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AUTHORS: Özlem ÜZÜMCÜ

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Infographics experiences of international baccalaureate teacher candidates in educational technologies

Özlem Üzümcü^{a*} 

^a Hasan Kalyoncu University, Türkiye.

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Highlights

- Infographics are effective as an alternative assessment tool.
- Infographics can be used in educational technology training in online environment.
- The use of infographics in the evaluation process of IB education was successful.

Abstract

This study aims to investigate the process of designing infographics through participants' knowledge construction in the assessment and evaluation process of IB Educator Certificate (IBEC) educational technologies education. The study, in which the case study method was used, was conducted with 12 participants who attended the educational technologies and material design course in IBEC education. 7 infographic assignments were given in 14 weeks and 42 hours of online training and analyzed according to the relevant analytical rubric. To measure the development in the training process, pre-test and post-test were measured with the Web 2.0 tools usage competencies scale. At the end of the training, the participants' views on the effect of infographics on their learning processes and its use in education were analyzed by descriptive analysis. Accordingly, it was observed that the participants produced designs with effective content in their infographic assignments during the process. At the end of the training, there was a significant increase in their use of web 2.0 tools, which is the scope of the course, in support of this. According to the participants' views, results such as facilitating learning, permanent learning and having fun while learning were also obtained.

Article Info: Research Article

Keywords: Educational technologies, infographics, international baccalaureate, online learning, web 2.0 tools

1. Introduction

The use of visualization in teaching processes is widely preferred for various reasons as well as making it easier to understand. Using visuals has effects such as ensuring the intelligibility of large amounts of data (Ware, 2019), encouraging permanent learning (Jones et al., 2017; Guinibert, 2020). Although visuals can represent emotions and thoughts that many words cannot express, it is not sufficient to express data with a large amount and complex content only with visuals (Islamoglu et al., 2015). Therefore, structures are needed to represent complex data beyond figures, diagrams and graphs. In response to this need, the infographic, emerges as a new presentation of visuality and information. Infographics are not just about visuals and knowledge; they also provide attention by visualizing a message or story (Kim et al., 2016; Tuncali, 2016), increasing the clarity of complex and large amounts of data (Wright, 2016; Chicca & Chunta, 2020; Polman & Gebre). In addition, it can be said that infographics are effective in transferring the desired information much faster by combining data with visuals (Damyanov & Tsankov, 2018).

* Corresponding author. Classroom Teaching Department, Hasan Kalyoncu University, Türkiye.
e-mail address: ozlem.uzumcu@hku.edu.tr

These effective presentations of infographics are widely used in various fields, including education (Smiciklas, 2012), which is linked to visual learning processes (Elena Gallagher et al., 2017). In these dissemination processes, infographics can be used both in teachers' teaching stages and students' learning processes (Alford, 2019). In a study, teachers found that infographics are different from other materials and valuable presenting a large number of visuals with data remarkably way in the infographic design process (Ozdamli & Ozdal, 2018). Students' infographic designs mainly were carried out within the scope of homework. Compared to other traditional article assignments, infographic assignments have been found to cause discoveries that will excite students, as well as the same learning outcomes, and are also effective in data visualization and presentation skills (Lindblom et al., 2016; Saurbier et al., 2014; Matix & Hodson, 2014). In addition, students found their infographic assignments more enjoyable, which positively affected their project preparation processes (Kos & Sims, 2014). In this context, various contributions of infographics to learning processes can be mentioned, whether the designer is a teacher or a student.

Looking at the structure of infographics, it can be said that it consists of two main elements; content and visuality (Joshi and Gupta, 2021). According to another view, it has three basic components; visual component, content components and information-knowledge (such as conclusion) (Siricharoen, and Siricharoen, 2015). Considering these scopes in the design processes of infographics, it is expected to have a catchy and aesthetic appearance (Borkin et al., 2013; Harrison et al., 2015). For this reason, it can be said that the design of infographics is not easy, but time consuming (Huang et al., 2018). Although the visual design of infographics can be done by visual design experts, web applications that offer templates are also very supportive. Looking at some of the applications that offer the opportunity of infographic design, it has made it possible for people without digital visual expertise to create impressive designs with general templates as well as field-specific templates such as education, health, advertising, and art (Dur, 2014). In these applications, options such as adding a picture, changing the font, positioning the added information or establishing a relationship are usually offered. Thus, it is thought that it can help learners construct knowledge in their own learning processes by allowing them to create their own designs within a specific framework.

