer Education and Instructional Technology (Room: C110; Tel: 210 7524; E-mail: csonay@metu.edu.tr) or Dr. Gökür Kaplan Akıllı (Room: Z18; Tel: 210 3673; E-mail: akilli@metu.edu.tr).

I am participating in this study totally on my own will and am aware that I can quit participating at any time I want/ I give my consent for the use of the information I provide for scientific purposes. (Please return this form to the data collector after you have filled it in and signed it).

Course:

Date ----/----/-----

Name Lastname

e-mail address (optional)

Signature

APPENDIX C

THEMES AND CODES IN THE INTERVIEW

Table C.1 Themes and Codes in the Interview

Opinions	Positive Aspects	Pedagogical Positive Aspects	
			Permanency
			Sum up
			Associability
			Motivational
			Sense of Belonging
			Interactivity
			Enjoyment
			Ease of Comprehension
			Feedback
			Time Efficiency
			Experience
		Technological Positive Aspects	
			Ease of Creation / Use
			Visuality

Table C.1 (Continued)

			Mobility
	Negative Aspects		
		Time Consuming	
		Boredom	
		Limited Features	
Perceived Learning Outcomes			
	Encouraging Active Learning		
	Meaningful Learning		
	Permanency		
	Awareness		

APPENDIX D

WEEBLY BLOG WEB 2.0 TOOL GUIDELINE

Weebly.com is a web based application enable users for creating web sites or blogs.

You can create an account by using your Facebook account or e-mail.



The image shows the Weebly login screen. At the top is the Weebly logo with the tagline "Şaşırtıcı derecede kolay". Below the logo is a blue button with the Facebook 'f' icon and the text "Facebook ile kayıt ol". Underneath this is a "ya da" separator. There are three input fields: "Tam Ad", "E-posta", and "Şifre". At the bottom is an orange button with the text "Kaydolun. Ücretsizdir!".

Figure D.0.1 Weebly login screen

After login following screen will be appear. Click on add site.

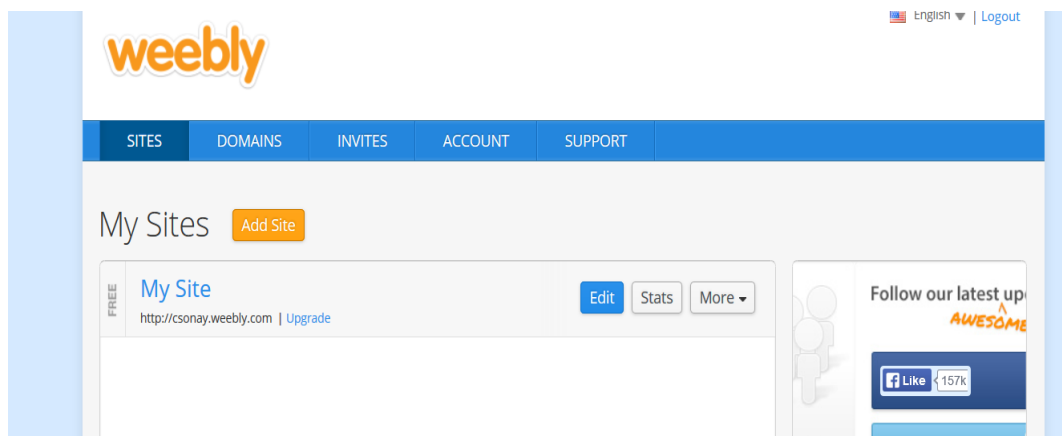


Figure D.0.2 Weebly my sites screen

The next screen will allow you to choose the most appropriate category for your purpose. (For us the most appropriate one is “Blog”.)