2. Literature

A World Vision in Global Education: International Baccalaureate

The International Baccalaureate (IB) education is an education approach that offers students intercultural understanding to build a better world with respect (IBO, 2022a). They want learners to have some features that will reflect the philosophy of this system, which has the authorization of more than 5000 schools around the world. These features called "learner profile", were determined as knowledgeable, thinkers, communicators, principled, open-minded, caring, risk-takers, balanced, and reflective (IBO, 2013). Considering these features, it is aimed to raise learners in a way that supports their learning in various aspects and encourages them to be sensitive and entrepreneurial citizens of the world (Kidson et al., 2019; Brunold-Conesa, 2010; Cause, 2009; Hacking et al., 2018). IB education starts in the pre-school period and continues with this understanding until high school education and career education. These programs consist of the Primary Years Program (PYP), Middle Years Program (MYP), Diploma Program (CP) and Career Program (CP). Its vision, which targets environments in which learners play a leading role in learning processes with a constructivist approach, foresees that students should be constantly interactive and dynamic (Jordan, 2013). In this sense, it is important for students to learn by doing and to be aware of their own limitations and advantages.

The education of IB educators is comprehensive, continuous and versatile, just like student education. IB Educator Trainings (IB Educator Certificate- IBEC) are carried out by the IB Organization or by units such as universities or institutions they have authorized, face-to-face or online, according to the school levels of teachers (PYP, MYP, DP) (IBO, 2022b). These trainings are carried out with the educational content that includes understanding supradisciplinary education, considering the characteristics desired to be gained by the students (IBO, 2022c).

IB and Alternative Assessment Tools

Since learners are expected to construct their knowledge in the IB education approach in which learners play an active role, it is expected to include innovative, process-based methods and techniques in which the learner will be active in the measurement processes (IBO, 2018x; Jordan, 2013; Yıldırım Seheryeli & Gelbal, 2020; Kamaruddin & Mohd Matore, 2021). It is stated that the use of infographics in education helps both in synthesizing complex information and assimilating information (Tarkhova et al., 2020). For these reasons, infographics offer innovative educational materials that reflect individuals' own cognitions and can be structured according to the relevant characteristics of information with original designs. At this point, infographics can be a suitable option as an innovative assessment and evaluation tool that supports the process of constructing knowledge in IB education with visuals. In this context, this study aims to investigate the process of designing infographics through participants' knowledge construction in the assessment and evaluation process of IBEC educational technology education. In this context, answers to the following questions were sought:

1. How did the IBEC participants' scores obtained from the infographic assignments they prepared change during the educational technology training process?
2. Is there a significant difference in IBEC participants' competencies using Web 2.0 tools before and after the training?
3. What are IBEC participants' views on infographics and their views on using infographics in their learning processes?

3. Methodology

3.1. Research Model/Design

In this study, the case study method was used to investigate in-depth the IBEC participants' use of infographics for assessment and evaluation in educational technology trainings. Case studies can be explained as a research method that uses rich data to examine a phenomenon or event in depth (Flyvbjerg, 2011; Crowe et al., 2011).

3.2. Data Collecting Tools

In this study, data were collected with infographics designed throughout the process, Web 2.0 tools usage competency scale and opinion form.

To measure educational technology competence, it was thought that a current scale developed for Web 2.0 tools would be appropriate. According to this the Web 2.0 Tool Usage Competency Scale was developed with the participation of 409 teachers and teacher candidates in the 2019-2020 academic year (Çelik, 2021). Consisting of 39 single-factor items, the scale is answered with five-point Likert-type options: never, rarely, sometimes, often, and always. The reliability coefficient of the scale, which explained 64% of the total variance, was found to be .98. The reason for choosing this scale related to Web 2.0 tools is that it has been published recently and it is thought to be effective in terms of validity as it includes current applications.

The education process was completed with six hours of education (42 hours) for 7 weeks (one lesson every 2 weeks, a total of 14 weeks) as described above. At the end of each class, the subjects covered as homework were asked to be evaluated. In these evaluations, the participant was asked to convey the subjects learned with their comments and to make these evaluations with infographics. The subject of the first week, infographics, their usage areas, purposes of use, design processes and websites they can use in design were explained and applications were made. These practices were carried out in cooperative group work, considering the learner profiles and supra-disciplinarity in accordance with the IB education. They benefitted from the relevant websites for the infographics that the participants were asked to prepare in the following weeks, and for the designs where they could edit their content.