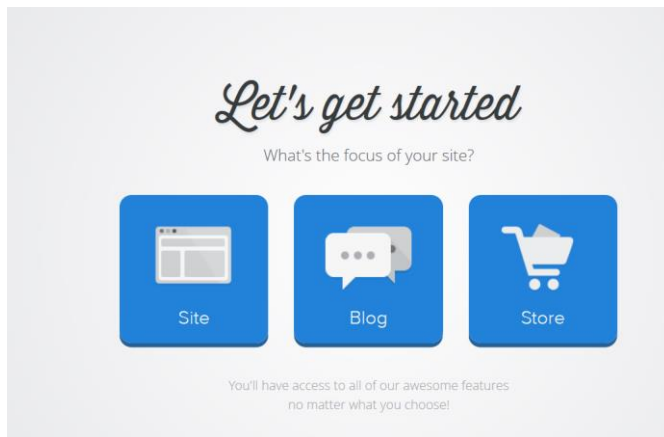


Figure D.0.3 Weebly website type selection screen

Then you will be able to choose the theme for your blog.

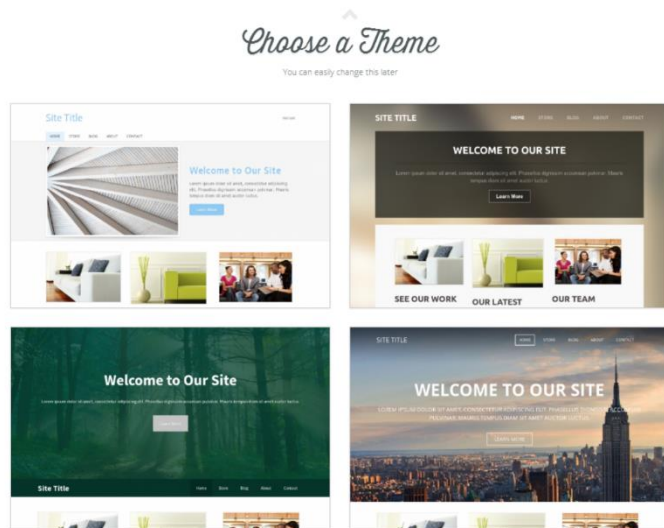


Figure D.0.4 Weebly theme selection screen

After selecting your theme you are expected to choose your website domain. Because of being free we use **weebly.com** domain. 😊

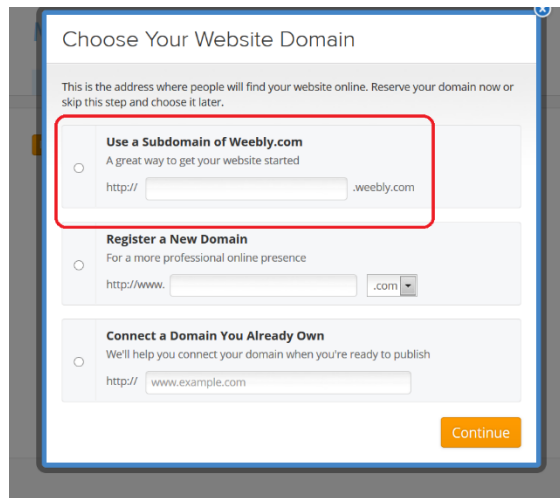


Figure D.0.5 Weebly domain selection screen

After this step you can start to create your website. You can add elements at the left side of the screen by drag and drop method. Elements are the building blocks of a site. All of your text, pictures, videos and other great content (aside from a few exceptions like header images) are added via elements. Let's take a look at some of these elements to get the hang of how they work.

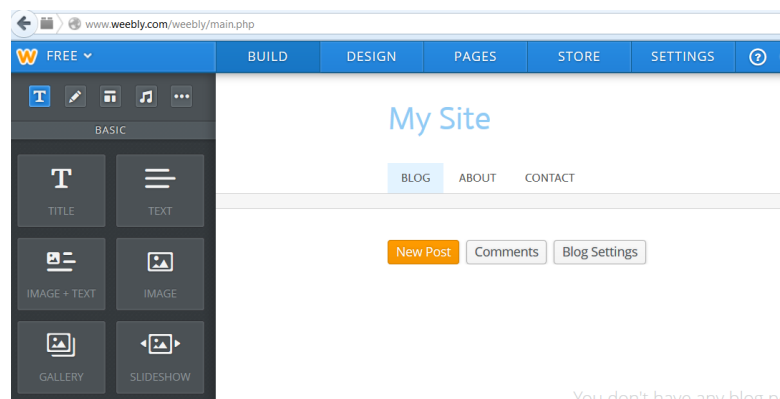


Figure D.0.6 Weebly design interface

The text element is exactly what it sounds like: an element for writing text. Click inside the element to start writing. You can write a word, a sentence, or multiple paragraphs in a single element.