A semi-structured interview form was sent by e-mail at the end of the training so that the participants could express themselves comfortably while their opinions were collected. There are two questions in this form. These are about the use of infographics in education and the effects of using infographics on their learning processes.

3.3. Sampling or Study Group

The research was carried out within the scope of the International Baccalaureate Educator Certificate Primary Years Program (IBEC PYP), authorized by a foundation university in Türkiye (for more information go to <https://ecatalogue.ibo.org/>). The participants of the research consist of 12 educators who attended the training in the 2021-2022 Fall semester. When the participants' demographic information is examined, it is seen that the branches of the participants, two male and ten female, are mostly classroom teaching, English, social studies, physical education, preschool, mathematics and science (Table 1). In addition, one participant is a senior undergraduate student, one participant is assistant principal and the other ten participants are working as teachers.

Table 1
Demographic information of the participants

Participants	Work place	Job	Branch	Gender
Participant 1	College	Teacher	English	Female
Participant 2	College	Assistant director	Classroom	Female
Participant 3	College	Teacher	Social Science	Female
Participant 4	College	Teacher	Physical education	Male
Participant 5	College	Teacher	Preschool	Female
Participant 6	College	Teacher	Information technologies	Female
Participant 7	College	Teacher	Classroom	Female
Participant 8	College	Teacher	Elementary mathematics	Female
Participant 9	College	Teacher	Classroom	Male
Participant 10	College	Teacher	Classroom	Female
Participant 11	College	Teacher	Turkish	Female
Participant 12	-	Student	Science	Female

**Participants will be shown with K and number like K1*

3.4. Data Analysis

Before and after the education, the competencies of the participants in using web 2.0 tools were measured with this scale and analyzed with the t test.

Since infographics contain data, visuality and aesthetics, various dimensions are suggested for evaluation criteria. Locoro et al. (2017) determined some dimensions as a result of literature research to evaluate infographics; clarity, informativity, elegance and attractiveness, intuitivity and synteticity. These determined dimensions reflect the features sought in infographics such as data quality, correct grouping and association, impressive and aesthetic appearance, and easy understanding. In this study, on the other hand, features that prioritize data structuring, such as information content, quality, relationships or dimensions, if any, were expected from the participants.

For this reason, the infographic content generation analytical rubric developed by Nuhoğlu Kibar and Akkoyunlu (2017), which deals with the content in more detail, was used in the infographics. This is because the participants were not expected to create high-level graphic designs, but to add images, symbols or logos by selecting from existing templates and to organize and present the data. The content production analytical rubric, which consists of 11 titles, includes dimensions such as main title, sub-title, information organization, key concepts, descriptions and is evaluated in four grades. While the lowest 1 and the highest 4 points can be obtained from an item, the highest total score that can be obtained from the rubric is 44.

The interview forms were analyzed by content analysis and descriptive analysis.

3.5. Validity and Reliability

The research was developed within the scope of the international IB certificate program and the scope and implementation of the educational content are officially available. Regarding the reliability of the study, some of the infographic and interview findings were analyzed and compared by another evaluator (Miles and Huberman, 1994). Accordingly, the agreement rate of the analyses was found to be 87%.

3.6. Research Procedures

The research is carried out in the fall semester of 2021-2022 within the scope of the training program in which a foundation university in Türkiye is authorized in the IBEC PYP. In this program, 6 courses are given: IB Philosophy and Teaching Methods, Curriculum Development, Social Responsibility, Teaching Practice and Professional Development, Educational Technologies and Material Design, Measurement and Evaluation. IBEC training consists of a total of 252 hours, each course being 14 weeks x 3 (42) hours. This study was carried out within the scope of Educational Technologies and Material Design Course. The online course is taught for 6 hours every two weeks. The content of this 42-hour course, its distribution by weeks, and the digital resources used are given (Table 2). The feature that distinguishes this course from other education technology courses is that the content is processed with IB transdisciplinary themes and IB learner profiles.

At the end of each lesson, participants were expected to evaluate the topics covered as homework. In these evaluations, the participants were asked to transfer the topics they learned with their interpretations, to structure the information and to make these evaluations with infographics. The first week's issue, what infographics are, their usage areas, purposes of use, design processes and websites that can be used in infographic design were explained and applications were made. These applications were carried out in collaborative group work by IB education, considering learner profiles and transdisciplinary practices. In the infographics the participants will prepare in the following weeks, they will benefit from the relevant websites in the designs to organize their content.

3.7. Findings

1. Infographics and Evaluation

Infographics were analyzed with the content generation analytical rubric in infographics consisting of 11 items and a maximum of 4 points can be obtained from each item. The results of the 7 projects prepared by the participants during the education process are given in Figure 1.

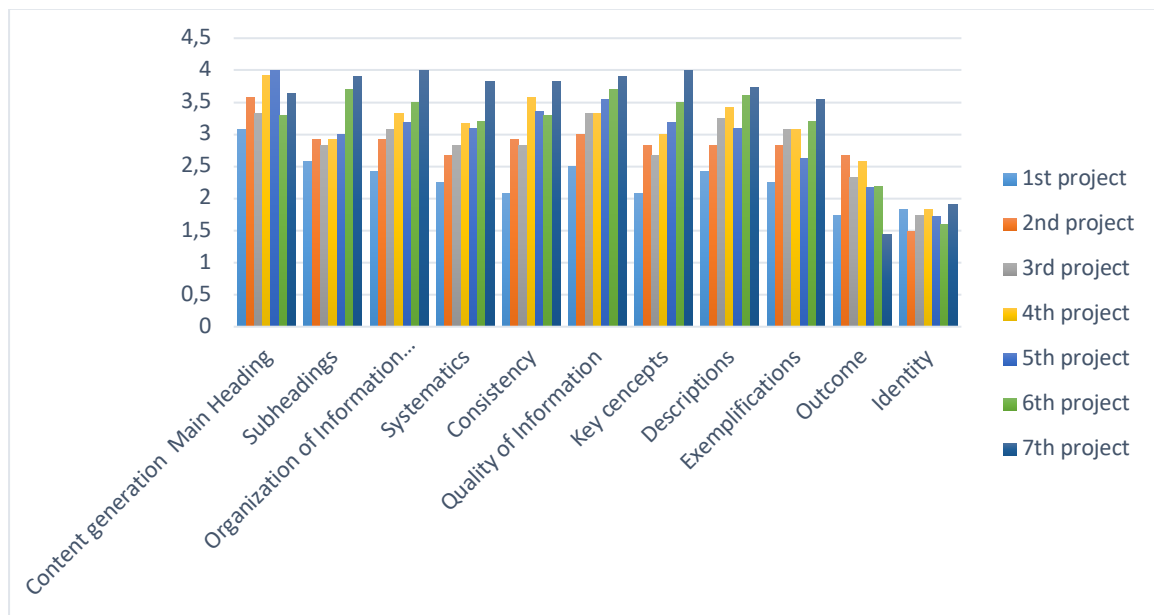


Fig. 1. Scores of infographic projects according to content generation evaluation

According to Figure, it is seen that there are generally average and below scores in the first week. Although there are relatively higher averages in the following weeks, it can be said that they have the highest averages in their last projects (Table 3). Based on the items, it was seen that the lowest scores were in the identity and outcome headings. The rubric explains the identity section as the person who prepared it, the date and the sources. While this part of the participants was added to some of their projects voluntarily, it was observed that some only gave their names and some only their sources. Similarly, it can be said that connecting the explained subject to a conclusion (outcome) is not a developing feature, but optionally changes according to weeks. It is observed that there is a regular increase in the scores obtained in areas such as subheadings, organization of information grouping, systematics, key concepts, descriptions.