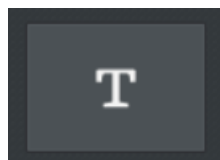


Figure D.0.7 Text element button

As you write, take note of the gray toolbar at the top of the element. This is the text toolbar and it allows basic changes to the formatting of your text. It works much like any other such toolbar normally works: select the text you want to change and click the appropriate button to make that change.

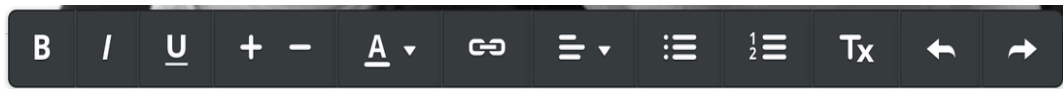


Figure D.0.8 Text toolbar

Title: Used for adding titles / headers to a page.

Text: The basic element for adding paragraphs, sentences, words, letters, and other text.

Image + Text: A text element with a place for text built right in.

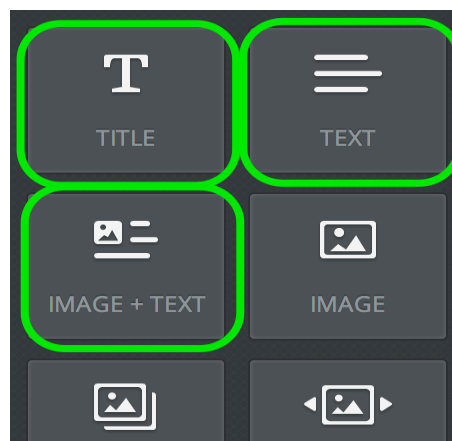


Figure D.0.9 Several buttons on Weebly interface

When you start adding elements to a page, you'll likely notice that they stack one on top of each other automatically. At first glance this may make it appear there's no way to place elements side-by-side. But the good news is that Columns Element can be used to add up to five columns to a page. This enables you place elements right alongside each other. The Columns Element is dragged to a page just like any other element.



Figure D.0.10 Columns button

The element starts with two columns, but you can add up to five via the toolbar that appears when you scroll over the element. Just click the appropriate number.



Figure D.0.11 Columns on design screen

Your site can have as many pages and sub-pages as needed; Weebly place no limits whatsoever on the number of pages that can be added to a site. Creating a new page is a matter of going to the Pages tab and clicking the Add Page button. There is an option to Add a Standard Page or Add a Blog. For now let's focus on creating Standard Pages.

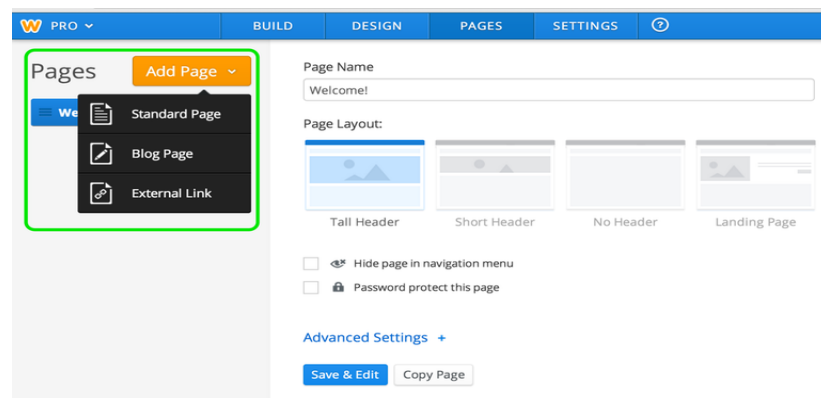


Figure D.0.12 Adding page screen

As you add (and name) each of your pages, they'll automatically become part of your site's navigation bar.

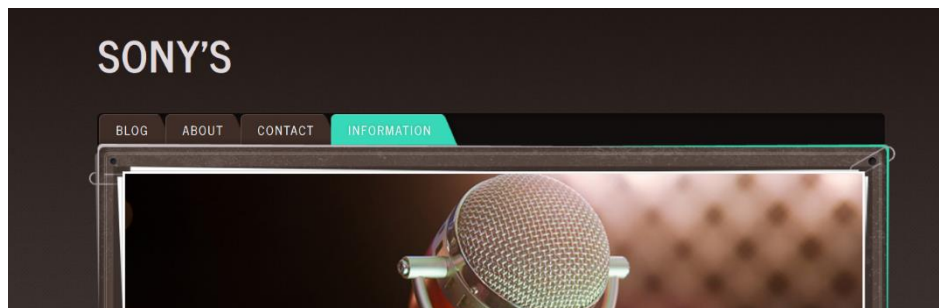


Figure D.0.13 Appearance of generated pages

You can re-arrange the order of the pages by clicking and dragging them up and down the Pages list. Dragging a page to the top of the list will make that page your Home. The Home page can be renamed to whatever you like; the name for this site's Home has been changed to Welcome. Changing the order of pages in the list will also change the order in which they're displayed in the navigation.

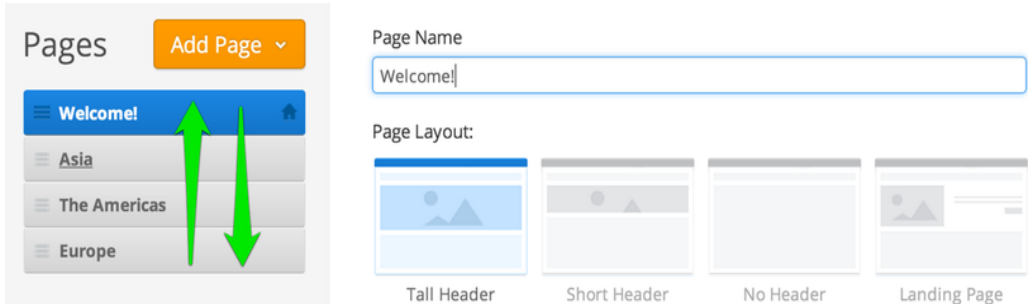


Figure D.0.14 Rearranging pages screen

You're also able to create subpages of other pages. You can do this by dragging a page or pages underneath and to the right of another page. These subpages appear in a drop-down menu when you scroll over the page to which you connected them.

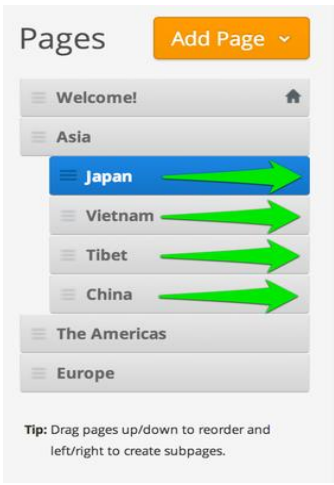


Figure D.0.15 Creating subpages screen

The button element enables you to create call-to-action buttons that link to other pages on your own site, pages on other sites, or files like PDFs and documents.