Table 3

Scores from infographic projects

	1st project	2nd project	3th project	4th project	5th project	6th project	7th project
Content generation Main Heading	3,08	3,58	3,33	3,91	4	3,30	3,63
Subheadings	2,58	2,91	2,83	2,91	3	3,70	3,90
Organization of Information Grouping	2,41	2,91	3,08	3,33	3,18	3,50	4
Systematics	2,25	2,66	2,83	3,16	3,09	3,20	3,81
Consistency	2,08	2,91	2,83	3,58	3,36	3,30	3,81
Quality of Information	2,50	3	3,33	3,33	3,54	3,70	3,90
Key concepts	2,08	2,83	2,66	3	3,18	3,50	4
Descriptions	2,41	2,83	3,25	3,41	3,09	3,60	3,72
Exemplifications	2,25	2,83	3,08	3,08	2,63	3,20	3,54
Outcome	1,75	2,66	2,33	2,58	2,18	2,20	1,45
Identity	1,83	1,5	1,75	1,83	1,72	1,60	1,90

Looking at the averages of the participants' total scores in their infographics, it is seen that the total score in the first week was lower than the others, while the scores in the other weeks were close to each other, with the highest scores in the fourth and seventh weeks (Figure 2).

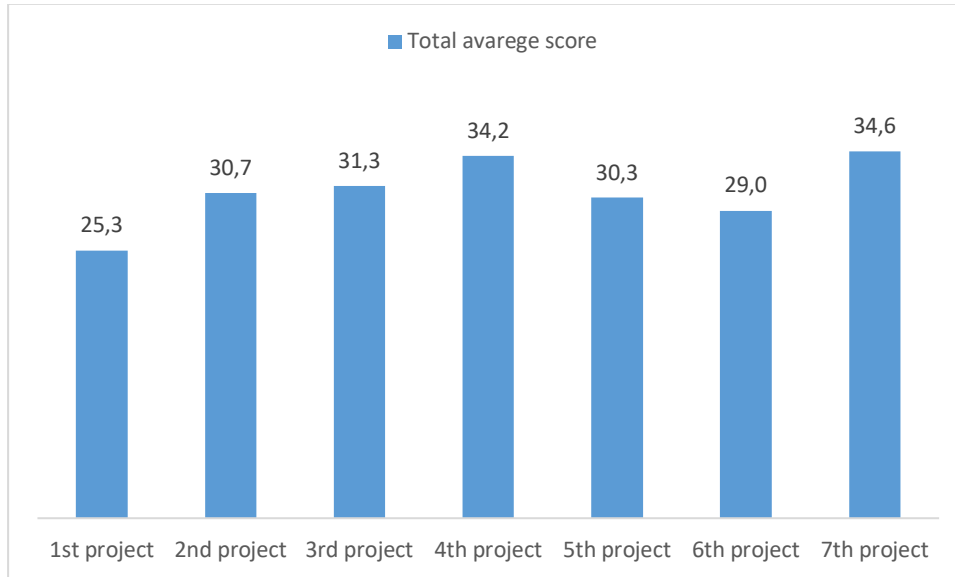


Fig. 2. Total score averages obtained from infographic projects

This shows that the subject's content can affect the preparation of the infographics. Since the fourth project is related to culture and art, its rich content and visuality affected the infographic quality. In the last project, the infographics including all the subjects in the education process similarly caused the highest score to be obtained due to the richness of the content and the increase in the experience on this subject (Picture 1).

Picture1 Some of the infographics designed during the education process



2. The competence of the participants in the use of Web 2.0 tools before and after the education

The participants's average scores according to the Web 2.0 tools scale before and after the education were checked. Before the analysis, the group's normality was $p > .05$ according to the Shapiro-Wilk test results. In other words, the group scores showed normal distribution in the pre-test and post-test. When the t-test results were examined, it was seen that there was a significant difference ($p < .01$) between the pre- and post-education web 2.0 tools usage competency scale scores ($P < .01$) and this difference was in favor of the post-test (Table 4). This shows that the targeted content and practices in the education process are successful in teaching.

Table 4

Web 2.0 tool usage competence scale scores and t-test results before and after the education

Groups	N	\bar{X}	Std. Deviation	df	t	Sig. (2-tailed)	Std. Error Mean
Pre-test	12	118,41	39,14	11	-5,56	,000	11,29
Pos-test		178,41	11,66				3,36

iii. Participant Feedback

At the end of the education, the participants were asked their opinions about the infographics with two open-ended questions. In the first question, "What do you think about the use of infographics in education?" Accordingly, the descriptive analysis results are given in Table 5.

Table 5.