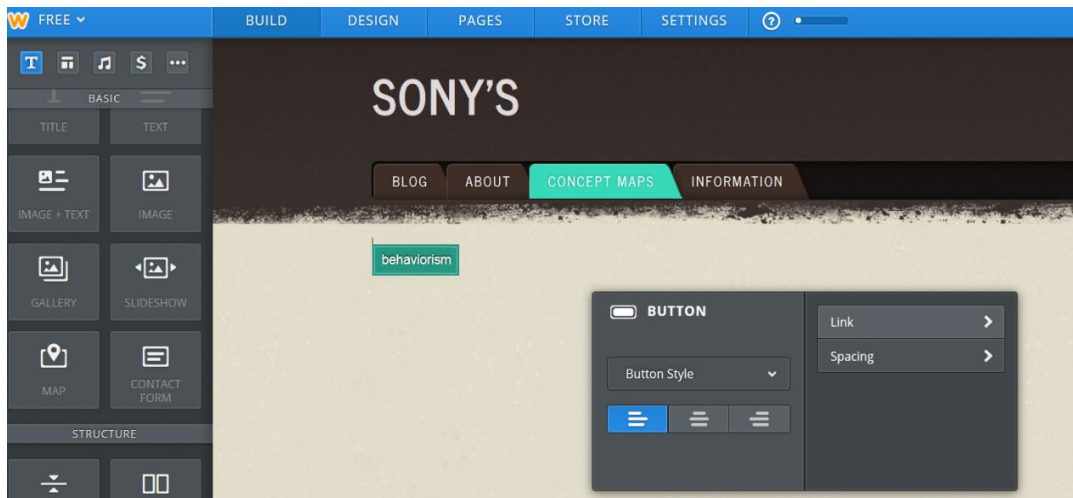


Figure D.0.16 Adding button screen

The button is essentially nothing more than a link that stands out because of its size and how it looks. You can edit the text of a button so that it says whatever you like. Though buttons ideally should contain no more than five or six words. You can link the button to a page, another website, a file or an email address via the rather appropriately named Link option. This will open up a dialog box that functions in exactly the same way as a standard text or image link.

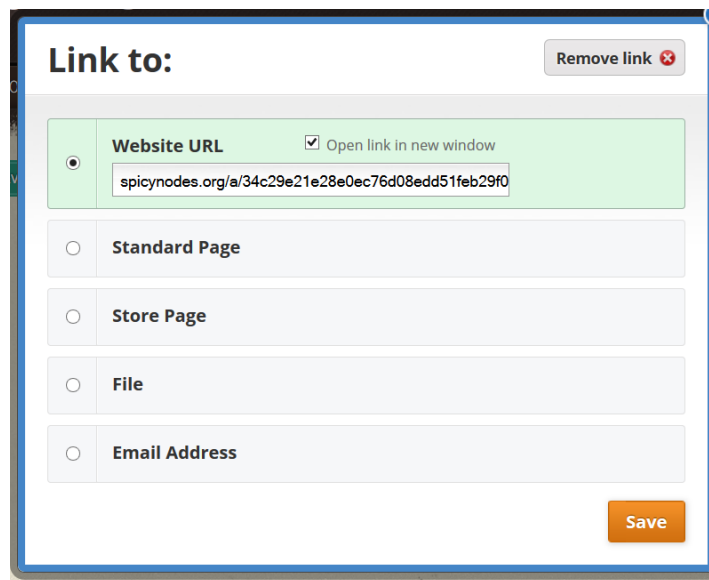


Figure D.0.17 Adding link screen

When you're ready, you can get your site out on the internet by publishing it. You can do this at any point, and you can always add more content to the site later and

publish it again. To publish a site, click the orange Publish button in the upper right corner of the editor.

This will bring up a verification box, letting you know your site has been Published. You can click the Published address to view your site, use the Facebook and Twitter buttons to link your friends and followers at either provider to your site, and click the "x" in the corner of the box to close the box and continue editing your site.



Figure D.0.18 Publishing screen

APPENDIX E

SPICYNODES CONCEPT MAP WEB 2.0 TOOL GUIDELINE

SpicyNodes is a way to visualize online information that mimics that way that people look for things in the real world. Bits of information — such as text, links, photos, and other media — are placed into "nodes," which are then linked together in an appealing interface that invites exploration. SpicyNodes can be used for everything from mind maps and content portals to organizational charts and lesson plans.

Thoughts are rarely linear, and SpicyNodes can help you organically map them in a way that maximizes flexibility. Nodes capture your thoughts, and the connections between nodes give you the opportunity to see both the big picture and the tiniest nuances.

- Go to <http://www.spicynodes.org> (Animated interactive concept mapping) and click **Sign Up**, create account.
- Click on “**Create new nodemap**”. Write the title of the nodemap.
- Chose a **style** from the left side of the screen and you will see the **preview** of the chosen style on the right side of the screen. After choosing the style, click on “**Save**” button. Then, click on the “**Edit content**” tab.
- By **clicking** on the home nodemap name, **change the name** of the home nodemap. According to your learning theory.
- Move the cursor on your home nodemap which is one of the learning theories and click on the “+” sign next to the software node to add more **child nodes**.

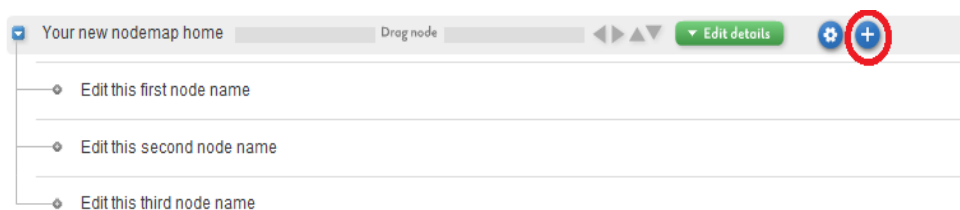


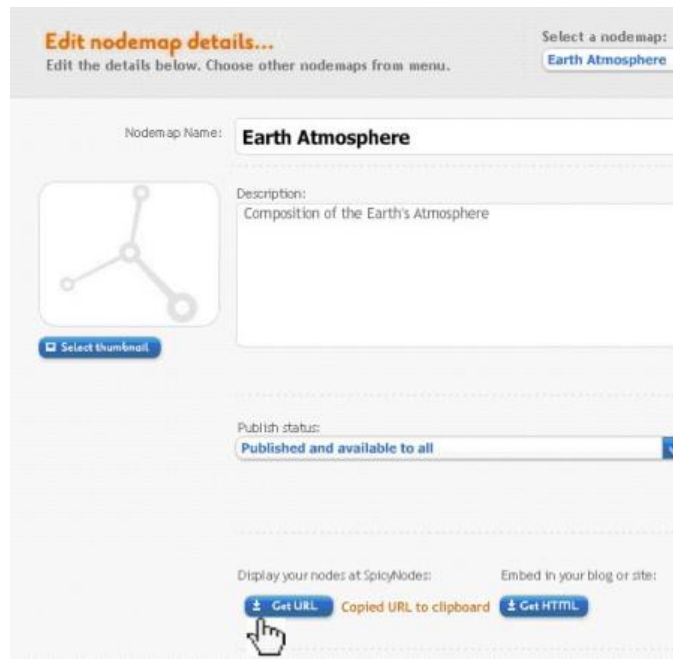
Figure E.0.1 Adding nodes screen

- To edit childnodes move the cursor on childnode and click on edit details. You can change childnode name, add description and add a file.
- With drag and drop method you can change the location of nodes.
- Search Google for a picture, copy the **image link** and paste it to the image box as shown in the figure below. Click on the “**Get file**” button. Then, if “**READY**” button is not seen, click on “**Save**” button. You can also add video from **YouTube** to your nodemap. And then, click **Save** button. (Be sure the image or video is uploaded by preview.)



Figure E.0.2 Embedding URL screen

- To get URL, click on “**Preview Nodes**” tab, then click on “**Get URL**” button, and the URL of your nodemap will be copied automatically.



FigureE.0.3 Getting URL screen

APPENDIX F

PIKTOCHART INFOGRAPHIC WEB 2.0 TOOL GUIDELINE

1. Go to https://magic.piktochart.com/users/sign_up and create an account.
2. After login select infographic under the "select the infographic format you would like to use" title and choose one of the free themes (I would recommend you to choose "create your own infographic.") and click on "create" and give your piktochart name as your name and surname. (Be careful!!! Do not choose **pro** themes.)
3. As you can see at the center of the screen infographic blocks are ordered. By clicking on each block you will be able to change block features. (Clone, move, delete, etc.)