Results of the participants' evaluation of the use of infographics in education

Theme	Content
Level	Suitable for all grade levels
	Effective for middle school and high school
	Effective in preschool education
	At primary level, it may not be enough on its own.
Usage time	At the beginning of the lesson when learning a new subject
	At the end of the topic to summarize the lesson
	when revision is done
	Making learning easier
Contribution to the learning process	Noticeable
	Ensuring permanent learning
	Availability in all areas
	Ensuring that the subject is considered as a whole
Preparation	The student can prepare
	The teacher can prepare
	The student and the teacher can prepare together for the consolidation of the subject.

Participants stated that infographics can be used at all levels of education. In addition, while they thought that education with visuals was effective in primary school, they stated that infographics consisting of almost all visuals would be interesting material in preschool education. P10 defined the infographic as follows:

"Infographics are a very effective way to explain a complex and difficult subject with its main lines and important points."

While the participants mostly found the use of infographics useful in the revision and summarization processes of the subjects, it was stated that they could also be used to attract attention at the beginning of the lesson.

P1: "When I want to inform my students about a subject, I prepare an infographic and hang it in my classroom and it attracts their attention. The fact that it attracts attention makes the information more impressive"

P12: "I think that infographics will help to realize meaningful learning if questions that will mobilize the reader are included in the infographics, especially at the end of the subject/unit phase, summary information and revision processes."

Considering the contribution of infographics to learning processes, the functions of attracting attention arising from visibility, providing and facilitating permanent learning were mentioned. Being able to handle the subject as a whole and being able to be used in all areas were also shown among its advantages.

P9: "Infographics serve as a very effective visual organizer in terms of seeing the whole in outline. A meticulously crafted infographic can be a very helpful roadmap."

P3: "I think that infographics are facilitating in group or individual studies as they enable short explanations with the help of visuals in education. It is also beneficial for presenting what has been done in project-based studies in summary and for designing the information as diagrams."

P5: "It is beneficial for pre-school children to visually express complex information in a concise and understandable way."

Regarding the preparation process of the infographics, the participants stated that both students and teachers could design them. They also stated that it would be beneficial for the teacher and the student to design together.

P12: "It is one of the visual organizers that can be prepared by both teachers and secondary school students."

The second question is "How would you evaluate your learning processes when you consider your infographic assignments in the IB Educational Technologies course?" and the descriptive analysis results are explained in Table 6.

Table 6.

Results of the evaluation of the participants' infographic experiences

Themes	Content
Working with infographics for the first time	All participants have worked with infographics for the first time
Difficulty preparing infographic	Difficulty at first, understanding as they do other homework over time
The effectiveness of infographics in the learning process	Having a facilitating effect on learning new and unknown subjects
fun process	Having fun preparing infographics after learning them
Participants use in their lessons	Practice in their own class after learning infographics

All the participants stated that they were introduced to infographics for the first time and stated that they had difficulties at the beginning of their learning process..

P3: "Because I had never heard of it, concepts such as "infographic" in my first lessons scared me and I thought I could not do it. That's why I think my first works were pretty inexperienced. However, thanks to both the advantage of group learning and the feedback of our teacher, I saw my shortcomings from different aspects every week and tried to strengthen these aspects."

It has been stated that infographics facilitate learning processes, provide permanent learning and are effective for reinforcing.

P6: "It was an effective material for reinforcing unknown subjects."

P7: "The infographics allowed us to summarize the subject at the end of the lesson and make the information permanent. I think that this situation contributes positively to our learning process."

P10: "Before I met infographics, I used concept maps. However, there were cases where the concept map was insufficient to explain the subject. In the process, I tried to design infographics that convey information in a fun way without getting bored. For this reason, preparing infographics as homework in the IB Educational Technologies course enabled us to acquire the habit of using infographics and to prepare infographics in a shorter time recently."

After learning the infographics, it was seen that the participants applied them in their classrooms, and they stated that the design phase was fun.

P5: "Preparing infographics may seem difficult and confusing for those who do not use much technology like me, but then you progress with pleasure."

P3: "This learning process, which was painful at first, accelerated and became applicable over time. In the last weeks, we shared the concepts and programs I learned in the classes where I taught, and we also made applications together. I do not leave my knowledge in theory, but also put it into practice."

3.8. Discussions

This study aimed to investigate the processes of designing infographics through the participants' constructing knowledge in the measurement and evaluation process of IBEC educational technologies training.