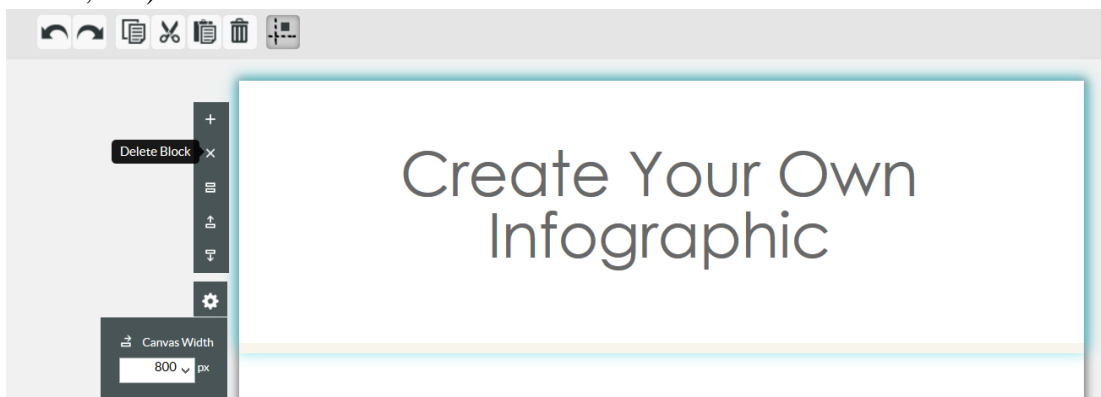


Figure F.0.1 Infographic design screen

4. At the left side of the screen there are buttons which enables you to add images, icons, background, etc. While creating your infographic please use them as much as possible.

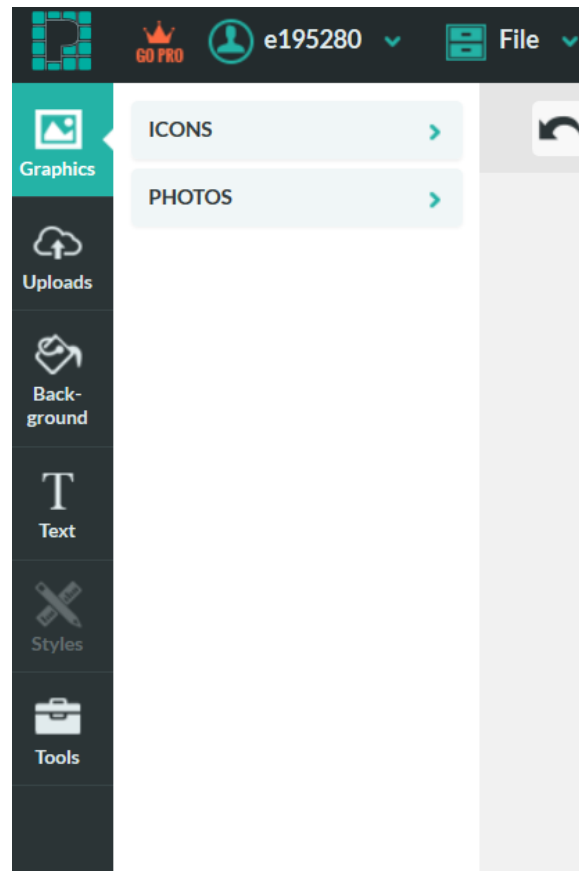


Figure F.0.2 Adding elements screen

Attention!!! While adding icons, images, backgrounds and tools you need to drag and drop it onto the theme!!!

5. In this task you are expected to prepare an infographic which includes all learning theories behaviorism, cognitivism, constructivism, social learning. For each theory use one block at least. Choose background color, images, icons, etc. that represent the theory.

6. Make sure you have the following items in your infographic for each theory.

a. A **picture** that symbolize the theory in general.

b. A few **sentences** that represent the theory in general.

c. One **video** that represents the theory in general

d. **Theorists**

e. One specific **theorist** to explain his/her principles. (by visual and verbal elements)

f. Think that in a case a student have trouble with his/her homework. Because of this reason student goes to school without doing homework. What would teacher do in this situation? Please explain by visuals and verbal for each theory. (Behaviorism, cognitivism, constructivism, and social learning.)