According to the analytical rubric developed by (Nuhoğlu Kibar & Akkoyunlu, 2017), the content of the infographics prepared by the participants in the 7-week training process was analyzed according to the analytical rubric developed by (Nuhoğlu Kibar & Akkoyunlu, 2017). It was observed that the average success was observed in the first week and this success increased afterward (Figure 2). It was observed that the participants designed infographics in which they could organize the content more effectively throughout the process. The participants produced better designs in giving the sub-dimensions of the topics, providing semantic integrity, giving key concepts, defining and exemplifying them over the weeks. In a study conducted with graduate students on infographics, it was observed that students' academic achievement increased, but there was no regular increase in infographic scores (Yuruk et al., 2019). In another study, students were found to have weak points such as not giving the main idea completely and including unnecessary details while preparing infographics (Tarkhova et al., 2020). This can be explained by the participants' experience in working with infographics and their adaptation to the training they attended, and as a result, their success in educational technologies. This was also demonstrated by comparing the participants' competencies in Web 2.0 tools before and after the training. Accordingly, while the participants had a medium level of Web 2.0 tool competency ($\bar{X}=118$) before the training, they reached a level that can be called high ($\bar{X}=178$) after the training. As a result, it is possible to say that the training process was adequate and the assignments given with infographics contributed to this (Jones et al., 2019). Alternative measurement tools and systems are needed for online environments (Albayrak, 2022). For this reason the research has shown that designing or using infographics is effective in students' learning processes (Tsai et al., 2020; Smith & Robertson, 2021; Çaka & Dursun, 2022). An experimental study concluded that the group that used infographics in the teaching process had better motivation and could learn new subjects faster (Bicen & Beheshti, 2022). In addition, since infographic design requires deep thinking on the subject by considering key concepts (Fadzil, 2018), it can be said that it is effective in structuring knowledge.

Looking at the overall scores in the infographics, it was observed that the fourth week and the last week, the seventh week, had the highest averages. The fact that the score results of these two weeks are close to each other is difficult to explain in terms of design development in the process. However, looking at the

subject content of these weeks, it is seen that the fourth week preferred Google Arts and Culture, which has rich content, while the last week had a large amount of data because it included all applications. This may indicate that more effective infographics can be designed with content with rich and diverse topics. Or it can be said that they design better infographics due to reasons such as adopting, liking and mastering the content. As a matter of fact, cognitive competencies such as understanding the subject as a whole, its parts and the relationships between its parts are considered necessary in infographic design (López Cupita & Puerta Franco, 2019; Damyanov & Tsankov, 2018). Therefore, a better understanding of topics and relationships and having sub-dimensions supports that infographic designs are effective.

Looking at the participants' opinions about infographics, it was observed that they had difficulty in their first infographic designs, but in their subsequent designs, they had a better command of the process, they were aware of the usefulness of infographics, and they designed with fun. Similarly, it was stated that infographic design is difficult and time-consuming (Gebre & Polman, 2016; Huang et al., 2018; Ozdamli & Ozdal, 2018), but it can be enjoyable after a certain level (Kos & Sims, 2014). However, among the main results obtained are that infographics facilitate learning on new and unknown topics, can be used at all grade levels and support permanent learning. It is also possible to see these results in various studies (Yildirim, 2016; Hart, 2013; Vanichvasin, 2013). Despite all these benefits, it is emphasized that infographics are not widely used in education; however, they should be popularized due to their advantages (Tsai et al., 2022).

4. Conclusion and Suggestions

In this study, infographic design processes were investigated in the measurement and evaluation process of IBEC Educational Technologies Education.

Accordingly, it was observed that the participants contributed to learning processes such as permanent learning, having fun while learning, summarizing the subjects by assigning infographics as homework in the education process, and that they created designs with effective content in infographics. Along with this positive result, the significant increase in the Web 2.0 tools competencies of IBEC participants showed that the training process was effective in supporting this result. Infographics offer rich learning experiences to learners, both for learners to be active and for new generation presentation through structuring complex and large amounts of information. It can be said that the use of infographics in the evaluation processes in the learner centered education approach is useful in terms of giving the learner the opportunity to present their own reflections with rich visuals and content. In this way, learners can express their own designs more effectively with the content they like, find important, emphasize, etc. based on their own learning experiences. For this reason, infographics can be expanded in assessment and evaluation processes and other effects can be investigated.

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