7. You are expected to introduce each theory by using **visual and verbal elements**.

For example, when defining behaviorism you can use student icon, reward, etc.

8. When you finish preparing your infographic, click on “**publish**” button and click on “Publish now” and copy your infographic’s URL under the “**Share the link via Email or IM**” title. Then go to your **weebly** blog and add your infographic link under your **homepage**.

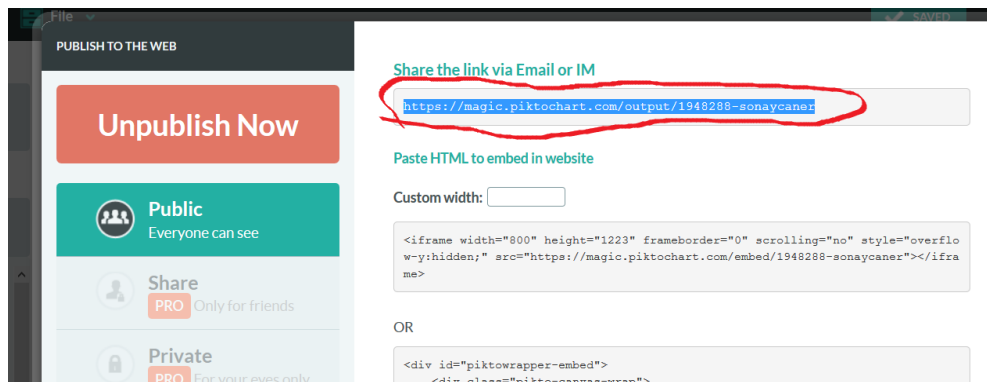


Figure F.3 Infographic publishing screen

APPENDIX G

INTERVIEW QUESTIONS (TURKISH)

Görüşme Protokolü

Merhaba

Öncelikle çalışmada katılımcı olarak yer aldığınız için teşekkür ederim. CEIT216 dersi kapsamında yaptığımız Web 2.0 etkinlikleri deneyiminiz üzerine bir görüşme yapacağız. Görüşme yaklaşık 10-15 dakika sürecektir. Bu sorulara içtenlikle cevap vermeniz çalışmanın geçerlik ve güvenilirliği açısından önemlidir. Görüşme sırasında vereceğiniz cevaplar ses kayıt cihazı ile kaydedilecektir. Bu kayıtlar ve kimliğiniz gizli tutulacaktır. Hiçbir şekilde üçüncü şahıslar ile paylaşılmayacaktır. Kendinizi hazır hissettiğinizde görüşmeye başlayabiliriz.

Görüşme Soruları

- 1- Bu öğretim sürecini değerli buluyor musunuz? Neden?
- 2- İnfografiğin bu öğrenme sürecinde nasıl bir rolü vardı?
- 3- İnfografik oluşturmakla ilgili öğrendiğin en önemli şeyler nelerdir?
- 4- Blogun bu öğrenme sürecinde nasıl bir rolü vardı?
- 5- Blog oluşturmakla ilgili öğrendiğin en önemli şeyler nelerdir?
- 6- Kavram haritasının bu öğrenme sürecinde nasıl bir rolü vardı?
- 7- Kavram haritası oluşturmakla ilgili öğrendiğin en önemli şeyler nelerdir?
- 8- Notlarının yeterliliklerini yansıtacağını düşünüyor musun? Neden?
- 9- Bu metodu diğer metodlardan daha iyi yapan şeyler nelerdir? (Blog ve infografik olmadan)
- 10- Bu metodu diğer metodlardan daha kötü yapan şeyler nelerdir? (Blog ve infografik olmadan)
- 11- Bu çalışma motivasyonunu nasıl etkiledi?
- 12- Bu metodun derse katılımına nasıl bir etkisi oldu?

APPENDIX H

BLOG PROMPTS

1. Define main components of the theory.
2. What is the definition of learning and how to assess learning according to this theory?
3. What are the negative and positive aspects of this theory?
4. Name one theorist and what makes him/her different from other theorists?
5. Please write a classroom case scenario for any course.